

The Team Descriptive Index (TDI):
A Multidimensional Scaling Approach for Team Description

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Abstract

The literature on teams is filled with many alternative team type taxonomies, and the persistence of so many conflicting taxonomies serves as evidence for the lack of consensus in the field about how to describe and differentiate teams in any standardized way. This paper presents the Team Descriptive Index (TDI) as an approach for rigorous team description based upon the Three-Dimensional Team Scaling Model (3DTSM) developed by Hollenbeck, Beersma, & Schouten (*Academy of Management Review*, 37, 92-106). The use of a continuous scaling approach to team description eliminates the need for researchers to force the teams they study into discrete categorical types that, more often than not, fail to accurately capture their nature in a precise way. We report the results of five different studies that provide construct validation evidence for a set of standardized measures for the 3DTSM with diverse samples that reflect the wide variety of contexts in which teams are studied.

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There is a long-held consensus that teams benefit organizations by promoting organizational adaptability and providing broader, more socially connected and meaningful roles for individuals (Hackman & Oldham, 1976). Given these potential advantages, it is no surprise that there has been a steady increase in the use of these team-based structures over the past two decades in work organizations (Garvey, 2002), as well as an increasing amount of research on teams (Ilgen, Hollenbeck, Johnson, and Jundt, 2005). One of the benefits of this research lies in the diversity of the contexts where these studies have been conducted. Laboratory experiments, detailed case studies, as well as longitudinal and cross-sectional field studies have all been conducted to examine team emergent states, processes, and outcomes in a variety of arenas. The diversity of this research provides a solid empirical research base on which broad-based theory can be developed and then tested for generalizability of inferences across tasks, samples, and contexts.

Unfortunately, the diversity of this expanding research creates certain challenges; perhaps the greatest of which is the difficulty this creates for generating a cumulative and comprehensive knowledge base through meaningful integration and aggregation of results across studies. Close inspection of the literature on teams reveals a perplexing overabundance of conflicting taxonomies for classifying teams in discrete and categorical ways (Hollenbeck, Beersma, & Schouten, 2012). This poses great difficulties for building consensus, and it makes it impossible for researchers to pinpoint exactly where and how their particular team of interest fits within the multitude of existing classifications of team types. Ultimately, any researcher studying teams

will struggle to complete one of the most basic of tasks in this kind of research: describing exactly what kind of team is being studied.

To address this challenge, Hollenbeck et al. (2012) developed a conceptual system for describing and differentiating teams. Rather than limiting team measurement to coarse categorical classifications that prevent fine differentiation between teams within a category, Hollenbeck et al. (2012) developed the Three-Dimensional Scaling Model (3DTSM) for team description. Ironically, although there is no consensus whatsoever on how to translate information on underlying dimensions of teams into larger, more holistic team types, Hollenbeck et al. (2012) were able to show that there was substantial consensus on the three important dimensions that underlie existing team taxonomies: skill differentiation, authority differentiation, and temporal stability. The 3DTSM was developed to describe those underlying continuous dimensions and developed proposition about how those dimensions (a) relate to team outcomes, (b) moderate the relationship between traditional predictors and team outcomes, and (c) serve as legitimate dependent variables for capturing team development over time.

Despite the relatively recent development of the 3DTSM framework, many different research teams have already begun to employ it for a variety of uses (Aube, Brunelle, & Rousseau, 2013; Park, Spitzmuller, & DeShon, 2013; Hirschfeld, Cole, Bernath, & Rizzuto, 2013; Hu & Liden, 2013; Evans, Eys, & Bruner, 2012; Christian, Christian, Garza, & Ellis, 2012; Zijlstra, Waller, & Phillips, 2012; Jonsen, Butler, Makela, Piekkari, Drogendijk, Luring et al., 2013; Miles & Hollenbeck, 2013; Nahrgang, DeRue, Hollenbeck, Spitzmuller, Jundt & Ilgen, 2013; Vashdi, Bamberger, & Erez, 2013; Liu, Hu, Li, Wang, & Lin, 2014). For example, in their study on team debriefing methods, Eddy, Tannenbaum, and Mathieu (2013) drew on the 3TDSM framework and stated:

“using the Hollenbeck et al. dimensions of skill differentiation, authority differentiation, and temporal stability, we would describe the current teams as follows: high in skill differentiation – teammates were not easily interchangeable and students on teams represented various functions (i.e., management, marketing, finance, accounting, and economics); low in authority differentiation – no one person held a position of formal authority or leader on the team; and moderate in temporal stability – as a student project team, teammates only worked together for 15 weeks. (p. 985)”

Although this is clearly a step in the right direction when it comes to standardizing descriptions, the lack of formal measures for the 3DTSM necessitates subjective judgments on the part of researchers that, in an ideal world, would be replaced by standardized methods that would eliminate variance due to these types of judgment calls.

Thus, the main purpose of the research described here was to develop and validate standardized scales for capturing the three important constructs described by Hollenbeck et al. (2012) via an new instrument called the Team Descriptive Index (TDI). By doing so, we answer Hollenbeck et al.’s (2012) call for “new, more focused scales built expressly for the purpose of capturing [the 3TDSM] framework (p. 94).” In addition, we provide a discussion of how to use the TDI in empirical research consistent with the proposition developed by Hollenbeck et al. (2012).

The development and validation of the TDI is important for two reasons. First, it provides a solution to the lack of standardized measures for describing teams. Specifically, it eliminates the need for researchers to force their teams into any one of a number of alternative, discrete, team-type categorization systems that often fail to precisely describe their teams. The TDI presents a three-dimensional conceptual space in which team researchers can “plot” their teams

based on how the teams score on the three dimensions. Much like the Global Positioning System (GPS) that helps us steer our vehicles, the TDI allows for finer characterization and description of teams so as to enable researchers to navigate through a conceptual three-dimensional “team space.”

Second, because the TDI treats the nature of the team in continuous terms, it opens doors to new theory and streams of research that have been rarely explored because of the categorical nature of existing team type systems. In particular, as Ilgen et al. (2005) note, the traditional I-P-O (Input-Process-Outcomes) model of teams has rigidly cast certain team-level variables into narrow roles that have restricted theoretical development. The nature of the team is one such variable, in the sense that this is always treated as an “Input,” despite the fact that the basic nature of a team can change over time. Thus, the TDI opens up new theoretical avenues for studying the nature of the team as a mediator variable or a dependent variable. This answers recent calls for a moratorium on research using the simple I-P-O frame (Ilgen et al., 2005), and replacing this with research that employs an IMOI (Input-Mediator-Output-Input) frame, where the status of what constitutes independent and dependent variables in research is reversed.

Theoretical Review

The first of the three dimensions in Hollenbeck et al.’s (2012) 3DTSM is skill differentiation. Defined as “the degree to which members have specialized knowledge or functional capacities that make it more or less difficult to substitute members (Hollenbeck et al., 2012: p. 84),” skill differentiation is a dimension that underlies 23 of the existing 42 categorical team type systems (55%) analyzed by Hollenbeck et al. (2012). Members of teams that are high in skill differentiation are less interchangeable relative to teams that are low in skill differentiation. Teams characterized by low skill differentiation are composed of members who

can perform all the roles within the team, and thus, no one team member is bound to a specific and distinctive role.

The second dimension of the 3DTSM is authority differentiation, defined as “the degree to which decision-making responsibility is vested in individual members, subgroups of the team, or the collective as a whole (Hollenbeck et al., 2012: p. 84).” Essentially, authority differentiation deals with power differences and how power is distributed among team members. Hollenbeck et al. (2012) found that 16 of the 42 existing categorical team type systems (38%) identified authority differentiation as an important dimension for team categorization. Teams that are high in authority differentiation have one formal leader who tends to make decisions unilaterally, whereas teams with low authority differentiation rely on voting procedures or consensus-based approaches when making decisions.

The last dimension identified by Hollenbeck et al. (2012) was temporal stability. Temporal stability was identified as an important dimension by 24 of the 42 existing categorical team type systems (57%) studied by Hollenbeck et al. (2012). Temporal stability was defined as “the degree to which team members have a history of working together in the past and an expectation of working together in the future (Hollenbeck et al., 2012: p. 84).” Teams that are stable in the long term have worked together a long time with few changes in membership and they expect to work together in the future. In contrast, teams characterized as low temporal stability are newly formed (or evolving) and they may experience frequent changes in membership as part of this process. Team members may even be strangers and there may be little expectation that the team will work together in the future.

At a larger level, the structure of the 3DTSM reflects the basic elements of structural interdependence that comprise traditional organizational charts. That is, a formal organizational

structure describes the nature of interdependence between individuals and units, both horizontal and vertical. Horizontal interdependence describes the specific functional responsibility of the individual or the unit, in terms of who does what (*Skill Differentiation*). Teams that are high in skill differentiation are highly interdependent on each other because each individual can only perform one small or specialized part of the task, and members are not substitutable. Individuals in teams that are low in skill differentiation are still interdependent, but in a different way. When teams are low in skill differentiation, interdependence is expressed in terms of work sharing and load balancing that could not take place where skill differentiation was high. Note that in both cases, members are interdependent (meeting the definitional requirement to be a team), but in different ways.

The vertical dimension of the chart establishes who has decision-making responsibility in the face of disagreement or conflict, and thus, describes interdependence in terms of who decides for whom (*Authority Differentiation*). In hierarchical teams, individuals are interdependent on a formal leader when it comes to decisions that affect them, whereas in teams that make decision via consensus, individuals are interdependent on the group as a whole for decisions that affect them. Again, in both cases, members are interdependent on others (meeting the definitional requirement to be a team), but in different ways.

Finally, the length of time people have been interdependent on each other as part of a specific reflects the team's history of working together (*Temporal Stability*). This is not a form of interdependence per se, but it does capture how long members have been working together, and any system for describing the nature of a team certainly needs to distinguish groups that have had a long history of interdependence from teams of strangers.

