# Testing and Visualizing Strategic Consensus Within and Between Teams

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## ABSTRACT

Research in strategic consensus mostly focuses on the degree of consensus about organizational strategy within a team and does not include other important elements of strategic consensus such as more fine-grained analysis of what different group members agree and disagree on, between-group consensus, or significance testing of differences in consensus (e.g., to evaluate a strategic intervention). We propose a new analytical approach to study strategic consensus to address these issues and to visualize strategic consensus in an intuitive and easy-to-grasp fashion. Using data from a field study, we also provide an illustration of the proposed methodology which includes a test of the effectiveness of a consensus-creating intervention. We conclude with guidelines for research and practice on utilizing the proposed methodology.

# 1 INTRODUCTION

Strategic consensus, the shared understanding of organizational strategy within an organizational unit (e.g., the top management team), has been recognized as one of the most important concepts in the strategy process and strategy implementation (Finkelstein & Hambrick, 2009; González-Benito *et al.*, 2010; Markoczy, 2001). Because of this prominent role, research in strategic management continues to develop a deeper understanding of strategic consensus (González-Benito *et al.*, 2010). A number of scholars have argued for the necessity of a multidimensional investigation of consensus (Kellermanns *et al.*, 2005; Markoczy, 2001; Wooldridge and Floyd, 1989). These authors have pointed out that in addition to the degree of consensus it is also important which strategic objectives the consensus is about and which individuals in the team are in agreement or disagreement on these issues. These researchers have also noted the importance of studying consensus *between* interdependent units in addition to within-group consensus. The dominant focus in research in strategic consensus on quantifying the amount of (within-group) consensus alone (González-Benito *et al.*, 2010; Kellermanns *et al.*, 2005, 2008) thus addresses only part of the issue that should be on the agenda in the investigation of strategic consensus. We contend that an important issue in this respect is the absence of appropriate methodology to capture these multiple dimensions of strategic consensus.

The current study provides the methodological tools to enable a multidimensional analysis of strategic consensus, proposing a set of complementary methodological procedures to study strategic consensus within and between groups, which we call *strategic consensus mapping* (SCM). SCM can visualize and quantify consensus within and between groups while also capturing the more specific content of this consensus as well as variations in the degree to which individuals share in the consensus. In addition, SCM allows testing whether longitudinal or cross-sectional differences in consensus are significant. To illustrate the methodology, we demonstrate SCM in a survey including a test of whether observed changes in consensus in a top management team due to a strategic intervention are statistically significant. The ability to test such changes in consensus is particularly relevant and important, because strategic interventions deliberately aimed at enhancing consensus are widely practiced in business yet seldom if ever quantitatively evaluated for their effectiveness (Hodgkinson *et al.*, 2006; Hodgkinson and Healey, 2008).

The contribution of the current study is threefold. First, the proposed set of complementary methodological procedures offers the possibility to study strategic consensus in a more comprehensive way as well as to visualize consensus in an intuitive, easy-to-grasp fashion. The SCM methodology includes the possibility for the more fine-grained study of strategic consensus by differentiating between different strategic objectives and different individuals. Second, the SCM methodology answers calls in the consensus literature to develop techniques that enable the analysis of consensus between groups (Kellermanns *et al.*, 2005). Third, the SCM methodology allows researchers to test the significance of differences in consensus both over time and in cross-sections of groups, thus responding to the call in the literature for 'the appropriate measurement systems for determining the effectiveness of [strategic interventions]' (Hodgkinson *et al.*, 2006).

# 2 UNDERSTANDING CONSENSUS AS A MULTI-FACETED CONCEPT

## 2.1 What is Strategic Consensus?

Kellermanns *et al.* (2005) point out that the differences in defining consensus can be a source of the inconsistencies in the consensus literature. Therefore, we begin by clearly explicating our view of strategic consensus, subscribing to the definition advanced by Kellermanns *et al.* (2005: 721) of strategic consensus as 'the shared understanding of strategic priorities among managers at the top, middle, and/or operating levels of the organization'. Furthermore, we make a clear distinction between within-group and between-group strategic consensus. Within-group strategic consensus is the shared understanding of strategic priorities among the members of one group, and between-group consensus is the shared understanding of strategic priorities between pairs of groups.

