# Organizational Climate Profiles:

# Identifying Meaningful Combinations of Climate Level and Strength

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**Abstract**

According to situation strength theory, organizational climate should have a stronger effect on group behavior when members' perceptions of the climate are both unambiguous (i.e., very high or very low) and shared than when they are more ambiguous and less shared. In the organizational climate literature, this proposition is typically examined by testing the interaction between climate level (i.e., mean) and strength (i.e., variability); surprisingly, the preponderance of empirical research testing this interaction does not support this theoretical expectation. This may be because the traditional variable-centered approach fails to consider the possibility of overlooked subpopulations consisting of unique combinations of climate level and strength, creating distinct climate profiles. To address this issue, we use a group-centered conceptualization and analyses (i.e., latent profile analysis) to examine the extent to which 302 workgroups (Sample 1) and 107 organizations (Sample 2) evidence statistically and practically meaningful climate profiles. Results revealed four to six distinct climate profiles across multiple climate types were differentially associated with theoretically relevant outcomes, including objective financial measures. Consistent with situation strength theory, groups with strong and favorable profiles tended to have more positive outcomes, whereas groups with weaker, less favorable profiles tended to have less positive outcomes. In contrast, the traditional variable-centered approach was generally unsupportive of an interaction between climate level and strength. Overall, these findings provide evidence that the group-centered approach is a more sensitive statistical modeling technique for testing a fundamental tenet of situation strength theory in the context of organizational climate research.

**Keywords:** organizational climate, latent profile analysis, safety performance

Organizational climate—i.e., shared perceptions of workplace norms, priorities, and expectations among employees within a collective (Schneider et al., 2011; Schneider & Reichers, 1983)—has demonstrated meaningful associations with individual and group outcomes across a variety of organizational domains (e.g., Christian et al., 2009; Hong et al., 2013; Whitman et al., 2012). Organizational climate is typically described using two broad descriptors: climate level and climate strength. Climate *level* refers to the quality of a given climate (i.e., its goodness or badness, favorability or lack thereof), whereas climate *strength* refers to the extent to which climate perceptions are shared among group members (Lindell & Brandt, 2000; Schneider et al., 2002). Consistent with situation strength theory (Mischel, 1976), a social group with clear priorities (either high or low climate level) *and* high levels of agreement (high climate strength), creates a strong situation that dictates how group members should (or should not) behave which, in turn, strengthens the relationship between climates and corresponding group outcomes (Schneider et al., 2002). This theoretically expected interaction between climate level and strength has been tested multiple times but has yielded mixed and inconclusive results (Keeler et al., in press). We propose that this inconsistency between theoretical expectations and empirical results may be partly a function of overlooked combinations of climate level and strength.

Thus far, all the empirical studies that have examined the interaction between climate level and climate strength for predicting group outcomes (e.g., González-Romá et al., 2002; González-Romá et al., 2009; Schneider et al., 2002) have used a *variable*-centered approach. In this approach, it is assumed that individuals—or, in this case, groups—are drawn from a single population from which a single set of parameters (e.g., an intercept and a set of regression coefficients) is estimated to model relationships among variables (Morin et al., 2018). However, it may be inappropriate to assume a single population given the many studies that have documented the existence of subclimates within organizations (e.g., Schneider et al., 2013; Schulte et al., 2009; Zohar & Luria, 2005). In contrast, a *group*-centered approach (or *person*-centered approach in the context of individual-level research) assumes that variable interrelations depend at least partly on overlooked heterogeneity within a target population (Morin et al., 2018; Wang & Hanges, 2011).

Whereas the dominant variable-centered approach is more parsimonious because the number of variables is usually less than the number of possible group profiles, it also tends to be less explanatory than a group-centered approach that considers how relationships vary as a function of overlooked subpopulations (Howard & Hoffman, 2018). In other words, assuming a single population with the variable-centered approach may be unrealistic. Because the existence of heterogeneous subpopulations is more likely than population homogeneity in a relatively large sample (Howard & Hoffman, 2018), it is plausible that the failure to consistently confirm the expectations of situation strength theory is due to the generally unmet assumption of population homogeneity underlying the variable-centered approach (see also Keeler et al., in press).

In the present study, rather than examine the climate-specific expectations of situation strength theory using the typical variable-centered approach, we adopt a more nuanced group-centered approach that acknowledges that there may be subpopulations of groups that systematically differ in terms of unique combinations of climate level and strength. Specifically, we use latent profile analysis (LPA[1]) to extract distinct climate profiles representing unique combinations of climate level and strength that are phenomenologically experienced by actual

[1] LPA is considered superior to other analytical approaches for identifying groups with continuous indicators including hierarchical cluster analysis and median split used by other safety climate researchers (Lingard et al., 2010), because it does not create hypothetical (and possibly fictitious) groups based on arbitrary cut-offs. Instead, it creates groups based on externally-valid covarying observations.

workgroups and organizations. In doing so, we reveal the number and nature of climate profiles that may exist, their prevalence, and associate them with relevant group outcomes including collective knowledge, motivation, and behavior, as well as organizational-level financial outcomes.

This study contributes to the organizational climate literature, and the application of situation strength theory to it, in at least two key ways. First, by taking a group-centered approach to conceptualize and operationalize the interplay between climate level and strength, we provide a more sensitive test of the tenets of situation strength theory than has formerly been offered in the climate literature using a variable-centered approach. In doing so using LPA, we find evidence of overlooked subpopulations at both the team and organization levels with unique combinations of climate level and strength.

Second, we test the extent to which these newly-identified subpopulations yield different relationships with team and organization-level outcomes. Consistent with situation strength theory, we find that groups with distinctive combinations of climate level and strength–those with higher climate level and strength–demonstrated stronger connections with meaningful unit-level outcomes. To verify the nuanced benefit of a group- versus variable-centered approach in our data, we compared results from both approaches and found that a group-centered approach offers stronger support for the expectations of situation strength theory than the traditional variable-centered approach. Taken together, the present study underscores the advantage of using a group-centered approach to study climate level and strength interactions, as our findings not only support situation strength theory, but also reveal the types of climate profiles of working groups and organizations and identify which collectives (based on their climate profiles) may benefit most from organizational interventions.

## The Interaction between Climate Level and Strength

### Existing Research

Situation strength theory proposes that stronger situations—where behavioral expectations are clearly dictated by the context—lead to greater behavioral consistency among group members (Mischel, 1976). In strong situations, group member behavior is less a function of their individual differences (e.g., personality) and more a function of situational constraints. Conversely, in weak situations, characterized by ambiguity in expectations or preferred modes of conduct, individuals are free to act in accordance with their individual differences; such freedom is expected in the absence of situational clarity (Mischel, 1976).

As articulated by Schneider et al. (2002), climates establish strong situations when they dictate clear expectations (e.g., service is highly valued) that are shared and perpetuated among group members. In such cases, the situation—or climate—is more likely to drive individual and group behavior rather than individual differences. In support of this expectation, Lee and Dalal (2016) found that safety climate strength attenuated the relationships between conscientiousness and two forms of safety behavior. In other words, stronger climates—reflecting strong situations—weakened the extent to which conscientiousness drove behavior. With the effects of individual differences weakened by the situation, situation strength theory proposes that strong climates (i.e., clearly favorable or unfavorable) should be more robustly linked to climate-relevant outcomes (e.g., safety-related behavior) than weak climates.

Consistent with situation strength theory, organizational climate researchers have identified a unique way to conceptualize and operationalize the situation by examining the extent to which a group of employees have shared perceptions of the organizational context. The more that the group members agree about their perceptions of the level of the climate, the stronger the situation. In strong climates, employees are more likely to act in accordance with perceived norms and expectations rather than personal preferences and thus have more desirable or undesirable attitudinal and behavioral outcomes, whereas in weak climates, employees are less likely to follow situational norms and expectations (Lindell & Brandt, 2000; Schneider et al., 2002). Climate researchers across a variety of organizational domains have examined whether climate level and strength interact to affect group behaviors. However, despite this prevailing theoretical expectation, empirical support for this interactive effect is mixed at best (Keeler et al., in press).

In partial support of situation strength theory, Gonzalez-Roma et al. (2009) found the theorized climate level and strength interaction in seven of twelve (58%) tests involving climates for support, innovation, goal achievement, and formalization predicting subjective and objective performance measures. Similarly, González-Romá et al. (2002) found support for a climate level and strength interaction in three of six (50%) regression tests involving climates for support, goal orientation, and innovation and the outcomes of group satisfaction and commitment. More recently, Flatau-Harrison et al. (2020a) proposed that safety climate strength moderates the individual safety climate level-safety motivation relationship. Initial analyses did not support this interaction; however, after re-operationalizing workgroups into larger units, they found a significant interaction. These studies provide mixed support for the interaction between climate level and strength.

Many other studies fail to find support for the climate-related propositions of situation strength theory. For instance, in their pioneering study of climate consensus (i.e., climate strength), Lindell and Brandt (2000) found virtually no support for the expectation that climate level and strength interact to predict group outcomes. The authors conjectured that their unsupportive findings were due to limited levels of interdependence among sampled group members and also range restriction in the levels of consensus observed across groups. Similarly, Schneider et al. (2002) found that among four service climate dimensions, the hypothesized interaction emerged for only one dimension (i.e., managerial practices) out of four possible interactions when predicting customers' perceptions of service quality. In a constructive replication of Schneider et al.'s (2002) findings, Sowinski et al. (2008) failed to detect the hypothesized interaction between service climate mean and strength when predicting three organizational outcomes (six total tests). Taken together, whereas the climate-related expectations of situation strength theory are conceptually sound, empirical findings are often unsupportive.

Recently, in a meta-analysis of 77 organizational climate studies, Keeler et al. (in press) found evidence indicating that climate strength may be a non-linear moderator of climate-outcome relationships. Although this finding was inconclusive, it may explain the failure of some studies to detect the expected climate level and strength interaction. As noted previously, another plausible reason for these inconsistent results is violation of the assumption of population homogeneity that is inherent to the variable-centered approach. We assert that there are likely to be multiple subpopulations within the large organizational samples that typify climate research and that these necessitate multiple parameters. Accordingly, we propose a group-centered conceptualization of the interaction between climate level and strength, where we expect multiple climate profiles to emerge. We next detail the advantages of this alternative approach for considering the interplay between climate level and strength relative to the traditional variable-centered approach.

## Variable-Centered vs. Group-Centered Approaches

The variable-centered approach focuses on linear relationships between variables (e.g., climate level and performance) and how those relationships might be strengthened or weakened by a third variable (e.g., climate strength; see Keeler et al. [in press] for other weaknesses inherent to this approach). When there is a significant interaction, statistically meaningful profiles of indicators are inferred, rather than observed. Combinations of indicators (e.g., high level and high strength) are represented on a line graph based on artificial statistical convention (i.e., one standard deviation [*SD*] above and below the *M*). However, this approach for identifying unique combinations of climate indicators is problematic for two reasons. First, the validity of the conclusions drawn from these analyses is predicated on multiple and relatively strict assumptions about the data, such as linear relationships (Chatterjee & Simonoff, 2013; Poole & O'Farrell, 1971). A failure to meet these assumptions has likely contributed to the inconsistent findings to date (Aguinis et al., 2005). Also, if the analyst decides to exclude workgroups for not meeting a minimum level of agreement as a threshold for aggregating individual scores to form group-level variables, the range of values for the climate strength variable will be restricted (James, 1982; Schneider et al., 2002), which makes it even harder to find a statistically significant interaction.

Further, statistical benchmarks (e.g., $M \pm 1SD$) are not necessarily representative of the scores that actual workgroups exhibit. Although plotting the interaction begins to convey which groups score higher than others on key outcomes, analyses are limited to hypothetical groupings determined by analytical convention. Thus, the variable combinations that are identified and modeled may have limited to no external validity.

In contrast, the group-centered approach identifies clusters of workgroups[2] based on how they score on select focal variables, or profile indicators. In this study, the profile indicators are climate level and strength. Conceptually, this could result in multiple combinations of level and

[2] In this study, the focal level of analysis is the workgroup. Latent profile analysis can also be done at the individual level of analysis which is often referred to as a person-centered analysis, such that individuals, rather than workgroups, are sorted into profiles based on similar levels of one or more variables.

strength scores that range from 1 to 5, given the response scales used in this study. These group-centered analyses identify climate profiles for *actual* workgroups rather than hypothetical ones. This provides an ecologically valid means of differentiating workgroups, offering inductive theoretical opportunities for climate researchers to fine-tune our understanding of how certain climates become distinct from others in their capacity to drive group outcomes.

From a practical perspective, the group-centered approach is also more likely to provide relevant diagnostic information to facilitate strategic interventions. For example, groups in the current study with specific safety climate profiles may display higher rates of near misses (close calls) or less frequent safety behaviors, which would suggest that these workgroups would benefit from safety training more so than workgroups with different climate profiles. This allows organizations to be more strategic in how and where they allocate their resources. Conversely, variable-centered analyses of the same constructs do not provide the same type of practical diagnostic information. In short, the group-centered approach for testing the climate level and strength interaction as a predictor of group outcomes provides a conceptually rich and practically informative way of testing the climate-related propositions of situation strength theory than does a variable-centered approach.

## The Current Study

Our first objective in this study was to determine whether distinct climate profiles (in terms of the combination of climate level and strength) emerge in organizational settings—that is, whether groups can be classified as belonging to a handful of distinct climate profiles. We examine this using LPA with an inductive, as opposed to deductive, approach (Woo & Allen, 2014). This is a necessary first step when conducting LPA in an understudied domain because it is not yet clear what organizational climate profiles will emerge or to what extent groups will cluster into these profiles. In Table 1, we provide a parsimonious hypothetical taxonomy of organizational climate profiles that results from trichotomizing climate level and strength into low (L), medium (M), and high (H) degrees, and then combine the trichotomized climate indicators (level and strength) to yield nine climate profiles. We note that the designated high, medium, and low values are relative to the other groups they are being compared to and do not necessarily reflect these variables in absolute terms, especially given the individual tendency to rate their group more positively than negatively (Tajfel & Turner, 1979) which likely results in generally more favorable organizational climate ratings (cf. Keeler et al., in press).

When climate level and strength are considered in absolute terms, however, we propose that at least two of the hypothetical profiles are unlikely to exist at all. Specifically, it is mathematically impossible for a climate to have a high (or low) level *and* low consensus (HL and LL; Lindell & Brandt, 2000). Conceptually, a group cannot have clarity in its priorities (high safety climate level; e.g., safety is prioritized here) without also having at least moderate levels of consensus (Dickson et al., 2006). Likewise, a group cannot achieve a mean score of five (or one) on a five-point scale without being completely homogeneous. This is because a mean that approaches either end of a response scale will, by definition, have limited variability around that mean. Although these specific profiles are unlikely to emerge (from an absolute perspective), the extent to which workgroups fit the other hypothetical profiles remains an open question that we address here.

