JOURNAL OF ORGANIZATIONAL BEHAVIOR, VOL. 19, 235–258 (1998)

# Measuring climate for work group innovation: development and validation of the team climate inventory

NEIL R. ANDERSON[1]* AND MICHAEL A. WEST[2]

[1]*Psychology Department, Goldsmiths College, University of London, London SE14 6NW, U.K.*
[2]*Institute of Work Psychology, University of Sheffield, Sheffield S10 2TN, U.K.*

**Summary** This paper reports the development and psychometric validation of a multi-dimensional measure of facet-specific climate for innovation within groups at work: the Team Climate Inventory (TCI). Brief reviews of the organizational climate and work group innovation literatures are presented initially, and the need for measures of facet-specific climate at the level of the proximal work group asserted. The four-factor theory of facet-specific climate for innovation, which was derived from these reviews, is described, and the procedures used to operationalize this model into the original version measure described. Data attesting to underlying factor structure, internal homogeneity, predictive validity and factor replicability across groups of the summarized measure are presented. An initial sample of 155 individuals from 27 hospital management teams provided data for the exploratory factor analysis of this measure. Responses from 121 further groups in four occupations (35 primary health care teams, 42 social services teams, 20 psychiatric teams and 24 oil company teams; total $N = 971$) were used to apply confirmatory factor analysis techniques. This five-factor, 38-item summarized version demonstrates robust psychometric properties, with acceptable levels of reliability and validity. Potential applications of this measure are described and the implication of these findings for the measurement of proximal work group climate are discussed. © 1998 John Wiley & Sons, Ltd.

*J. Organiz. Behav.* **19**: 235–258 (1998)

## Climate: Definitional Issues

The concept of climate has received considerable attention from applied psychologists and organizational sociologists over the last three decades. Numerous empirical studies have been conducted and regular reviews of the research findings have appeared (the major reviews are

* Addressee for correspondence: Neil Anderson, Goldsmiths College, University of London, New Cross, London SE14 6NW, U.K.
We wish to express our thanks to Edward Buck and Jan Jackson for their assistance in analyzing sections of this data set. Our thanks also to Brenda Poulton, Stephen Kellett, Michael Stead and Tracey Heppleston all of whom assisted with data collection. We would acknowledge Paul Jackson, Toby Wall and Peter Warr for their helpful comments on an earlier draft of this paper.

CCC 0894–3796/98/030235–24$17.50

*Received 18 July 1995*
*Accepted 26 June 1996*

Campbell, Dunnette, Lawler and Weick, 1970; Joyce and Slocum, 1984; Rentsch, 1990; Rousseau, 1988; Schneider and Reichers, 1983; Schneider, 1990). Despite this growth in research interest, climate research has been affected by two intractable and related difficulties: defining the notion of climate, and measuring climate accurately at different levels of analysis.

Many definitions of climate have been put forward, but two approaches in particular have received substantial patronage; the *cognitive schema approach* and the *shared perceptions approach*. The former conceptualizes climate as individuals' constructive representations or cognitive schema of their work environments, and has been operationalized principally through attempts to uncover individuals' sense-making of their proximal work environment (e.g. Ashforth, 1985; James and Jones, 1974; James and Sells, 1981; Schneider and Reichers, 1983). For instance, James and Sells (1981) define climate as 'individuals' cognitive representations of proximal environments . . . expressed in terms of psychological meaning and significance to the individual' (p. 276). Superordinate to this focus at the individual level, other authors have emphasized the importance of shared perceptions as underpinning the notion of climate (e.g. Koys and DeCottis, 1991; Payne, Fineman and Wall, 1976; Uttal, 1983). Thus, Reichers and Schneider (1990) define organizational climate as '. . . the shared perception of the way things are around here. More precisely, climate is shared perceptions of organizational policies, practices, and procedures' (p. 22). The difficulty faced by researchers adopting this approach has been to attain consensus over criteria for minimum levels of agreement sufficient to indicate that perceptions are truly shared amongst members of an organization or organizational subunit (Guion, 1973; Jackofsky and Slocum, 1988; Joyce and Slocum, 1984; Patterson, West and Payne, 1992; Payne, 1990). The *cognitive schema* and the *shared perceptions* approaches are, in principle, compatible with one another and are thus not mutually exclusive. In this study we adopt the latter approach, applying the concept of shared perceptions to the work group level of analysis to develop a measure of proximal work group climate.

Attention has been directed by researchers adopting the shared perceptions approach in defining cut-offs for consensus and interrater agreement between individuals' ratings of climate dimensions indicative of shared perceptions of climate (Dansereau and Alutto, 1990). Despite this increasing focus upon shared perceptions, there has been a paucity of research which has addressed the work group or team as a level of analysis distinct from the wider organization or the individual. Indeed, the concept of 'organization climate' has entered everyday usage, yet the diversity and sheer size of many organizations would suggest a more micro-analytical examination of sharedness at the level of the work group, team or subunit, is warranted.

In this paper we argue that an appropriate level of analysis at which to examine shared perceptions of climate is the proximal work group. Having established this focus, we describe the development of a measure of proximal work group climate designed to elicit team members' perceptions of climatic dimensions hypothesized to relate to one facet of group output—work group innovation.

## Proximal Work Group Climate

We define the proximal work group as either the permanent or semi-permanent team to which individuals are assigned, whom they identify with, and whom they interact with regularly in order to perform work-related tasks. Individuals are likely to identify most closely with their proximal work group and to have commitment to its ongoing social structure, although our conceptualization precludes purely social cliques in the workplace since the prerequisite of task-interdependence is held to be an essential element of our definition. Of course, individuals will commonly be members of more than one group at work, but our attention is specifically upon the group within which their day-to-day tasks and activities at work are carried out. Further, we assert that the proximal work group represents the primary medium through which shared climates will evolve through active social construction and become embedded into the fabric of the organization (Hosking and Anderson, 1992; West, 1995).

For sharedness to even be a possibility, we would argue, demands (a) that individuals interact at work, at least on an infrequent basis, (b) that there exists some common goal or attainable outcome which predisposes individuals toward collective action, and (c) that there is sufficient task interdependence such that individuals need to develop shared understandings and expected patterns of behaviour (see for instance, West, 1995). Importantly, these three criteria represent *necessary* but not *sufficient* conditions for shared climate to exist; even if all are present in a group, it does not necessarily follow that a shared climate will evolve (Schneider and Reichers, 1983). Individuals who identify with their proximal work group and who interact with colleagues are likely to develop shared patterns of understanding and norms of behaviour, thereby allowing the opportunity for a shared climate to evolve (Campion, Medsker and Higgs, 1993). Of course, shared climates may also evolve through other means. Individuals may progress through similar socialization processes and their common experiences lead to shared perceptions. Individuals at different levels in the hierarchy may similarly be exposed to common experiences which lead to shared perceptions of climate. The organizational elite may communicate downwards a common message as to its vision, culture and strategies so powerfully that employees develop shared perceptions to some extent. Thus, sharedness can arise at a variety of strata in the organization and be influenced by a range of factors. Our point is simply that it is most likely that sharedness will evolve where individuals have the opportunity to interact and to co-construct perceptions within their proximal or immediate work environment—their proximal work group (e.g. Hosking and Anderson, 1992). Importantly, then, it becomes necessary to be able to measure such shared climates within groups, and this indeed was the main objective of the current study—to develop and validate a facet-specific measure of proximal work group climate.

It is unlikely, then, that shared climates exist at the overarching level of the organization in its entirety, particularly where the organization is large, divisionalized and multilayered in its formal structure (see also Dansereau and Alutto, 1990). We would argue that it is more justified to search for shared climates within identifiable groups, teams, cliques and cohorts within an organization, where each of the three criteria outlined above may conceivably be met. As agreed previously, individuals are likely to identify with their proximal work group, and moreover, shared patterns of understanding and norms of behaviour are most likely to develop at this level, allowing the opportunity for a shared climate to evolve (Campion *et al*., 1993). For these reasons, this article argues for the utility of the concept of proximal work group climate as an appropriate level of focus and for the need to develop measures specifically at the group level of analysis (see also Anderson and West, 1996).

## Facet Specific or Generalized Climate

Another controversial issue in climate research has been the meaning of the construct itself and its operationalization in applied research. Although definitional specificity has proved to be an elusive goal for climate researchers, much ground has been made recently through attempts to deconstruct the notion of generalized climate into its constituent dimensions or subdomains. These advances stem from Schneider and Reichers' (1983) assertion that it is meaningless to apply the concept of climate without a particular referent (e.g. climate for change, climate for quality, climate for innovation, etc.). Rousseau (1988) argues similarly, and advocates the study of 'facet-specific climates', again referring to climate as a dynamic but intangible aspect of organizational reality. Deconstructing climate as a generic term embracing multiple facets has been a valuable way of clarifying some of the confusion over the precise meaning of the term. Indeed, research into facet-specific climates continues to hold out promise as one route toward overcoming the conceptual-definitional impasse, noted in many of the recent reviews as the critical blockage to climate research (Glick, 1985; Rentsche, 1990; Rousseau, 1988; Schneider, 1985).