The Team Descriptive Index

The TDI was specifically designed to capture the dimensions underlying the 3DTSM, and thus, frees researchers of the need to either apply an existing team typology that is not tailored for their specific teams or develop a new team typology specifically for the teams being studied. Because all of the existing approaches to describing teams have relied on discrete team-type systems comprised of multiple classifications across dimensions, a great deal of specific variance is lost when teams are lumped together into large, holistic categories. In reality, the teams within these large categories can be quite different from one another in terms of skill specialization, hierarchical structure of the team, and the length of time in which the team has been together. Thus, as a descriptive system, the TDI is both flexible and parsimonious. In addition, since the dimensions that are captured by the TDI have often been used as components within past holistic systems, this provided some capacity to leverage past research.

With regards to the nature of team interdependence, the TDI focuses on structural interdependence. Specifically, the skill differentiation dimension of the TDI captures the horizontal interdependence among team members while the authority differentiation dimension assesses vertical interdependence. By taking this approach to measuring interdependence, the TDI does not confound *process* interdependence with *structural* interdependence, unlike current approaches to measuring task interdependence (Ilgen et al., 2005). We make the argument that team types are not equivalent to team processes and thus sought to distinguish structural interdependence from process interdependence. Just as the team process model developed by Marks, Mathieu, and Zaccaro (2001) clearly describes the *process* interdependence in teams, the TDI provides researchers with the ability to describe the *structural* interdependence in teams.

In this study, two versions of the TDI were developed: the TDI Long Form and the TDI Short Form. The TDI Long Form is designed for research in which the nature of the team is of

central interest. A total of 21 items that employ a traditional 5-point Likert response scale assess the three dimensions (See Appendix A). The TDI Short Form, in contrast, is designed to be used for efficiently describing the nature of teams in research where the nature of the team is not a central theoretical concern (See Appendix B).

Even though the nature of the team may not be critical for this latter kind of study, for purposes of developing a cumulative knowledge base, describing the nature of teams being studied is still necessary. Future replication studies, narrative reviews, or meta-analytic studies need this information in order to develop a cumulative knowledge base and test for theoretical boundary conditions. For example, armed with this information, a meta-analysis would be able to explore how the nature of teams predicts some team outcomes or moderate the relationships between antecedents and team outcomes. In the TDI Short Form, each of the three dimensions is assessed with a 9-point Thurstone response scale with 5 descriptive anchors. Thus, the two forms differ in length and response scales (see Stark, Chernyshenko, Drasgow, and Williams, 2006 for a comparison and contrast of Likert versus Thurstone response scaling).

Both forms of the TDI were validated based on a series of studies that document (a) internal consistency, (b) alternative forms reliability, (c) test-retest reliability, (d) inter-rater reliability and agreement, (e) factor structure, (f) convergent validity with existing measures of team design (Morgeson & Humphrey, 2006; Campion, Medsker, & Higgs, 1993), (g) discriminant validity with existing measures of team processes (Mathieu, Maynard, Taylor, Gilson, & Ruddy, 2007) , and (h) criterion-related validity with outcome variables (Edmondson, 1999; Hyatt & Ruddy, 1999) that are part of a nomological net for this framework.

Method

Scale Construction

The TDI attempts to capture the three theoretical dimensions described in the 3TDSM, and hence items were developed based to directly reflect that conceptual model. That is, to ensure content validity, items and dimension definitions were developed deductively using the definitions and descriptions of the three dimensions provided by Hollenbeck et al. (2012). For both the TDI Long Form and the TDI Short Form, a definition of the dimension precedes each set of items measuring skill differentiation, authority differentiation, and temporal stability. The content of the TDI Long Form's 21 items and the TDI Short Form's 3 items were constructed from Hollenbeck et al.'s (2012) descriptions of their respective dimension and critical components identified in their review of the literature on teams. For example, the authority differentiation items were constructed directly from their discussion on the extent to which decision-making, leadership, and power are spread across members in a team (see Hollenbeck et al., 2014, pp. 92-94). The TDI Long Form scale points were generated by varying degrees of each item component, and the TDI Short Form's behavioral anchors were developed from the descriptions of teams identified by Hollenbeck et al. (2012) and act as exemplars at various points on each of the dimensions.

Samples

The TDI was developed and validated across 5 different samples from the U.S. and China. The overall structure of research is provided in Table 1, which also serves as a reference of subsequent tables of results.

Sample 1. Participants consisted of 218 undergraduate students at a large Midwestern university in the United States. Participants ranged from 19-21 in years of age, and their team experiences were drawn from classes, internships, and part-time work. Participants received a brief overview of the three dimensions proposed by Hollenbeck et al. (2012) before participating

in a discussion led by the first and second authors asking them about a team experience they had, current or past, in any area. Following the discussion, participants described their past team experiences and completed surveys containing the TDI Long Form and the TDI Short Form. Examples of the teams for which participants completed the TDI Long Form and the TDI Short Form are semester-long class project teams, sports teams, restaurant staff teams, and work teams at companies in which participants interned.

In addition to completing the TDI Long and Short Forms, participants rated the teams they described on team processes, team outcomes, work design, and work unit characteristics. *Team processes* were assessed using a scale developed by Mathieu et al. (2007) that required respondents to rate each of the 10 team processes on a 5-point Thurstone-type (1 = *Hardly any skill*, 3 = *Adequate skill*, 5 = *Complete skills*) that best described each of the 10 team processes. Definitions of each process accompanied its respective item, and each of the three anchors included descriptions of what would characterize its rating.

Three *team outcomes* were measured using a combination of items from a scales developed by Edmondson (1999) and Hyatt & Ruddy (1997). Team performance ($\alpha = 0.66$), team satisfaction ($\alpha = 0.76$), and team adaptability ($\alpha = 0.76$) were each measured with 6 items rated on a 5-point Likert scale (1 = “*strongly disagree*” to 5 = “*strongly agree*”). Additionally, *work design* was measured using items from the Work Design Questionnaire (Morgeson & Humphrey, 2006). Specifically, autonomy ($\alpha = 0.93$), task significance ($\alpha = 0.91$), job complexity ($\alpha = 0.85$), skill variety ($\alpha = 0.91$), specialization ($\alpha = 0.86$), social support ($\alpha = 0.84$), and interaction outside the organization ($\alpha = 0.90$) were each measured using items employing a 5-point Likert scale (1 = “*strongly disagree*” to 5 = “*strongly agree*”). All constructs were measured with 4 items except for autonomy (9 items) and social support (6 items). We also

adapted items from the Work Group Characteristics Measure (Campion et al., 1993) to measure two *work group characteristics*, self-management ($\alpha = 0.84$) and participation ($\alpha = 0.88$). Both of these constructs were also rated with 3 items on a 5-point Likert scale (1 = “*strongly disagree*” to 5 = “*strongly agree*”).

Sample 2. Participants in Sample 2 were 166 MBA students (22.2% female) at a large Midwestern university. The average age of participants was 27.5 years ($SD = 3.31$), and average work experience was 4 years ($SD = 2.59$). As with Sample 1, participants were asked to describe a team experience from past workplace experiences, and then complete a survey assessing that team on team processes and team outcomes, as well as the TDI Short Form (Time 1). Two weeks after this initial survey, participants were asked to recall the same team experiences and complete the TDI Short Form again (Time 2). Examples of teams described by participants are news production team, problem-solving teams, and election campaign teams.

Similar to methods employed with Sample 1, ten team processes were assessed using the same scale developed by Mathieu et al. (2007). Additionally, three team outcomes were measured using the same combination of items employed in Sample 1 (Edmondson, 1999; Hyatt & Ruddy, 1997). The internal reliabilities were $\alpha = 0.64$ for team performance, $\alpha = 0.76$ for team satisfaction, and $\alpha = 0.79$ for team adaptability. The process and outcome measures were obtained immediately after the completion of the TDI Short Form during Time 1.

Sample 3. Participants were 133 employees and their supervisors (47.9% female) employed at a Chinese subsidiary company held by a state-owned enterprise (SOE) in Shanghai. This company, henceforth called the Chinese High Tech Company, is China’s first domestic enterprise that designed and manufactured semiconductors and products related to light-emitting diode. Participants were, on average, 27.94 years old ($SD = 5.60$). The average tenure was 2.58

years ($SD = 2.26$), and 70% of participants had at least a bachelor's degree. The employees and their immediate supervisors were from 32 small, intact work groups representing major departments of the company, such as operations (manufacturing), engineering, technology and facilities, operations materials, quality controls, information technology, customer service, human resource, finance, and administration. Employee participants completed the TDI Long Form and the TDI Short Form. Each team had an average of 4.16 members ($SD = 1.22$).

All teams would be considered traditional work teams in which membership was typically stable, usually full-time, and roles well-defined. Team supervisors determined work assignments, evaluated performance, and managed poor performers. Each team had weekly meetings to discuss work-related problems in the previous week before setting the team goals for the next week. Thus, team members frequently coordinated and interacted with each other to both evaluate previous problems and accomplish their new team goals for the week.

Team goals varied based on the team's technical expertise area. For example, in a production team, different team members worked with one another to execute one unique part of the company's patented film production process, but the success of the whole production process was dependent on the collective collaborations of all members. An example of a different kind of team was the technical support team, which was comprised of technicians of similar expertise and job responsibilities. A team of technicians coordinated with one another and worked together to provide technical assistance to frontline workers, repair machine failure, conduct preventive maintenance or identify opportunities for improvement. The members of these teams had overlapping skills and were interdependent with each other when it came to workload sharing and balancing.

Sample 4. A sample of 243 participants (47.7% female) was obtained from a public ground transportation company in Beijing, China. Participants from this Chinese Public Transportation Company were employed as bus drivers, ticket officers, administrative staff, and supervisors. The average age of participants was 38.30 years ($SD = 7.85$), and average tenure was 7.30 years ($SD = 3.32$); 54% of participants had at least a bachelor's degree. On average, there were 13.5 people per team ($SD = 2.23$) and each team managed several busses that ran along the same route. Teams were comprised of bus drivers, ticket officers, administrative staff and a supervisor.