*Research Question 1: How many organizational climate profiles emerge and do the same ones emerge across different types of organizational climate (e.g., safety, ethics)?*

Our second objective was to examine whether work units categorized into the resultant climate profiles differ in relevant outcomes. Because some of the hypothetical climate profiles may not emerge in our samples, we did not articulate an exhaustive list of hypotheses regarding differential climate effects. Instead, based on situation strength theory (Mischel, 1976), we offer general expectations regarding the associations between climate profiles and group outcomes. In line with situation strength theory, because strong situations promote convergence in climate perceptions as well as increased attitudinal and behavioral consistency, stronger connections between climates and climate-relevant outcomes are expected under strong situations (Lindell & Brandt, 2000; Schneider et al., 2002). Thus, we expect that strong, positive climates will tend to yield the most favorable outcomes whereas strong, negative climates will tend to yield the least favorable outcomes.

*Hypothesis 1: Groups with profiles indicating higher climate level and strength (e.g., strong favorable climate; HH) will have the most desirable outcomes relative to any other profiles.*

*Hypothesis 2: Groups with profiles indicating lower climate level but high strength (e.g., strong unfavorable climate; LH) will yield the least desirable outcomes relative to any other profiles.*

Our last objective in this study was to test the extent to which conclusions differ based on the analytical approach taken. Specifically, we contrasted group-centered results using LPA to variable-centered results using traditional regression analyses. By comparing the results from these two approaches using the same data, we examined the extent to which climate-related conclusions regarding situation strength theory are a function of the analytical approach taken. Consequently, our second research question was:

*Research Question 2: Do variable-centered regression analyses and LPA comparisons reveal the same level of support for the tenets of situation strength theory?*

We examined our hypotheses and research questions using two unit-level samples. In Sample 1, we analyzed safety climate and safety-related outcomes using a workgroup-level sample from five high reliability organizations. In Sample 2, an organization-level sample of over 100 manufacturing companies, we seek to replicate and extend the findings from Sample 1 at a higher level of analysis and with several additional climate types and both safety-related and non-safety-related outcomes.

## Sample 1 Method

### Transparency and Openness

We adhered to the *Journal of Applied Psychology* methodological checklist. Data are not available due to their proprietary nature. Data were analyzed using Mplus version 8.3 (Muthén, & Muthén, 1998-2017). The studies were not preregistered because data were collected from multiple organizations as part of applied research collaborations. Texas A&M University Institutional Review Board approvals were obtained for the various data collections (2009-0884; 2010-0365, 2011-0615M; 2015-0685D; 2016-0316D).

### Participants and Procedure

Because climates should be examined as they pertain to a particular aspect of organizational life to have practical relevance (Schneider & Reichers, 1983), we conducted our Sample 1 profile analyses in the domain of workplace safety. We selected safety climate because of its demonstrated practical importance relating to safety behaviors and injuries (Beus et al., 2010; Christian et al., 2009) and because it is one of the most extensively-studied domain-specific climates in the applied psychology and management literature (Kuenzi & Schminke, 2009; Schneider et al., 2013).

Given the large sample size requirements for conducting LPA, it was necessary to combine data from multiple organizations to achieve sufficient statistical precision. Consequently, we included employee data from five high reliability organizations (i.e., oil and gas, mining, hospital) within the United States, Chile, and China to constitute Sample 1. Some of the data reported in this manuscript have been previously published in separate manuscripts (Beus et al., 2015; Beus et al., 2019; He et al., 2020; Xu et al., 2020). None of the previous manuscripts examine safety climate strength or use person-centered analyses.

Employees completed a paper-and-pencil or online survey (depending on the organization) concerning workplace safety. After screening out non-serious responders (based on response times and longstrings/straightlining) and individuals who could not be assigned to a workgroup due to insufficient representation (less than two members per group), the final sample consisted of 2,132 employees embedded in 302 groups with an average group size of 7.06 members (*SD* = 5.51). Approximately half (52%) of the respondents were male, aged from 19 to 88 years old (*M* = 37.14, *SD* = 11.11). Additionally, one month after the first administration (Time 2; T2), safety outcomes (e.g., safety knowledge) were measured for two organizational samples composed of 451 employees embedded in 62 groups. This enabled us to examine the time-lagged connection between safety climate profiles and relevant safety outcomes.

**Measures**

All items for the constructs included in Sample 1 were responded to on a 5-point agreement scale. Internal consistency reliabilities (i.e., Cronbach's Alphas) for these scales ranged from .78 to .97 and are reported on the diagonal of Table 2.

**Safety climate level and strength.** Safety climate was measured using the shortened 8-item version of Beus et al.'s (2019) generalized safety climate measure. This shortened measure maintains representation of seven core safety climate domains (e.g., management commitment to safety, coworker safety practices). An example item for safety climate was: "My co-workers are committed to safety improvement." As is common practice, we operationalized safety climate level as the group mean, with higher scores reflecting a more favorable climate. We operationalized safety climate strength as the sign-reversed *SD* of the workgroup safety climate scores (e.g., Bliese & Halverson, 1998; James et al., 1993; Schneider et al., 2002), with higher scores representing stronger climate (i.e., climates with higher levels of within-group agreement).

**Safety knowledge.** We assessed safety knowledge using three of the seven items from Griffin and Neal (2000). An example item read "I know how to perform the job in a safe manner."

**Safety motivation.** We assessed safety motivation using three of the four items from Neal et al. (2000). An example item read "I am driven to improve workplace safety."

**Safety behavior.** We assessed safety behavior using Griffin and Neal's (2000) two-dimensional measure of safety compliance and safety participation. Four items assessed safety compliance (e.g., "I use all the necessary safety equipment to do the job") and four items assessed safety participation (e.g., "I promote the safety program within the organization").

## Multi-Group Comparisons and Data Aggregation

Before combining data from the five organizations into a single dataset, we used both classical multi-group confirmatory factor analysis (CFA) and advanced alignment optimization approaches to test for measurement invariance across the different groups (Steenkamp & Baumgartner, 1998; Asparouhov & Muthén, 2014; Vandenberg & Lance, 2000). We found that approximate measurement invariance was achieved for all constructs of interest and, thus, that the measures utilized were unbiased and comparable across organizations. More details on these analyses can be found in Appendix A.

To verify the appropriateness of aggregating individual-level data to the workgroup level for LPA, we calculated within-group agreement using $r_{wg(j)}$ (James et al., 1984), between-group variability using the intra-class correlation coefficient (ICC[1]; see Appendix B), and the stability of group mean estimates using (ICC[2]). These analyses revealed that the median $r_{wg(j)}$ values were all above .70 for the examined constructs, ICC(1) values ranged from .04 to .15, and ICC(2) values ranged from .24 to .56. Although ICC(2) values in these data were low, this is to be expected given the relatively small sizes of the sampled workgroups ($M$ = 7 members, $SD$ = 5.51) and the fact that ICC(2) is sensitive to average group size (Bliese, 1998; Lebreton & Senter, 2008). We thus deemed the generally supportive $r_{wg(j)}$ and ICC(1) values as offering sufficient evidence together for aggregation to the workgroup level.

**Latent Profile Analyses**

We conducted LPA using Mplus version 8.3 (Muthén, & Muthén, 1998-2017). LPA identifies clusters of workgroups with similar levels of the profile indicators (i.e., safety climate level and strength). By identifying workgroups with similar levels of safety climate level and strength, profiles of safety climate emerge. The number of meaningful profiles is determined by the number of workgroups that were assigned to each profile, as well as the following six fit indices recommended by Morin et al. (2011) and Foti et al. (2012): Akaike's information criterion (AIC), the Bayesian information criterion (BIC), the sample-size adjusted BIC (SSA–BIC), the Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), the bootstrapped likelihood ratio test (BLRT), and entropy. In general, lower values of these fit indices are better. Recent simulation studies have identified SSA–BIC as the most accurate of these indices for LPA (Henson et al., 2007; Li et al., 2009; Nylund et al., 2007). Therefore, we prioritized SSA-BIC when interpreting model fit. In comparing adjacent models (models with +/- one profile), we used the LMR-LRT and BLRT statistics (Morin et al., 2011). Generally, a significant *p* value means that the examined model has a better fit than a similarly-parameterized model with one fewer profile. Entropy values (ranging from 0 to 1 with higher values indicating greater profile separation; Lubke & Muthén, 2007) were also considered.

We adopted a three-step approach to further reinforce the number of profiles identified and to determine their relationship with various outcome variables (Asparouhov & Muthén, 2013). In the first step, we examined a series of models beginning with two and increasing to up to six profiles until the increase in model fit no longer justified the reduced parsimony achieved by identifying another latent profile (i.e., profile enumeration). This is a commonly-used inductive approach (Foti et al., 2012; Morin et al., 2011; Woo & Allen, 2014). Second, the assignment of a workgroup to a profile is made based on the posterior probability distribution of profile membership calculated in the previous step. A workgroup is assigned to the profile with the highest posterior probability (Asparouhov & Muthén, 2013). The last step incorporates the outcome variables (e.g., safety behavior) into the model to explore whether profile membership relates to these variables. Specifically, we used the DE3STEP command in Mplus (Asparouhov & Muthén, 2013), which uses a chi-square test to determine whether each profile is significantly different from the other profiles on each outcome variable. This three-step approach is advantageous over cluster analyses as it accounts for the error in the profile classification when examining the profiles in relation to other variables (Wang & Hanges, 2011).

**Sample 1 Results**

We report group-level descriptive statistics and variable intercorrelations for Sample 1 in Table 2. To verify the discriminant validity of the constructs included in this study prior to running LPA, we first tested the fit of a five-factor model (i.e., safety climate, motivation, knowledge, compliance, and participation) using CFA and compared it with several alternative models by setting correlations between different combinations of latent factors equal to one. We assessed model fit using the $\chi^2$ statistic, comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Based on recommendations by Hu and Bentler (1999), we used the following cut-offs to evaluate model fit: CFI and TLI > .90, SRMR and RMSEA < .08. As shown in Appendix C, fit indices indicated that the five-factor model was the best fit to the data, $\chi^2$ (198) = 618.382, $p$ < .001; CFI = .95; TLI = .94; RMSEA = .07 (90% CI [.06, .07]); SRMSR = .04. We therefore proceeded to conduct LPA.

**LPA Results**

Table 3 depicts model fit indices for five LPA models (from two to six profiles). As can be seen, fit is best for the 5-profile model as it produced the lowest fit indices as well as a significant BLRT and LMR. Although the 6-profile model produced lower AIC and SSA–BIC values, two profiles in this model (Profiles 1 and 2) were only slight variations of one profile in the five-class model (Profile 1), and one of these profiles only consisted of seven groups. Consequently, based on parsimony and interpretability, we adopted the 5-profile model as the best representation of these data. Average safety climate level and strength values for each profile appear in Table 4.

It is important to note that when applying the descriptors of "high, medium, and low" (or H, M., and L, respectively) to climate level and strength to label the profiles, we considered both relative and absolute differentiation. For example, we characterize the profile with the lowest safety climate score (3.39; profile 5) as "L" when in fact its mean (3.39) is near the scale midpoint (3.00). We also considered the scale anchors (e.g., 4 and 5 on a 5-point agreement scale both convey agreement and could be interpreted as "H") and an approximate threshold of a .75 incremental difference between means when assigning labels of H, M, or L to climate level. Likewise, we characterize profiles with sign-reversed *SD*s of greater than -.50 as having a high level of strength (agreement) and less than -1.0 as having a low level of strength (agreement).

For Sample 1, five safety climate profiles emerged in the following order of prevalence for climate level and strength, respectively: HM (65%), MH (13%), LL (9%), ML (8%), and HH (5%). Thus, in response to Research Question 1, these findings indicate that there are five statistically distinguishable safety climate profiles that typify the workgroups examined in Sample 1. Of note, a profile that could be described as LH (low climate level, high agreement) did not emerge in these data.

**Outcomes Associated with Safety Climate Profiles**

As reported in Table 5, chi-square tests were used to determine if the profiles differed significantly in their associations with the specified outcome variables. Consistent with Hypothesis 1, workgroups with the HH profile had the highest safety knowledge, compliance, and participation scores at Time 1 (T1) relative to the other groups. Unfortunately, at T2, there was an insufficient number of workgroups (i.e., only one) with the HH profile to draw meaningful inferences based on this profile. However, consistent with expectations based on situation strength theory, groups with stronger and more favorable safety climates (reflecting comparatively stronger situations) had higher safety knowledge and safety behavior relative to groups with other climate profiles. For example, after HH, the next most favorable profile was HM and this profile had more desirable outcomes than any of the remaining profiles. The pattern of outcomes for the other climate profiles was also fairly consistent with situation strength theory, such that groups with HM, ML, and LL profiles (reflecting progressively weaker situations) each reported decreasingly desirable outcomes. Of note, the MH profile produced relatively lower T1 and T2 scores compared to the ML profile (only slightly higher than the LL profile). Nevertheless, these results generally support Hypothesis 1, with the direction of differences for the profiles being largely consistent with the expectations of situation strength theory.

Hypothesis 2 proposed that the least desirable (most unsafe) outcomes are associated with workgroups with a LH profile, reflecting high group consensus about an unfavorable level of safety climate. Fortunately for the surveyed organizations, no workgroups could be characterized as fitting in this category. We were thus unable to directly evaluate Hypothesis 2. Yet, among the five safety climate profiles that did emerge, the LL profile had the lowest levels of safety knowledge, motivation, and behavior, which remains consistent with the expectations of situation strength theory.[3]

**Comparison of LPA Results to Regression Results**

In order to address Research Question 2, which asked if conclusions differ depending on the analytical approach taken, we conducted ordinary least squares moderated multiple regression analyses with each of the examined outcomes. As presented in Table 6, only three of eight possible interactions (38%) across T1 and T2 were statistically significant. This is generally consistent with the rate at which other variable-centered, regression-based tests of climate level and strength interactions have been reported in the published literature (e.g., Gonzalez-Roma et al., 2009; Schneider et al., 2002). In contrast, LPA results for the same data were substantially more supportive of the expectation that groups with stronger, more favorable climates (HH and HM profiles) tend to have statistically better outcomes than groups with relatively less favorable climates (ML, MH, and LL profiles). Chi-square analyses indicated that all eight outcomes varied

[3] We also controlled for baseline levels of outcomes and used the residual score approach to explore whether climate profiles lead to changes in outcomes between T1 and T2 for both samples. We included those results in Appendix D.

significantly based on profile membership (see Table 5). Additionally, the analyses of effect sizes ($\eta^2$) showed that the climate profiles generated by the group-centered approach explained a larger proportion of variance in all outcome variables compared to the interaction term of the variable-centered approach (see Appendix E). Thus, a group-centered approach using LPA appears to offer greater support for the tenets of situation strength theory pertaining to organizational climate than the traditional variable-centered approach using moderated multiple regression.