In the light of shared mental model theory (Mathieu *et al.*, 2008), it is argued that individuals' formation of strategic consensus facilitates communication (Kellermanns *et al.*, 2008) and coordination of actions and creation of synergies (Cannon-Bowers, Salas, and Converse, 1993) within a group. Furthermore, consensus lowers the pursuit of subunit goals over organizational objectives through multilevel alignment between groups (Ketokivi and Castañer, 2004). Higher strategic consensus is argued to improve strategy implementation (Noble, 1999; Rapert, Velliquette, and Garretson, 2002), and to be associated positively with group and organizational performance (Kellermanns *et al.*, 2010; Mathieu *et al.*, 2008). In close conjunction to this view, we subscribe to the relevance of having higher consensus throughout the organization (De Haas and Kleingeld, 1999).

### 2.2 What Is Lacking in the Current Measurement of Strategic Consensus?

Given the positive influence of strategic consensus, researchers highlight a need for a more comprehensive understanding of the concept and its role in the strategy process (Kellermanns *et al.*, 2005; Markoczy, 2001; Wooldridge and Floyd, 1989). Wooldridge and Floyd (1989) and Markoczy (2001) propose strategic consensus as a multifaceted concept which can be broken down into how strongly consensus is held (degree), what it is about (content), who in the organization participates in it (locus), and by how many members it is shared (scope). These analyses suggest that only when these different facets are taken into account, a thorough understanding of strategic consensus in relation to its antecedents, outcomes, and boundary conditions can be reached.

Despite these calls for multidimensional conceptualizations, questions regarding the dimensions of strategic consensus other than its degree have been 'much less answered' empirically (Markoczy, 2001: 1013), even when there are some earlier attempts at consensus mapping (Bowman and Ambrosini, 1997; Wooldridge and Floyd, 1992). For obvious reasons, it is important to have consensus not only in terms of the degree but also on the 'right' content (Kellermanns *et al.*, 2008). To illustrate, a company organizing a strategic intervention to construct consensus among the participating group members on the new strategic direction of cost-efficiency may not consider the intervention a success if an increase in sharedness has indeed emerged but on another strategy (e.g., differentiation). In studying and fostering strategic consensus, it is important to be able to determine both the specific content group members agree and disagree on and which individuals in the group converge or diverge in their understanding of the strategy, because this allows for more fine-grained analysis of strategic consensus in research as well as for more focused and better targeted interventions in practice. Implied in this analysis is the value of the ability to assess differences and changes in consensus, for instance to evaluate the effectiveness of an intervention to foster strategic consensus.

Furthermore, it is important to see to what extent different organizational units agree on strategic priorities, because a strong alignment between groups is needed to achieve organizational objectives in addition to within-group strategic consensus (Kellermanns *et al.*, 2005). For instance, Ketokivi and Castañer (2004) show that an integrated understanding throughout different levels of the organization eliminates the pursuit of subunit goals over organizational objectives. There is surprisingly little research on the measurement of consensus between groups, in part, we contend, because appropriate methodology to address this issue has hardly been developed – better tools to study the issue may stimulate the development of theory and empirical research in the area.

In sum, current consensus measures in the literature such as standard deviation (Bourgeois, 1980; Dess, 1987; West and Schwenk, 1996) and average squared Euclidean distance (Colbert *et al.*, 2008; Homburg, Krohmer, and Workman, 1999; Rapert *et al.*, 2002) for within-group consensus and mean of absolute differences among strategic priorities for between-groups consensus (St. John and Rue, 1991), capture the degree of consensus only and are less suited to capture the multiple facets of consensus. In a sense, this is holding back the development of a more comprehensive understanding of strategic consensus in research in strategic management. Further theory development in strategic consensus should therefore benefit substantially from the development of methodology that makes it possible to more fully capture the multifaceted nature of strategic consensus. In the next section, we therefore propose a new methodological approach to address these issues.