In terms of the nature of the work conducted by these teams, the efficiency of transportation along a team's route depended on communication and coordination between bus drivers, ticket officers, team supervisors, and administrative staff. Bus drivers communicated with other drivers on their team and headquarters, alerting them of any traffic jams, accidents, unexpected influx of passengers, and other problems typically encountered on routes within Beijing. Moreover, each bus driver and ticket officer also worked closely together. Ticket officers were stationed at each of the three entrances on the bus and were responsible for directing the flow of passenger traffic and bus fare transactions. Ticket officers at the front of the bus served as a communication link between the bus driver and the other ticket officers, allowing every team member on the bus to be aware of any changes in their typical routine. Ticket officers stationed at the middle entrance were responsible for directing passenger traffic off the bus and ensuring no passenger boarded unlawfully. Finally, ticket officers at the back of the bus served as a monitor for all activity on the bus and were responsible for boarding passengers with bus passes. Similar to methods employed with Sample 3, employee participants completed the TDI Long Form and the TDI Short Form.

Sample 5. Participants were 102 upper level executives (44.3% female) of a diverse set of large and mid-size U.S. business organizations located in the Midwest Region of the United States. They were, on average, 41.5 years in age ($SD = 9.71$) and average tenure with the organization was 4.26 years ($SD = 5.58$). Participants completed the TDI Short Form as part of a larger diagnostic exercise that was a component of an executive development course that they were attending. Part of the course required the executives to identify a set of current problems faced by the teams they managed, and we then examined the associations between measures derived from the TDI with the problems identified by these executives.

Results

Internal Consistency Estimates

Establishing internal consistency of scales is the first of three methods for establishing reliability of a measure (Nunnally & Bernstein, 1994; Rosenthal & Rosnow, 1991). Internal consistency estimates of reliability for the TDI Long Form were assessed by calculating Cronbach's alpha using Sample 1, Sample 3, and Sample 4 data (see Table 2). Poor initial item-total statistics associated with 3 of the original 8 items for temporal stability led us to drop these items, resulting in a 5-item scale for temporal stability. The average internal reliability across the three samples was $\alpha = 0.87$ for skill differentiation, $\alpha = 0.94$ for authority differentiation, and $\alpha = 0.82$ for temporal stability. These results indicate that each of the TDI dimensions has strong internal consistency reliability.

Alternative Forms Reliability

To establish the degree of equivalence between the TDI Long Form and the TDI Short Form, alternative forms reliability was assessed using data from Sample 1, Sample 3, and Sample 4 by correlating responses on the TDI Long Form with responses on the TDI Short Form.

Obtaining alternative form correlations is not only helpful in further establishing the reliability of measures (Nunnally & Bernstein, 1994), but it also speaks to the interchangeability of two parallel forms. Given the purpose of developing the TDI Long Form and the TDI Short Form is to have equivalent forms of team description, it is necessary to establish alternative forms reliability.

In Sample 1, the TDI Long Form responses were correlated with the TDI Short Form, resulting in an average raw correlation across dimensions of $r = 0.79$ ($p < .05$) across the three dimensions (see Table 3a). When corrected for unreliability in the TDI Long Form, this average correlation became $r = 0.86$ ($p < .05$). To account for potential non-independence, HLM was used to run these analyses. Thus, we were able to examine relationships at the individual level while taking into account the team-based structure of the samples. The average raw correlation across dimensions for Sample 3 was $r = 0.77$ ($p < .05$) and $r = 0.68$ ($p < .05$) for Sample 4 (see Tables 3b – 3c). These correlations increase to $r = 0.80$ ($p < .05$; Sample 3) and $r = 0.73$ ($p < .05$, Sample 4) when the TDI Long Form is corrected for unreliability.

In addition to high alternative form reliability, it is also important to discuss the multitrait-multimethod matrix resulting from these three samples in order to assess potential bias due to methods. Note that in Table 3a, the average heterotrait-heteromethod correlation ($r = 0.22$, $p < .05$) was similar in size to the heterotrait-monomethod correlations (TDI Long Form: $r = 0.25$, $p < .05$; TDI Short Form: $r = 0.22$, $p < .05$). Similarly, we see in Table 3b that the average heterotrait-heteromethod correlation ($r = .08$) converges on the heterotrait-monomethod correlations (TDI Long Form: $r = 0.06$; TDI Short Form: $r = 0.07$). In Sample 4 (see Table 3c), the heterotrait-monomethod correlations (TDI Long Form: $r = 0.07$; TDI Short Form, $r = 0.12$, $p < .05$) are, again, similar in size with the average heterotrait-heteromethod correlation ($r = 0.10$ p

< .05). The similarity between the correlations observed in the heterotrait-monomethod triangles with the correlations observed in the heterotrait-heteromethod rectangles is evidence that the three dimensions of the 3DTSM are slightly correlated with one another, and that these correlations are not due to the methods employed in their measurement (Campbell & Fiske, 1959).

These findings, taken altogether, show that dimension measurements from the TDI Short Form converge with measurements obtained from the TDI Long Form, establishing alternate-forms reliability for the TDI Long Form and TDI Short Form.

Test-retest Reliability

As a third method of establishing the reliability of the TDI scales, test-retest reliability was assessed with data from Sample 2 by correlating responses to the TDI Short Form at Time 1 with Time 2 responses that were obtained two weeks later (e.g., Nunnally & Bernstein, 1994). Test-retest reliability establishes the stability of a measure over a period of time when one would not expect changes in true scores (Rosenthal & Rosnow, 1991). Table 4 presents the test-retest reliability results and provides evidence for high test-retest reliability of the TDI Short Form. All three dimensions had high test-retest reliability with correlations at $r = 0.69$ ($p < .05$) for skill differentiation, $r = 0.76$ ($p < .05$) for authority differentiation, and $r = 0.82$ ($p < .05$) for temporal stability.

Inter-rater Reliability and Agreement

Whenever ratings of a single construct are obtained through multiple raters, ratings must be aggregated to obtain a single score. However, before ratings can be aggregated, inter-rater reliability and agreement needs to be established to justify aggregation of ratings. A common method of determining the within-group consensus necessary for justification is through

intraclass correlation coefficients (ICC) and $r_{wg(j)}$ (Bartko, 1976; James, 1982; James, Demaree, & Wolf, 1984; James, Demaree, & Wolf, 1993). The multiple source within-team ratings of skill differentiation, authority differentiation, and temporal stability collected from Samples 3 and 4 were used to assess inter-rater reliability and agreement by calculating ICCs and r_{wg} . The results of these analyses are presented in Tables 5a and 5b.

Prior to aggregating the data, we followed recommendations from Kline (2005) and Vandenberg & Lance (2000) to check for configural and metric invariance between the samples. In support of configural invariance, the factor structure was stable across the two samples (CFI = .92; Cheung & Rensvold, 2002). In support of metric invariance, a visual inspection of the factor loadings in both samples revealed that they were all significant and exhibited relatively small changes (Kline, 2005). Further, to test for metric equivalence, all factor loadings were constrained to be identical across the two samples. The resulting CFI changed only slightly (CFI = .90), suggesting that metric invariance can be supported (Cheung & Rensvold, 2002). Moreover, this value still meets the threshold for acceptable fit (Kline, 2005).

ICC(1) provides an estimate of the proportion of the total variance of a variable that is explained by group membership (Bryk & Raudenbush, 1992). According to James (1982), the ICC(1) values generally range from 0.00 to 0.50, with a median value of 0.12. The average ICC(1) values for the three dimensions in the TDI Long Form obtained from Sample 3 is 0.44, and the ICC(1) values for each of the dimensions is well above the median level. The average ICC(1) values obtained from Sample 4 is 0.30, and individual ICC(1) values for each of the dimensions are still above the median level.

In contrast to ICC(1) values, ICC(2) values provide an estimate of the reliability of the group means. For ICC(2), a cutoff of 0.60 is recommended (Bliese, 2000; Glick, 1985). Results

of Sample 3 and Sample 4 analyses show that all ICC(2) values are well above the 0.60 cutoff. The average ICC(2) for the three dimensions were 0.76 (Sample 3) and 0.81 (Sample 4). These results suggest that the averaged team members' assessments of the team's skill differentiation, authority differentiation, and temporal stability are reliable.

The third criterion $r_{wg(j)}$ reflects the degree of within-unit agreement on a given variable (James, 1982; James et al., 1984; James et al., 1993). It is the extent to which unit member perceptions agree more than they would be expected by chance. Normally, a value of .70 or higher is acceptable (Klein & Kozlowski, 2000). As shown in Tables 5a and 5b, within-unit agreement on the three dimensions were greater than expected by chance for both Sample 3 (average $r_{wg} = 0.89$) and Sample 4 (average $r_{wg} = 0.93$). The results of the r_{wg} analyses, in addition to the ICC(1) and ICC(2) results, provide sufficient justification for the aggregation of individual ratings to the team level.

Factor Structure (U.S. and China)

To test the appropriateness of our *a priori* factor structure for the TDI, we conducted a series of confirmatory factor analytic (CFA) tests using Mplus 4.2 (Muthén & Muthén, 2006) with maximum likelihood estimation. This test was performed on those samples that completed the TDI Long Form (i.e., Samples 1, 3, and 4). The TDI Long Form consists of a total of 21 items that we hypothesize to load on the three factors we have discussed; skill-differentiation (8 items), authority-differentiation (8 items) and temporal stability (5 items). General recommendations for CFAs specify a ratio of 10 cases per item (Kline, 2005); while we met this threshold for Sample 1 (218 participants), our Sample 3 had too few participants (133). Given that both Sample 3 and Sample 4 were collected in mainland China using Chinese national citizens and using the same translated instrument, we combined these samples for our analysis.

Table 6 presents the results of our factor analysis. For both samples, we first specified a 1-factor model in which all 21 items loaded on a single construct. As is clear, this model exhibited significant misfit to the data. We then specified a 3-factor model in which the skill-differentiation, authority differentiation, and temporal stability constructs were identified and allowed to covary. Chi-square difference tests of our nested models show that the less constrained 3 dimensional model provides significantly improved fit to the data

To further examine the fit of our models, we adopted the multiple index presentation strategy of comparing the comparative fit index (CFI) and standardized root mean square residual (SRMR) as suggested by Hu and Bentler (1999). In line with these authors, we consider a model to exhibit acceptable fit when the CFI rises above 0.90 and when the SRMR is less than 0.09 (see also: Kline, 2005). Fit statistics suggest that both models meet the minimum criteria suggested by Hu and Bentler (1999) and Kline (2005). Both samples met or exceeded the CFI cutoff of 0.90 (Sample 1: .90, combined Samples 3 and 4: .97). Furthermore, SRMR for both models were less than the .09 cutoff (Sample 1: 0.08; combined Sample 3 and 4; 0.05). Thus, the available evidence suggests retention of our *a priori* 3 dimensional factor structure.