Because of the potentially sample-specific nature of the LPA findings, we obtained an additional sample in an effort to replicate and extend the results from Sample 1. Specifically, we obtained data from a large pre-existing organization-level sample that included safety climate as well as four other climate types and both self and non-self-reported organization-level outcomes. We then ran the same analyses on Sample 2 to evaluate the extent to which Sample 1's conclusions hold in another sample with more climate types and at a higher level of analysis.

## Sample 2 Method

### Participants and Procedure

Data for Sample 2 were originally collected using paper-and-pencil questionnaires which were administered to non-managerial employees from 112 small and medium-sized manufacturing and production organizations in Italy (Beus et al., 2020). After excluding organizations with fewer than four respondents[4], the final dataset comprised 1,252 respondents from 107 organizations with an average of 11.70 (*SD* = 4.68; min = 4; max = 30) respondents per

[4] We selected this number in an effort to obtain a sufficient organization-level sample size for LPA while simultaneously trying to ensure adequate reliability of mean climate estimates. This is in contrast to our team-level threshold of at least two respondents given the possibility of teams of only two in our data (Kozlowski & Ilgen, 2006).

organization. Respondents were, on average, 40.08 (*SD* = 9.58) years of age and worked in their respective organizations for an average of 10.94 (*SD* = 8.19) years.

Six months after the first administration, a follow-up survey was given to respondents from a subset of the organizations that participated in the initial data collection. A total of 574 non-managerial employees from 52 of the 107 originally surveyed companies (49%) participated in the second wave. The average number of respondents per organization was 11.04 (*SD* = 1.27, min = 9, max = 14) with 76% of them reporting that they also responded to the initial survey. On average, participants were 40.04 (*SD* = 8.75) years old and had an average of 13.08 (*SD* = 7.22) years of organizational experience. The same constructs were assessed in both administrations.

**Measures**

We report internal consistency reliabilities (i.e., Cronbach's alphas) in Table 7 for both Sample 2 data collections: Time 1 (T1) and Time 2 (T2).

**Safety climate**. Consistent with Sample 1, safety climate was assessed using the shortened 8-item scale of Beus et al. (2019).

**Productivity climate**. Productivity climate was assessed using a 5-item measure adapted from Wallace (2004). Participants were asked to indicate to what extent they agree with the proposed statements using a five-point agreement scale. A sample item from this measure is "Management encourages employees to get the job done as quickly as possible".

**Promotion climate**. Promotion climate was assessed using a 6-item measure adapted from Wallace and Chen (2006). Participants were asked to indicate on a five-point frequency scale (1 = *never*, 5 = *always*) how often their organization focuses on promotion-related issues such as "work accomplishments".

**Prevention climate**. Prevention climate was assessed using a 6-item measure adapted from Wallace and Chen (2006). An example item asked participants to indicate on a five-point frequency scale how often their organization focuses on “following rules and regulations” to accomplish its objectives.

**Ethical climate**. Ethical climate was assessed using a 4-item measure adapted from Victor and Cullen (1988). Participants were asked to indicate how accurately each statement described their organization using a scale ranging from 1 (*completely inaccurate*) to 6 (*completely accurate*). A sample item is “Employees are expected to comply with the law and professional standards over and above other considerations.”

**Organizational commitment.** Organizational commitment was assessed using Klein et al.’s (2014) 4-item measure. Participants responded to items using a five-point scale (1 = *not at all*, 5 = *completely*) with an example item reading: “How committed are you to your organization?”

**Accidents.** At both T1 and T2, participants reported the number of accidents “that resulted in worker injury and/or property/equipment damage” that occurred during the last 12 months.

**Organizational productivity.** Organizational productivity was assessed using both participant self-reported measures (at T1 and T2) and objective financial measures (after T1). First, participants indicated on a five-point scale (1 = *not at all*, 5 = *completely*) to what extent they believe their “organization’s production goals have been met in the past 12 months”. Second, financial measures for one year following the T1 data collection were retrieved from Aida-Bureau van Dijk (ABD), a database of financial information for public and private companies operating in Italy. These measures were only available for a subset of organizations in this sample (52-61

[49-57%] organizations) and included *profit per employee*, *return on assets* (ROA) and *earnings before interest, taxes, depreciation, and amortization* expressed as a percentage of a company's revenue margin (EBITDA margin). Profit per employee (a company's net income divided by the number of its employees) represents an aggregate indicator of employee productivity, whereas ROA (a company's net income divided by its total assets) is a measure of organizational productivity that indicates how efficient a company is in managing its assets and generating income. Finally, EBITDA margin (a company's net income plus interest, taxes, depreciation, and amortization expressed as a percentage of the company's revenue) is a cash-flow proxy that is comparable across organizations given that it omits accounting and financial deductions which are subject to managers' choice (Rozenbaum, 2019).

**Data Aggregation**

As with Sample 1, we calculated $r_{wg(j)}$ and ICC1 and ICC2 values (reported in Appendix B), with ICC(1) values ranging from 0.14 to 0.35, ICC(2) values ranging from 0.64 to 0.86, and all $r_{wg(j)}$ values being above 0.70. Taken together, these results support aggregating this sample's variables to the organization level.

## Sample 2 Results

Organizational-level descriptive statistics are reported in Table 7 for T1 and T2. To demonstrate the distinctiveness of the constructs included in Sample 2, we first tested the fit of a six-factor model (i.e., five climate types and collective commitment) using CFA and compared it with several alternative models using the same procedure and cut-off scores used in Sample 1. Several fit indices indicated that the six-factor model had the best fit to the data ($\chi^2$ (480)

=1304.90, $p < .001$; CFI = .96; TLI = .95; RMSEA = .04 (90% CI [.04, .04]); SRMSR = .04) compared to alternative CFA models (see Appendix C for details).

**LPA for Five Climate Types**

First, we re-evaluated Research Question 1 concerning the number of profiles that emerged, but this time for five separate climate types. Table 8 depicts LPA model fit indices for the five climate models (from 2 to 6 profiles). We used the same criteria from Sample 1 to select the best model for each climate type. In doing so, a six-profile model fit the data best for safety climate and a 5-profile model provided the best fit for both promotion and productivity climates as they generally produced the lowest fit indices (e.g., SSA–BIC, BIC, and AIC values) and demonstrated significant improvements in adjacent model comparison tests (i.e., BLRT and LMR). For prevention climate, the 4-profile model with lower fit indices obtained the best fit. Although the 5-profile model produced lower SSA–BIC, BIC, and AIC values, one profile in this model consisted of only two organizations and was slightly different from one profile in the 4-profile model. For ethical climate, the 4-profile model was selected. Even though the 6-profile model had slightly lower SSA–BIC and AIC values, two profiles in this model only consisted of three organizations and one profile was similar to another profile in the 4-profile model. Therefore, a 4-profile model was chosen for prevention and ethical climates for parsimony and interpretability.

Average climate level and strength values for each profile within each climate type are presented in Table 9. These same data are presented in Table 10 in a manner that mimics the format of Table 1. Out of nine hypothetical climate profiles, the HL profile did not emerge for any of the climate types. The HM and HH climate profiles are the most prevalent, and the LL, LM, and LH are the least prevalent, across the five climate types examined. Also, significant differences between profiles on multiple dependent variables at T1 and T2 are indicated in Tables 11-15. To re-evaluate Hypothesis 1 in this sample, we next describe differential relationships with outcomes observed across profiles by climate type, beginning with safety climate.

**LPA for Safety Climate Profiles and Associated Outcomes**

For safety climate, six profiles emerged in the following order of prevalence: HM (43%), HH (18%), MM (15%), MH (11%), ML (7%), and LL (6%). We note that this is very similar to the profiles that emerged in Sample 1 for safety climate, but with higher prevalence of climates fitting a HH profile. In Sample 2, organizations with the HH profile had the highest collective commitment and employee-rated production at Time 1, followed by ML, HM, MH, ML, and LL profiles. Similar patterns of results were found for the same variables at Time 2. Both HH and MH profiles had the lowest rates of accidents. Consistent with theory, the LL profile had the highest rates for accidents at both Times 1 and 2. Additionally, the HM profile had greater profit per employee compared to the ML profile. Although these outcome variables are different—and these data were aggregated to the organization level—it is noteworthy that profiles characterized by high safety climate level and strength yielded the most favorable outcomes again in Sample 2, with comparably lower safety climate level and lower strength yielding the least favorable outcomes. This provides further support for Hypothesis 1 regarding safety climate.

**LPA for Productivity Climate Profiles and Associated Outcomes**

Five productivity climate profiles emerged in the following order of prevalence: ML (34%), HM (28%), MH (21%), LM (16%), LH (2%). Notably, although only two organizations had the LH profile, this profile was significantly distinct from other profiles and emerged consistently across all models with two to six profiles. Opposite our expectations for safety climate profiles, high-level productivity climates are often unfavorable for organizations operating in safety-salient contexts such as this (i.e., manufacturing); hence, lower levels of productivity climate should yield more favorable attitudinal and safety outcomes while high-level productivity climates with moderate to high consensus should yield the least favorable attitudinal and safety outcomes.

In line with this expectation, organizations with the LM profile scored the highest in collective commitment followed by organizations with the ML profile while HM and MH profiles had the lowest scores for collective commitment. At Time 2, the LH profile had higher collective commitment than the ML profile. The profile with the lowest rates of accidents at both Time 1 and Time 2 was the LH profile, followed by the MH, LM, HM, and ML profiles. However, given that only two organizations belong to the LH profile, these results need to be interpreted cautiously. Organizations with the MH profile had the highest level of profit per employee relative to the other profiles, whereas the ML profile had the lowest profit per employee. A similar pattern emerged for ROA where the MH profile had the most desirable outcomes whereas the ML profile had the lowest. Because of the obvious emphasis of productivity climates on financial success, this general pattern of findings (lower safety, higher financial success) in climates that place higher priority on productivity is to be expected.

**LPA for Promotion Climate Profiles and Associated Outcomes**

For promotion climate, five profiles emerged in the following order of prevalence: HM (42%), MM (33%), ML (13%), LL (7%), and LH (6%). Organizations with a high level of agreement about a low level of promotion (LH) had lower levels of collective commitment compared to organizations with a similar level of promotion but less agreement (LL). At Time 2, HM, MM, and ML organizations had higher levels of collective commitment than LH organizations. Results for profit per employee, ROA, and EBITDA margin scores were less consistent. HH and LH profiles had the highest profit per employee and LH had the highest EBITDA margin. The LL profile had the lowest profit per employee and EBITDA margin.

**LPA for Prevention Climate Profiles and Associated Outcomes**

For prevention climate, four profiles emerged in the following order of prevalence: HH (47%), MM (36%), ML (11%), and LL (6%). In contrast to the promotion climate profiles where a HM profile emerged, a HH profile emerged for prevention climate. Organizations with high consensus about a high-level prevention climate (HH) had the highest level of collective commitment and employee-rated production and lowest rates of accidents. This pattern of results was also true for Time 2. No significant differences in financial outcomes were found between prevention climate profiles.

**LPA for Ethical Climate Profiles and Associated Outcomes**

Four ethical climate profiles emerged in the following order of prevalence: MM (55%), LL (21%), LH (17%), and HH (7%). As with safety climate, a stronger, more favorable ethical climate (HH) was associated with significantly higher productivity and commitment and fewer accidents at both T1 and T2 compared to other, less desirable, climate profiles (MM, LH, and LL). Regarding the financial outcomes, profit per employee, ROA, and EBITDA margin were the highest for the HH ethical climate profile with much lower financial performance scores for the other profiles.

**Summary of Hypotheses 1-2 Tests in Sample 2**

The findings for safety, productivity, prevention, and ethical climates generally supported Hypothesis 1 in which stronger, more favorable climate profiles were likely to yield better outcomes compared to other less favorable or lower consensus climate profiles. Of note, higher productivity climate level is considered a less favorable climate for attitudinal and safety outcomes. Some mixed results were found for promotion climate and for climate profiles associated with financial outcomes. For the studied organizations in Sample 2, an LH profile emerged only in productivity, promotion, and ethical climate. The results showed that the LH profile generally resulted in the least desirable outcomes compared to other climate profiles, supporting Hypothesis 2. However, only a few inconsistent results were found for promotion climate profiles associated with objective financial outcomes. Taken together, our findings generally remain consistent with the expectations of situation strength theory.

**Comparison of LPA Results to Regression Results**

Next, to build on Sample 1's findings regarding Research Question 2, we compared conclusions for each outcome from ordinary least squares moderated multiple regression and LPA. As shown in Table 16, none of the regression-based interaction effects were significant for promotion and productivity climates, whereas only one (11%), one (11%), and three (33%) of nine interaction effects were statistically significant for safety, ethical, and prevention climates, respectively. These findings are generally consistent with the rate at which other variable-centered, regression-based interaction tests of climate level and strength have been reported in published studies (e.g., Gonzalez-Roma et al., 2009; Schneider et al., 2002).

Conversely, LPA yielded a higher number of statistically significant results, detecting more nuanced differences in the examined outcomes for the various climate profiles. Chi-square analyses indicate that out of nine outcomes examined for each climate type, there was a range of four to nine outcomes where profiles yielded significant differences (Tables 11-15). In general, the results for safety, prevention, and ethical climates demonstrated that organizations with stronger, more favorable climate profiles tended to have better outcomes than organizations with relatively less favorable and lower-consensus climate profiles. For productivity climate, organizations with higher-level, higher-consensus profiles often had better financial outcomes (and worse safety outcomes) than organizations with relatively lower-level but higher-consensus profiles. Somewhat less consistent results emerged for promotion climate. These results echo our findings from Sample 1, but with additional climate types and at a higher level of analysis. Moreover, the analyses of effect sizes ($\eta^2$) indicated that for each type of organizational climate, the climate profiles produced by the group-centered approach explained a larger proportion of variance in all outcomes compared to the interaction term of the variable-centered approach (see Appendix E). Taken together, our results generally confirm that a group-centered approach utilizing LPA detects more nuanced differences between climate profiles—configured by different degrees of climate level and strength—and provides more robust support for the climate-related expectations of situation strength theory than the traditional variable-centered approach using moderated multiple regression.