# 3 METHODOLOGY: STRATEGIC CONSENSUS MAPPING

Strategic consensus mapping (SCM) presumes data that quantify individuals' (i.e., members of workgroups, teams, or business units) assessment of strategic priorities, for instance through rating or rank ordering, as they could be gathered in a survey (cf. the assessment of strategic consensus typically found in strategic management research; Kellermanns et al., 2010). The SCM methodology consists of a set of methodological procedures which aim to capture the aforementioned facets of strategic consensus. These procedures are presented here in the order in which they need to be executed.

First, a Principal Component Analysis (PCA) is employed to measure the degree of within-group strategic consensus and to visualize its content. Second, from the results of this PCA two new measures are derived that are required to quantify (operationalize) both the degree of within- and between-group consensus. Third, these quantified measures of within- and between-group consensus are used to visualize the between-group consensus using multidimensional scaling (MDS). Finally, the statistical significance of the observed differences in within- and/or between-group strategic consensus, both cross-sectional and longitudinal, are assessed with permutation tests.

## 3.1 Visualizing the Degree and the Content of Within-group Strategic Consensus

In order to simultaneously obtain a visual mapping for the content and a measure for the degree of strategic consensus, we conduct a Principal Components Analysis (PCA) on a transposed data matrix. This procedure provides a map that jointly plots the strategy items in relation to the respondents' preferences of these items for all members of the team. In multivariate analysis, PCA is a widely applied statistical dimension reduction technique that summarizes a data set by one or more uncorrelated underlying latent variables called principal components. In particular, these components are constructed in such a way that the first component accounts for as much of the variance as possible, and each succeeding component extracts as much of the remaining variance as possible (see, for example Jolliffe, 2002). Therefore, the first principal component can be considered as an aggregate measure of groups' opinion since this component captures most of the variance.

Here, we apply PCA on a transposed data matrix which has respondents in the columns (as variables) and strategy items (i.e., strategic goals) in the rows (as cases). This approach, also referred to as the vector model of unfolding (Borg and Groenen, 2005), allows for finding a *p*-dimensional space that contains (a) a configuration of *m* objects that represent the strategy items (the content of the strategy, shown as object points in the map), and (b) a *p*-dimensional configuration of *n* vectors that represents the respondents within the group, in a way that the projections of all object points onto each vector correspond to the individual preferences on the strategy items of each respondent in the data set.

The specification of this approach is as follows; Let **H** be the data matrix with *m* rows (strategy items) and *n* columns (respondents). **H** needs to be standardized such that all columns have a zero mean and variance of 1. Then PCA in *p* dimensions is equivalent to minimizing the sum of squared errors $\|\mathbf{E}\|^2$ between **H** and the low dimensional representation **XA'**, that is,

$$L_{PCA}(\mathbf{X},\mathbf{A}) = \|\mathbf{H} - \mathbf{XA}'\|^2 = \sum_{ij} e_{ij}^2 ,$$

where **X** is an $m\times p$ matrix of the object scores for the *m* rows on the first *p* principal components and **A** is an $n\times p$ matrix of component loadings. **X** is standardized to be orthogonal and has column variance 1 and the component loadings matrix **A** contains the correlations of the *n* respondents with *p* principal components **X**. That is, PCA reduces the dimensionality of the data to *p* dimensions, the object scores contain the coordinates for each strategy item on these *p* dimensions, and the component loadings are the correlations between object scores for each strategy item and the original variables.

In two-dimensional space, the results of the PCA can be depicted by a biplot where the rows of **X** (object scores of strategy items) are represented as points and the rows of **A** (component loadings of respondents) as vectors (Gower and Hand, 1996). Figure 1 illustrates several visual features that are associated with the resulting biplot representation of such a sample PCA solution.