There has been growing interest in how particular types of climate (e.g. for innovation or safety) lead to particular types of work group outcomes (e.g. innovativeness or accident avoidance). However, as already noted, this requires that the existence of 'shared climates' can be demonstrated in work groups, and necessarily therefore, that they can be measured with validity and reliability. Moreover, it is as yet unclear whether certain dimensions of climate are predictive of just one facet-specific outcome or numerous outcomes. For instance, high cohesion may be simultaneously associated with greater innovativeness, lower frequency of accidents at work, greater resistance to change, and so forth. Despite a proliferation in recent years of in-house and proprietary climate measures, usually at the organizational level of analysis, there remains a dearth of measures which have been properly validated to demonstrate both consensual and discriminable validity within and across work groups and organizational subunits. Consensual validity has been defined in terms of the shared perceptions approach, a measure having consensual validity if there is sufficient agreement within a team or organizational subunit over perceived climate. Ironically, there is still little consensus amongst researchers over the precise level at which the minimum cut-off for consensual validity should be set. Most measures of climate take the organization as the unit of analysis (see for example, Patterson *et al*., 1992) but there are real concerns about the extent to which agreement on climate perceptions can be demonstrated across the entire organization, characterized by quite disparate subcultures, departments, roles and hierarchical levels.

In terms of intragroup agreement, the James, Demaree and Wolf (1984) within-group interrater agreement statistic, $r_{wg}$, was put forward as a measure of between-rater agreement. James *et al*. (1984) propose the $r_{wg}$ statistic as a measure of agreement for single item scales and a derivative, the $r_{wg(j)}$ statistic for multiple item scales. They argued for a criterion value of 0.70 and above as being indicative of an agreement level sufficient to suggest sharedness. George (1990) used this statistic to determine estimates of within-group interrater agreement for positive and negative affect within 26 work groups. She found an average interrater agreement of 0.87, concluding that it is meaningful to speak of an affective tone of work groups. The $r_{wg(j)}$ statistic has provoked some debate, however. Kozlowski and Hattrup (1992) argue that $r_{wg(j)}$ should only be used as an index of *agreement* and not of *reliability*, whereas Schmidt and Hunter (1989) have criticized the James *et al*. method for not complying to tenets of classical measurement theory. Nevertheless, James and his co-workers have responded constructively to these criticisms, suggesting a slightly modified calculation procedure for $r_{wg(j)}$ and guidelines for its interpretation (James, Demaree and Wolf, 1993). As James *et al*. (1993) argue, there have been so few studies using their statistic in organizational settings that it is premature to draw definitive conclusions over its application (see also Patterson *et al*., 1992).

 

## Work Group Innovation

In common with the literature on organizational climate, the last 30 years have witnessed a burgeoning volume of research into innovation in organizations. This literature is now as vast as it is disparate, with contributions from management scientists, applied sociologists, and organizational psychologists (see for example, Hosking and Anderson, 1992; Kanter, 1983; Pettigrew, 1985; West and Farr, 1990). As an indication of the size of this literature base, reviews by Rogers and Eveland (1978) and Kelly and Kranzberg (1978) cite 2400 and 4000 publications respectively on organizational and technological innovation alone. Recent reviews provide relatively integrated and structured overviews of this research (see Anderson, 1992; Anderson and King, 1993; King and Anderson, 1995; West and Farr, 1990), and so we confine our comments here to briefly acknowledge work group innovation as being the facet-specific construct of interest in the present study. West and Farr, (1989) define innovation as 'the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefit role performance, the group, the organization or the wider society' (p. 16). Comparatively few studies have focused at the level-of-analysis of the work group. This is a notable shortcoming since it is often the case that an innovation is originated and subsequently developed by a team into routinized practice within organizations (West and Farr, 1990; Anderson and King, 1993; King and Anderson, 1995). For example, a management team may initiate changes in organization procedures; a marketing team may modify approaches to advertising product lines; and an assembly team may institute new and improved methods of product manufacture. It is therefore important to address the topic of work group innovation as an outcome in relation to proximal group climate.

To summarize, the present study had the objective of developing a multidimensional measure of proximal work group climate for innovation for use in future research based upon *a priori* deconstructions of group climate, and upon an hypothesized four-factor theory of climate for innovation (West, 1990). The following sections describe the theoretical model and the development and psychometric validation of this measure—the Team Climate Inventory (TCI).

## Development of the Team Climate Inventory (TCI)

### *The four-factor theory*

Previous reviews of research into both climate and innovation (e.g. West and Farr, 1990; West, 1990; Anderson and King, 1993; King and Anderson, 1995) informed the development of a four-factor theory of climate for work group innovation. Reviews of this literature revealed a consistent pattern of climate factors found across studies to be associated with team innovativeness. Summarizing these factors, West (1990) proposed a four-factor model of work group innovation, hypothesizing that four major factors of climate are predictive of innovativeness (see West and Anderson, 1996). This theory is described in detail elsewhere (West, 1990; West and Anderson, 1996); but a brief description of the four factors—*vision*, *participative safety*, *task orientation*, and *support for innovation*—is presented below.

 

**Vision**

'Vision is an idea of a valued outcome which represents a higher order goal and a motivating force at work' (West, 1990, p. 310). Work groups with clearly defined objectives are more likely to develop new goal-appropriate methods of working since their efforts have focus and direction. West (1990) asserts that work group vision has four component parts: clarity, visionary nature, attainability, and sharedness. Clarity refers to the degree to which the vision is readily understandable. Visionary nature depicts the extent to which the vision has a valued outcome to individuals in the group and thus engenders their commitment to group goals. Sharedness refers to the extent to which the vision gains widespread acceptance by individuals within the team. Visions should also be relatively attainable if they are to facilitate innovation, since if the goal cannot be reached, it may either be demotivating or so abstract that practical steps towards its achievement cannot realistically be envisaged.

**Participative safety**

'Participativeness and safety are characterized as a single psychological construct in which the contingencies are such that involvement in decision-making is motivated and reinforced while occurring in an environment which is perceived as interpersonally non-threatening' (West, 1990, p. 311). West proposes that the more people participate in decision-making through having influence, interacting, and sharing information, the more likely they are to invest in the outcomes of those decisions and to offer ideas for new and improved ways of working. The construct of participative safety hence relates to active involvement in group interactions wherein the predominant interpersonal atmosphere is one of non-threatening trust and support. For example, it is argued that participative safety exists where all members of a work group feel able to propose new ideas and problem solutions in a non-judgemental climate (see also Rogers, 1983).

**Task orientation**

'A shared concern with excellence of quality of task performance in relation to shared vision or outcomes, characterized by evaluations, modifications, control systems and critical appraisals' (West, 1990, p. 313). Within groups, the task orientation factor is evidenced by emphasis on individual and team accountability; control systems for evaluating and modifying performance; reflecting upon work methods and team performance; intra-team advice; feedback and cooperation; mutual monitoring; appraisal of performance and ideas; clear outcome criteria; exploration of opposing opinions; constructive controversy (Tjosvold, 1982); and a concern to maximize quality of task performance. This factor hence describes a general commitment to excellence in task performance coupled with a climate which supports the adoption of improvements to established policies, procedures, and methods.

**Support for innovation**

'... the expectation, approval and practical support of attempts to introduce new and improved ways of doing things in the work environment' (West, 1990, p. 38).

Support for innovation varies across teams to the extent that it is both articulated and enacted. West argues that articulated support, by implication, may be found in personnel documents, policy statements, or conveyed by word of mouth. It is argued that a necessary condition for group innovation is enacted support, as opposed to merely articulated support, whereby active support is provided for innovatory behaviour. Daft (1986), for instance, found that resources needed to be made available to develop innovations, whilst Schroeder, Van de Ven, Scrudder and Polley (1989) stressed the importance of support from the power elite for innovation implementation.

To summarize, the four factor model was propounded by West (1990) as a facet-specific theory of climate for work group innovativeness. This paper is primarily concerned, however, with the initial phase of research into West's (1990) model—the development and psychometric validation of a measure of group climate based upon the four-factor theory. The following sections describe the development and validation of this measure—the Team Climate Inventory (TCI)—in some detail. The major predictive validity study testing West's model is presented in West and Anderson (1996).

# Method

## *Item generation*

Initially, an extensive review of published measures of climate was conducted (see also Koys and DeCottis, 1991). These measures were examined for their component subdimensions in relation to the posited four-factor climate model. Only subscales or items appropriate to these factors were retained. Measures were further screened against a level-of-analysis criterion, with those measuring exclusively at the individual or organizational level being rejected. Relatively few items or scales were retained so that most of the items comprising the original version measure were self-generated. This original version comprised of 61 items grouped onto four scales of facet-specific climate. The composition of these subscales is described below.

### Vision

Twelve items elicited information about team members' views on the clarity, sharedness, attainability, and value of team objectives, (see Burningham and West, 1995). Respondents were also asked to indicate the extent to which they felt their team colleagues were in agreement with, and committed to, these objectives. Respondents were asked to indicate the extent to which each statement was true of their team on a 7-point scale ranging, *1=not at all* to *7=completely*, (see Table 1 for a complete list of all items).