## Discussion

It has long been assumed, based on situation strength theory, that climates reflecting strong situations result in more consistent behavior patterns in groups which should, in turn, be associated with stronger connections with theoretically-relevant group outcomes (e.g., Lindell & Brandt, 2000; Schneider et al., 2002). However, empirical tests of this theoretical expectation have been mixed. We proposed that one reason for the inconsistency between theory and empirical results may be the reliance on variable-centered as opposed to group-centered conceptual and analytical approaches. The group-centered approach recognizes the possibility of distinct subpopulations within a sample and extracts phenomenologically-experienced climate profiles which cannot be identified and contrasted using the variable-centered approach. Consequently, using a group-centered approach, the purpose of this study was to (a) identify meaningful climate profiles that typify the configurations of climate level and strength in workgroups and organizations, (b) test whether there are meaningful differences in group outcomes across these profiles, and (c) compare conclusions derived from group-centered versus variable-centered approaches in evaluating the propositions of situation strength theory. We accomplished this by testing two research questions and two hypotheses with unit-level data from a multi-national, multi-industry sample of 302 workgroups (Sample 1) and then again at a higher level of analysis with data from a sample of 107 manufacturing organizations (Sample 2).

Results stemming from the three noted objectives contribute to the climate literature in at least three key ways. First, we propose an alternative conceptualization and method for examining the interaction between climate level and strength by taking a group-centered approach and using LPA to identify emergent climate profiles. The four to six distinct climate profiles that characterized groups and organizations in our data offer a starting point for future examinations of climate level and strength interactions. Second, consistent with situation strength theory, we found that groups with stronger and more favorable climate profiles tended to experience more desirable outcomes across two time periods than groups with comparatively weaker and less favorable climate profiles. This pattern of findings substantiates the oft-repeated, but little-supported, expectation that climate level and strength interact to magnify the connection between climate and relevant group outcomes. Finally, by comparing results based on a group-centered LPA approach to results generated using a variable-centered regression approach, we reveal how the traditional approach for testing climate level and strength interactions may have hindered the ability to identify the theorized phenomenon. That is, whereas a variable-based approach offers limited support for the climate-related expectations of situation strength theory, a group-based approach more strongly supports theoretical expectations using the very same data. Next, we expand on the theoretical and practical implications of these core findings.

**Theoretical Implications**

It is accepted practice that climate researchers must demonstrate a high level of agreement among respondents to justify aggregating individual responses to the group level (James, 1982). Yet, as demonstrated and examined in the current study, the amount of sharedness, or climate strength, has been proposed as a meaningful construct in and of itself (Chan, 1998; Keeler, et al., in press; Kozlowski & Klein, 2000). At the very least, using agreement as a threshold for aggregating responses to the group level results in range restriction (more specifically, restricted variance, see Cortina et al., 2019). That being said, in organizational samples that met heuristic guidelines for within-group agreement (see Appendix B), we still identified four to six climate profiles with at least three comparatively different levels of climate strength (low, medium, and high). This provides empirical evidence for meaningful variability in climate strength, even beyond standard cut-off levels (e.g., .70 or .80 for $r_{wg(j)}$). That is, even with group climates generally exceeding standard cutoff values for within-group agreement, we still found meaningful differences in climate strength that evidenced varying connections with group outcomes when paired with different climate levels. Thus, while climates fundamentally consist of *shared* perceptions in a group, our findings underscore the reality that there can still be impactful variability in that sharedness.

Situation strength theory proposes that strong, unambiguous situations create circumstances that influence behavior to a greater degree than individual differences do. Despite generally weak pre-existing support in the climate literature for this expectation, our findings using a group-centered conceptual and analytical approach substantiate the notion that less ambiguous climates create strong situations that have greater effects on group members' behavior. Of note, unambiguous situations can be either positive or negative. That is, theoretically, a stronger climate—whether favorable or unfavorable—should have a greater influence on group members' behavior (for better or worse) than a weaker climate. This is because, in either case, the situation is strong. This expectation was perhaps best illustrated with productivity climate in our organization-level data. Excessive emphasis on productivity may promote financial success while simultaneously jeopardizing workplace safety (Jiang & Probst, 2015). Consistent with this, lower-level but high-consensus productivity climates (LH) reported the fewest accidents whereas higher-level, high-consensus productivity climates (MH) recorded the best financial outcomes. Interestingly, groups with the MH profile—high agreement regarding a more moderate level of productivity—reported the second-lowest accident rate as well (next to the LH profile). This suggests that being consistently more *moderate* regarding productivity in a safety-salient context may be good enough for both financial and safety-related success.

Beyond these findings with productivity climate—with only two organizations characterizing the LH profile—we identified very few climate profiles in either sample that were characterized by low climate level and high climate strength (LH). This is perhaps not surprising, however, when considering the climates under consideration and the industries from which data were collected. It is simply not sustainable for workgroups or organizations with excessively poor safety or ethics climates, for example, to remain viable, particularly in high-reliability, safety-salient contexts. If workgroup members perpetuate a shared willingness to compromise safety within a group, it is doubtful such employees would be employed for long. Although a limited number of organizations did fit the LH profile for promotion and ethical climates, these profiles are somewhat less concerning when one considers the absolute, rather than relative, climate levels in these instances (2.60 and 3.31 on a 5-point scale). In any case, the prevalence of certain climate profiles emerging in group-level data should be considered in tandem with the type of climate under investigation. For many climate types, including the majority considered here, it is simply not likely that LH profiles will be observed.

When considering the climate types examined in this study, there are high-level patterns of results worth highlighting. For example, if using the Competing Values Framework (CVF; Quinn & Rohrbaugh, 1983) to categorize climates based on common underlying values (see Beus, Solomon et al., 2020), it is noteworthy that safety, ethics, and prevention climates all reflect hierarchy values. That is, these climates share the commonality of being based on values of internal stability and control, manifested in perceived priorities and practices that facilitate rule-following, order, and predictability. Conversely, productivity and promotion climates reflect market values, or an emphasis on competitiveness and achievement (Hartnell et al., 2011; Quinn & Kimberly, 1984). Given these high-level conceptual demarcations, it is noteworthy that the hierarchy climates (i.e., safety, ethics, prevention) yielded more similar climate profiles and generally more favorable connections with group outcomes relative to the market climates (i.e., productivity, promotion). Given the natural importance of internal control and predictability in the high-reliability and manufacturing contexts of our data, it makes sense that higher-level, higher-consensus hierarchy climate profiles would tend to yield more favorable and consistent connections with group outcomes than higher-level, higher-consensus market climate profiles. This is in line with recent findings regarding climate-context congruence (Beus et al., 2021), particularly with hierarchy climates that demonstrate stronger connections with group performance when the consequences for errors are more severe and when worker health and safety are at stake. Because the work context is an important factor in climate research, we encourage future consideration of climate profiles that considers other contexts where market climates may be better fitting. For example, it is likely that a different pattern of results regarding climate profiles would be revealed when considering market climates in more competitive industries (e.g., finance) that may be more congruent with their underlying values.

**Practical Implications**

Our findings reveal that climate profiles appear to have predictive value and may therefore provide valuable insights about the importance of managing climate level and consensus in both workgroups and organizations. As expected by situation strength theory, this study's results suggest that—among the climate types examined here—the ideal climate profile generally consists of a stronger, more favorable climate. Notably, the less studied indicator—climate strength—is key in that it determines the functionality of climate level for various group outcomes. Given that the majority of workgroups and organizations revealed HM climate profiles, organizations may want to specifically invest in efforts to increase climate strength within these groups, so that they are put on a trajectory toward obtaining HH profiles rather than ML profiles. This could be accomplished by striving for greater consistency in leader messaging, clearer and more pervasive socialization practices, and more targeted selection procedures (see Gonzalez-Roma et al., 2002; Klein et al., 2001; Zohar & Tenne-Gazit, 2008).

Our findings also offer a potential means for organization leaders to identify workgroups to monitor more closely for targeted interventions. While groups with higher-level and higher-consensus climate profiles might be observed to identify best practices, groups with lower-level and/or lower-consensus profiles could be observed to facilitate improvement. For instance, for workgroups with ML or MH profiles, managers might attempt to elevate the climate level by encouraging positive social interactions and networking among employees and by promoting a trusting and transparent environment, which has been shown to impact both climate level and strength (e.g., Zohar & Luria, 2004). Alternatively, the composition of workgroups could be strategically reconfigured so that members of a ML or LL group—particularly in leadership positions—are replaced by members of a HH group to see if this results in the new group shifting to establish a climate profile with more favorable consensus.

**Limitations and Future Research Directions**

Although this study has a number of strengths, we acknowledge its limitations as well. For instance, LPA is an inherently inductive analytical technique that is likely to uncover sample-specific nuances in model results. Because of this, we cannot conclude definitively that the group climate profiles we identified in our data (or their prevalence) will generalize to other samples, even with the same climate types. As reported, there was some variability in the profiles that emerged for safety climate (using the same measure) in Sample 1 versus Sample 2. For example, Sample 2 yielded groups fitting an additional profile (MM) that did not emerge in Sample 1. However, part of the explanation for this difference could also be that Sample 1 was workgroup-level data whereas Sample 2 was at the organization level. It is likely that some organizational factors (e.g., leadership styles, industry characteristics) are likely to influence the emergence of climate profiles as well as their associations with climate-relevant outcomes. We also note that despite this difference, there were noteworthy similarities in the type and prevalence of safety climate profiles that emerged across these two datasets. Similarities were also observed with related ethics and prevention climates. Nevertheless, researchers will need to consider the possibility of sample-specific results when conducting future tests using LPA. Moreover, some less-prevalent climate profiles may exist in our sample, which could potentially lead to less clear-cut patterns of prediction. As summarized in Research Question 1 and Table 10, the LL, LM, and

LH appear to be less frequent compared to other profiles across all climate types in both samples. Related to the above issues, it may be unrealistic to gain access to samples that are sufficiently large to conduct LPA in applied settings; thus, creating benchmarks, guidelines, or applications for identifying climate profiles may be the focus of future research.

Another potential limitation is that although we expanded the range of climate types by examining four additional climates in Sample 2, some domain-specific climates (e.g., service, justice, support) were not examined in this study. Nevertheless, regardless of climate type, our findings generally supported situation strength theory and we do not have specific reasons to expect other climate types to provide different results. That said, future research could broaden the range of climate types assessed, considering CVF climate types beyond hierarchy and market to also include clan (e.g., climates for support or justice) and adhocracy climates (e.g., climates for innovation or autonomy). We encourage climate researchers to broaden the consideration of climate types in this way when examining climate profiles in the future.

Moreover, we relied on two indicators to construct the climate profiles: climate level and climate strength. Another potential climate indicator that could be considered is climate uniformity (González-Romá & Hernández, 2014), which provides a more nuanced way of capturing the variability of climate perceptions in a group beyond standard deviation. For example, it can characterize the extent to which there is a bi-modal distribution of perceptions or a more uniformly variable one. However, in testing climate uniformity along with climate level and strength using LPA, we found that uniformity did not vary dramatically across the groups. For example, only 8% of the groups in Sample 1 had a non-uniform-distribution. In this case, we believe that parsimony (and interpretability) is the approach that is more likely to advance the climate literature in the current study. In the future, researchers could collect samples with larger unit sizes, which may potentially increase the variance of climate uniformity, and explore climate profiles that incorporate climate uniformity.

Likewise, we encourage climate researchers to consider theoretically-relevant antecedents of the type and prevalence of climate profiles in future research. Such antecedents could include socialization practices, leadership styles, or employee selection procedures. For example, institutionalized socialization practices (e.g., company-wide orientations and training) might yield fewer distinct workgroup climate profiles over time relative to using more localized, on-the-job socialization practices which might yield greater variability in climate profiles across workgroups. Opportunities for social interactions in workgroups and organizations has been found to affect climate strength (Zohar & Luria, 2004; Zohar & Tenne-Gazit, 2008) and may likewise affect the emergence of distinct climate profiles across organizations or organizational units. Considering these and other possible antecedents of climate profiles would meaningfully extend the present findings.

## Conclusion

Situation strength theory posits that unambiguous situations lead to greater behavioral consistency. This expectation has been tested repeatedly in the climate literature but with largely disappointing results. Using a group, as opposed to a variable-centered conceptual and analytical approach, we demonstrated more robust support for the climate-related expectations of situation strength theory than past research has accomplished. That is, rather than testing simple climate level and strength interactions, we used LPA to inductively identify distinct climate profiles reflecting meaningful combinations of climate level and strength. We identified these climate profiles in both workgroup and organization-level data and with multiple climate types, finding that groups with stronger, more favorable climates generally yielded more favorable connections with group outcomes than groups with weaker, less favorable climates. This more firmly substantiates the previously assumed, but weakly supported, expectations of situation strength theory in the climate literature and provides a foundation from which future climate research can build to advance understanding of organizational climate profiles.

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**Table 1**

Hypothetical Profiles of Organizational Climate Level and Strength

| Climate strength | Climate level | | |
|---|---|---|---|
| | Low | Medium | High |
| Low | LL<br>Low-level, weak climate | ML<br>Medium-level, weak climate | HL<br>High-level, weak climate |
| Medium | LM<br>Low-level but inconsistent climate | MM<br>Medium-level, inconsistent climate | HM<br>High-level but inconsistent climate |
| High | LH<br>High-level, strong climate | MH<br>Medium-level, strong climate | HH<br>High-level, strong climate |

**Table 2**

Descriptive Statistics and Correlations among the Variables in Sample 1

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Safety climate level | 4.01 | 0.41 | (.96) | | | | | | | | | |
| 2. Safety climate strength | -0.56 | 0.27 | .24** | -- | | | | | | | | |
| 3. Safety knowledge | 4.22 | 0.35 | .45** | .11 | (.96) | | | | | | | |
| 4. Safety motivation | 4.09 | 0.31 | .34** | -.11 | .78** | (.93) | | | | | | |
| 5. Safety compliance | 4.12 | 0.43 | .65** | .15 | .73** | .77** | (.83) | | | | | |
| 6. Safety participation | 4.02 | 0.42 | .69** | .11 | .60** | .78** | .80** | (.93) | | | | |
| 7. T2 Safety knowledge | 4.16 | 0.37 | .45** | -.16 | .76** | .55** | .64** | .62** | (.96) | | | |
| 8. T2 Safety motivation | 4.35 | 0.31 | .52** | .01 | .61** | .60** | .59** | .64** | .60** | (.98) | | |
| 9. T2 Safety compliance | 4.19 | 0.30 | .51** | -.12 | .68** | .50** | .66** | .64** | .92** | .58** | (.92) | |
| 10. T2 Safety participation | 4.22 | 0.31 | .48** | -.04 | .68** | .47** | .64** | .65** | .84** | .65** | .91** | (.95) |

*Notes.* Correlations among the first five factors were for five combined samples ($N$ = 302 workgroups); Unit-level Internal consistency reliabilities (Coefficient Alphas) appear in parentheses on the diagonal; Time 2 measures were collected 1 month after safety climate measures; Time 2 measures and T1 safety motivation were obtained from one organization ($N$ = 62 workgroups); ** $p < .01$.