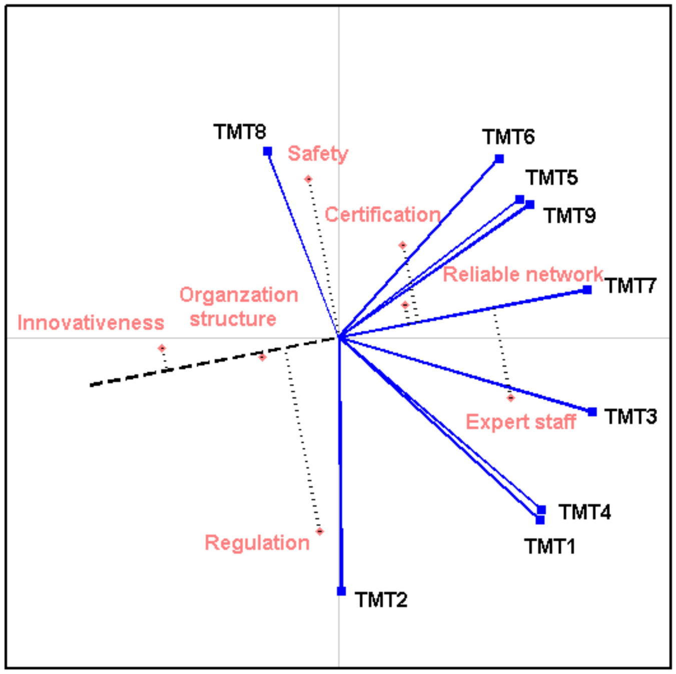


Figure 1. Example of a PCA biplot. The projections of the strategy items on respondent TMT7 are illustrated. Higher positive (negative) projection of an object point on the component vector representing TMT7 indicates higher (lower) prioritization.

First, the spread of all vectors in the biplot demonstrates the degree of within-group strategic consensus. There is a high degree of within-group strategic consensus, if the vectors are grouped in a small bundle. However, if the vectors of the respondents are spread widely in opposing directions this is due to a low degree of within-group consensus.

Second, the orthogonal projection of a strategy item onto a respondent's vector indicates the rating of that particular strategy item by the respondent. A high positive projection of strategy items (i.e., the projection closest to the edge of the vector) indicates a high prioritization of those items by the respondent and strategic items that are projected on the opposite direction indicates a low prioritization of those items by that respondent. We illustrate the projections of strategy items onto the respondent 'TMT7', which is shown with dashed lines in Figure 1. We observe that respondent 'TMT7' rates 'Expert Staff' the highest as this goal has the largest projection on the vector representing respondent 'TMT7'. 'Expert Staff' is then followed by 'Certification' and 'Reliable Network'. Since 'Innovativeness' has the largest projection on the opposite direction, we can infer that 'TMT7' valued that strategy item the least. Thus, the within-group strategic consensus is visualized in such a way that it captures the ‘content’ and ‘locus’ facets of Markoczy’s (2001) multi-faceted definition of consensus.

Third, the cosine of the angle between two respondents is an approximation of their pair wise correlations (Linting *et al.*, 2007). Thus, respondents with small angles between their vectors have a similar opinion on their valuation of strategy items. In Figure 1, the goal prioritization of respondent ‘TMT1’ is very similar to that of ‘TMT4’, but very different from ‘TMT8’. This feature can also be very useful in operationalizing the dyadic strategic consensus (e.g., dyadic goal importance congruence in Colbert *et al.*, 2008).

Fourth, since the first principal component explains most of the variance, it can be interpreted as the prototypical group member, whose direction represents the overall group opinion the best. Thus, the projections of strategy items onto the first axis represent the overall view of the group by the prototypical group member. In Figure 1, when we make the projections of the strategic goals onto the first dimension to attain the overall view of the group, we observe that the prototypical group member prioritizes ‘Expert Staff’ the most, then ‘Certified Work Process’ and ‘Reliable Networks’; whereas ‘Innovativeness’ is prioritized as the least important goal of all by this group.

Finally, the length of a vector indicates how well the respondent is represented, where a length of 1 indicates perfect fit (Gower and Hand, 1996). The interpretation of the projections onto very short vectors indicating low variance accounted for would be misleading, thus must be avoided (Linting *et al.*, 2007). The low variance accounted for must be interpreted as an indication of very diverse opinions in that group and thus as low consensus. The first two dimensions of the PCA solution generally will be adequate to account for a large portion of the variance, providing that the number of variables and cases are not very high. In our example in Figure 1, all respondents fit well into two dimensions, because almost all respondents have vectors with a length close to one. Indeed, 79.5% of the variance in this example is accounted for by the first two dimensions.