### Participative safety

The construct of Participative Safety was subdivided into two components—*team participation* and *safety*.

*Team participation* was measured using 15 items to which respondents were asked to respond on a 5-point *strongly disagree* to *strongly agree* scale. Following Wall and Lischeron (1978), the measure was designed to tap three dimensions of participation: influence over decision making, information sharing, and interaction frequency. Eight of these items were drawn from the Tjosvold, Wedley and Field (1986) scale of constructive controversy and adapted for use in the present study. Responses were on 5-point scales ranging from *1=strongly disagree* to *5=strongly agree*.

*Safety* was measured by nine items asking respondents to indicate the extent of perceived safety in their work group. Again, this was rated on a 5-point response scale ranging from *1=a very little extent* to *5=a very great extent*.

 

**Task orientation**

This concept was also sudbivided into two components—*climate for excellence* and *constructive controversy*.

*Climate for excellence* was measured via a 10-item scale addressing the extent to which team members interacted in order to promote excellence in the team's work (Burningham and West, 1995). The 7-point response scale ranged *1=to a very little extent* to *7=to a very great extent*.

Tjosvold *et al.*'s (1986) concept of *constructive controversy* was used in the study as being conceptually similar to the task orientation construct. Tjosvold *et al.* propose that when controversy is productively discussed, it creates epistemic curiosity that leads to the 'exploration of opposing positions, open-minded consideration and understanding of these positions, and a willingness to integrate these ideas into a high quality, accepted solution' (p. 127). Seven items from the constructive controversy scale were therefore included in the original version TCI. Items were rated on a 5-point response scale from *1=strongly disagree* to *5=strongly agree*.

**Support for innovation**

Four items were taken from Siegel and Kaemmerer's (1978) climate for innovation measure, and four new items were developed to tap enacted support for innovation. Siegel and Kaemmerer's measure was designed to assess organizational level attributes and so items were modified using the word 'team' instead of 'organization'. The enacted support subscale assessed the extent to which time, cooperation, practical support and resources were given by team members to implement new ideas and proposals. Respondents were asked to indicate the extent to which each statement was the true of their team on a 5-point scale ranging from *1=strongly disagree* to *5=strongly agree*.

## *Procedure for validation*

This 61-item, four-scale original version Team Climate Inventory was piloted with 14 nursing teams in a hospital setting and with two hospital management teams prior to use in this main study in order to obtain reactions and comments on the measure (Anderson and Pineros, 1990). No data were collected as part of this pilot; the purpose was simply to evaluate the face validity and acceptability of the TCI to respondents.

Development of the TCI was undertaken as part of a wider-ranging longitudinal study into the relation between facet-specific climate for innovation and the innovativeness of management teams within the British National Health Service (see West and Anderson (1992, 1996) and Anderson, Hardy and West (1990) for detailed reports of this research). The procedure for administering the scale to team members was as follows: the senior management teams of 35 major hospitals in three Regional Health Authorities across the U.K. were approached and invited to participate in the study. Twenty-seven teams agreed to participate, giving a total sample size of 243 individual subjects. Team size ranged between four and 19 members. A typical team consisted of the Unit General Manager, Head of Nursing, Accountant, Personnel Manager, Business Manager, and several Senior Medical Consultants. The 27 hospitals ranged in size from 310 to 4000 employees, and had budgets ranging from £6 million (approx $10 million) per annum to £47 million (approx $80 million) per annum. Each team was visited by a researcher who outlined the research project and the commitment to the research process that would be required from the management team. Batches of the original version measure were sent to all Unit General Managers with a covering letter requesting that they distribute the questionnaires to all members of their team. Individual respondents were provided with a pre-paid, addressed envelope and were instructed to return their completed questionnaire direct to the researchers. All questionnaires were completed anonymously and subjects were assured of the strict confidentiality of responses to the questionnaire.

# Results

Results are presented in order of the analyses undertaken: (i) *exploratory factor analysis*, the sample being 155 managers from the 27 original hospital management teams; (ii) *internal homogeneity*, alpha coefficients for this sample; (iii) *predictive validity*, variance accounted for in independently rated team innovativeness by TCI results across the 27 hospital teams; (iv) *confirmatory factor analysis*, based upon an independent sample of 121 teams from a variety of organizations; and (v) *consensual and discriminable validity* measured by James *et al.* (1993) $r_{wg(j)}$ and interclass correlations (ICC) across all sample groups in this study.

## *Exploratory factor analyses*

A total of 155 questionnaires were returned from the 243 management team members surveyed, giving an overall response rate of 63.7 per cent. Of this sample, all teams provided multiple respondents with the number of respondents ranging between three of four for the smallest team (i.e. 75 per cent response rate) to 11 of 19 for the largest team (i.e. 58 per cent response rate). The latter team, in fact, provided the lowest within-team response across this sample. Initial analysis of between-item correlations on the four scales relating to group climate (vision, participative safety, task orientation and support for innovation) revealed positive and significant associations across several items and therefore highlighted the possibility of an underlying simple structure within the climate subscales. To examine this issue, a series of exploratory factor analyses were computed using the Varimax procedure on SPSS-X. These analyses were computed at the individual level of analysis in accordance with traditional approaches to item analysis and scale development. Items were examined for skewness, kurtosis and intercorrelations at this level prior to running the exploratory factor analysis (Anderson and West, 1996). This strategy of running item analyses on individual level data first was intentional. As Anderson and West (1996) note, examining item statistics at the individual level avoids additional problems of dealing with summed data at the team level. Indeed, combined team-level data can obscure the psychometric characteristics of items by collapsing-down distribution statistics to the team level. Additionally, of course, retaining individual level data at this stage of development of the measure also maximized the sample size, an important consideration in exploratory factor analysis as noted below.

Pre-analysis tests for the suitability of this data set for factor analysis were computed as recommended by Comrey (1978). The Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy was 0.81, and the Bartlett test of sphericity was significant at $p < 0.001$, indicating the suitability of this data for factor analytic procedures. One caveat should be noted at this point. The ratio of cases was 155 : 61, or 2.5 : 1. Whilst it is acknowledged that this ratio is somewhat lower than that recommended by some factor analysts (e.g. Gorsuch, 1983; Nunnally, 1978), others have argued that smaller ratios are acceptable, and alternatively, that the absolute number of cases should be considered as critical (Comrey, 1978; Ferguson, 1981; Kline, 1986). Kline

 

(1986), for instance, argues that a minimum of 100 cases is required. The exploratory factor analysis was thus undertaken at the individual level of analysis, rather than at the group level in order to retain the maximum number of cases.

An initial factor analysis without iteration was computed. The first factor extracted accounted for 34.2 per cent of the variance, and application of the Scree Test (Cattell, 1966) indicated a five-factor solution. All factors held eigenvalues of greater than unity, whilst this five-factor solution accounted for 57.4 per cent of total variance. A further analysis was thus computed limiting the number of factors to five with iteration and Varimax (orthogonal rotation). This solution extracted 61.7 per cent of total variance. The factor loadings, cross-loadings, eigenvalues, and variance statistics are presented in Table 1.

The factor loadings are relatively unambiguous, although some cross-loadings are evident, as discussed below. A total of 38 items load at 0.50 or above onto the five-factor simple structure. Factor I, which accounts for 37.8 per cent of the variance, loads exclusively onto scale items relating to vision (e.g. *How worthwhile do you think these objectives are to you?*; *How worthwhile do you think these objectives are to your team?*; *To what extent do you think members of your team are committed to these objectives?*; *To what extent do you think these objectives are realistic and can be attained?*). This factor is conceptually clear, with 11 items loading from the original vision subscale. Factor I is therefore labelled *vision*.

Factor II comprises eight items from the original participation subscale loading at 0.50 or above. However, four items from this original subscale load onto factor V, indicating a division between these items arising from orthogonal rotation of the factor matrix. The items loading onto factor II all relate to perceptions of a participative climate within the team; perceptions of the degree of information sharing between team members; perceptions of influence over others in decision making; and of interpersonal safety and trust within the team (e.g. *There are real attempts to share information throughout the team*; *We all influence each other*; *People feel understood and accepted by each other*). Conversely, factor V comprises four items relating to the frequency of interaction both formally and informally, between team members (e.g. *We keep in touch with each other as a team*; *We keep in regular contact with each other*; *Members of the team meet frequently to talk both formally and informally*). Consequently, factor V can be conceived as a scale of interaction frequency, whilst factor II is comprised of conceptually distinct items relating to participativeness and interpersonal safety. Factor II is thus titled *participative safety*, and factor V is provisionally labelled *interaction frequency*.

Factors III and IV display unambiguous patterns of item loadings, with factor III comprising exclusively items measuring support for innovation (e.g. *People in this team are always searching for fresh, new ways of looking at problems*; *This team is always moving toward the development of new answers*; *Team members provide practical support for new ideas and their application*). A total of eight items from the original support for innovation subscale load onto Factor III which accounts for a further 6.0 per cent of total variance.