**Table 3**

Fit Statistics for Profile Structures in Sample 1

| # of profiles | LL | FP | AIC | BIC | SSA–BIC | Entropy | LMR (*p*) | BLRT (*p*) |
|---|---|---|---|---|---|---|---|---|
| 2 | -175.38 | 7 | 364.77 | 390.74 | 368.54 | 0.71 | 0.00 | 0.00 |
| 3 | -171.24 | 10 | 362.47 | 399.57 | 367.86 | 0.77 | 0.04 | 0.09 |
| 4 | -165.39 | 13 | 356.78 | 405.02 | 363.79 | 0.74 | 0.26 | 0.00 |
| 5 | -154.34 | 16 | 340.69 | 400.06 | 349.31 | 0.78 | 0.04 | 0.00 |
| 6 | -150.67 | 19 | 339.34 | 409.84 | 349.58 | 0.84 | 0.10 | 0.00 |

*Notes.* LL = log-likelihood; FP = free parameters; AIC = Akaike information criteria; BIC = Bayesian information criteria; SSA–BIC = sample-size-adjusted BIC; LMR = Lo, Mendell, and Rubin (2001) test; BLRT = bootstrapped log-likelihood ratio tests.

**Table 4**

Descriptive Information for Each Latent Profile in Sample 1

| Number | Profiles | % of sample at Time 1 | Number of workgroups at Time 1 | Safety climate level | | Safety climate strength | |
|---|---|---|---|---|---|---|---|
| | | | | *M* | *SE* | *M* | *SE* |
| 1 | High safety climate with high consensus (HH) | 5 | 16 | 4.70 | 0.06 | -0.20 | 0.04 |
| 2 | High safety climate with medium consensus (HM) | 65 | 195 | 4.13 | 0.04 | -0.54 | 0.02 |
| 3 | Medium safety climate with high consensus (MH) | 13 | 38 | 3.65 | 0.12 | -0.30 | 0.06 |
| 4 | Medium safety climate with low consensus (ML) | 8 | 25 | 3.98 | 0.06 | -1.07 | 0.06 |
| 5 | Low safety climate with low consensus (LL) | 9 | 28 | 3.39 | 0.08 | -0.84 | 0.04 |

*Notes*. $N$ = 302 workgroups. Safety climate strength is a sign-reversed SD.

**Table 5**

Mean Outcome Scores by Safety Climate Profile in Sample 1

| Outcome | HH (a) *N* = 16, 1 | HM (b) *N* = 195, 44 | MH (c) *N* = 38, 5 | ML (d) *N* = 25, 6 | LL (e) *N* = 28, 6 | chi-square |
|---|---|---|---|---|---|---|
| Safety knowledge | 4.63[b,c,d,e] | 4.29[a,c,e] | 3.9[a,b] | 4.18[a,e] | 3.95[a,b,d] | 51.88* |
| Safety motivation | X | 4.16[c] | 3.93[b] | 4.23 | 3.86 | 48.41* |
| Safety compliance | 4.76[b,c,d,e] | 4.22[a,c,d,e] | 3.72[a,b,d] | 4.08[a,b,c,e] | 3.63[a,b,d] | 132.95* |
| Safety participation | 4.65[b,c,d,e] | 4.12[a,c,e] | 3.54[a,b,d] | 4.04[a,c,e] | 3.59[a,b,d] | 122.97* |
| T2 Safety knowledge | X | 4.26[c,e] | 4.03[b,d] | 4.38[c,e] | 3.84[b,d] | 80.39* |
| T2 Safety motivation | X | 4.44[c,e] | 4.11[b] | 4.44 | 3.86[b] | 21.4* |
| T2 Safety compliance | X | 4.27[c,e] | 4.05[b,d] | 4.49[c,e] | 3.88[b,d] | 150.79* |
| T2 Safety participation | X | 4.3[e] | 4.12[d,e] | 4.48[c,e] | 3.76[b,c,d] | 155.64* |

*Notes.* $N$ = 302 workgroups for most Time 1 variables; $N$ = 62 workgroups for Time 2 variables (T2) and Time 1 safety motivation. Ns at the top of the columns represent the number of work groups at each time period. X = Given that outcome data were only available for one of the HH workgroups, the mean levels of these outcomes are unstable, unrepresentative, and therefore not presented in this table. Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table 6**

Regression Results Predicting Safety-Related Outcomes in Sample 1

| Variable | Safety knowledge $\beta$ | Safety motivation $\beta$ | Safety compliance $\beta$ | Safety participation $\beta$ | T2 Safety knowledge $\beta$ | T2 Safety motivation $\beta$ | T2 Safety compliance $\beta$ | T2 Safety participation $\beta$ |
|---|---|---|---|---|---|---|---|---|
| SCL | 0.49*** | 0.35* | 0.65*** | 0.69*** | 0.44*** | 0.57*** | 0.51*** | 0.46*** |
| SCS | -0.01 | -0.21 | -0.01 | -0.05 | -0.30** | -0.10 | -0.25* | -0.17 |
| SCL * SCS | -0.04 | -0.20 | 0.02 | 0.05 | -0.37*** | -0.05 | -0.32** | -0.31** |

*Notes.* All coefficients are standardized; SCL = safety climate level. SCS = safety climate strength; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

**Table 7.** Descriptive Statistics and Correlations among the Variables in Sample 2

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Prom climate | 3.44 | 0.59 | (.93) | | | | | | | | | | | | | | | | | |
| 2. Prom climate strength | -0.81 | 0.35 | .42* | - | | | | | | | | | | | | | | | | |
| 3. Prev climate | 4.16 | 0.45 | .04 | .20* | (.96) | | | | | | | | | | | | | | | |
| 4. Prev climate strength | -0.55 | 0.32 | -.03 | .39* | .57* | - | | | | | | | | | | | | | | |
| 5. Safety climate | 3.95 | 0.46 | .20* | .15 | .56* | .17 | (.96) | | | | | | | | | | | | | |
| 6. Safety climate strength | -0.52 | 0.23 | .02 | .24* | .36* | .29* | .58* | - | | | | | | | | | | | | |
| 7. Prod climate | 3.44 | 0.55 | .25* | .01 | -.03 | -.06 | -.07 | -.16 | (.88) | | | | | | | | | | | |
| 8. Prod climate strength | -0.61 | 0.27 | .09 | .34** | .01 | .35* | .03 | .37* | -.02 | - | | | | | | | | | | |
| 9. Ethical climate | 4.52 | 0.57 | .14 | .08 | .62* | .21* | .58* | .37* | .02 | -.03 | (.93) | | | | | | | | | |
| 10. Ethical climate strength | -0.74 | 0.30 | .04 | .34* | .32* | .32* | .36* | .67* | .04 | .53* | .29* | - | | | | | | | | |
| 11. T1 Collective comm | 4.06 | 0.42 | -.00 | -.01 | .50* | .01 | .46* | .18 | -.13 | -.12 | .39* | .13 | (.97) | | | | | | | |
| 12. T1 Organizational Prod | 3.79 | 0.53 | .04 | .07 | .38* | .06 | .22* | .03 | -.20* | -.16 | .35* | -.09 | .39** | - | | | | | | |
| 13. T1 Accidents | 0.82 | 0.72 | .05 | -.13 | -.11 | -.11 | -.11 | -.33* | .17 | -.30* | -.16 | -.26* | -.10 | -.07 | - | | | | | |
| 14. T2 Collective comm | 4.06 | 0.37 | .16 | .09 | .53* | -.00 | .40* | .12 | -.01 | -.24 | .47* | -.05 | .87* | .46* | -.21 | (.95) | | | | |
| 15. T2 Organizational Prod | 3.81 | 0.52 | .14 | .01 | .21 | -.01 | .13 | .02 | -.07 | -.21 | .37* | -.20 | .37* | .87* | -.15 | .42* | - | | | |
| 16. T2 Accidents | 0.89 | 0.81 | .16 | -.15 | -.09 | -.06 | -.06 | -.36* | .26 | -.38* | -.10 | -.22 | -.11 | -.03 | .99* | -.21 | -.15 | - | | |
| 17. T2 Profit per employee | 11.51 | 32.98 | .15 | .09 | .20 | .18 | .29* | .22 | -.14 | .23 | .41* | .23 | .25 | .36* | -.12 | .07 | .34* | -.18 | - | |
| 18. T2 Return on assets | 2.82 | 9.54 | .13 | .03 | .12 | .10 | .14 | .13 | -.21 | .19 | .26* | .04 | .08 | .37* | -.18 | .01 | .39* | -.28 | .82* | - |
| 19. T2 EBITDA margin | 8.31 | 9.62 | .17 | -.06 | -.04 | -.05 | .11 | .14 | -.09 | .23 | .24 | .15 | .04 | .27* | -.13 | -.04 | .25 | -.17 | .73* | .74* |

*Notes.* Prom = Promotion; Prev = Prevention; Prod = Productivity; Comm = Commitment; T1 = Time 1; T2 = Time 2. All statistics are reported at the organizational level (T1 = 107; T2 = 52-61). Organizational-level Internal consistency reliabilities (Coefficient Alphas) appear in parentheses on the diagonal. * $p < .05$.

**Table 8**

Fit Statistics for Profile Structures in Sample 2

| Climate type | # of profiles | LL | FP | AIC | BIC | SSA–BIC | Entropy | LMR ($p$) | BLRT ($p$) |
|---|---|---|---|---|---|---|---|---|---|
| Safety climate | 2 | -31.36 | 7 | 76.71 | 95.42 | 73.31 | 0.88 | 0.00 | 0.00 |
| | 3 | -29.27 | 10 | 78.54 | 105.27 | 73.68 | 0.69 | 0.27 | 0.38 |
| | 4 | -26.50 | 13 | 79.00 | 113.75 | 72.68 | 0.81 | 0.16 | 0.24 |
| | 5 | -21.81 | 16 | 75.63 | 118.39 | 67.84 | 0.79 | 0.03 | 0.14 |
| | 6 | -17.74 | 19 | 73.49 | 124.27 | 64.24 | 0.82 | 0.06 | 0.21 |
| Productivity climate | 2 | -91.00 | 7 | 196.01 | 214.72 | 192.60 | 0.98 | 0.01 | 0.02 |
| | 3 | -85.27 | 10 | 190.54 | 217.27 | 185.67 | 0.83 | 0.01 | 0.03 |
| | 4 | -81.99 | 13 | 189.97 | 224.72 | 183.65 | 0.76 | 0.11 | 0.27 |
| | 5 | -76.50 | 16 | 185.00 | 227.77 | 177.22 | 0.80 | 0.02 | 0.07 |
| | 6 | -73.71 | 19 | 185.43 | 236.21 | 176.18 | 0.82 | 0.16 | 1.00 |
| Promotion climate | 2 | -115.22 | 7 | 244.45 | 263.16 | 241.04 | 0.76 | 0.00 | 0.00 |
| | 3 | -110.39 | 10 | 240.79 | 267.51 | 235.92 | 0.80 | 0.03 | 0.07 |
| | 4 | -106.63 | 13 | 239.26 | 274.00 | 232.93 | 0.71 | 0.07 | 0.25 |
| | 5 | -100.78 | 16 | 233.55 | 276.32 | 225.77 | 0.81 | 0.01 | 0.05 |
| | 6 | -99.52 | 19 | 237.04 | 287.83 | 227.79 | 0.82 | 0.50 | 1.00 |
| Prevention climate | 2 | -69.71 | 7 | 153.42 | 172.13 | 150.01 | 0.88 | 0.00 | 0.00 |
| | 3 | -60.93 | 10 | 141.86 | 168.59 | 137.00 | 0.73 | 0.00 | 0.00 |
| | 4 | -54.58 | 13 | 135.17 | 169.92 | 128.84 | 0.84 | 0.01 | 0.00 |
| | 5 | -48.40 | 16 | 128.79 | 171.56 | 121.00 | 0.85 | 0.01 | 0.05 |
| | 6 | -43.13 | 19 | 124.25 | 175.04 | 115.01 | 0.88 | 0.02 | 0.10 |
| Ethical climate | 2 | -108.17 | 7 | 230.34 | 249.05 | 226.93 | 0.56 | 0.02 | 0.03 |
| | 3 | -104.78 | 10 | 229.55 | 256.28 | 224.69 | 0.63 | 0.10 | 0.67 |
| | 4 | -98.67 | 13 | 223.34 | 258.09 | 217.01 | 0.74 | 0.01 | 0.00 |
| | 5 | -95.21 | 16 | 222.42 | 265.19 | 214.63 | 0.78 | 0.09 | 0.67 |
| | 6 | -88.51 | 19 | 215.03 | 265.81 | 205.78 | 0.89 | 0.01 | 0.00 |

*Notes.* LL = log-likelihood; FP = free parameters; AIC = Akaike information criteria; BIC = Bayesian information criteria; SSA–BIC = sample-size-adjusted BIC; LMR = Lo, Mendell, and Rubin (2001) test; BLRT = bootstrapped log-likelihood ratio tests.