### 3.2 Quantifying the Degree of Within-Group Strategic Consensus

This study develops a new measure for the degree of strategic consensus within a group, which uses the PCA component loadings of the group members. In addition to complementing to the visualization of the content and degree of consensus our approach also has some methodological advantages. Because it is based on a non-parametric method, it does not hold any distributional assumptions and does not depend on the number of scale anchors.

A novel $\alpha$ measure to assess the degree of within-group strategic consensus is defined by

$$\alpha = \sqrt{\sum_{s=1}^{2}\left(m^{-1}\sum_{j} a_{js}\right)^{2}} \ ,$$

where $\alpha_{js}$ is the $s^{\text{th}}$ component loading for respondent $j$ ($j$ = 1, …, $n$). This $\alpha$ measure takes the first two principal components into account which is in accordance with the visualization in the previous subsection. The measure can geometrically be interpreted as the length of the averaged component loadings vector of the first and the second dimensions.

$\alpha$ takes values between 0 and 1. If all members of the group exactly have the same view on the evaluation of strategy items and consequently their vectors are thus close to each other in a narrow bundle, than the $\alpha$ measure will be close to 1. However, if there is a wide spread of vectors, for instance like rays evenly distributed on a circle, than the average component loadings will be close to zero, and the $\alpha$ measure will be very low. In Figure 1, the $\alpha$ value is 0.55 indicating a moderate degree of within-group strategic consensus.

One extra adaptation to PCA is performed. The dimensions in regular PCA are chosen to maximize the reconstructed variance, subject to being orthogonal to higher dimensions. However, the total variance accounted by two dimensions does not change under rotation of these two dimensions. Therefore, we use this freedom of rotation to ensure that the average (vector) of component loadings coincides with the first dimension. By doing so, the direction of the first dimension can still be interpreted as the prototypical group member as before.

### 3.3 Quantifying the Degree of Between-Group Strategic Consensus

To strategically align people in an organization, developing consensus on strategic priorities within each group is important but ensuring that there is a shared understanding of strategy across groups is also essential. Kellermanns *et al.* (2005) suggest the use of the correlation-based approach for measuring consensus across groups, especially when managers from several levels are part of the study. We, therefore, propose a correlational measure for the degree of between-group consensus which is derived from the within-group PCA object scores of the strategy items. Because the first principal axis can be interpreted as the prototypical member of the group representing the aggregate measure of the entire group's overall opinion, the correlation between the prototypical members of two groups captures the notion of between-group consensus for these two groups.

The measure we propose, $r(A, B)$, is operationalized as the correlation of the object scores of the strategy items on the first principal component between two groups (A and B). Clearly, an $r$(A,B) of 1 indicates the perfect sharedness over the strategy items by the two groups, $r$(A, B) ≈ 0 represents no strategic consensus between the two groups, whereas $r$(A, B) ≈ -1 reveals two opposite understandings of the strategy in the two groups.

Moreover, our measure can also be applied to measure the overall strategic alignment in an organization, by using an aggregated index of the degree of between-group strategic consensus for all possible pairs of groups within the organization. This $r_{\text{overall}}$ can be operationalized as the normalized sum of squared $r$-measures for all pairs such that the index ranges between 0 and 1. Thus, it indicates the overall degree of strategic consensus between all groups in an organization. This index can also be used to compare strategic alignment between different organizations.

### 3.4 Visualizing the Degree and Locus of Between-group Strategic Consensus

In addition to our within-group consensus visualization that captures the content of consensus, we propose a visualization technique for between-group strategic consensus. The between-group visualization is a map that represents all the groups in the organization in a two dimensional space according to their respective level of between-group consensus. It demonstrates which groups are located closely together and thus share a strategic understanding, thus allowing us to determine the *locus* of consensus between groups (cf. Markoczy, 2001).