Factor IV is comprised of seven items, all from the original task orientation subscale and adds a further 4.6 per cent of the variance (e.g. *Does your team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome?*; *Does the team continually monitor its own performance in order to achieve the highest standards?*; *Do you and your colleagues monitor each other so as to maintain a high standard of work?*). As items loading onto both factor III and factor IV are drawn exclusively from distinct subscales of the original version measure, the subscale titles are retained from these factors: factor III as *support for innovation*, and factor IV as *task orientation*.

To summarize this five-factor solution, it is apparent that the underlying simple structure displays a fairly unambiguous pattern of item loadings, mostly in line with the postulated model of climate for innovation. Overviewing Table 1, four items display cross-leadings of 0.40 or above. These are items 9 (*How worthwhile do you think these objectives are to the wider society?*), 38 (*People in the team co-operate in order to help develop and apply new ideas*), 47 (*Does the team have clear criteria which members try to meet in order to achieve excellence as a team?*) and 58 (*We keep in touch with each other as a team*). In addition, it should be noted that on all of these items, primary loadings were relatively high (0.59, 0.62, 0.53 and 0.74, respectively). We therefore determined a threshold of 0.50 and above to retain items instead of the more common 0.40 or even 0.30. One caveat regards the original participative safety subscale which, following Varimax rotation of the matrix, is more appropriately represented as two discrete factors—participative safety and interaction frequency, extracted as factors II and V in this solution. The other three factors (factor I: vision, factor II: support for innovation, and factor IV: task orientation) complete this solution which accounts for 61.7 per cent of the total variance. Note that although the original scales contained negatively connotated items, none of these loaded in this factor solution.

## *Internal homogeneity*

More detailed analyses of this solution were undertaken to examine the internal consistency of the factors and factor independence. Table 2 presents means, standard deviations, intercorrelations and Cronbach's alpha coefficients for the five factors as composite scales on this sample of hospital management teams.

Alpha coefficients range between 0.84 and 0.94 indicating acceptable levels of internal homogeneity and reliability for all five factors. This table displays some intriguing results. All scales are significantly and positively intercorrelated ($p < 0.01$). Scale correlations range between 0.35 (interaction frequency with objectives) and 0.62 (task orientation with support for innovation), indicating a strong halo effect across scales. Whilst these correlations are not high enough to give rise to concerns over multicollinearity, they do highlight the possibility that perceptions of climate may be prone to a halo effect. Further research focusing on work groups in different environments is called for to examine this finding in other contexts.

## *Predictive validity*

As previously noted, the development of the Team Climate Inventory was undertaken as part of a longitudinal study testing the validity of the four-factor theory of facet-specific climate for innovation (West and Anderson, 1996). Reports of innovations implemented by the management teams in the 27 hospitals in the 6 months succeeding the administration of the TCI were judged by expert and naive raters on a number of dimensions, including overall innovativeness, number of innovations, radicalness, magnitude, novelty and administrative effectiveness (see West and Anderson, 1996; Anderson and West, 1994). Combined, team level scores on the TCI were used to predict team scores on the dimensions of innovativeness. Support for innovation emerged as the only significant predictor of overall innovation, accounting for a substantial 46 per cent of the variance; and the only predictor of innovation novelty. Participative safety emerged as the best predictor of the number of innovations and team self-reports of innovativeness, while task orientation predicted administrative effectiveness. For a detailed report of these findings and examples of the types of innovations implemented by the management teams see West and

 

Table 1. Varimax-rotated loadings on the five-factor solution

| | Team Climate Inventory (TCI)* items | I Vision | II Participation safety | III Support for innovation | IV Task orientation | V Interaction frequency |
|---|---|---|---|---|---|---|
| 1. | How clear are you about what your teams objective are? (r) | **0.85** | 0.04 | 0.12 | 0.22 | 0.12 |
| 2. | To what extent do you think they are useful and appropriate objectives? (r) | **0.85** | 0.25 | 0.37 | 0.11 | 0.10 |
| 3. | How far are you in agreement with these objectives? (r) | **0.81** | 0.17 | 0.10 | 0.22 | 0.06 |
| 4. | To what extent do you think other team members agree with these objectives? (r) | **0.77** | −0.01 | 0.06 | 0.11 | 0.20 |
| 5. | To what extent do you think your team's objectives are clearly understood by other members of the team? (r) | **0.75** | −0.09 | 0.23 | 0.14 | 0.09 |
| 6. | To what extent do you think your team's objectives can actually be achieved? (r) | **0.74** | 0.10 | 0.17 | 0.18 | 0.07 |
| 7. | How worthwhile do you think these objectives are to you? (r) | **0.74** | 0.26 | 0.24 | 0.18 | 0.01 |
| 8. | How worthwhile do you think these objectives are to the organization? (r) | **0.70** | 0.29 | 0.27 | 0.14 | 0.00 |
| 9. | How worthwhile do you think these objectives are to the wider society? (r) | **0.59** | −0.15 | 0.10 | 0.31 | 0.47 |
| 10. | To what extent do you think these objectives are realistic and can be attained? (r) | **0.55** | 0.32 | 0.30 | 0.10 | −0.09 |
| 11. | To what extent do you think members of your team are committed to these objectives? (r) | **0.54** | 0.31 | 0.27 | 0.22 | −0.05 |
| 12. | How worthwhile do you think these objectives are to your team? | 0.08 | **0.84** | 0.21 | 0.15 | 0.14 |
| 13. | We share information generally in the team rather than keeping it to ourselves (r) | 0.14 | **0.72** | 0.19 | 0.11 | 0.12 |
| 14. | We have a 'we are in it together' attitude (r) | 0.10 | **0.69** | 0.24 | 0.10 | 0.09 |
| 15. | We all influence each other (r) | 0.32 | **0.66** | 0.06 | 0.17 | 0.22 |
| 16. | People keep each other informed about work-related issues in the team (r) | 0.13 | **0.66** | 0.14 | 0.04 | 0.10 |
| 17. | People feel understood and accepted by each other (r) | 0.15 | **0.65** | 0.11 | 0.18 | 0.10 |
| 18. | Everyone's view is listened to even if it is in a minority (r) | 0.01 | **0.64** | 0.06 | 0.20 | 0.17 |
| 19. | There are real attempts to share information throughout the team (r) | 0.06 | **0.62** | 0.18 | 0.20 | 0.11 |
| 20. | There is a lot of give and take (r) | 0.08 | **0.58** | 0.08 | 0.33 | 0.20 |
| 21. | Disagreeing with another's idea is not a rejection of that person | 0.26 | 0.06 | 0.16 | 0.12 | 0.01 |
| 22. | People try to control each other [R] | −0.24 | 0.05 | 0.14 | **−0.55** | 0.24 |
| 23. | We try to blame each other [R] | −0.26 | −0.05 | 0.01 | **−0.60** | 0.14 |
| 24. | How friendly or easy to approach are the people in your team? | **0.61** | 0.04 | −0.11 | 0.38 | 0.09 |
| 25. | To what extent are the members of your team critical of new ideas? [R] | −0.01 | −0.21 | −0.06 | −0.46 | 0.03 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 26. | How threatening do you find putting forward new ideas to the team? [R] | −0.25 | 0.06 | 0.01 | −0.38 | −0.14 |
| 27. | How supportive are the other members of your team? | **0.63** | 0.24 | 0.19 | 0.24 | −0.01 |
| 28. | To what extent is there feeling of trust between members of your team? | 0.34 | 0.21 | 0.20 | 0.41 | 0.16 |
| 29. | To what extent are persons in your team willing to listen to your problems? | 0.32 | 0.24 | 0.11 | 0.27 | 0.27 |
| 30. | To what extent do others foster an atmosphere of non-threatening co-operation amongst members of the team? | 0.39 | 0.19 | 0.12 | 0.41 | −0.11 |
| 31. | To what extent do you feel at ease with the members of your team? | 0.42 | 0.11 | −0.02 | 0.31 | 0.28 |
| 32. | Do other team members have a genuine concern over your personal well-being? | **0.51** | 0.24 | 0.25 | 0.11 | 0.22 |
| 33. | This team is always moving toward the development of new answers (r) | 0.30 | 0.14 | **0.73** | 0.24 | 0.05 |
| 34. | Assistance in developing new ideas is readily available (r) | 0.30 | 0.28 | **0.72** | 0.24 | 0.05 |
| 35. | This team is open and responsive to change (r) | 0.16 | 0.18 | **0.67** | 0.19 | 0.08 |
| 36. | People in this team are always searching for fresh, new ways of looking at problems (r) | 0.20 | 0.14 | **0.63** | 0.33 | 0.17 |
| 37. | In this team we take the time needed to develop new ideas (r) | 0.35 | 0.32 | **0.62** | 0.12 | 0.22 |
| 38. | People in the team co-operate in order to help develop and apply new ideas (r) | 0.40 | 0.13 | **0.62** | 0.11 | 0.15 |
| 39. | Members of the team provide and share resources to help in the application of new ideas (r) | 0.25 | 0.36 | **0.60** | 0.27 | 0.15 |
| 40. | Team members provide practical support for new ideas and their application (r) | 0.21 | 0.30 | **0.56** | 0.20 | 0.19 |
| 41. | Do your team colleagues provide useful ideas and practical help to enable you to do the job to the best of your ability? (r) | 0.17 | 0.22 | 0.06 | **0.79** | 0.06 |
| 42. | Do you and your colleagues monitor each other so as to maintain a higher standard of work? (r) | 0.37 | 0.21 | 0.20 | **0.76** | 0.13 |
| 43. | Are team members prepared to question the basis of what the team is doing? (r) | 0.31 | 0.35 | 0.10 | **0.74** | 0.37 |
| 44. | Does the team critically appraise potential weaknesses in what it is doing in order to achieve the best possible outcome? (r) | 0.31 | 0.03 | 0.23 | **0.69** | 0.08 |
| 45. | Do members of the team build on each other's ideas in order to achieve the best possible outcome? (r) | 0.05 | 0.35 | 0.09 | **0.55** | 0.30 |
| 46. | Is there a real concern among team members that the team should achieve the highest standards of performance? (r) | 0.22 | 0.16 | 0.13 | **0.54** | 0.33 |
| 47. | Does the team have clear criteria which members try to meet in order to achieve excellence as a team? (r) | 0.27 | 0.41 | 0.28 | **0.53** | 0.10 |