Convergent Validity with Team Design Measures

Convergent validity for a focal measure is established when there are significant, non-zero correlations between the focal measure and measures of similar constructs that make up part of the nomological net (Rosenthal & Rosnow, 1991). Convergent validity was assessed in Sample 1 by correlating the TDI Long Form and TDI Short Form measures with work design and work group characteristics. Specific elements of team design should be reflected in ratings of these three team dimensions, and hence design characteristics form part of the nomological net for the 3DTSM. As would be expected, skill differentiation was correlated with job complexity,

skill heterogeneity and specialization following Hollenbeck et al. (2012) argument that that members of teams characterized as being high on skill differentiation take on simple jobs and roles within the team that require a unique skill set. Table 7a shows skill differentiation to have a negative relationship with job complexity within the team (average $r = -0.25$, $p < .05$) and positive relationships with skill heterogeneity within the team (average $r = 0.29$, $p < .05$) and specialization within the team (average $r = 0.37$, $p < .05$). These results provide support for the convergent validity of the measures of skill differentiation.

The nomological net for authority differentiation included the constructs of self-management, participation in decision-making, and autonomy. Teams high on authority differentiation are characterized as having a single individual who manage the team's progress towards its goals in a context where team members are less likely to participate in the decision-making and more likely to be directed in their roles (Hollenbeck et al., 2012). As seen in Table 7b, authority differentiation had a significantly negative relationship with self-management (average $r = -0.46$, $p < .05$), participation, (average $r = -0.43$, $p < .05$) and autonomy (average $r = -0.20$, $p < .05$), suggesting good convergent validity.

Finally, the nomological net for temporal stability included social support, task significance, and external orientation. In general, one would expect that it would take longer to accomplish significant and meaningful work that impacts the external environment, and that the relationships developed as part of that work would be more supportive relative to work conducted and relationships developed over very short time periods (Hollenbeck et al., 2012). Consistent with these expectations, the results (see Table 7c) show positive relationships between temporal stability, on the one hand, with measures of social support (average $r = 0.37$, p

< .05), task significance (average $r = 0.26$, $p < .05$), and external orientation (average $r = 0.23$, $p < .05$), on the other hand, indicating good convergent validity.

Taken as a whole, the significant relationships resulting from the convergent validity analyses provide ample support for the construct validity of the TDI Long Form and TDI Short Form as a measure of skill differentiation, authority differentiation, and temporal stability.

Discriminant Validity with Team Process Measures

Discriminant validity, that is, the extent to which a measure diverges from operationalizations of unrelated constructs, was first assessed in Sample 1 by correlating the TDI Long Form and the TDI Short Form measures with measures of team processes. Although some team processes might naturally flow from some of the team type dimensions, the relationships between team types and team process are not as intrinsic as the relationships one might expect between measures of team types with measures of team design. Correlations between the two TDI forms and all ten team processes described by Mathieu et al. (2007) are presented in Tables 8a and 8b.

A total of 60 correlations resulted from these analyses, and of these correlations, only 16 were significant ($p < .05$) with an average absolute correlation of $r = 0.07$. These results suggest that the TDI Long Form and the TDI Short Form show good discriminant validity with measures of team processes. These analyses were supplemented with Sample 2 by correlating the TDI Short Form with measures from team processes (see Table 8c). Results show the TDI Short Form measures were weakly correlated with all ten team processes, yielding in an absolute average correlation of $r = 0.00$ with none of the 30 resulting correlations being significant ($p < .05$). These results provide evidence for the discriminant validity of the TDI Short Form.

Criterion-related Validity with Team Outcomes and Problems

The criterion-related validity of a measure is established by its correlation with important outcomes or other relevant criteria (Rosenthal & Rosnow, 1991). For the purposes of our validation, team outcomes and team problems served as criterion variables. The assessment of criterion-related validity was conducted first by correlating TDI Long Form and the TDI Short Form measures data from Sample 1 and Sample 2 with three team outcomes: team performance, team satisfaction, and team adaptability. Additionally, regression analysis was used with data collected from Sample 5 to determine the association and account for covariance between 10 common team problems and the three team dimensions as measured by the TDI Short Form.

Results from analyses conducted with Sample 1 (see Table 9a and 9b) show that skill differentiation was significantly correlated with team satisfaction (average $r = 0.19$, $p < .05$) and team adaptability (average $r = 0.24$, $p < .05$). Authority differentiation was significantly but negatively correlated with team performance (average $r = -0.17$, $p < .05$) and team adaptability (average $r = -0.17$, $p < .05$), whereas temporal stability was significantly correlated with team performance (average $r = 0.14$, $p < .05$) and team satisfaction (average $r = 0.31$, $p < .05$). Results from analyses using Sample 2 data provide slightly different results (see Table 9c). Skill differentiation was significantly correlated with team performance and team adaptability, and temporal stability was correlated with team satisfaction.

Table 10 presents the regression results conducted with Sample 5 data. The results of these analyses show that there are strong associations between the 10 most commonly experienced problems among teams and two of the dimensions of the TDI scale as reported by executives. Specifically, teams that were high in skill differentiation seemed to be able to avoid problems associated with members not pulling their own weight, lack of flexibility and indecisiveness, but experienced problems with lack of effort and lack of efficiency. Teams that

were high in temporal stability seemed to be able to avoid problems associated with lack of task knowledge, attrition among the best members and conflict management, but experienced problems associated with lack of understanding on the part of outsiders and a tendency to give up on plans too quickly.

Authority differentiation was not associated with any of the problems reported by this set of executives, but we were able to trace this to the fact that there was restriction in range on this variable for these teams. Sample 5 was composed of upper level business executives, and thus the teams that they led tended to be high and invariant in terms of authority differentiation. To examine this potential alternative explanation, we tested to see if the variance in authority differentiation for Sample 5 differed from our other samples.

To examine this, we conducted an analysis where we compared the variance in authority differentiation with the executive samples with the variance in the undergraduate and MBA samples. We theorized that, because the upper level business executives themselves were the formal leader of their team that their responses would show substantially less variance compared to the MBA and undergraduate samples. We conducted an F-test on the ratio of the variance of the undergraduates or MBA compared to the executives; this significance test is F-distributed with numerator/denominator degrees of freedom equal to $N-1$. In support, both the undergraduate and MBA samples reported significantly higher variance in authority differentiation compared to the executives.

Discussion

The research presented here is the first of its kind in the development of a multi-dimensional scale for describing teams. As an operationalization of the 3DTSM proposed by Hollenbeck et al. (2012), the TDI scales provide a flexible and efficient solution to the problem

encountered when researchers attempt to identify the exact kind of team being studied in their context. In addition, the scales provide a more precise vehicle for testing main and moderating effects associated with the nature of the team, and these effects can be assessed as part of primary empirical research or secondary investigations (meta-analysis).

Most importantly, in terms of future theory development, because the TDI treats the nature of the team in continuous terms, it creates new opportunities for examining the nature of the team as a mediating variable or an outcome variable. Although one can employ categorical variables as dependent variables, this practice is rare, and thus, this state of affairs has not been conducive to conceptualizing the nature of the team as an outcome. In fact, Ilgen et al. (2005) called for a moratorium on research that employs the ubiquitous I-P-O framework because it typecasts certain team-level variables into narrow roles that has restricted theoretical development. The nature of the team is one such variable because it is almost always treated as an “Input,” despite the fact that the basic nature of a team can change over time.

We developed two versions of the TDI; a Long Form, Likert-style scale with 21 items and a Short Form, Thurstone-style scale of 3 items. We found that the TDI Long Form showed high internal consistency reliability, high alternative forms reliability with respect to the TDI Short Form, and high test-retest reliability for the short form. In terms of team member agreement, multiple dimension ratings from people on the same team yielded good intraclass correlation coefficients across samples and dimensions. In addition to demonstrating the reliability of the TDI Long Form and the TDI Short Form, we also confirmed the factor structure for the TDI Long Form and validated the scales across a variety of samples to provide evidence for content validity and criterion-related validity. Factor analysis results support and confirm the three-dimensional factor structure proposed by Hollenbeck et al. (2012) over a one-dimensional

factor structure, and convergent validity analyses lead to the conclusion that each of the dimensions correspond with other appropriate work design measures.

In the spirit of exploratory discovery (Rosenthal & Rosnow, 1991; Nunnally & Bernstein, 1994), criterion-related validity results show that there were many significant relationships between team outcomes and the TDI dimensions. Moreover, the results of our exploration of the TDI dimensions' relationships with the many common problems experienced in team contexts suggest there are some counter-intuitive relationships that need to be further explored. We should stress that the criterion-related validity results for all of the samples here are not in any way intended to be used as a test of some systematic and comprehensive theory that predicts multiple outcomes across different contexts. Rather, they merely reflect the results of our exploration of how the TDI dimensions relate to various team problems experienced by corporate executives who lead teams. Some of these results are intriguing, and perhaps even counter-intuitive, but given the newness of the dimensional approach to describing the nature of teams, at present we do not have the necessary theoretical base to fully explain some of these relationships. Clearly, theoretically-driven extensions that further our understanding of these relationships is needed, and we hope that this work will lead to more top-down, formal theoretical work.

The promising results associated with the construct validity of the TDI were obtained from a very diverse set of samples and contexts – a set that mirrors the diversity of research on teams in general. That is, the samples and contexts included research participants that would comprise laboratory and field settings, participants from multiple cultures, participants working at different hierarchical levels and participants working in different industries on teams of varying sizes. Establishing the reliability and validity of the TDI scales through multiple samples speaks to the external validity of the scales in that they are both accurate and useful in a great

range of contexts. Despite the range of samples, analyses yielded consistent results, thus lending additional credibility to the scales in their overall general usefulness across settings.