To obtain a mapping for between-group consensus, we use classical multidimensional scaling (MDS) which has been proposed to help understand people's judgments on the similarity of the members of a set of objects (Torgerson, 1952). The main objective of MDS is to represent given measures of dissimilarity between all pairs of objects as distances between pairs of points in a low dimensional space such that the distances correspond as closely as possible to the proximities. So the technique aims to find such coordinates for the objects that the difference between the original proximities and (Euclidean) distances is minimal.

As measure of dissimilarities between two groups, we use one minus the correlations between two groups' object scores of the strategy items (that is the $r$ measures for all possible pairs of groups, see Borg and Groenen, 2005). In this case, MDS finds an optimal representation of the between-group $r$ measures by distances in two-dimensional space.[1] Hence, each group is represented as a point and the distances between points represent their respective between-group consensus. Groups that have a more similar valuation of the strategy items are thus grouped close together, whereas groups with opposing views are placed far away from each other on the MDS map.

To provide a larger perspective on the strategic consensus between organizational groups, we added some additional features to the between-group consensus maps. First, each group is represented not only via a single point in the two dimensional space – as in any MDS plot – but via a bubble which size represents the current degree of within-group consensus (that is, the $\alpha$ measure), and via an outer-circle surrounding the bubble which indicates the potential maximum size of the bubble (thus the size when there is perfect consensus within that group ($\alpha$ = 1). See

1 For dissimilarities that are Euclidean embeddable such as $1 - r$, classical MDS has the property that the produced distances between points always underestimate the dissimilarity. So the resulting MDS plot is conservative and produces a lower bound of the dissimilarity or, equivalently, an upper bound of the correlation between two groups. Other forms of MDS exist (such as least-squares MDS minimizing Stres) that provide a two-sided approximation of the dissimilarities. However, when the number of groups is not very high, solutions tend not to differ much. If the number of groups is high, we suggest researchers to do a classical MDS first, and then use its as an initial configuration to least-squares MDS (for example, by the SMACOF algorithm in SPSS Proxscal, see Borg and Groenen, 2005).

Figure 2 for an example. Second, in our representations we preferred to position the TMT in the center of the MDS plots. Although any group can arbitrarily be chosen as the reference, we selected the TMT because they are the formal owners of organizational strategies. Third, in order to make the mappings more comparable and insightful about the proportions, we added ten circles to indicate correlations ranging from 0.9 to 0 with the TMT.

### 3.5 Assessing the Statistical Significance of Differences in Strategic Consensus.

Testing changes in strategic consensus over time (e.g., before and after a strategic intervention) or differences in strategic consensus between groups requires determining the statistical significance of the difference in the degree of consensus. To provide significance tests of such differences, the respective $\alpha_{\text{diff}}$ or $r_{\text{diff}}$ values need to be defined. For instance, if we are interested in whether there has been a significant change in the within-group consensus of a group over time, then the null hypothesis is formed as $\alpha_{\text{diff}} = 0$, where $\alpha_{\text{diff}} = \alpha_{\text{post}} - \alpha_{\text{pre}}$. In a similar vein, if we are interested in whether group A has a higher within-group consensus than group B, then the null hypothesis becomes $\alpha_{\text{diff}} > 0$, where $\alpha_{\text{diff}} = \alpha_{\text{A}} - \alpha_{\text{B}}$. If we propose that group A holds views more similar to group C's than to group B's, then the null hypothesis is that $r_{\text{diff}} = 0$ where $r_{\text{diff}} = r(\text{A, C}) - r(\text{A, B})$.

To our knowledge, the only study that proposes a methodology to compare consensus across groups is Pasisz and Hurtz (2009). They suggest a series of *F* tests to compare within-group agreement between two or more groups. However, their proposed procedure is parametric, and thus it may be very sensitive to deviations from normal distribution (Markowski and Markowski, 1990). For our methodology, applying classical parametric hypothesis testing is not feasible, because PCA is a non-parametric method without a statistical error model, and the within- and between-group consensus measures are functions of the PCA results. The same is true for the distributions of $\alpha_{\text{diff}}$ or $r_{\text{diff}}$ for which no standard statistical theory is available. Therefore, we opt for the permutation test as a nonparametric method of hypothesis testing.