**Table 9**

Descriptive Information for Each Latent Climate Profile in Sample 2

| Climate type | Number | Profiles | % of sample at T1 | Number of organizations at T1 | Climate level | | Climate strength | |
|---|---|---|---|---|---|---|---|---|
| | | | | | *M* | *SE* | *M* | *SE* |
| Safety climate | 1 | High level with high consensus (HH) | 18 | 19 | 4.42 | 0.08 | -0.27 | 0.04 |
| | 2 | High level with medium consensus (HM) | 43 | 46 | 4.16 | 0.04 | -0.47 | 0.03 |
| | 3 | Medium level with high consensus (MH) | 11 | 12 | 3.55 | 0.10 | -0.36 | 0.02 |
| | 4 | Medium level with medium consensus (MM) | 15 | 16 | 3.58 | 0.09 | -0.71 | 0.03 |
| | 5 | Medium level with low consensus (ML) | 7 | 8 | 3.71 | 0.12 | -0.96 | 0.04 |
| | 6 | Low level with low consensus (LL) | 6 | 6 | 3.01 | 0.10 | -0.92 | 0.03 |
| Productivity climate | 1 | High level with medium consensus (HM) | 28 | 30 | 3.96 | 0.06 | -0.46 | 0.03 |
| | 2 | Medium level with high consensus (MH) | 21 | 22 | 3.15 | 0.14 | -0.37 | 0.07 |
| | 3 | Medium level with low consensus (ML) | 34 | 36 | 3.58 | 0.06 | -0.88 | 0.03 |
| | 4 | Low level with high consensus (LH) | 2 | 2 | 1.62 | 0.05 | -0.24 | 0.09 |
| | 5 | Low level with medium consensus (LM) | 16 | 17 | 2.80 | 0.10 | -0.73 | 0.13 |
| Promotion climate | 1 | High level with medium consensus (HM) | 42 | 45 | 3.90 | 0.08 | -0.55 | 0.04 |
| | 2 | Medium level with medium consensus (MM) | 33 | 35 | 3.36 | 0.10 | -0.89 | 0.08 |
| | 3 | Medium level with low consensus (ML) | 13 | 14 | 3.16 | 0.09 | -1.41 | 0.08 |
| | 4 | Low level with high consensus (LH) | 6 | 6 | 2.60 | 0.25 | -0.45 | 0.02 |
| | 5 | Low level with low consensus (LL) | 7 | 7 | 2.25 | 0.17 | -1.11 | 0.05 |
| Prevention climate | 1 | High level with high consensus (HH) | 47 | 50 | 4.44 | 0.07 | -0.31 | 0.02 |
| | 2 | Medium level with medium consensus (MM) | 36 | 39 | 4.00 | 0.07 | -0.59 | 0.03 |
| | 3 | Medium level with low consensus (ML) | 11 | 12 | 3.90 | 0.10 | -1.01 | 0.04 |
| | 4 | Low level with low consensus (LL) | 6 | 6 | 3.49 | 0.20 | -1.36 | 0.06 |
| Ethical climate | 1 | High level with high consensus (HH) | 7 | 7 | 5.47 | 0.59 | -0.35 | 0.32 |
| | 2 | Medium level with medium consensus (MM) | 55 | 59 | 4.78 | 0.16 | -0.72 | 0.12 |
| | 3 | Low level with high consensus (LH) | 17 | 18 | 3.97 | 0.17 | -0.47 | 0.06 |
| | 4 | Low level with low consensus (LL) | 21 | 23 | 4.08 | 0.20 | -1.10 | 0.08 |

*Notes*. $N$ = 107 organizations. Climate strength is a sign-reversed *SD*.

**Table 10**

Prevalence and Descriptive Statistics (Means/*SD*s) of Hypothetical Organizational Climate Level and Strength Profiles across Samples

| Climate Strength | Climate Level | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Low | | | Medium | | | High | | |
| | **LL** | | | **ML** | | | **HL** | | |
| | 9 | Safety (1) | 3.39 (-0.84) | 8 | Safety (1) | 3.98 (-1.07) | 0 | Safety (1) | |
| | 6 | Safety | 3.01 (-0.92) | 8 | Safety | 3.71 (-0.96) | 0 | Safety | |
| | 0 | Productivity | | 36 | Productivity | 3.58 (-0.88) | 0 | Productivity | |
| **Low** | 7 | Promotion | 2.25 (-1.11) | 14 | Promotion | 3.16 (-1.41) | 0 | Promotion | |
| | 6 | Prevention | 3.49 (-1.36) | 12 | Prevention | 3.90 (-1.01) | 0 | Prevention | |
| | 23 | Ethics | 3.40 (-0.92) | 0 | Ethics | | 0 | Ethics | |
| | **LM** | | | **MM** | | | **HM** | | |
| | 0 | Safety (1) | | 0 | Safety (1) | | 65 | Safety (1) | 4.13 (-0.54) |
| | 0 | Safety | | 16 | Safety | 3.58 (-0.71) | 46 | Safety | 4.16 (-0.47) |
| **Medium** | 17 | Productivity | 2.80 (-0.73) | 0 | Productivity | | 30 | Productivity | 3.96 (-0.46) |
| | 0 | Promotion | | 35 | Promotion | 3.36 (-0.89) | 45 | Promotion | 3.90 (-0.55) |
| | 0 | Prevention | | 39 | Prevention | 4.00 (-0.59) | 0 | Prevention | |
| | 0 | Ethics | | 59 | Ethics | 3.98 (-0.60) | 0 | Ethics | |
| | **LH** | | | **MH** | | | **HH** | | |
| | 0 | Safety (1) | | 13 | Safety (1) | 3.65 (-0.30) | 5 | Safety (1) | 4.70 (-0.20) |
| | 0 | Safety | | 12 | Safety | 3.55 (-0.36) | 19 | Safety | 4.42 (-0.27) |
| **High** | 2 | Productivity | 1.62 (-0.24) | 22 | Productivity | 3.15 (-0.37) | 0 | Productivity | |
| | 6 | Promotion | 2.60 (-0.45) | 0 | Promotion | | 50 | Promotion | |
| | 0 | Prevention | | 0 | Prevention | | 0 | Prevention | 4.44 (-0.31) |
| | 18 | Ethics | 3.31 (-0.39) | 0 | Ethics | | 7 | Ethics | 4.56 (-0.29) |

*Note*. Safety (1) represents Safety Climate profiles from Sample 1. All climates were rated on a 5-point scale, except ethics which was rated on a 6-point scale and then converted to a 5-point scale to facilitate comparisons to the other climates.

**Table 11**

Mean Outcome Scores by Safety Climate Profile in Sample 2

| Outcome | HH (a) | HM (b) | MH (c) | MM (d) | ML (e) | LL (f) | chi-square |
|---|---|---|---|---|---|---|---|
| T1 Collective Commitment | $4.42^{b,c,d,f}$ | $4.08^{a,c,d,e,f}$ | $3.8^{a,b,e}$ | $3.82^{a,b,e}$ | $4.34^{b,c,d,f}$ | $3.38^{a,b,e}$ | 57.62* |
| T1 Organizational Productivity | $4.05^{f}$ | 3.76 | 3.62 | $3.69^{e}$ | $4.01^{d,f}$ | $3.52^{a,e}$ | 10.55 |
| T1 Accidents | $0.38^{b,e,f}$ | $1.07^{a,c,d,f}$ | $0.2^{b,d,e,f}$ | $0.58^{b,c,e,f}$ | $1.15^{a,c,d}$ | $1.84^{a,b,c,d}$ | 62.06* |
| T2 Collective Commitment | $4.31^{b,c,d}$ | $4.09^{a}$ | $3.83^{a,e}$ | $4^{a,e}$ | $4.25^{c,d}$ | 3.6 | 14.64* |
| T2 Organizational Productivity | $4.36^{b,c,d,e}$ | $3.67^{a}$ | $3.45^{a,e}$ | $3.84^{a}$ | $3.81^{a,c}$ | 3.86 | 32.5* |
| T2 Accidents | $0.38^{b,c,e,f}$ | $1.27^{a,c,d,f}$ | $0.04^{a,b,d,e,f}$ | $0.56^{b,c,e,f}$ | $1.29^{a,c,d,f}$ | $1.84^{a,b,c,d,e}$ | 560.68* |
| T2 Profit per employee | 32.2 | $11.49^{e}$ | 8.45 | -2 | $0.65^{b}$ | 0.59 | 9.56 |
| T2 Return on Assets | 5.53 | 2.77 | 3.68 | 0.48 | 0.7 | 0.83 | 4.01 |
| T2 EBITDA margin | 16.32 | 5.68 | 9.78 | 6.23 | 7.28 | 9.42 | 4.94 |

*Notes*. $N$ = 107 organizations at Time 1 (T1). $N$ = 52-61 organizations at Time 2 (T2). Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table 12**

Mean Outcome Scores by Productivity Climate Profile in Sample 2

| Outcome | HM (a) | MH (b) | ML (c) | LH (d) | LM (e) | chi-square |
|---|---|---|---|---|---|---|
| T1 Collective Commitment | $3.94^{e}$ | $3.94^{e}$ | 4.12 | $4.07^{e}$ | $4.32^{a,b,d}$ | 8.06 |
| T1 Organizational Productivity | 3.63 | 3.83 | 3.88 | 4.3 | 3.82 | 4.24 |
| T1 Accidents | $0.86^{b,d}$ | $0.5^{a,c,d}$ | $1.12^{b,d}$ | $0.01^{a,b,c,e}$ | $0.7^{d}$ | 164.98* |
| T2 Collective Commitment | 4.14 | 3.7 | $4.16^{d}$ | $4.41^{c}$ | 4.22 | 90.89* |
| T2 Organizational Productivity | 3.75 | 3.57 | 3.95 | 3.75 | 3.93 | 2.45 |
| T2 Accidents | $1.04^{d}$ | $0.48^{c,d}$ | $1.23^{b,d}$ | $0.01^{a,b,c}$ | 0.62 | 76.76* |
| T2 Profit per employee | 10.35 | $27.9^{c}$ | $-3.38^{b,e}$ | 11.69 | $10.43^{c}$ | 7.68 |
| T2 Return on Assets | 2.76 | $7.21^{c}$ | $-2.55^{b,d,e}$ | $3.71^{c}$ | $5.41^{c}$ | 9.91* |
| T2 EBITDA margin | 10.42 | 10.65 | $3.85^{d}$ | $10.9^{c,e}$ | $8.51^{d}$ | 15.15* |

*Notes*. $N$ = 107 organizations at Time 1 (T1). $N$ = 52-61 organizations at Time 2 (T2). Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table 13**

Mean Outcome Scores by Promotion Climate Profile in Sample 2

| Outcome | HM (a) | MM (b) | ML (c) | LH (d) | LL (e) | chi-square |
|---|---|---|---|---|---|---|
| T1 Collective Commitment | 4.14 | 3.93 | 4.11 | 3.84[e] | 4.28[d] | 6.4 |
| T1 Organizational Productivity | 3.89 | 3.67 | 3.74 | 3.68 | 3.97 | 3.14 |
| T1 Accidents | 0.89[d] | 0.72 | 1.11[d] | 0.4[a,c] | 0.76 | 7.57 |
| T2 Collective Commitment | 4.2[d] | 4.03[d] | 4[d] | 3.28[a,b,c,e] | 4.2[d] | 18.69* |
| T2 Organizational Productivity | 3.86 | 3.74 | 3.95 | 3.8 | 3.55 | 2.46 |
| T2 Accidents | 1.03[d] | 0.63 | 1.5[d] | 0.32[a,c] | 0.67 | 8.85 |
| T2 Profit per employee | 18.36[e] | 6.94 | 5.6 | 18.83[e] | -3.72[a,d] | 9.13 |
| T2 Return on Assets | 2.4 | 5.1 | 1.89 | 4.4 | -4.38 | 4.32 |
| T2 EBITDA margin | 5.97[d] | 12.73[e] | 8.67 | 13.02[a,e] | -0.63[b,d] | 25.82* |

*Notes.* $N$ = 107 organizations at Time 1 (T1). $N$ = 52-61 organizations at Time 2 (T2). Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table 14**

Mean Outcome Scores by Prevention Climate Profile in Sample 2

| Outcome | HH (a) | MM (b) | ML (c) | LL (d) | chi-square |
|---|---|---|---|---|---|
| T1 Collective Commitment | $4.2^{b}$ | $3.85^{a,c,d}$ | $4.15^{b}$ | $4.12^{b}$ | 6.72 |
| T1 Organizational Productivity | $3.96^{b}$ | $3.6^{a}$ | 3.76 | 3.83 | 5.62 |
| T1 Accidents | 0.66 | 0.98 | 1.03 | 0.74 | 4.44 |
| T2 Collective Commitment | $4.34^{b,c,d}$ | $3.81^{a,d}$ | $4.06^{a}$ | $4.14^{a,b}$ | 13.04* |
| T2 Organizational Productivity | $4.01^{b}$ | $3.62^{a}$ | 3.83 | 3.89 | 4.53 |
| T2 Accidents | 0.73 | 0.96 | 1.05 | 0.76 | 1.33 |
| T2 Profit per employee | 19.97 | 5.16 | 2.34 | 10.4 | 3.34 |
| T2 Return on Assets | 4.66 | 1.24 | 0.67 | 6.33 | 2.55 |
| T2 EBITDA margin | 9.6 | 5.41 | 9.25 | 16.75 | 5.27 |

*Notes.* $N$ = 107 organizations at Time 1 (T1). $N$ = 52-61 organizations at Time 2 (T2). Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table 15**

Mean Outcome Scores by Ethical Climate Profile in Sample 2

| Outcome | HH (a) | MM (b) | LH (c) | LL (d) | chi-square |
|---|---|---|---|---|---|
| T1 Collective Commitment | 4.43[c,d] | 4.17[c,d] | 3.91[a,b] | 3.8[a,b] | 17* |
| T1 Organizational Productivity | 4.35[c,d] | 3.87[c] | 3.27[a,b,d] | 3.81[a,c] | 24.17* |
| T1 Accidents | 0.34[b,c,d] | 0.69[a] | 1.04[a] | 1.11[a] | 15.79* |
| T2 Collective Commitment | 4.3[c,d] | 4.23[c,d] | 3.69[a,b] | 3.87[a,b] | 62.33* |
| T2 Organizational Productivity | 4.43[b,c,d] | 3.87[a,c] | 3.28[a,b,d] | 3.93[a,c] | 50.67* |
| T2 Accidents | 0.21[b,c,d] | 0.76[a] | 0.95[a] | 1.25[a] | 18.25* |
| T2 Profit per employee | 140.45[b,c,d] | 10.15[a] | 4.29[a] | -0.07[a] | 22.42* |
| T2 Return on Assets | 27.76[b,c,d] | 3.68[a] | -3.66[a] | 1.56[a] | 94.75* |
| T2 EBITDA margin | 42.58[b,c,d] | 7.36[a] | 5.94[a] | 7[a] | 49.12* |

*Notes.* $N$ = 107 organizations at Time 1 (T1). $N$ = 52-61 organizations at Time 2 (T2). Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table 16**