*Table 1 continued over page*

Table 1. Continued

| | Team Climate Inventory (TCI)* items | I Vision | II Participation safety | III Support for innovation | IV Task orientation | V Interaction frequency |
|---|---|---|---|---|---|---|
| 48. | Do your team colleagues provide helpful advice and constructive feedback in order to encourage you to do the job to the best of your ability? | 0.41 | 0.33 | 0.29 | 0.13 | 0.23 |
| 49. | Does the team continually monitor its own performance in order to achieve the highest standards? | 0.18 | 0.24 | **0.75** | 0.27 | 0.07 |
| 50. | Does the team continuously evaluate its work in order to improve its effectiveness? | 0.04 | 0.29 | **0.67** | 0.19 | 0.04 |
| 51. | People express their own views fully | 0.39 | 0.21 | 0.14 | 0.22 | 0.45 |
| 52. | We first try to understand the problem fully | 0.30 | 0.18 | 0.25 | 0.41 | 0.19 |
| 53. | People try to win by pushing and keeping their own original views | −0.19 | −0.07 | −0.23 | **−0.66** | 0.00 |
| 54. | We understand the problem before we seek a solution | 0.11 | 0.29 | 0.38 | 0.26 | 0.28 |
| 55. | We seek a solution good and acceptable to all | 0.21 | 0.35 | −0.04 | 0.07 | 0.07 |
| 56. | Opposing views aid in the full consideration of all the issues | 0.13 | 0.12 | 0.38 | 0.03 | 0.24 |
| 57. | All ideas are expressed before we begin to evaluate them | 0.36 | 0.09 | 0.44 | 0.20 | 0.19 |
| 58. | We keep in touch with each other as a team (r) | 0.17 | 0.49 | 0.23 | 0.10 | **0.74** |
| 59. | We keep in regular contact with each other (r) | 0.08 | 0.35 | 0.24 | 0.19 | **0.74** |
| 60. | Members of the team meet frequently to talk both formally and informally (r) | 0.06 | 0.29 | 0.18 | 0.16 | **0.73** |
| 61. | We interact frequently (r) | 0.01 | 0.28 | 0.16 | 0.05 | **0.61** |
| | Eigenvalue | 17.02 | 4.05 | 2.71 | 2.06 | 1.90 |
| | Percentage of variance | 37.80% | 9.00% | 6.00% | 4.60% | 4.20% |

Total Variance Accounted for = 61.7 per cent.
Items loading at or above 0.50 are shown in bold for clarity.
(r), item retained for the short-form version TCI.
[R], reverse scored item.
* © Copyright, Anderson and West/ASE (1994). See also Anderson, N. R. and West, M. A. (1994). *The Team Climate Inventory*, Assessment Services for Employment, NFER-Nelson-Nelson, Darville House, 2 Oxford Road East, Windsor, Berkshire, SL4 1DF, U.K. Research usage of the TCI is permitted. Use for commercial or consultancy purposes is governed by world copyright held by ASE, NFER-Nelson.

Table 2. Descriptive statistics, reliabilities, and intercorrelation matrix for the five-factor solution

| Factor | | Descriptives | | | | Intercorrelation matrix | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | *n* | *n*-items loading at 0.50 | Mean score | *S.D.* | Coefficient alpha | Objectives | Participative safety | Support for innovation | Task orientation |
| I | Vision | 149 | 11 | 59.31 | 10.74 | 0.94 | | | | |
| II | Participative safety | 154 | 8 | 30.32 | 4.87 | 0.89 | 0.46* | | | |
| III | Support for innovation | 153 | 8 | 38.42 | 7.28 | 0.92 | 0.60* | 0.60* | | |
| IV | Task orientation | 153 | 7 | 42.57 | 7.73 | 0.92 | 0.59* | 0.60* | 0.62* | |
| V | Interaction frequency | 154 | 4 | 14.97 | 2.84 | 0.84 | 0.35* | 0.49* | 0.44* | 0.49* |

* $p < 0.01$.

Anderson (1996). Follow-up studies into the predictive validity of this measure further support its utility as a facet-specific scale (e.g. Agrell and Gustafson, 1994; Forrester, 1995). These results suggest the predictive validity of the TCI and provide some support for the theory of work group innovation.

## *Confirmatory factor analysis*

To ensure the robustness of this five-factor solution, a confirmatory factor analysis (CFA) using AMOS version 3.51 (Arbuckle, 1995) was performed. AMOS is a comprehensive text- and graphics-based structural equation modelling and CFA program similar in design to LISREL and EQS. This analysis utilized an independent sample who completed the 38-item, short-form Team Climate Inventory. The questionnaire was administered to three additional samples of work groups: 273 members of 35 primary health care teams; 220 members of 24 management teams in an international oil company, 360 members of 42 social series teams and 118 members of 20 community psychiatric care teams. This confirmatory sample therefore comprised a total of 121 teams (total $N$ individuals = 971).

Initially, individual responses to items were summed within teams to create a group level sum for each item. An intercorrelation matrix was then calculated for these 38 group level variables and this intercorrelation matrix utilized as input data within AMOS. The issue of sample size remains an active debate within the structural equation modelling literature (for detailed recent commentaries, see Brannick, 1995; Kelloway, 1995; Williams, 1995). With smaller samples ($n < 150$) there is a danger of obtaining nonconvergent solutions, even for more highly specified models (Boomsma, 1982; Anderson and Gorbing, 1984). With larger samples ($n > 400$), trivial discrepancies can lead to rejection of a satisfactory model since absolute indices of fit (see below) are prone to influence by sample size (Bollen, 1989; Loehlin, 1992). Two main suggestions and 'rules of thumb' have been proposed in response. First, as Loehlin (1992) states 'As a rough rule of thumb, one would probably do well to be modest in one's statistical claims if $N$ is less than 100'. The sample size for the present study, once data had been combined into team level responses, was 121. Second, nonconvergent solutions have been found to be frequent in CFA samples of less than 150 *with only two observed variables per factor*, (Boomsma, 1982; Anderson and Gorbling, 1984). Here, as described below, we modelled between four and twenty items per factor, and one of our computed models failed to reach convergence. Therefore, although the sample size was reduced substantially by combining individual responses into team level data, the present data set met both of these recommended criteria.

The following procedure was adopted to examine the relationship between different theoretical models (Bentler and Bonnet, 1980; Breckler, 1990; Byrne, 1989; Loehlin, 1992). Firstly, a one factor model with all items loading onto a single factor was run. Next, two, two factor models were run. In each model the first factor contained all the Participation and Support items hypothesized by West (1990) to relate to the *quantity* of innovations generated by teams. The second factor contained all the Task Orientation and Vision items hypothesized by West (1990) to relate to the *quality* of innovations developed by teams. These two models differed in that the first did not allow for any factor inter-correlation (*Two factor (2a)*), whereas the second did allow for factor inter-correlation (*Two factor (2b)*). Next, two, four factor models were run. In these models, the first factor contained all the Vision items, the second all the Participative Safety items, the third all the Support for Innovation items, and the fourth all the Task Orientation items. In these models, the four Interaction Frequency items revealed in the exploratory factor analysis were incorporated into the Participation scale in order to test this factor structure as

 

Table 3. Overall fit indices for the team climate inventory scales

| | Absolute indices | | | | Relative indices | | | Parsimony index |
|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | *df* | $\chi^2/df$ | $\Delta\chi^2$ | TLI | NFI | CFI | PNFI |
| Null model | | 703 | | | | | | |
| One factor | 1966.74 | 665 | 2.96 | | 0.91 | 0.88 | 0.92 | 0.79 |
| Two uncorrelated factors (2a) | 1799.68 | 665 | 2.71 | 167.06 | 0.92 | 0.89 | 0.93 | 0.80 |
| Two correlated factors (2b) | 1714.04 | 664 | 2.58 | 85.64 | 0.93 | 0.90 | 0.93 | 0.81 |
| Four uncorrelated factors (4a) | 1650.50 | 665 | 2.48 | 63.54 | 0.93 | 0.90 | 0.94 | 0.81 |
| Four correlated factors (4b) | 1406.82 | 659 | 2.13 | 243.68 | 0.95 | 0.92 | 0.95 | 0.81 |
| Five uncorrelated factors (5a) | 1569.94 | 665 | 2.36 | (163.12) | 0.94 | 0.91 | 0.94 | 0.81 |
| Five correlated factors (5b) | 1286.93 | 655 | 1.96 | 283.01 | 0.96 | 0.92 | 0.96 | 0.82 |