The permutation test produces the distribution of any test statistic for two groups under the null hypothesis of no difference between the two groups by calculating all (or a high number of) possible values of the test statistic (in our study αdiff and rdiff) with the rearrangements of the labels on the observed data (Good, 2000). The permutation test compares the $\alpha$diff and rdiff values of the true groups with the $\alpha$diff and rdiff values which are obtained from a large number of data sets (e.g., N = 1000) where the grouping information is destroyed and individuals are randomly assigned to one of the groups (Hesterberg et al., 2005). To make sure that the group size remains the same, the array indicating the group number of the individuals is randomly permuted, and the new random group memberships are assigned for each permutation data set. In order to determine the significance, the p-value of the observed $\alpha$diff and rdiff are determined by their percentiles with respect to the permutation distribution. If the null hypotheses of no difference is rejected, then the observed $\alpha$diff or rdiff is significant at the level of the *p*-value.

## 4 APPLICATION OF STRATEGIC CONSENSUS MAPPING IN A FIELD STUDY

To illustrate our methodology, we collected data from a large Western European service provider company. The company is composed of a top management team (TMT) and nine functional departments where each department has several sub-departments. The head of each department directs a management team composed of 4 to 10 managers, who in turn supervise at least one sub-department. The TMT of the company includes the managing director and the heads of the nine functional departments. To assess the strategic alignment of the organizational units, we focused on the management teams of these nine departments and the TMT. In the subsequent departmental analyses, TMT members were included in their respective departments as well.

Rather than employing generic strategic goal statements, the TMT provided us with strategic goals specific to this company. These goal statements included strategic ends (where to go) and strategic means (how to get there), which is a distinction commonly used in strategic consensus research (Kellermanns *et al.*, 2005, 2010). We presented these strategic goals to 72 top and middle managers of the organization and instructed the respondents as follows: ‘Please rank the following strategic goals of your company from most important to least important’. We received 64 responses for a response rate of 89%. 63% of our respondents were male, and 56% had a Master’s degree (the rest had a Bachelor degree or a comparable college degree). The average working experience of the respondents was 18.6 years, and the average experience in the current position was 3.37 years.

We observed higher variance in consensus on strategic means. Hence, to illustrate our methodology, we focus on strategic means. Due to confidentiality, some of the company-specific department names were relabeled, and names of the respondents were anonymized. Furthermore, we used only shortened versions of the seven strategic means of the company which read as ‘Innovativeness’, ‘Regulation Framework’, ‘Reliable Network’, ‘Safety’, ‘Expert Staff’, ‘Organization Structure’, and ‘Certification’.

The results are presented in a different ordering than the methodology section, from a large (organization wide) to a smaller perspective (teams and individuals). We suggest that this way of looking at the results provides a better understanding of the organization and enables to make more efficient interpretations of consensus and alignment in the organization, even when the order in which these results are produced is as described in the previous section.

## 4.1 Locus and Degree of Between-Group Strategic Consensus

Figure 2 shows the MDS plot that visualizes the strategic alignment of all organizational units in the organization. The distances between the bubbles represent the degree of consensus between the organizational units: the smaller the distance, the larger the consensus between the groups. The TMT is placed at the center of the plot to spot the locus of the consensus more easily. We observe that the Sales, Strategy and IT departments have a high shared understanding with the TMT on the strategic means since they are all positioned close to TMT, whereas the views of the Operations and Business Development departments are barely aligned with the views of the TMT, as they are located further away. The degree of between-group consensus also shows these relations, for instance $r$(TMT, Sales) = 0.86 and $r$(TMT, Operations) = 0. 41.