Theoretical Implications

The existing categorical systems for measuring team types hinders consensus-building in the teams literature. Rather than coming to agreement about how to describe the nature of different teams, the existence of multiple alternative classification systems and the 42 different team types that emerge from these systems makes it harder to compare results and test the generalizability of theoretical conclusions. In addition, the lack of established consensus makes it tempting for authors to invent their own home-grown team type when no existing team type provides a perfect fit for their context (Hollenbeck et al., 2012), thus making a bad situation even worse.

The TDI scales provides a standardized method of measurement, attached to a specific theoretical framework (the 3DTSM), that assesses teams on continuous scales and allows teams researchers to identify the location of the teams being studied in the conceptual space relative to other teams. As a result, team description becomes a more standardized and manageable process, and both primary and secondary researchers are in a better position for making comparisons and contrasts across studies of teams relative to what can be accomplished with overly subjective team type systems currently in place. Consequently, scholars now are able to describe teams with greater precision than permitted by the categorical team type systems typically employed to identify, describing, and classifying teams.

Additionally, the TDI scales provide guidance on specifying boundary conditions for theories regarding teams. Researchers can turn their attention to identifying how the nature of the team influences the strength and direction of theoretical relationships with greater precision.

Moreover, by plotting each study in the three-dimensional space that can be constructed from the TDI, reviews of the literature can quickly depict where research is abundant and where it is lacking. Each subsequent study within a research stream provides a “plot coordinate” in the research literature and meta-analyses can be conducted to help build consensus in the field.

Also, as noted earlier, use of the continuous TDI scales promotes theoretical development that treats the nature of the team as a dependent variable. The nature of the team is rarely theorized as a dependent variable because of past categorical treatments. The TDI scales developed in this study serve as the solution to this limitation in research on teams; studies exploring how the nature of teams changes over time.

Finally, by providing a continuous scale of measurement for teams, the TDI expands researchers’ pool of research questions with respect to the question of “how” variables are related. The TDI allows researchers to examine curvilinear relationships that could never be theorized based upon categorical data, thus removing another barrier to theoretical development.

Empirical Implications

The potential of the 3DTSM to simplify team measurement for empirical research is supported by the development of the TDI scales. First, regardless of whether the TDI Long Form is used to fully flush out the nature of the team being studied or a brief description of the team is provided through the TDI Short Form, team studies can now have greater precision in when describing teams via these scalar dimensions. The quantitative description about a team provided by the TDI scales also enables visual representations of said teams. Being able to “plot” one’s team in the conceptual space with such exactness and ease is likely to make descriptions of the nature of a team a routine standard in teams research (Hollenbeck et al., 2012), thus greatly increasing the ability to conduct replication studies that extend the knowledge base.

Additionally, entire programs of research on teams can be shown in the conceptual space, which highlights where the empirical base is strong, weak, or nonexistent for various relationships. This can be visually portrayed through the three-coordinate description of teams and thus highlights areas for future research in both laboratory and field settings. As we have demonstrated in the research presented here, the TDI Long Form and TDI Short Form are reliable, valid, and useful in a field setting. Members' ratings of their teams on the three dimensions can be collected, aggregated, and compared. Moreover, researchers interested in how the field environment specific to a team affects its functioning, processes, emergent states, and outcomes can now measure these relationships without restrictions on where in the model the team's nature or type can be placed. The TDI also provides a more precise measurement of a team's nature and allows researchers to make multiple assessments over time, which is especially important in the field where the organic development of a team in real world contexts is often quite complex. The dimensionality of the scales opens avenues for exploring changes in teams and examining teams' growth curves over time.

Practical Implications

Using the TDI scales to pinpoint a team's location in the conceptual space created by the three dimensions of the 3DTSM has significant practical implications for managers in the growing population of organizations that are structuring their employees in teams. Hollenbeck et al. (2012) note how the 3DTSM can be used as a framework for a standardized diagnostic model by which managers are able to precisely locate a team in the conceptual space and then familiarize themselves with potential virtues and liabilities of its location.

The TDI scales also provide managers the necessary diagnostic tool to make strategic decisions about potential changes in team design. That is, in addition to describing the virtues

and liabilities associated with the team's current position, the model can help one anticipate what to expect when moving from one position to another. Since, there are virtues and liabilities associates with alternative team structural designs, practitioners armed with knowledge of the advantages and disadvantages of each team type can be more strategic when it comes to organizational change that can be accomplished via team restructuring.

Finally, the use of the TDI scales by managers in organizations will support research and significantly contribute to the relationship between academia and practice. Scholars and managers will be utilizing the same tool to achieve their respective objectives, allowing for better communication between the two spheres, greater transference of knowledge, and more evidence-based management (Hollenbeck, DeRue & Guzzo, 2004).

Limitations

Despite the strengths and implications of this research, it is not without limitations. First, although there is a great benefit to developing and validating the TDI scales in multiple samples, it is important to consider that all of the samples were collected from only two countries, the U.S. and China. This presents a potential limitation in the ability to further generalize the TDI scales to other countries and cultures. The U.S. and China have different cultural orientations, but both are large, industrialized countries. As Cook and Campbell note, generalizability *to* populations is achieved through formal "random sampling for representativeness," which means that research participants are randomly selected from sole definable population (Cook & Campbell, 1979). This is exceedingly rare in empirical research, and certainly, our research participants are not random samples from their own sub-populations, let alone all humans. Hence, we cannot generalize to any population in the manner described by the "random sampling for representativeness" model.

Instead, we employed what Cook and Campbell (1979) refer to as the “deliberate sampling for heterogeneity” model which adopts a different logic. In order to demonstrate the reliability and validity of the TDI *across* different populations we tried to include samples that differed widely from each other, but at the same time, might serve as research participants in studies that need to describe the nature of their teams (so for example, laboratory studies involving students, top management teams, studies in non-Western work organizations). With this model in mind, we show that the TDI is reliable and valid across a wide variety of teams, such as those composed of undergraduate students with part-time jobs (Sample 1), full-time employees pursuing MBA’s (Sample 2), knowledge-intensive workers (Sample 3), service employees (Sample 4), and high level U.S. executives (Sample 5).

Moreover, we argue that the generalizability of the TDI *across* populations holds greater value than generalizability *to* populations as the intent of the TDI is to measure the variability of teams on skill differentiation, authority differentiation, and temporal stability. By assessing the extent to which these three dimensions are captured with the scales in the TDI in several heterogeneous samples, we demonstrate the TDI’s utility for describing a great variety of teams. Indeed, Cook & Campbell (1979) argued that establishing generalizability *across* smaller samples is more valuable than establishing generalizability *to* one large sample as the latter is often associated with greater threats to internal validity.

Also, although we tried to show fidelity to the 3TDSM, one drawback to that model is that it only captures three dimensions, and hence, errs on the side of parsimony versus comprehensive coverage of all potential dimensions that might be useful for describing teams. As such, our efforts to establish a parsimonious measure grounded in a theoretical framework led us to refrain from including additional dimensions in the TDI. For example, Hollenbeck et al.

(2012) suggested possibly adding a dimension that reflect reward structures (competitive versus cooperative) or physical proximity (face-to-face versus virtual), but we did not pursue those dimensions as part of this effort.

Although this may be viewed as a missed opportunity, we believe that maintaining this parsimony is advantageous for two reasons. First, by only including the three dimensions of the 3TDSM, we were able to support the theory upon which it was developed. The reliability and validity of the TDI forms support the underlying dimensions identified by Hollenbeck et al. (2012) as important and core dimensions upon which teams are described. Second, our three-dimensional approach allows for the depiction of team space in a visual way that becomes complicated once one generates a fourth dimension. The three-dimensional space model also promotes thinking about movement within this space in the form of GPS coordinates that serves as a fitting foil for the subjective team types systems that were closer to navigation by stellar constellations.

Another potential limitation to the research presented here is that, although we have ratings from multiple sources (and over multiple time periods), none of our studies included objective measures or ratings from trained observers. A concern with validating a measure using entirely subjective measures is in the potential to compound systematic error (Nunnally & Bernstein, 1994). All data used in this research was collected using survey measures; there are no objective assessments of any of the TDI scale dimensions and nomological net constructs or trained observer ratings of teams. However, the results of alternative forms reliability and intraclass correlations analyses suggest the TDI scales to be free of common method bias, reducing the concern associated with subjective measures.

Future Research

One potential future direction for scholars would be to further examine the temporal stability dimension of the TDI. Three of the original 8 items generated for assessing temporal stability in the TDI Long Form were dropped during the development of the TDI due to poor internal consistency. The items dropped all reflected issues related to the “flow” of members into and out of the team, either on a permanent or temporary basis. We came into this research believing that temporal stability implied lack of flow, but our actual results call this assumption into question. Our research participants did not seem to associate temporal stability with lack of flow, challenging the natural inclination to assume that a team’s historical membership stability is due strictly to non-permeable boundaries. Future research should examine potential moderators that might explain where, when and with whom, perceived flow does or does not contribute to perceptions of temporal stability.

A second direction for future research would be to utilize the TDI to explore novel research questions made possible by its continuous measures. For example, researchers could investigate the effects changes in a team’s nature over time have on team processes and emergent states. An example of a context for studying this question would be changes in a team’s composition. What, if any, are the differential effects of losing team members, adding team members, or interchanging team members? How would such changes affect the team’s skill-based interdependence, and what effects would those changes subsequently have on team processes? As it is impractical to assume a team will remain compositionally unchanged in its lifetime (Mathieu, Tannenbaum, Donsbach, & Alliger, 2014), this is one promising direction for future researchers to explore by using the TDI.

Alternatively, future researchers may choose to focus on the fit between members, their teams, and contexts by investigating the right balance of skill differentiation, authority

differentiation, and temporal stability for a specific environment. For example, what would be the appropriate level of skill-based interdependence in high-pressure environments, and what are the implications for lack of fit? What effect does differing preferences for decision-making interdependence among team members have on team processes? From the fit literature, we know that such are situations hold important implications for individual and group performance.