*N*, 121 teams for all models.
TLI, Tucker Lewis Index; NFI, Normed Fit Index; CFI, Normed Noncentrality Fit Index; PNFI, Parsimonious Normed-Fit Index.

originally hypothesized by West (1990). Again, these models differed with regard to factor intercorrelations; the first did not allow for factor intercorrelation (*four-factor (4a)*) whereas the second did (*four-factor (4b)*). Finally, two, five-factor models were run extracting the interaction frequency scale as a separate fifth scale, again one allowing the factors to intercorrelate and the other not. See Bollen (1989); Byrne (1989), and Loehlin (1992) for general introductions and overviews of these procedures. Table 3 displays the CFA results and reports absolute, relative and parsimonious indices of fit to comprehensively evaluate the fit of the different models computed. The change in chi-square illustrates the incremental improvement achieved by each successive model (Bentler and Bonnett, 1980; Bollen, 1989). The ratio of chi-square to degrees of freedom ($\chi^2/df$) is also given, with ratios of less than 2.0 indicating a good fit. However, since absolute indices can be adversely affected by sample size (Byrne, 1989; Loehlin, 1992), three relative indices (TLI, NFI, and CFI) together with the Parsimonious Normed-Fit Index were computed and provide a more robust evaluation of model fit (e.g. Tucker and Lewis, 1973; Byrne, 1989). For the TLI, NFI and CFI, coefficients close to unity indicate a good fit, with acceptable levels of fit being above 0.90 (Marsh, Balla and MacDonald, 1988; Mulaik, James, Van Alstine, Bennett, Lind and Stilwell, 1989). The PNFI takes the degrees of freedom for a specified model into account and so, for models involving larger numbers of observed and unobserved variables, the PNFI value will often be lower than those obtained for relative indices (Mulaik *et al.*, 1989; Loehlin, 1992).

The results indicate that the five correlated factors model (model 5b) has the most parsimonious fit, with the TLI suggesting that this model accounts for 96 per cent of the variance (TLI $= 0.96$; $\chi^2/df = 1.96$). Further, the $\chi^2$ to degrees of freedom ratio is below 2.0, again suggesting acceptable fit for this model. The NFI and CFI are also above 0.90 for this model. Although this five-factor correlated model possesses the most robust fit statistics of all models tested, it should be noted that for only two models, the one factor model and the two uncorrelated factors model, the NFI fell marginally below acceptable levels (NFI $= 0.88$ and 0.89, respectively). However, the change in chi-square figures indicate an improvement for each successive model computed, apart from the five uncorrelated factors model (model 5a) over the four-correlated factors model (model 4b) where the chi-square increased rather than decreased.

Indeed, the four-correlated factors model is only marginally less parsimonious than the five-correlated factors model, although the chi-square to degrees of freedom ratio would suggest the latter to possess better fit (model 4b: $\chi^2/df = 2.13$; model 5b; $\chi^2/df = 1.96$). Both models are acceptable, however, and the differences in fit too small to permit conclusive distinctions being drawn between these two correlated factors models. This point is considered further in the Discussion. However, in order to maximize the predictive utility of the measure we elected to employ the five-factor solution in further analyses.

### *Consensual and discriminable climates*

We noted earlier the issue of whether shared climates can be claimed to exist within organizations and that previous researchers have drawn attention to the problem of determining criteria for minimum levels of agreement. Using the James *et al.* (1984) formula we calculated the $r_{wg(j)}$ and inter-class correlation (ICC) statistics for the groups in the five samples (National Health Service hospital management teams, oil company teams, community psychiatric teams, primary health care teams and social services teams) across the five scales. For four of the five scales distributions revealed no significant skew. However, the vision scale was negatively skewed and so the James *et al.* (1984) procedure for employing an expected variance to take account of this skew was followed. Table 4 shows that the average $r_{wg(j)}$ within each of the five samples across the five Team Climate Inventory scales ranged from 0.67 through to 0.98 with only one out of the 25 values falling below the 0.7 level used by George (1990) and by Nunally (1978) as an acceptable level for internal consistency. These results suggest that the measure is consistently tapping shared climate perceptions, rather than aggregating radically diverse individual perceptions.

However, it is also important to demonstrate differences between groups to determine the discriminant power of any climate instrument (Rousseau, 1988). One-way ANOVAS on the aggregate variables were therefore performed within each of the five samples. Hays (1981) suggests that minimum evidence for differences across groups would be an $F$ ratio from an ANOVA greater than 1.00. The results in Table 4 show that on all but one of the scale scores across all of the samples, the ANOVAS produce $F$ ratios greater than unity. Moreover, in all but three out of 25 cases, the $F$ value is statistically significant ($p < 0.05$). This indicates that the measure distinguished between different groups and thus possessed adequate discriminable, as well as consensual, validity.

## Discussion

This paper has described the development of the Team Climate Inventory for measuring an important aspect of facet-specific work group climate—climate for innovation. Evidence of the factor structure of the measure has been provided, based both on exploratory and confirmatory factor analyses. Evidence is also given about the internal homogeneity and reliability of the scales and their predictive validity. Finally, consensus amongst teams in relation to team climate is demonstrated, both within and across samples in relation to the five dimensions of the TCI. These analyses provide initial support for the utility of the measure as a self-report measure of facet-specific climate within work groups and organizational teams.

Rousseau (1988) has argued for the development of facet-specific measures of climate and our data show that it does indeed make sense to develop measures of climate which are facet-specific. Our data also show that the level of agreement about climate is considerably greater than that for

 

Table 4. Team scores and mean indices of concensus on the five climate factors

| | Vision | | | | | Participative safety | | | | | Support for innovation | | | | | Task orientation | | | | | Interaction frequency | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *X* | *S.D.* | *ICC* | *F* | $r_{wg(j)}$ | *X* | *S.D.* | *ICC* | *F* | $r_{wg(j)}$ | *X* | *S.D.* | *ICC* | *F* | $r_{wg(j)}$ | *X* | *S.D.* | *ICC* | *F* | $r_{wg(j)}$ | *X* | *S.D.* | *ICC* | *F* | $r_{wg(j)}$ |
| 27 NHS teams | 5.84 | 1.06 | 0.040 | 1.11 | 0.84 | 3.79 | 0.62 | 0.003 | 0.40 | 0.91 | 4.81 | 0.91 | 0.035 | 1.80* | 0.70 | 4.51 | 1.09 | 0.026 | 1.64* | 0.82 | 3.77 | 0.59 | 0.067 | 2.72* | 0.93 |
| 35 primary care teams | 4.84 | 1.13 | 0.027 | 1.96* | 0.90 | 3.59 | 0.69 | 0.04 | 2.50* | 0.89 | 3.95 | 0.71 | 0.038 | 0.28* | 0.92 | 4.20 | 1.34 | 0.022 | 1.78* | 0.81 | 3.49 | 0.77 | 0.032 | 2.14* | 0.90 |
| 42 social services teams | 5.10 | 1.12 | 0.017 | 1.71 | 0.85 | 3.71 | 0.65 | 0.04 | 2.28* | 0.91 | 3.57 | 0.71 | 0.05 | 3.29* | 0.93 | 4.79 | 1.28 | 0.02 | 2.00* | 0.75 | 3.74 | 0.66 | 0.04 | 2.95* | 0.92 |
| 20 psychiatric teams | 5.27 | 1.05 | 0.120 | 3.68* | 0.67 | 3.93 | 0.65 | 0.100 | 3.34* | 0.98 | 3.62 | 0.63 | 0.130 | 3.95* | 0.92 | 5.77 | 1.28 | 0.060 | 2.35* | 0.85 | 4.16 | 0.56 | 0.100 | 3.14* | 0.94 |
| 24 oil co. teams | 5.33 | 0.90 | 0.047 | 2.19* | 0.97 | 3.84 | 1.37 | 0.160 | 5.57* | 0.92 | 4.40 | 1.03 | 0.126 | 4.47* | 0.72 | 4.75 | 0.94 | 0.099 | 3.65* | 0.70 | 3.84 | 0.72 | 0.067 | 5.54* | 0.92 |
| 148 teams overall | 5.26 | 1.05 | 0.050 | 2.13* | 0.85 | 3.77 | 0.80 | 0.060 | 2.82* | 0.92 | 4.07 | 0.80 | 0.060 | 3.18* | 0.84 | 4.80 | 1.19 | 0.050 | 2.28* | 0.79 | 3.80 | 0.68 | 0.060 | 3.30* | 0.92 |

* $p < 0.05$.

measures which are less facet-specific (for example, see Patterson *et al*., 1992). This conclusion is amply illustrated by the finding that broad measures of team level cohesion are not particularly useful for predicting team outcomes, since cohesion can serve a variety of purposes for groups (Schroder, 1990). Our examination of climates for innovation indicates that by focusing on a specific aspect of climate and its relationship to specific aspects of group level outcomes, greater predictive accuracy is achieved. These findings noted, we would also acknowledge that the dimensions comprising the TCI may correlate with other types of group level outcome. For instance, higher scale scores on task orientation may correlate with overall group productivity since team members are constantly appraising each others' performance; higher scores on participative safety may predict strong group cohesiveness which, in turn, may be suggestive of higher levels of resistance to change imposed from above upon the group (King and Anderson, 1995); and, group scores on the vision scale may be predictive of double-loop learning in the group since team members are continuously questioning the relevance of their goals and objectives. The point is that the facet-specific nature of any multidimensional climate scale is likely to be mediated by a wider nomological net of relations between climate dimensions and various group level outputs. The TCI was originally operationalized and developed as a facet-specific measure of climate for innovations; it is likely in addition to be useful in measuring climate dimensions predictive of other types of group output, but further research is called for to examine this issue.