Regression Results Predicting Outcomes in Sample 2

| Variable | Collective Commitment $\beta$ | Organizational Productivity $\beta$ | Accidents $\beta$ | T2 Collective Commitment $\beta$ | T2 Organizational Productivity $\beta$ | T2 Accidents $\beta$ | T2 Profit per employee $\beta$ | T2 Return on Assets $\beta$ | T2 EBITDA Margin $\beta$ |
|---|---|---|---|---|---|---|---|---|---|
| SCL | $0.54^{***}$ | $0.32^{**}$ | 0.14 | $0.55^{**}$ | 0.26 | 0.30 | 0.24 | 0.09 | 0.01 |
| SCS | -0.11 | -0.12 | $-0.38^{**}$ | -0.20 | 0.04 | $-0.42^{*}$ | 0.15 | 0.12 | 0.26 |
| SCL * SCS | 0.07 | 0.09 | 0.09 | 0.02 | $0.34^{**}$ | 0.16 | 0.13 | 0.07 | 0.25 |
| PDCL | -0.17 | $-0.22^{*}$ | 0.17 | 0.04 | -0.11 | 0.29 | -0.24 | $-0.34^{*}$ | -0.20 |
| PDCS | -0.11 | -0.16 | $-0.29^{**}$ | -0.26 | -0.19 | $-0.40^{**}$ | 0.27 | 0.23 | $0.27^{*}$ |
| PDCL * PDCS | 0.08 | 0.03 | -0.01 | -0.07 | 0.10 | 0.03 | 0.14 | 0.20 | 0.17 |
| PCL | -0.01 | -0.004 | 0.13 | 0.12 | 0.16 | 0.24 | 0.16 | 0.17 | 0.28 |
| PCS | 0.02 | 0.09 | -0.19 | 0.07 | -0.06 | -0.25 | 0.02 | -0.05 | -0.20 |
| PCL * PCS | 0.13 | 0.09 | -0.01 | 0.20 | 0.01 | 0.14 | -0.14 | -0.17 | -0.28 |
| PVCL | $0.74^{***}$ | $0.51^{***}$ | -0.07 | $0.91^{***}$ | $0.38^{*}$ | -0.08 | 0.15 | 0.07 | -0.05 |
| PVCS | $-0.33^{**}$ | -0.14 | -0.12 | $-0.33^{*}$ | -0.11 | -0.01 | 0.12 | 0.11 | 0.02 |
| PVCL * PVCS | $0.16^{*}$ | $0.15^{*}$ | -0.09 | $0.23^{**}$ | 0.13 | 0.01 | 0.09 | 0.18 | 0.20 |
| ECL | $0.37^{***}$ | $0.41^{***}$ | -0.09 | $0.59^{***}$ | $0.46^{**}$ | -0.06 | $0.34^{*}$ | 0.27 | 0.15 |
| ECS | 0.02 | $-0.21^{*}$ | $-0.23^{*}$ | -0.19 | -0.22 | -0.21 | 0.21 | 0.01 | 0.17 |
| ECL * ECS | 0.02 | 0.01 | -0.01 | 0.01 | 0.25 | 0.02 | $0.25^{*}$ | 0.11 | 0.25 |

*Notes.* Regression models were conducted separately for different types of climate. All coefficients are standardized. SCL = safety climate level. SCS = safety climate strength. PDCL = productivity climate level. PDCS = productivity climate strength. PCL = promotion climate level. PCS = promotion climate strength. PVCL = prevention climate level. PVCS = prevention climate strength. ECL = ethical climate level. ECS = ethical climate strength. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

## Appendix A

### Measurement Equivalence

Measurement invariance is fundamental in permitting meaningful mean comparisons across groups (Steenkamp & Baumgartner, 1998; Vandenberg & Lance, 2000). Previous research has posited three levels of measurement invariance: configural, metric, and scalar (Steenkamp & Baumgartner, 1998): the configural model assumes the same factor structure across groups; the metric model imposes invariance constraints on the factor across groups; the scalar model restricts the factor intercepts to be equal across groups. Establishing metric invariance allows the comparison of covariances and unstandardized regression coefficients across groups, but only by reaching scalar invariance can the latent means be meaningfully compared (Davidov, 2010; Steenkamp & Baumgartner, 1998). However, researchers have recently claimed that the classical exact measurement equivalence approach yields some problems (e.g., less practical and largely influenced by the number of groups; Asparouhov & Muthén, 2014; Muthén & Asparouhov, 2013). Byrne et al. (1989) and Steenkamp and Baumgartner (1998) argued that partial or approximate invariance could be an acceptable condition for comparing means across groups (i.e., some factor loading and intercepts may not be held equal across groups). New advanced methods have been developed to achieve the best partial or approximate invariance model which allows meaningful mean comparison across groups (Asparouhov & Muthén, 2014). Thus, we first use the classical, restrictive approach to detect the exact measurement invariance and if the exact invariance does not hold, we then use recently-developed alignment optimization method to identify the best-fitting, more realistic approximate measurement invariance model.

**Invariance Analysis Using Multiple-group Confirmatory Factor Analysis**

First, we utilized the traditional approach for testing measurement invariance (Muthén & Asparouhov, 2017). Accordingly, we performed configural, metric, and scalar multiple-group confirmatory factor analysis (MGCFA) and reported fit indices for each model (see Table A1). As safety climate, safety compliance, and safety participation were assessed by five organizations while safety knowledge was assessed by four organizations, we performed two series of MGCFA in which one is for the former safety variables and the other is for safety knowledge. As chi-square tests are sensitive to larger sample size, measurement invariance was evaluated using the recommended cut-off criteria for the change in other model fit indices: $\Delta$CFI < 0.01, $\Delta$RMSEA < 0.015, and $\Delta$SRMR < 0.03 (Chen, 2007; Hu & Bentler, 1999).

Regarding the MGCFA models for safety climate, compliance, and participation, we found that there was a high degree of invariance between the configural and metric models as the changes for the fit indices were below the cut-off values ($\Delta$CFI = .007, $\Delta$RMSEA = 0.002, and $\Delta$SRMR = 0.016). Further, the scalar model was close to the fit of the metric model as changes in RMSEA and SRMR were acceptable ($\Delta$RMSEA = 0.015 and $\Delta$SRMR = 0.011) and CFI change was somewhat borderline ($\Delta$CFI = .028). For the MGCFA models for safety knowledge, we found that the configural model was slightly different from the metric model: although the changes for the CFI was below the cut-off values ($\Delta$CFI = 0.008), the RMSEA and SRMR were slightly above the requirements ($\Delta$RMSEA = 0.099, and $\Delta$SRMR = 0.041). Further, the scalar model was not exactly invariant from the metric model as changes in CFI, RMSEA were slightly above the criteria ($\Delta$CFI = 0.020, $\Delta$RMSEA = 0.035), although SRMR is acceptable ($\Delta$SRMR = 0.017). In summary, strictly speaking, these results were not sufficient to establish exact scalar measurement invariance as not all of fit indices (i.e., CFI, RMSEA and SRMR) satisfied the requirements even if some fit indices have a minor deviation from the criteria. Second, we conducted the alignment approach to identify the best-fitting approximate measurement invariance model endorsed by many researchers (Asparouhov & Muthén, 2014; Steenkamp & Baumgartner, 1998).

**Invariance Analysis Using the Alignment Method**

A description of parameter invariance for intercepts is presented in Tables A2 and A3. The fit function contribution describes the amount of non-invariance from each parameter across groups; the smaller the fit contribution score, the more invariant a parameter is. The $R^2$ is another measure of invariance; it indicates the extent to which the variability of intercepts and across groups in the configural model is explained by the variation in the factor mean and variance across groups. Higher $R^2$ indicates higher invariance. However, sometimes $R^2$ can be small even if the corresponding parameter is highly invariant (Muthén & Asparouhov, 2017).

The most important indicator of the invariance is the proportion of groups with non-invariance (Asparouhov & Muthén, 2014; Muthénand & Asparouhov, 2014). Muthén and Asparouhov (2014) set the upper limit of non-invariance at 25%, meaning that less than 25% non-invariance is allowed without undermining the reliability of comparing the factor means. The results for safety climate, compliance, and participation alignment analyses showed that the total proportion of non-invariance for intercepts by items across five organizations was 17.5% and the proportion observed in the slopes was as low as 2.5%. Averaging the two proportions of non-invariance, the total proportion of non-invariance observed was 10%, which was substantially below the upper limit of 25%. Similarly, the findings for safety knowledge alignment analyses indicated that the total proportion of non-invariance for intercepts and across four organizations was 8.3% and zero, respectively. The average of the two proportions of non-invariance was 4.2%. These findings demonstrated that approximate measurement invariance was achieved for all safety-related constructs supporting the aggregation of organizational samples within Sample 1.

Moreover, we conducted Monte Carlo simulations to further validate our conclusion. Monte Carlo simulations for two different sample sizes (2000 and 2500, which is close to our sample size) were used (Muthén & Asparouhov, 2017). We found that the simulated correlations between population and estimated factor means were well above Muthén and Asparouhov's (2017) recommended cut-off score of 0.98, further demonstrating the trustworthiness of the aligned results. Therefore, we concluded that approximate measurement invariance is reached and the measures utilized were unbiased and comparable across organizations.

**Table A1**

Traditional Tests of Measurement Equivalence (Sample 1)

| | Model | $\chi^2$ | *df* | CFI | TLI | RMSEA | SRMR | $\chi^{2\ diff}$ | $df^{diff}$ | ΔCFI | ΔTLI | ΔSRMR | ΔRMSEA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFA models comprised of safety climate, compliance, and participation across five organizations | Configural model | 1609.50*** | 495 | 0.96 | 0.95 | 0.07 | 0.05 | - | - | | | | |
| | Metric model | 1851.12*** | 547 | 0.95 | 0.95 | 0.07 | 0.07 | 241.622*** | 52 | 0.01 | 0.00 | 0.02 | 0.00 |
| | Scalar model | 2641.19** | 599 | 0.92 | 0.92 | 0.09 | 0.08 | 800.07*** | 52 | 0.03 | 0.02 | 0.01 | 0.01 |
| CFA models for safety knowledge across four organizations | Configural model | 0.00 | 0 | 1.00 | 1.00 | 0.00 | 0.00 | - | - | | | | |
| | Metric model | 33.58*** | 6 | 0.99 | 0.98 | 0.10 | 0.04 | 33.576 | 6 | 0.01 | 0.02 | 0.04 | 0.10 |
| | Scalar model | 112.91*** | 12 | 0.97 | 0.97 | 0.13 | 0.06 | 79.331 | 6 | 0.02 | 0.01 | 0.02 | 0.03 |

*Notes.* $\chi 2$ = Chi-square statistic; *df* = degrees of freedom; CFI = the comparative fit index; TLI = the Tucker-Lewis index; AIC = Akaike information criterion; BIC = Bayesian information criterion; RMSEA = the root mean square error of approximation; SRMR = the standardized root mean square residual; $^{***}p<0.001$.

**Table A2**

The Alignment Approach to Test the Approximate Measurement Invariance Across Five Organizations (Sample 1)

| Parameter | Item | Fit Function Contribution | $R^2$ | Aligned Parameter | Invariant Group | Non-invariant Group |
|---|---|---|---|---|---|---|
| Intercept | Safety Compliance 1 | -3.519 | 0.906 | 3.954 | 1 2 3 4 5 | |
| | Safety Compliance 2 | -3.446 | 0.354 | 3.861 | 3 4 5 | 2 1 |
| | Safety Compliance 3 | -4.502 | 0.944 | 3.889 | 1 2 3 4 | 5 |
| | Safety Compliance 4 | -5.147 | 0.976 | 3.823 | 1 2 3 4 5 | |
| | Safety Participation 1 | -4.336 | 0.243 | 3.821 | 1 3 4 5 | 2 |
| | Safety Participation 2 | -3.682 | 0.878 | 3.733 | 1 2 3 4 5 | |
| | Safety Participation 3 | -6.049 | 0.416 | 4.093 | 2 3 4 5 | 1 |
| | Safety Participation 4 | -4.620 | 0.592 | 3.714 | 2 3 4 5 | 1 |
| | Safety Climate 1 | -4.129 | 0.412 | 3.811 | 1 3 4 5 | 2 |
| | Safety Climate 2 | -5.916 | 0.071 | 3.933 | 3 4 5 | 2 1 |
| | Safety Climate 3 | -5.783 | 0 | 3.701 | 2 4 5 | 3 1 |
| | Safety Climate 4 | -4.311 | 0.325 | 3.95 | 2 3 4 5 | 1 |
| | Safety Climate 5 | -3.787 | 0.656 | 3.681 | 1 2 3 4 5 | |
| | Safety Climate 6 | -3.571 | 0.373 | 4.054 | 1 2 3 4 5 | |
| | Safety Climate 7 | -3.876 | 0.595 | 4.061 | 2 3 4 5 | 1 |
| | Safety Climate 8 | -4.073 | 0.643 | 4.078 | 1 2 3 4 | 5 |
| Loading | Safety Compliance 1 | -3.797 | 0.794 | 0.665 | 1 2 3 4 5 | |
| | Safety Compliance 2 | -4.269 | 0.795 | 0.713 | 1 2 3 4 5 | |
| | Safety Compliance 3 | -3.190 | 0.988 | 0.806 | 1 2 3 4 5 | |
| | Safety Compliance 4 | -3.328 | 0.93 | 0.822 | 1 2 3 4 5 | |
| | Safety Participation 1 | -3.753 | 0.688 | 0.805 | 1 2 3 4 5 | |
| | Safety Participation 2 | -3.494 | 0.892 | 0.807 | 1 2 3 4 5 | |
| | Safety Participation 3 | -4.207 | 0.377 | 0.595 | 2 3 4 5 | 1 |
| | Safety Participation 4 | -3.259 | 0.969 | 0.752 | 1 2 3 4 5 | |
| | Safety Climate 1 | -3.672 | 0.543 | 0.766 | 1 2 3 4 5 | |
| | Safety Climate 2 | -4.518 | 0.245 | 0.507 | 1 2 3 4 5 | |
| | Safety Climate 3 | -3.987 | 0.455 | 0.681 | 1 2 3 4 5 | |
| | Safety Climate 4 | -4.168 | 0.07 | 0.794 | 2 3 4 5 | 1 |
| | Safety Climate 5 | -3.682 | 0.536 | 0.779 | 1 2 3 4 5 | |
| | Safety Climate 6 | -3.382 | 0.29 | 0.726 | 1 2 3 4 5 | |
| | Safety Climate 7 | -3.505 | 0.239 | 0.744 | 1 2 3 4 5 | |
| | Safety Climate 8 | -3.756 | 0 | 0.701 | 1 2 3 4 5 | |

*Notes*. Fit function contribution describes the amount of non-invariance from each parameter across organizations; $R^2$ indicates the extent to which the variability of intercepts and across groups in the configural model is explained by the variation in the factor mean and variance across organizations.

**Table A3**

The Alignment Approach to Test the Approximate Measurement Invariance Across Four Organizations (Sample 1)

| Parameter | Item | Fit Function Contribution | $R^2$ | Aligned Parameter | Invariant Group | Non-invariant Group |
|---|---|---|---|---|---|---|
| Intercept | Safety Knowledge 1 | -2.686 | 0.829 | 4.467 | 2 3 5 | 1 |
| | Safety Knowledge 2 | -1.924 | 0.987 | 4.35 | 1 2 3 5 | |
| | Safety Knowledge 3 | -2.115 | 0.919 | 4.323 | 1 2 3 5 | |
| Loading | Safety Knowledge 1 | -2.668 | 0.499 | 0.465 | 1 2 3 5 | |
| | Safety Knowledge 2 | -2.016 | 0.5 | 0.586 | 1 2 3 5 | |
| | Safety Knowledge 3 | -1.910 | 0.968 | 0.545 | 1 2 3 5 | |

*Notes.* Fit function contribution describes the amount of non-invariance from each parameter across organizations; $R^2$ indicates the extent to which the variability of intercepts and across groups in the configural model is explained by the variation in the factor mean and variance across organizations.