Finally, future researchers may want to use the TDI as a springboard for identifying additional dimensions. We suggest that such work be guided by Occam's Razor as the conceptual framework supporting the TDI becomes increasingly complex as additional dimensions are added to it. The utility of the TDI lies in its simplicity; the addition of superfluous dimensions will reduce its practical utility. Additional dimensions should only be added if they significantly enhance the amount of variance explained in team outcomes, processes, emergent states, and outcomes.

For example, researchers hoping to expand the TDI should direct their attention to explaining the counter-intuitive nature of relationships resulting from the TDI's relation with several criteria. Our initial exploration of these relationships is admittedly pre-theoretical, but it demonstrates that skill differentiation and temporal stability explain a large amount of variance in the problems encountered by teams, and thus, may serve as worthwhile target of formal theoretical treatment. Clearly, the directionality of some of these relationships needs further extrapolation, and future research could aim to identify a dimension that could explain these relationships. Moreover, theoretically-driven extensions that further our understanding of these relationships is needed, and we hope that this work will lead to more top-down theoretical work.

Conclusion

The preponderance of conflicting categorical team types has held back progress in the literature on teams, and many researchers have begun to embrace the 3DTSM as a more precise and flexible framework for team description (Aube, Brunelle, & Rousseau, 2013; Eddy et al., 2013; Hu & Liden, 2013; Christian et al., 2012; Park et al., 2013; Evans et al. 2012; Hirschfeld et al., 2013; Zijlstra et al., 2012; Miles & Hollenbeck, 2013; Nahrgang et al., 2013; Jonsen et al., 2013; Vashdi et al., 2013; Liu et al., 2014). Although researchers are increasingly using this framework to describe their teams, at this point, they are all just using subjective judgments to describe their teams on each of the three dimensions. In terms of building a more cumulative research base, it would be better if these subjective judgments could be replaced by standardized measures that would be common across studies. Hopefully, the TDI scales described here can help standardize current team description processes, and set the stage for future research on additional continuous dimensions useful for building and testing theories regarding teams.

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Appendix A

The Team Descriptive Index Long Form

Instructions : Please read each definition carefully and then indicate from each set of statements the **one** statement that **best** describes your team.

Temporal Stability

Definition: The degree to which membership in the team is stable over time and characterized by fixed boundaries making it difficult to join or leave the team. Teams high on this dimension are stable in the long term, and membership does not change often or very easily. Teams low on this dimension are new or unstable, and people are strangers or coming and going so fast it is hard to know who is on the team and who is not.

- 1a. This team had been together for a **very long time** *in the past* (2 years or more).
- 1b. This team had been together for a **long time** *in the past* (1 to 2 years).
- 1c. This team had been together for a **moderate amount of time** *in the past* (1 month to 1 year).
- 1d. This team had been together for a **short amount of time** *in the past* (1 week to 1 month).
- 1e. This team had been together for a **very short amount of time** *in the past* (1 day to 1 week).

- 2a. This team expected to be together for a **very long time** *in the future* (2 years or more).
- 2b. This team expected to be together for a **long time** *in the future* (1 to 2 years).
- 2c. This team expected to be together for a **moderate time** *in the future* (1 month to 1 year).
- 2d. This team expected to be together for a **short time** *in the future* (1 week to 1 month).
- 2e. This team expected to be together for a **very short time** *in the future* (1 day to 1 week).

- 3a. This was an **established team** that worked on *many long term or ongoing projects*.
- 3b. This was an **established team** that worked on *many short term projects*.
- 3c. This was a **new team** that was working on *one long term project*.
- 3d. This was a **new team** that was working on *one short term project*.
- 3e. This was a **new team** that only met once or twice for *one very short term project*.

- 4a. **All** of the team members *knew each other extremely well*.
- 4b. **Most** members of this team *knew each other pretty well*.
- 4c. **Some** members of this team were *familiar with each other*.
- 4d. **Few** team members were *familiar with each other*.
- 4e. **No one** on this team knew anyone else; members of this team were *all total strangers*.

- 5a. **All** of the team members had *strong ties to the same people outside the team*.
- 5b. **Most** team members had *strong ties to the same people outside the team*.
- 5c. **Half** the team members had *strong ties to the same people outside the team*.
- 5d. **Few** team members had *strong ties to the same people outside the team*.
- 5e. **None** of the team members had *strong ties to the same people outside the team*.

Instructions : Please read each definition carefully and then indicate from each set of statements the **one** statement that **best** describes your team.

Authority Differentiation

Definition: The degree to which decision-making responsibility is vested in one individual versus the group as a whole. This dimension deals with power structure, that is, how team decisions are made in the face of disagreement or differences of opinion. Teams high on this dimension have a very strong formal leader relative to other members. Teams that are low on this dimension have team members with basically equal amounts of power.

- 1a. There was one team member who was **formally recognized** as the official *team leader*.
- 1b. There was no official leader but the **same person always emerged** as the informal *team leader*.
- 1c. There was no official leader but the **same small subgroup usually emerged** as informal *team leaders*.
- 1d. There was no official leader and **many different people emerged** as informal *team leaders*.
- 1e. There was no official team leader; and **no one emerged** as an informal *team leader*.

- 2a. The team leader made all of the *team decisions*, **both large and small** decisions.
- 2b. The team leader made all of the large *team decisions*, but **delegated some small** decisions.
- 2c. The team leader made all the large *team decisions* and **delegated almost all the small** decisions.
- 2d. The team leader delegated **some of the large decisions** and **almost all of the small** decisions.
- 2e. There was no leader; the team made *decisions* by **voting or reaching consensus**.

- 3a. The leader *did not seek input* from **anyone** when making decisions.
- 3b. The leader *sought input* from **just one or two** other team member when making decisions.
- 3c. The leader *sought input* from **most, but not all** team members when making decisions.
- 3d. The team leader *sought input* from **all** team members when making decisions.
- 3e. There was no leader; everyone had an **equal amount** of input into team decisions.

- 4a. The leader *never met* with **anyone** prior to making decisions.
- 4b. The leader *met privately*, and **one-on-one** with team members prior to making decisions.
- 4c. The leader *met privately* with **small subgroups** of team members prior to making decisions.
- 4d. The leader *met publically* with **all members** and led a public discussion prior to making decisions.
- 4e. There was no leader; decisions were based on *leaderless public group discussions* among **all members**.

- 5a. The team leader had a **great deal** of *power* in dealing with people outside the team.
- 5b. The team leader had **some** *power* in dealing with people outside the team.
- 5c. The team leader had a **little** *power* in dealing with people outside the team.
- 5d. The team leader had **almost no** *power* in dealing with people outside the team.
- 5e. There was no leader; **no one stood out** as having any more or less *power* outside the team.

- 6a. **No team member** had unique expertise that the team leader needed, but did not possess.
- 6b. **One member** had unique expertise that the leader needed. but did not possess.
- 6c. **A few members** had unique expertise that the leader needed, but did not possess.
- 6d. **Most members** of the team had unique expertise that the leader needed, but did not possess.
- 6e. There was no leader; **every member** of the team had unique expertise that others needed.

- 7a. **Every** member of the team admired the leader.
- 7b. **Most** members of the team admired the leader.
- 7c. **Half** the team members admired the leader.
- 7d. **Few** of the team members admired the leader.
- 7e. There was no leader; **no one stood out** as being admired more than anyone else.

- 8a. The leader could **always** unilaterally add or eliminate someone from the team.
- 8b. The leader could **usually** unilaterally add or eliminate someone from the team.
- 8c. The leader could **sometimes** unilaterally add or eliminate someone from the team.
- 8d. The leader could **rarely** unilaterally add or eliminate anyone from the team.
- 8e. There was no team leader; **no one stood out** in terms of being able to add or eliminate members.

Instructions : Please read each definition carefully and then indicate from each set of statements the **one** statement that **best** describes your team.

Skill Differentiation

Definition: The degree to which members have special knowledge or functional capacities that make it difficult to substitute one member for another. In teams characterized by high skill differentiation, it typically takes a long time to develop the abilities associated with specific roles, and thus people are not easily interchangeable. In contrast, teams that are characterized by low skill differentiation have members who can all substitute for one another such that team members are not bound to one unique role.

- 1a. **All** of the team members had unique skills and so it was impossible to substitute one member for another in terms of skills
- 1b. **Most** of the team members had unique skills and so it was very difficult to substitute one member for another in terms of skills.
- 1c. **Half** of the team members had unique skills and so it was difficult to substitute one member for another in terms of skills.
- 1d. **Very few** of the team members had unique skills and so it was often possible to substitute one member for another in terms of skills.
- 1e. **None** of the members had unique skills and so it was easy to substitute one team member for another in terms of skills.
- 2a. **All** of the team members had specialized training and so it was impossible to substitute one member for another in terms of training.
- 2b. **Most** of the team members had specialized training and so it was very difficult to substitute one member for another in terms of training.