Another reason why the TCI appears to produce high levels of consensus amongst team members is because of its focus on the proximal work group. Most previous measures of climate have evaluated organizations as a whole where there may be considerably more variation in perceptions of the work environment, and where, as Payne (1990) has argued, there is less likelihood of social interaction leading to shared meanings. As noted earlier in this paper, it may well be that the proximal work group represents one of several examples within organizations where consensual climates can be readily identified. Other possibilities include those occupying similar roles at identical hierarchial levels within the organization, individuals having progressed through a standardized socialization procedure into the organization, or the downward communication of organizational vision which is accepted by those lower down the organization hierarchy.

One issue which arose from the analyses undertaken in this study concerns the factor structure of the TCI, and specifically, whether a four- or a five-factor structure represents the measure most parsimoniously. West (1990) proposed a four-factor theory as his model of facet-specific climate in work groups. Agrell and Gustafson (1994), in a study using a Swedish translated version of the original measure, conducted an exploratory factor analysis with Varimax rotation on data for 124 respondents comprising 16 work teams. This indicated a four-factor solution which accounted for 54 per cent of the total variance. Conversely, in the present study, the exploratory factor analysis conducted on the data from 27 hospital management teams suggested a five-factor solution; the difference being the separation out of four items from the original participation scale relating specifically to interaction frequency within the team. The confirmatory factor analysis subsequently undertaken on a different sample of 121 teams suggested both the four-factor and the five-factor solutions were acceptable in terms of goodness of fit statistics, but that the five-factor intercorrelated model demonstrated the most parsimonious fit. As the items comprising the fifth factor are conceptually distinct, this scale is likely to have incremental value either as a subscale within the participation scale, or as a separate factor. Further research into this aspect of the psychometric structure of the TCI is thus called for.

The extent to which it is possible to assume the existence of climates within teams was also examined in this study. The data suggest that discriminable climates do exist within teams, since there is evidence of greater variation between, than within, teams. However, there is a need to more precisely address the level of agreement within teams, as well as examining the differences between them. Our findings indicate that there is a good deal of agreement about the dimensions of climate within teams although, perhaps not surprisingly, there is variation in level of agreement both across teams within samples and within teams across particular dimensions. In the current study, the extent of agreement within teams varied across dimensions, the evidence suggesting that there was most agreement in relation to the participative safety scale and least agreement in relation to the task orientation scale (see Table 4). Moreover, in comparing across teams within any one sample, it is clear that agreement on any particular climate dimension can vary considerably and in ways which are not immediately predictable. Clearly, agreement on dimensions of climate can itself be used as an important defining characteristic of groups. Future research might usefully examine the question of why particular dimensions produce more or less agreement, and whether these variations occur in consistent ways across teams.

At a more pragmatic level, the 38-item TCI provides an accessible and easily administered measure of team climate for innovation (Anderson and West, 1994). Its potential for use in settings such as organizational climate surveys, team building and development, selection of new members into groups, and group development over time, should be noted. Practitioners and consultants in the field now face a bewildering choice of psychometric measures, but few have been conceived of, and validated, specifically at the group level of analysis. In conclusion, the TCI holds promise as a measure of group climate in organizations, and for team building and organization development interventions. Further research is needed to investigate the potential of the TCI as a measure of team climate in such a variety of contexts and applications.

## References


Abbey, A. and Dickson, J. W. (1983). 'R & D work: Climate and innovations in semiconductors', *Academy of Management Journal*, **26**, 362–368.

Agrell, A. and Gustafson, R. (1994). 'The Team Climate Inventory and group innovation: A psychometric test on a Swedish sample of work groups', *Journal of Occupational and Organizational Psychology*, **67**, 143–151.

Anderson, J. and Gorbing, D. W. (1984). 'The effects of sampling error on convergence, improper solutions and goodness-of-fit indices for maximum likelihood confirmatory factor analysis', *Psychometrics*, **49**, 155–173.

Anderson, N. R. (1992). 'Work group innovation: A state-of-the-art review'. In: Hosking, D. M. and Anderson, N. R. (Eds) *Organizational Change and Innovation: Psychological Perspectives and Practices in Europe*, Routledge, London, pp. 127–138.

Anderson, N. R. and King, N. (1993). *Innovation in Organizations*. In: Cooper, C. L. and Robertson, I. T. (Eds) *International Review of Industrial Organizational Psychology*, Vol. 8, Wiley, Chichester, pp. 1–33.

Anderson, N. R. and Pineros, C. (1990). 'Innovation in nursing teams: SAPU Memo Number 1004', Unpublished manuscript, MRC/ESRC Social & Applied Psychology Unit, University of Sheffield, U.K.

Anderson, N. R. and West, M. A. (1994). *The Team Climate Inventory. Manual and Users' Guide*, Assessment Services for Employment, NFER-Nelson, Windsor, U.K.

Anderson, N. R. and West, M. A. (1996). 'The Team Climate Inventory: The development of the TCI and its applications in teambuilding for innovativeness', *European Journal of Work and Organizational Psychology*, **5**, 53–66.

Anderson, N. R., Hardy, G. and West, M. A. (1990, September). 'Innovative teams at work', *Personnel Management*, 48–53.

Arbuckle, J. L. (1995). *AMOS 3.5 for Windows*, Small Waters Corporation, Chicago, Il.


 

Ashforth, B. E. (1985). 'Climate formation: Issues and extensions', *Academy of Management Review*, **4**, 837–847.
Bentler, P. and Bonnett, D. (1980). 'Significance tests and goodness of fit in the analysis of covariance structures', *Psychological Bulletin*, **88**, 588–606.
Bollen, K. A. (1989). *Structural Equations with Latent Variables*, Wiley, New York.
Boomsma, A. (1982). 'The robustness of LISTREL against small sample sizes in factor analysis models. In: Joreskog, K. G. and Wold, H. (Eds) *Systems Under Indirect Observation, Part I*, North-Holland, Amsterdam, pp. 149–173.
Brannick, M. T. (1995). 'Critical comments on applying covariance structure modelling', *Journal of Organizational Behavior*, **16**, 201–213.
Breckler, S. (1990). 'Applications of covariance structure modelling in psychology: cause for concern?' *Psychological Bulletin*, **107**, 260–273.
Burningham and West (1995). 'Individual climate, and group interaction processes as predictors of work team innovation', *Small Group Research*, **26**, 106–117.
Byrne, B. (1989). *A Primer of LISREL: Basic Applications and Programming for Confirmatory Factor Analytic Models*, Springer-Verlag, Berlin.
Campbell, J. P., Dunnette, M. D., Lawler, E. F. and Weick, K. E. (1970). *Managerial Behaviour, Performance and Effectiveness*, McGraw Hill, New York.
Campion, M. A., Medsker, G. J. and Higgs, A. C. (1993). 'Relations between work group characteristics and effectiveness: Implications for designing effective work groups', *Personnel Psychology*, **46**, 823–850.
Cattell, R. B. (1966). 'The scree test for the number of factors', *Multivariate Behavioral Research*, **1**, 140–161.
Comrey, A. (1978). 'Common methodological problems in factor analytical studies', *Journal of Clinical & Consulting Psychology*, **46**, 648–659.
Daft, R. L. (1986). 'A dual-core model of organization innovation', *Academy of Management Journal*, **21**, 193–210.
Dansereau, F. and Alutto, J. A. (1990). 'Level-of-analysis issues in climate and culture research', In: Schreider, B. (Ed.) *Organizational Climate and Culture*, Jossey Bass, San Francisco, pp. 193–236.
Ferguson, G. A. (1981). *Statistical Analysis in Psychology and Education*, McGraw Hill, New York.
Forrester, R. H. (1991). 'Team climate and innovation: An empirical study'. Paper presented at the Fourth European Congress of Psychology, Athens, July 1995.
George, J. (1990). 'Personality, affect and behavior in groups'. *Journal of Applied Psychology*, **75**, 107–116.
Glick, W. H. (1985). 'Conceptualising and measuring organizational and psychological climate: Pitfalls in multi-level research', *Academy of Management Review*, **10**, 601–616.
Gorsuch, R. (1983). *Factor Analysis*, Lawrence Erlbaum Associates, London.
Guion, R. M. (1973). 'A note on organizational climate', *Organizational Behavior and Human Performance*, **9**, 120–125.
Hays, W. L. (1981). *Statistics*. Rinehart and Winston, New York.
Hosking, D. M. and Anderson, N. R. (Eds) (1992). *Organizational Change and Innovation: Psychological Perspectives and Practices in Europe*, Routledge, London.
Jackofsky, E. F. and Slocum Jr, J. W. (1988). 'A longitudinal study of climate', *Journal of Organizational Behavior*, **8**, 319–334.
James, L. R. and Jones, A. P. (1974). 'Organizational climate: A review of theory and research', *Psychological Bulletin*, **81**, 1096–1112.
James, L. R. and Sells, S. B. (1981). 'Psychological climate: Theoretical perspectives and empirical research'. In: Magnusson, D. (Ed.) *Toward a Psychology of Situations. An International Perspective*, Erlbaum, Hillsdale, NJ, pp. 275–295.
James, L. R., Demaree, R. G. and Wolf, G. (1984). 'Estimating within-group interrater reliability with and without response bias', *Journal of Applied Psychology*, **69**, 85–98.
James, L. R., Demaree, R. G. and Wolf, G. (1993). '$r_{wg}$: An assessment of within-group interrater agreement', *Journal of Applied Psychology*, **78**, 306–309.
Joyce, W. F. and Slocum, D. (1984). 'Collective climate: Agreement as a basis for defining aggregate climates in organizations', *Academy of Management Journal*, **27**, 721–742.
Jorsekog, K. and Sorbom, D. (1984). *LISREL VI: Analysis of Linear Structural Relationships by Maximum Likelihood, Instrumental Variables and Leasts Squares Methods*, 3rd edn, Department of Statistics, University of Uppsala, Sweden.
Kanter, R. M. (1983). *The Change Masters: Corporate Entrepreneurs at Work*. Allen & Unwin, London.