**Appendix B**
**Intra-class Correlation and Within-group Agreement**

| Sample | Variable | ICC(1) | 1CC(2) | $r_{wg(j)}$ |
|---|---|---|---|---|
| Sample 1 | Safety Climate | 0.15 | 0.56 | 0.95 |
| | Safety Knowledge | 0.09 | 0.42 | 0.94 |
| | Safety Motivation | 0.07 | 0.33 | 0.94 |
| | Safety Compliance | 0.14 | 0.54 | 0.95 |
| | Safety Participation | 0.11 | 0.47 | 0.92 |
| | T2 Safety Knowledge | 0.08 | 0.39 | 0.94 |
| | T2 Safety Motivation | 0.08 | 0.37 | 0.94 |
| | T2 Safety Compliance | 0.04 | 0.24 | 0.93 |
| | T2 Safety Participation | 0.06 | 0.33 | 0.95 |
| Sample 2 | Prevention climate | 0.26 | 0.80 | 0.94 |
| | Promotion climate | 0.25 | 0.80 | 0.76 |
| | Safety climate | 0.33 | 0.85 | 0.95 |
| | Productivity climate | 0.35 | 0.86 | 0.90 |
| | Ethics climate | 0.27 | 0.81 | 0.90 |
| | Collective commitment | 0.18 | 0.72 | 0.92 |
| | T2 Collective commitment | 0.14 | 0.64 | 0.85 |

## Appendix C

## Alternative CFA Models

To demonstrate the distinctiveness of the studied constructs, we conducted a series of confirmatory factor analyses (CFAs) for Samples 1 and 2. Model fit was assessed with the $\chi^2$ statistic, comparative fit index (CFI), Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). Based on recommendations by Hu and Bentler (1999), the following cut-offs were used to indicate adequate model fit: CFI and TLI > .90, SRMR and RMSEA < .08. The five-factor and six-factor models for Samples 1-2, respectively, were compared with several alternative models by setting correlations between different combinations of latent factors equal to one. Table C1 presents the model fitting results for all CFA models tested. We found that for Sample 1, the five-factor model showed the best fit to the data compared to alternative models. For Sample 2, the six-factor model showed the best fit to the data compared to alternative models.

**Table C1**

CFA Results of Studied Constructs and Alternative Models

| Sample | Model | $\chi^2$ | df | $\chi^2$ diff | CFI | TLI | RMSEA[90%CI] | SRMR |
|---|---|---|---|---|---|---|---|---|
| Sample 1 | Model 1: Five factor | 618.38*** | 198 | - | 0.95 | 0.94 | 0.07[0.06, 0.07] | 0.04 |
| | Model 2: Four factor (SCP + SP) | 622.87*** | 199 | 4.49* | 0.94 | 0.94 | 0.07[0.06, 0.07] | 0.04 |
| | Model 3: Four factor (SK + SM) | 989.93*** | 199 | 371.55*** | 0.91 | 0.89 | 0.09[0.09, 0.1] | 0.05 |
| | Model 4: Three factor (SCP + SP + SK) | 1078.44*** | 206 | 460.06*** | 0.90 | 0.89 | 0.1[0.09, 0.1] | 0.05 |
| | Model 5: One factor (SC + SK + SM + SCP + SP) | 3424.36*** | 209 | 2805.98*** | 0.63 | 0.59 | 0.18[0.18, 0.19] | 0.15 |
| Sample 2 | Model 1: Six factor | 1304.90*** | 480 | - | 0.96 | 0.95 | 0.04[0.04, 0.04] | 0.04 |
| | Model 2: Five factor (PC + PVC) | 3425.81*** | 481 | 2120.91*** | 0.85 | 0.83 | 0.07[0.07, 0.08] | 0.09 |
| | Model 3: Five factor (SC + EC) | 2719.96*** | 481 | 1415.05*** | 0.88 | 0.87 | 0.06[0.06, 0.07] | 0.06 |
| | Model 4: Four factor (PC + PVC, SC + EC) | 4840.81*** | 482 | 3535.90*** | 0.78 | 0.75 | 0.09[0.09, 0.09] | 0.10 |
| | Model 5: Four factor (PC + PDC, SC + EC) | 6209.02*** | 482 | 4904.12*** | 0.71 | 0.68 | 0.1[0.1, 0.1] | 0.10 |
| | Model 6: Two factor (PC + PVC + SC + EC + PDC) | 1429.01*** | 489 | 124.11*** | 0.95 | 0.95 | 0.04[0.04, 0.04] | 0.06 |
| | Model 7: One factor (PC + PVC + SC + EC + PDC + Com) | 1429.01*** | 489 | 124.11*** | 0.95 | 0.95 | 0.04[0.04, 0.04] | 0.06 |

*Notes.* SCP = safety compliance; SP = safety participation; SK = safety knowledge; SM = safety motivation; PC = promotion climate; PVC = prevention climate; SC = safety climate; PDC = productivity climate; EC = ethical climate; Com = collective commitment; $^{*}p<0.05$, $^{***}p<0.001$; $\chi 2$ = Chi-square statistic; *df* = degrees of freedom; CFI = the comparative fit index; TLI = the Tucker-Lewis index; RMSEA = the root mean square error of approximation; SRMR = the standardized root mean square residual.

## Appendix D

### Analyses using Residual Scores

We controlled baseline levels of outcomes and used the residual score approach to explore whether climate profiles are associated with changes in outcomes between T1 and T2. First, using R software, we regressed each T2 outcome variable on the corresponding T1 variable, gathered the standardized residuals for each outcome from these regression models, and then treated these residuals as outcomes in the LPA analyses. The results are presented in Tables D1 and D2. Similarly, chi-square tests were used to test if the profiles differed significantly on those residual outcome variables.

For Sample 1, the results indicated that no significant differences across groups. For Sample 2, no significant differences were found for promotion and prevention climates. For *safety* climate profiles, organizations with the LL profile had the largest increase in collective commitment and accident rates. The MM safety climate profile had the largest increase in organizational productivity and decrease in accidents, however it also had a larger decrease in collective commitment. For *productivity* climate, the LH profile had the largest increase in collective commitment, whereas the HM profile had the largest increase in organizational productivity. Both HM and ML profiles had a larger decrease in accident rates whereas the LM profile had the largest increase in accident rates. For *ethical* climate, the LL profile resulted in the largest decrease in collective commitment and organizational productivity, whereas the HH profile resulted in relatively larger increase in organizational productivity and decrease in accident rates. Taken together, the findings partially support situational strength theory. Future research could collect multi-wave outcome data and examine how climate profiles influence changes over longer time intervals. Changes in climate profiles (e.g., from HM to HH) may result in more dramatic changes in outcomes. Future research could also use latent transition modeling to explore the extent to which changes in climate profiles are associated with changes in outcomes.

**Table D1**

Mean Residualized Outcome Scores by Safety Climate Profile in Sample 1

| Outcome | HH (a) *N* = 16, 1 | HM (b) *N* = 195, 44 | MH (c) *N* = 25, 6 | ML (d) *N* = 38, 5 | LL (e) *N* = 28, 6 | chi-square |
|---|---|---|---|---|---|---|
| Safety Knowledge | X | 0.15 | -0.11 | 0.45 | -0.6 | 5.54 |
| Safety Motivation | X | 0.23 | -0.76 | 0.34 | -1.33 | 66.85 |
| Safety Compliance | X | 0.14 | -0.38 | 0.69 | -0.73 | 6.64 |
| Safety Participation | X | 0.15 | -0.1 | 0.02 | -0.32 | 12.16 |

*Notes.* $N$ = 302 workgroups for most Time 1 variables; $N$ = 62 workgroups for Time 2 variables and Time 1 safety motivation. Ns at the top of the columns represent the number of work groups at each time period. X = Given that outcome data were only available for one of the HH workgroups, the mean levels of these residualized outcomes are unstable, unrepresentative, and therefore not presented in this table. Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

**Table D2**

Mean Residualized Outcome Scores by Climate Profile in Sample 2

| Climate Type | Outcome | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Outcome | HH (a) | HM (b) | MH (c) | MM (d) | ML (e) | LL (f) | chi-square |
| Safety climate | Collective Commitment | $-0.44^{f}$ | $0.6^{c,d,e}$ | $-1.06^{b,e,f}$ | $0.12^{b,f}$ | $0.46^{b,c,f}$ | $1.15^{a,c,d,e}$ | 33.09* |
| | Organizational Productivity | -0.24 | 0.25 | $0.55^{e}$ | $-0.75^{e}$ | $0.34^{c,d,f}$ | $0.13^{e}$ | 16.33* |
| | Accidents | $0.25^{f}$ | $-0.04^{f}$ | $-0.62^{f}$ | 0.34 | $-0.42^{f}$ | $0.11^{a,b,c,e}$ | 422.79* |
| | Outcome | HM (a) | MH (b) | ML (c) | LH (d) | LM (e) | chi-square | |
| Productivity climate | Collective Commitment | $0.15^{d}$ | $-0.72^{c,d}$ | $0.06^{b,d}$ | $1.8^{a,b,c,e}$ | $0.21^{d}$ | 209.09* | |
| | Organizational Productivity | $0.68^{e}$ | -0.38 | -0.44 | $0.24^{e}$ | $-0.12^{a,d}$ | 14.33* | |
| | Accidents | $-0.3^{d}$ | 0.04 | $-0.46^{e}$ | $0.1^{a,e}$ | $0.48^{c,d}$ | 16.48* | |
| | Outcome | HM (a) | MM (b) | ML(c) | LH (d) | LL (e) | chi-square | |
| Promotion climate | Collective Commitment | -0.2 | -1.46 | 0.12 | 0.16 | -0.23 | 1.62 | |
| | Organizational Productivity | -0.01 | 0.51 | -0.16 | 0.14 | -0.45 | 3.85 | |
| | Accidents | -0.34 | -0.02 | -0.21 | 0.32 | 0.19 | 3.58 | |
| | | HH (a) | MM (b) | ML(c) | LL (d) | chi-square | | |
| Prevention climate | Collective Commitment | 0.03 | -0.06 | 0.65 | -0.11 | 1.74 | | |
| | Organizational Productivity | 0.02 | -0.09 | -0.06 | 0.02 | 0.12 | | |
| | Accidents | -0.07 | 0.23 | 0.8 | -0.16 | 2.36 | | |
| | Outcome | HH (a) | MM (b) | LH (c) | LL (d) | chi-square | | |
| Ethical climate | Collective Commitment | $-0.18^{b,c,d}$ | $0.34^{a,c}$ | $-0.62^{a,b}$ | $-2.06^{a}$ | 51.52* | | |
| | Organizational Productivity | $0.17^{b,c,d}$ | $0^{a}$ | $0.02^{a}$ | $-1.44^{a}$ | 24.28* | | |
| | Accidents | $-0.59^{c,d}$ | $0.32^{c,d}$ | $-0.26^{a,b}$ | $0.11^{a,b}$ | 12.27* | | |

*Notes.* $N$ = 107 organizations at Time 1. $N$ = 52-61 organizations at Time 2. Superscripts indicate profiles that are significantly different ($p < .05$); * $p < .05$.

## Appendix E

## Comparison of Effect Size between the Group- versus Variable-centered Approach

**Table E1**

Effect Sizes in Sample 1

| Outcome | $\eta^2_{\text{LPA}}$ | $\eta^2_{\text{regression}}$ |
|---|---|---|
| Safety knowledge | 0.10 | 0.00 |
| Safety motivation | 0.13 | 0.04 |
| Safety compliance | 0.27 | 0.00 |
| Safety participation | 0.29 | 0.00 |
| T2 Safety knowledge | 0.23 | 0.13 |
| T2 Safety motivation | 0.19 | 0.00 |
| T2 Safety compliance | 0.20 | 0.09 |
| T2 Safety participation | 0.20 | 0.09 |

*Notes.* $N$ = 302 workgroups for most Time 1 variables; $N$ = 62 workgroups for Time 2 variables (T2) and Time 1 safety motivation. $\eta^2_{\text{LPA}}$ = the proportion of variance in a dependent variable that can be explained by the profile membership using the group-centered approach; $\eta^2_{\text{regression}}$ = the proportion of variance in a dependent variable that can be explained by the interaction term using the variable-centered approach

**Table E2**

Effect Sizes in Sample 2

| Outcome | Safety climate | | Productivity climate | | Promotion climate | | Prevention climate | | Ethical climate | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $\eta^2_{LPA}$ | $\eta^2_{regression}$ | $\eta^2_{LPA}$ | $\eta^2_{regression}$ | $\eta^2_{LPA}$ | $\eta^2_{regression}$ | $\eta^2_{LPA}$ | $\eta^2_{regression}$ | $\eta^2_{LPA}$ | $\eta^2_{regression}$ |
| T1 Collective Commitment | 0.23 | 0.01 | 0.07 | 0.01 | 0.05 | 0.01 | 0.08 | 0.03 | 0.14 | 0.00 |
| T1 Organizational Productivity | 0.07 | 0.01 | 0.05 | 0.00 | 0.03 | 0.01 | 0.06 | 0.03 | 0.13 | 0.00 |
| T1 Accidents | 0.21 | 0.01 | 0.10 | 0.00 | 0.04 | 0.00 | 0.04 | 0.01 | 0.07 | 0.00 |
| T2 Collective Commitment | 0.23 | 0.00 | 0.18 | 0.01 | 0.11 | 0.03 | 0.13 | 0.08 | 0.26 | 0.00 |
| T2 Organizational Productivity | 0.12 | 0.13 | 0.05 | 0.01 | 0.03 | 0.00 | 0.08 | 0.03 | 0.17 | 0.05 |
| T2 Accidents | 0.40 | 0.03 | 0.13 | 0.00 | 0.10 | 0.01 | 0.02 | 0.00 | 0.05 | 0.00 |
| T2 Profit per employee | 0.09 | 0.02 | 0.12 | 0.02 | 0.04 | 0.01 | 0.05 | 0.01 | 0.23 | 0.06 |
| T2 Return on Assets | 0.02 | 0.00 | 0.14 | 0.04 | 0.05 | 0.02 | 0.03 | 0.02 | 0.11 | 0.01 |
| T2 EBITDA margin | 0.13 | 0.06 | 0.09 | 0.03 | 0.10 | 0.05 | 0.07 | 0.02 | 0.14 | 0.06 |

*Notes*. $N$ = 107 organizations at Time 1 (T1). $N$ = 52-61 organizations at Time 2 (T2); $\eta^2_{\text{LPA}}$ = the proportion of variance in a dependent variable that can be explained by the profile membership using the group-centered approach; $\eta^2_{\text{regression}}$ = the proportion of variance in a dependent variable that can be explained by the interaction term using the variable-centered approach