- 2c. **Half** of the team members had specialized training and so it was difficult to substitute one member for another in terms of training.
- 2d. **Few** of the team members had specialized training and so it was often possible to substitute one member for another in terms of training.
- 2e. **None** of the members had specialized training and so it was making to substitute one team member for another in terms of training.
- 3a. **All** of the team members had unique contacts with people outside the team and so it was impossible to substitute one member for another when it came to their contacts.
- 3b. **Most** of the team members had unique contacts with people outside the team and so it was very difficult to substitute one member for another when it came to their contacts.
- 3c. **Half** of the team members had unique contacts with people outside the team and so it was difficult to substitute one member for another when it came to their contacts.
- 3d. **Few** of the team members had unique contacts with people outside the team and so it was often possible to substitute one member for another when it came to their contacts.
- 3e. **None** of the members had unique contacts with people outside the team and so it was easy to substitute one team member for another when it came to their contacts.
- 4a. **All** of the team member had access to unique previous experiences and so it was impossible to substitute one member for another when it came to their experience.
- 4b. **Most** of the team members had unique previous experiences and so it was very difficult to substitute one member for another when it came to their experience.
- 4c. **Half** of the team members had unique previous experiences and so it was difficult to substitute one member for another when it came to their experience.
- 4d. **Few** of the team members had unique previous experiences and so it was often possible to substitute one member for another when it came to their experience
- 4e. **None** of the members had unique previous experiences and so it was easy to substitute one member for another when it came to their experience.
- 5a. **All** of the team member had access to unique tools and equipment and so it was impossible to substitute one member for another in terms of tools and equipment.
- 5b. **Most** of the members had unique access to unique tools and equipment and so it was very difficult to substitute one member for another in terms of tools and equipment.
- 5c. **Half** of the members had unique access to unique tools and equipment and so it was difficult to substitute one member for another in terms of tools and equipment.
- 5d. **Few** of the members had access to unique tools and equipment and so it was often possible to substitute one member for another in terms of tools and equipment.
- 5e. **None** of the members had access to unique tools and equipment and so it was easy to substitute one member for another when it came to tools and equipment.
- 6a. **All** of the team member had a unique demographic profile (age, gender, race, etc.) and so it was impossible to substitute one member for another demographically.
- 6b. **Most** of the team members had a unique demographic profiles (age, gender, race, etc.) and so it was very difficult to substitute one member for another demographically.
- 6c. **Half** of the team members had a unique demographic profiles (age, gender, race, etc.) and so it was difficult to substitute one member for another demographically.

- 6d. **Few** of the team members had a unique *demographic profiles* (age, gender, race, etc.) and so it was often possible to substitute one member for another demographically.
- 6e. **None** of the members had a unique *demographic profiles* (age, gender, race, etc.) and so it was easy to substitute one member for another demographically.
- 7a. **None** of the team members were *cross-trained* on all of the tasks that the team performed and so it was impossible to substitute one team member for another in terms of training.
- 7b. **Few** of the team members were *cross-trained* on all of the tasks that the team performed and so it was very difficult to substitute one team member for another in terms of training.
- 7c. **Half** of the team members were *cross-trained* on all of the tasks that the team performed and so it was difficult to substitute one team member for another in terms of training.
- 7d. **Most** of the team members were *cross-trained* on all of the tasks that the team performed and so it was often possible to substitute one team member for another in terms of training.
- 7e. **All** of the team members were *cross-trained* on all the task the team performed and so it was easy to substitute on team member for another in terms of training.
- 8a. **All** of the team members performed *complex tasks* and so it was impossible to substitute one member for another.
- 8b. **Most** of the team members performed *complex tasks* and so it was very difficult to substitute one member for another.
- 8c. **Half** of the team members performed *complex tasks* and so it was difficult to substitute one team member for another.
- 8d. **Few** of the team members performed *complex tasks*, making it somewhat possible to substitute one member for another.
- 8e. **None** of the team members performed *complex tasks*, making it easy to substitute one member for another.

Appendix B

The Team Descriptive Index Short Form

Instructions : Please read each definition carefully and then select the **single most appropriate** number on the 1 to 9 scale provided that **best** describes your team.

Temporal Stability

Definition: The degree to which membership in the team is stable over time and characterized by fixed boundaries making it difficult to join or leave the team. Teams high on this dimension are stable in the long term, and membership does not change often or very easily. Teams low on this dimension are new or unstable, and people are strangers or coming and going so fast it is hard to know who is on the team and who is not.

9 - High This team had been together for a very long time (e.g., two or more years) and was very likely to be together for a long time into the future (two or more years). Team members were very familiar with each other and the team rarely, if ever, recruited new members.

8

7 This team was likely to have a future together (one to two years), *and* had a history of working together (one to two years). New members were added to the team occasionally, but for the most part, it was the same people all the time.

6

5 - Medium This was a new team that came together to work on a specific, long term project (e.g., six months to one year) with a defined ending. There was no expectation that this team would work together again after this project was completed. There was a main, core set of team members, but new members were sometimes added to do specific temporary tasks.

4

3 This was a new team was working on a specific, short-term project (6 months or less) with a defined ending. There was no expectation that this team would work together again after this project was completed. There were a few core team members, but most people were assigned to the team as part of a temporary assignment.

2

1 - Low This was a short term group that was only going to meet one or two times for a short period (one week or less). People were almost total strangers to one another and did not spend enough time together to really get to know each other.

Instructions : Please read each definition carefully and then select the **single most appropriate** number on the 1 to 9 scale provided that **best** describes your team.

Authority Differentiation

Definition: The degree to which decision-making responsibility is vested in one individual versus the group as a whole. This dimension deals with power structure, that is, how team decisions are made in the face of disagreement or differences of opinion. Teams high on this dimension have a very strong formal leader relative to other members. Teams that are low on this dimension have team members with basically equal amounts of power.

- 9 - High There was one team member who was formally recognized at the official team leader and this person made most, if not all, of the decisions autocratically, often after seeking no input or input from just one or two team members.
8
- 7 There was one team member who was formally recognized at the official team leader, and this person generally sought input from most, but not all team members on decisions and would often delegate decisions.
6
- 5 - Medium The team voted on a leader, and although this person had critical task knowledge and interpersonal skills, they could also be voted out, and so they usually sought input from all the team members prior to making decisions.
4
- 3 There was no formal leader, but one team member almost always emerged as the informal leader most of the time. This person possessed critical task knowledge and interpersonal skills, but sought input from all team members prior to making decisions
2
- 1 - Low There was no real leader, all members had equal amounts of influence and different individuals emerged as leaders at different times depending upon the nature of the task, the nature of the situation, or the schedules of other team members.

Instructions : Please read each definition carefully and then select the **single most appropriate** number on the 1 to 9 scale provided that **best** describes your team.

Skill Differentiation

Definition: The degree to which members have special knowledge or functional capacities that make it difficult to substitute one member for another. In teams characterized by high skill differentiation, it typically takes a long time to develop the abilities associated with specific roles, and thus people are not easily interchangeable. In contrast, teams that are characterized by low skill differentiation have members who can all substitute for one another such that team members are not bound to one unique role.

9 - High Team members had unique skills *and* unique contacts with people inside *and* outside the organization that made it impossible to substitute one member for another.

8

7 Team members had unique skills *or* unique contacts with people inside *or* outside the organization that made it very difficult to substitute one member for another.

6

5 - Medium Team members had a core set of skills and contacts that they all shared, but each person also had some small unique skill and/or set of contacts that made it somewhat difficult to substitute one member for another.

4

3 Team members were fully cross-trained, and although some tasks were complex, almost all team members could do almost all the tasks if the need arose, and thus substitution was usually possible.

2

1 - Low Team members were fully cross trained or the tasks were so simple that even untrained people could perform almost of the tasks almost all of the time. It was easy to substitute one member for another.

Table 1

Structure of Research

Sample	N	Description	Tables	
1	U.S. Undergrads Students ^{1,2,5,6,7,8}	218	Short Form & Long Form Work Design Team Processes Team Outcomes	2 3a 6 7a – 7c 8a – 8b 9a – 9b
2	U.S. MBA Students ^{3,7,8}	166	Test-retest Team Processes Team Outcomes	4 8c 9c
3	Chinese High Tech Company ^{1,2,4,5}	133	Multiple TDI ratings per team	2 3b 5a 6
4	Chinese Public Transportation Company ^{1,2,4,5}	243	Multiple TDI ratings per team	2 3c 5b 6
5	U.S. Executives ⁸	102	Identification of team problems	10

Note. Superscripts denote the analyses conducted with each sample.

1. Internal Consistency Estimates
2. Alternative Forms Reliability
3. Test-Retest Reliability
4. Inter-rater Reliability and Agreement

5. Factor Structure (U.S. and China)
6. Convergent Validity with Team Design Measures
7. Discriminant Validity with Team Processes Measures
8. Criterion-Related Validity with Team Outcomes

Table 2

Internal Consistency Estimates of Reliability for the TDI Long Form

Measure	Sample 1 (N = 218)	Sample 3 (N = 133)	Sample 4 (N = 243)
Skill Differentiation	0.80	0.97	0.85
Authority Differentiation	0.92	0.97	0.94
Temporal Stability	0.77	0.86	0.83

Note. *p < .05 . **p < .01

Table 3a

TDI Alternative Forms Dimension Correlations (Sample 1)

Measures	Mean	S.D.	1	2	3	4	5	6
1 Skill Differentiation (L)	2.80	0.83	-					
2 Authority Differentiation (L)	2.82	1.07	0.17*	-				
3 Temporal Stability (L)	3.30	0.89	0.28**	0.29**	-			
4 Skill Differentiation (S)	5.22	2.03	<u>0.71</u>**	0.11	0.19**	-		
5 Authority Differentiation (S)	6.07	2.57	0.14*	<u>0.84</u>**	0.38**	0.06	-	
6 Temporal Stability (S)	5.24	2.24	0.25	0.30**	<u>0.81</u>**	0.20**	0.40**	-

Note. N = 218. The TDI Short and Long Forms are noted as (S) and (L) respectively.

*p < .05 . **p < .01

Table 3b

TDI Alternative Forms Dimension Correlations (Sample 3)

Measures	Mean	S.D.	1	2	3	4	5	6
1 Skill Differentiation (L)	2.77	1.14	-					
2 Authority Differentiation (L)	3.21	1.17	0.03	-				
3 Temporal Stability (L)	3.50	0.61	0.09	0.07	-			
4 Skill Differentiation (S)	2.66	1.14	<u>0.86</u>**	0.04	0.02	-		
5 Authority Differentiation (S)	3.01	1.07	-0.06	<u>0.79</u>**	0.05	0.01	-	
6 Temporal Stability (S)	3.53	0.81	0.14	0.16	<u>0.67</u>**	0.08	0.11	-

Note. N = 133. The TDI Short and Long Forms are noted as (S) and (L) respectively. Correlations were conducted with HLM.