 

Kelloway, E. K. (1995). 'Structural equation modelling in perspective', *Journal of Organizational Behavior*, **16**, 215–224.

Kelly, P. and Kranzberg, M. (Eds) (1978). *Technological Innovation: A Critical Review of Current Knowledge*, San Francisco Press, San Francisco.

King, N. and Anderson, N. R. (1995). *Innovation and Change in Organizations*, Routledge, London.

Kline, P. (1986). *A Handbook of Test Construction: Introduction to Psychometric Design*, Methuen, London.

Koys, D. J. and DeCottis (1991). 'Inductive measures of psychological climate', *Human Relations*, **44**, 265–285.

Kozlowski, S. W. J. and Hattrup, K. (1992). 'A disagreement about within-group agreement: Disentangling issues of consistency versus consensus', *Journal of Applied Psychology*, **77**, 161–167.

Loehlin, J. (1992). *Latent Variables Models*, Erlbaum, Hillside, N.J.

Long, J. (1983). *Confirmatory Factor Analysis*, Sage, Beverley Hills, California.

Marsh, H., Balla, J. and MacDonald, R. (1988). 'Goodness-of-fit in confirmatory factor analysis: The effect of sample size', *Psychological Bulletin*, **103**, 391–410.

Mulaik, S., James, L., Van Alstine, J., Bennett, N., Lind, S. and Stilwell, C. (1989). 'Evaluation of goodness-of-fit indices for structural equation models', *Psychological Bulletin*, **105**, 430–445.

Nunnally, J. C. (1978). *Psychometric Theory*, McGraw Hill, New York.

Patterson, M., West, M. A. and Payne, R. L. (1992). 'Collective climates: A test of their socio-psychological significance', Paper presented at the Academy of Management Conference, Los Angeles, 1992.

Payne, R. L. (1990). 'Madness in our method: A comment on Jackofsky and Slocum's paper 'A longitudinal study of climates'. *Journal of Organizational Behavior*, **11**, 77–80.

Payne, R. L., Fineman, S. and Wall, T. D. (1976). 'Organizational climate and job satisfaction: A conceptual synthesis', *Organizational Behaviour and Human Performance'*, **16**, 45–62.

Pettigrew, A. (1985). *The Awakening Giant: Continuity and Change in ICI*, Blackwell, Oxford.

Pritchard, R. D. and Karasick, B. W. (1973). The effects of organizational climate on managerial job performance and job satisfaction', *Organizational Behavior and Human Performance*, **9**, 126–146.

Reichers, A. E. and Schneider, B. (1990). 'Climate and culture: An evolution of constructs'. In: Schneider, B. (Ed.) *Organizational Climate and Culture*, Jossey-Bass, San Francisco.

Rentsch, J. (1990). 'Climate and culture: interaction and qualitative differences in organizational meanings', *Journal of Applied Psychology*, **75**, 668–681.

Rogers, E. M. (1983). *Diffusion of Innovations*, The Free Press, New York.

Rogers, E. M. and Eveland, J. D. (1978). 'Diffusion of innovation perspectives on national R&D assessment: Communication and innovation in organizations'. In: Kelly, P. and Kranzberg, M. (Eds) *Technological Innovation: A Critical Review of Current Knowledge*, San Francisco Press, San Francisco.

Rousseau, D. M. (1988). 'The construction of climate in organization research'. In: Cooper, C. L. and Robertson, I. T. (Eds) *International Review of Industrial and Organizational Psychology*, Vol. 3, Wiley, Chichester, pp. 139–159.

Schmidt, F. L. and Hunter, J. E. (1989). 'Interrater reliability coefficients cannot be computed when only one stimulus is rated', *Journal of Applied Psychology*, **74**, 368–370.

Schneider, B. (Ed.) (1985). 'Organizational behavior', *Annual Review of Psychology*, **36**, 573–611.

Schneider, B. (1990). 'The climate for service: An application of the climate construct'. In: Schneider, B. (Ed.) *Organizational Climate and Culture*, Jossey Bass, San Francisco, pp. 383–412.

Schneider, B. and Reichers, A. E. (1983). 'On the etiology of climates', *Personnel Psychology*, **36**, 19–39.

Schroder, B. (Ed.) (1990). *Organizational Climate and Culture*, Jossey Bass, San Francisco.

Schroeder, R. G., Van de Ven, A. H., Scrudder, G. D. and Polley, D. (1989). 'The development of innovation ideas'. In: Van de Ven, A. H., Angle, H. L. and Poole, M. S. (Eds) *Research on the Management of Innovation: The Minnesota Studies*, Harper & Row, New York, pp. 107–134.

Siegel, S. M. and Kaemmerer, W. F. (1978). 'Measuring the perceived support for innovation in organizations', *Journal of Applied Psychology*, **63**, 553–562.

Tjosvold, D. (1982). 'Effects of approach to controversy on superiors' incorporation of subordinates' information in decision making', *Journal of Applied Psychology*, **67**, 189–193.

Tjosvold, D., Wedley, W. C. and Field, R. H. G. (1986). 'Constructive controversy, the Vroom–Yetton Model, and managerial decision-making', *Journal of Occupational Behaviour*, **7**, 125–138.

Tucker, L. and Lewis, C. (1973). 'A reliability coefficient for maximum likelihood of factor analysis', *Psychometrika*, **38**, 1–10.

Uttal, B. (1983). 'The corporate culture vultures', *Fortune Magazine*.

 

Wall, T. D. and Lischeron, J. H. (1978). *Worker Participation: A Critique of the Literature and Fresh Evidence*, McGraw-Hill, Maidenhead.
West, M. A. (1987). 'A measure of role innovation at work', *British Journal of Social Psychology*, **6**, 83–85.
West, M. A. (1989). 'Role innovation in the world of work', *British Journal of Social Psychology*, **8**, 305–315.
West, M. A. (1990). 'The social psychology of innovation in groups'. In: West, M. A. and Farr, J. L. (Eds) *Innovation and Creativity at Work: Psychological and Organizational Strategies*, Wiley, Chichester, pp. 4–36.
West, M. A. (1995). *Effective Teamwork*, British Psychological Society, Leicester.
West, M. A. and Anderson, N. R. (1992). 'Innovation, cultural values and the management of change in British hospitals', *Work and Stress*, **6**, 193–210.
West, M. A. and Anderson N. R. (1996). 'Innovation in top management teams'. *Journal of Applied Psychology*, **81**, 680–693.
West, M. A. and Farr, J. L. (1989). 'Innovation at work: psychological perspectives', *Social Behaviour*, **4**, 15–30.
West, M. A. and Farr, J. L. (Eds) (1990). *Innovation and Creativity at Work: Psychological and Organizational Strategies*, Wiley, Chichester.
Williams, L. J. (1995). 'Covariance structure modelling in organizational research: Problems with the method versus applications of the method', *Journal of Organizational Bedavior*, **16**, 225–233.

 