*p < .05 . **p < .01

Table 3c

TDI Alternative Forms Dimension Correlations (Sample 4)

Measures	Mean	S.D.	1	2	3	4	5	6
1 Skill Differentiation (L)	4.18	0.32	-					
2 Authority Differentiation (L)	3.80	0.81	-0.18*	-				
3 Temporal Stability (L)	4.55	0.43	0.33**	0.06	-			
4 Skill Differentiation (S)	4.14	0.45	<u>0.59</u> **	-0.01	0.12**	-		
5 Authority Differentiation (S)	3.61	0.88	-0.07	<u>0.72</u> **	0.19**	0.04	-	
6 Temporal Stability (S)	4.47	0.49	0.29**	0.08	<u>0.73</u> **	0.14**	0.18**	-

Note. N = 243. The TDI Short and Long Forms are noted as (S) and (L) respectively. Correlations were conducted with HLM.

*p < .05 . **p < .01

Table 4

TDI Short Form Test-Retest Correlations (Sample 2)

Measures	Mean	S.D.	1	2	3	4	5	6
1 Skill Differentiation (T1)	6.02	1.65	-					
2 Authority Differentiation (T1)	6.75	1.93	-0.02	-				
3 Temporal Stability (T1)	5.51	2.07	0.07	-0.04	-			
4 Skill Differentiation (T2)	6.49	1.63	<u>0.69</u>**	0.07	0.05	-		
5 Authority Differentiation (T2)	6.84	1.75	-0.08	<u>0.76</u>**	-0.03	0.03	-	
6 Temporal Stability (T2)	5.73	2.05	-0.03	0.07	<u>0.82</u>**	0.08	0.08	-

Note. N = 166.

*p < .05 . **p < .01

Table 5a

Inter-rater Reliability and Agreement for the TDI Long Form (Sample 3)

Measure	ICC(1)	ICC(2)	$r_{wg(j)}$
Skill Differentiation	0.48	0.79	0.83
Authority Differentiation	0.48	0.79	0.93
Temporal Stability	0.37	0.70	0.90

Note. N = 133 at level 1; N = 32 at level 2.

*p < .05 . **p < .01

Table 5b

Inter-rater Reliability and Agreement for the TDI Long Form (Sample 4)

Measure	ICC(1)	ICC(2)	r _{wg(j)}
Skill Differentiation	0.39	0.90	0.98
Authority Differentiation	0.29	0.85	0.85
Temporal Stability	0.13	0.67	0.96

Note. N = 243 at level 1; N = 18 at level 2.

*p < .05 . **p < .01

Table 6

TDI Factor Structure

Sample	Model	χ^2	<i>df</i>	CFI	SRMR	$\Delta\chi^2, df$
Sample 1 (N = 218)	1-factor	1038	189	0.59	0.16	
	3-factor	410	186	0.90	0.08	628*, 3
Sample 3&4 (N = 376)	1-factor	5354	189	.68	.34	
	3-factor	666	186	.97	.05	4687*, 3

Notes. Due to relatively low ratio of cases to variables in the two Chinese samples they were combined for the purposes of the factor analysis. 1-factor model refers to a single “team structure” factor on which all indicators load. 3-factor model refers to the *a priori* hypothesized factor structure for the TDI. A significant $\Delta\chi^2$ test suggests that the more constrained model causes data misfit and thus the less constrained model is preferred.

*p < .05.

Table 7a

Skill Differentiation Convergent Validity with Design Measures (Sample 1)

Measures	Mean	S.D.	Skill Differentiation (L)	Skill Differentiation (S)
Job Complexity	2.77	0.92	-0.23**	-0.27**
Skill Heterogeneity	3.67	0.88	0.28**	0.30**
Specialization	3.54	0.87	0.32**	0.41**

Note. N = 218. The TDI Short and Long Forms are noted as (S) and (L) respectively.

*p < .05 . **p < .01

Table 7b

Authority Differentiation Convergent Validity with Design Measures (Sample 1)

Measures	Mean	S.D.	Authority Differentiation (L)	Authority Differentiation (S)
Self-Management	3.57	0.96	-0.47**	-0.44**
Participation	3.91	0.90	-0.45**	-0.41**
Autonomy	3.66	0.78	-0.21**	-0.19**

Note. N = 218. The TDI Short and Long Forms are noted as (S) and (L) respectively.

*p < .05 . **p < .01

Table 7c

Temporal Stability Convergent Validity with Design Measures (Sample 1)

Measures	Mean	S.D.	Temporal Stability (L)	Temporal Stability (S)
Social Support	4.40	0.55	0.39**	0.34**
Task Significance	3.20	1.07	0.29**	0.22**
External Orientation	3.09	1.08	0.26**	0.19**

Note. N = 218. The TDI Short and Long Forms are noted as (S) and (L) respectively.

*p < .05 . **p < .01

Table 8a

TDI Long Form Dimensions Discriminant Validity with Process Measures (Sample 1)

Measures	Mean	S.D.	Skill Differentiation	Authority Differentiation	Temporal Stability
Mission Analysis	4.32	0.86	0.25**	0.07	0.04
Goal Specialization	4.32	0.85	0.17*	-0.01	0.13
Strategy Formulation & Planning	4.02	0.85	0.23**	-0.06	0.09
Monitoring Goal Process	4.20	0.91	0.09	0.01	0.03
Systems Monitoring	3.92	1.20	0.20**	0.09	0.16*
Team Monitoring & Backup Behavior	4.40	0.80	0.07	-0.06	0.10
Coordination Activities	4.38	0.83	0.04	-0.10	0.11
Affect Management	4.33	0.86	0.10	-0.04	0.16*
Conflict Management	4.28	0.89	0.07	-0.17*	-0.04
Motivating & Confidence Building	4.45	0.77	0.11	0.07	0.10

Note. N = 218.

*p < .05 . **p < .01

Table 8b

TDI Short Form Dimensions Discriminant Validity with Process Measures (Sample 1)

Measures	Mean	S.D.	Skill Differentiation	Authority Differentiation	Temporal Stability
Mission Analysis	4.32	0.86	0.29**	0.11	0.12
Goal Specialization	4.32	0.85	0.15*	0.01	0.20**
Strategy Formulation & Planning	4.02	0.85	0.21**	-0.02	0.04
Monitoring Goal Process	4.20	0.91	0.10	-0.01	0.10
Systems Monitoring	3.92	1.20	0.23**	0.12	0.19**
Team Monitoring & Backup Behavior	4.40	0.80	0.08	0.01	0.05
Coordination Activities	4.38	0.83	0.08	-0.07	0.13
Affect Management	4.33	0.86	0.08	-0.08	0.13
Conflict Management	4.28	0.89	0.05	-0.17**	0.01
Motivating & Confidence Building	4.45	0.77	0.16*	0.07	0.14*

Note. N = 218.

*p < .05 . **p < .01

Table 8c

TDI Short Form Dimensions Discriminant Validity with Process Measures (Sample 2)

Measures	Mean	S.D.	Skill Differentiation	Authority Differentiation	Temporal Stability
Mission Analysis	2.06	0.89	-0.01	0.07	0.03
Goal Specialization	1.94	0.85	0.01	-0.09	0.07
Strategy Formulation & Planning	2.28	0.96	-0.10	0.03	0.02
Monitoring Goal Process	2.08	1.03	0.06	-0.11	-0.07
Systems Monitoring	2.40	1.13	0.01	-0.06	-0.06
Team Monitoring & Backup Behavior	1.71	0.95	0.09	-0.01	-0.14
Coordination Activities	1.77	0.86	-0.01	0.03	0.02
Affect Management	1.87	0.89	-0.04	0.02	-0.07
Conflict Management	2.07	0.81	-0.07	0.03	0.03
Motivating & Confidence Building	1.82	0.89	-0.10	0.00	0.01

Note. N = 166.

*p < .05 . **p < .01

Table 9a

TDI Long Form Dimensions Criterion-related Validity with Team Outcomes (Sample 1)

Measures	Mean	S.D.	Skill Differentiation	Authority Differentiation	Temporal Stability
Team Performance	4.26	0.48	0.04	-0.17*	-0.13
Team Satisfaction	4.31	0.52	0.19**	0.08	0.33**
Team Adaptability	4.14	0.54	0.28**	-0.18**	-0.04

Note. N = 218.

*p < .05 . **p < .01

Table 9b

TDI Short Form Dimensions Criterion-related Validity with Team Outcomes (Sample 1)

Measures	Mean	S.D.	Skill Differentiation	Authority Differentiation	Temporal Stability
Team Performance	4.26	0.48	0.02	-0.16*	-0.14*
Team Satisfaction	4.31	0.52	0.20**	0.00	0.28**
Team Adaptability	4.14	0.54	0.19**	-0.15*	0.00

Note. N = 218.

*p < .05 . **p < .01

Table 9c

TDI Short Form Dimensions Criterion-related Validity with Team Outcomes (Sample 2)

Measures	Mean	S.D.	Skill Differentiation	Authority Differentiation	Temporal Stability
Team Performance	4.12	0.48	0.19*	0.12	0.03
Team Satisfaction	4.11	0.57	0.11	0.03	0.26**
Team Adaptability	4.02	0.57	0.28**	0.09	0.05

Note. N = 166.

*p < .05 . **p < .01

Table 10

Criterion-Related Validity for Top 10 Team Problems (Sample 5)

Team Problem	TDI Dimension		
	Skill Differentiation (β)	Authority Differentiation (β)	Temporal Stability (β)
The unique and local challenges faced by this group are not understood by top leaders.	-0.07	0.07	0.42**
They lack the knowledge necessary to do the work.	-0.18	-0.05	-0.22*
The best performers wind up leaving the organization.	0.06	0.05	-0.29**
They give up on plans too quickly	0.12	-0.01	0.37**
They are not effective negotiators.	0.12	0.11	-0.26**
They do not seem to give 100% effort every day.	-0.50**	0.01	-0.10
Some members of this group don't pull their own weight in group contexts.	0.39**	0.01	-0.16
They are not flexible.	0.24*	-0.15	0.14
They are too indecisive.	0.26**	-0.08	0.08
They are not efficient.	-0.22*	0.12	0.00
Variance explained (R^2)	0.22**	0.03	0.26**

Notes. N = 102. Regression of the top ten problems that teams face on each of the TDI dimensions for Sample 5. Coefficients represent standardized regression beta.

* $p < .10$. ** $p < .05$

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