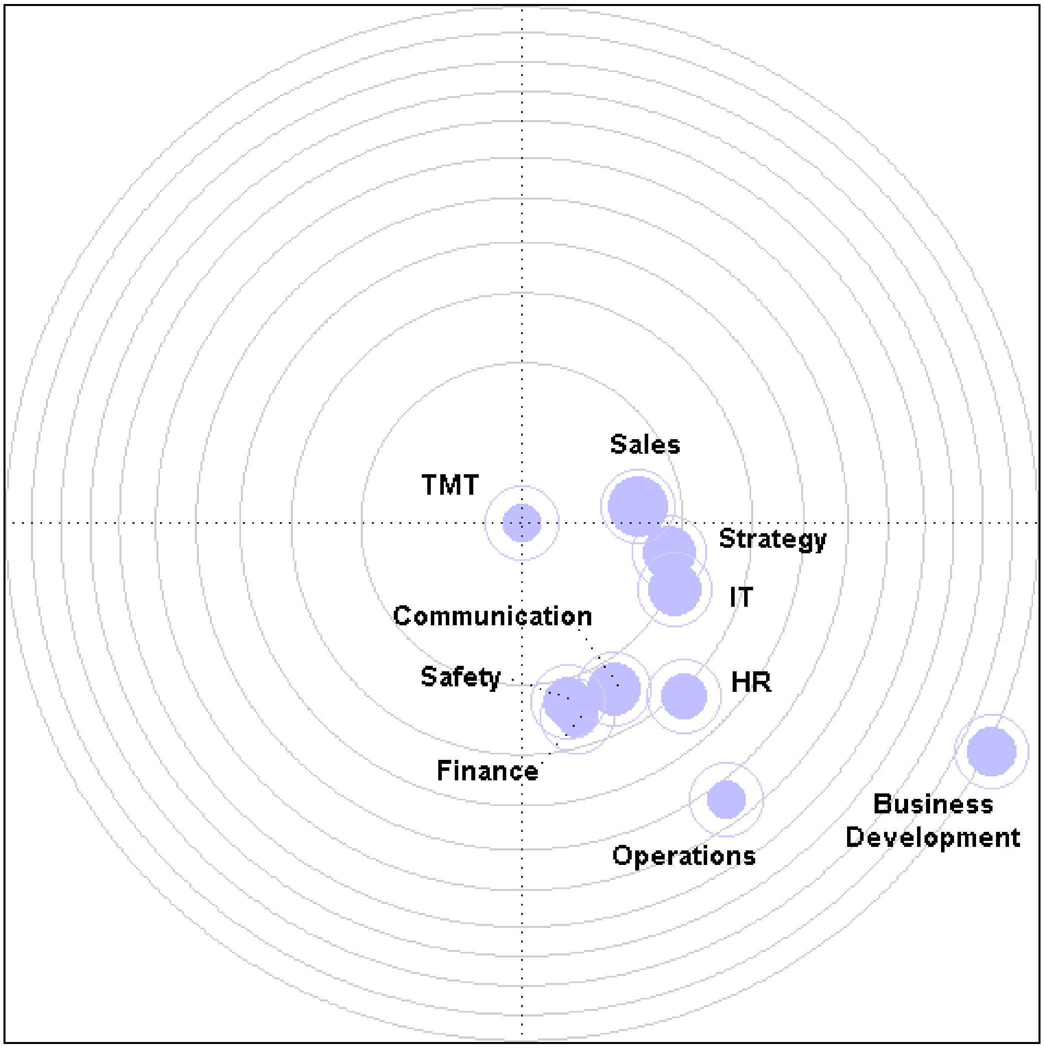


Figure 2. Depicting the locus and degree of between-group consensus. Distances between bubbles represent the degree of between-group consensus: smaller distances represent higher between-group consensus. The size of a bubble represents within-group consensus. The circles around the bubbles indicate the potential size of the shaded-circle where complete consensus exists.

The bubbles in Figure 2 represent the degree of within-group consensus of each department and circles around bubbles indicate the potential size of a bubble when there is full consensus within the group on the importance of all strategic means within the group ($\alpha$ = 1). Sales, Communication and IT departments have relatively larger bubbles ($\alpha$ measures are 0.81, 0.79, and 0.73 respectively), contrary to Operations, TMT and Finance that have smaller ones ($\alpha$ measures are 0.53, 0.54, and 0.56 respectively).

The degree of within-group consensus needs to be interpreted together with the distance of the departments to the center, and together they indicate the locus of consensus in the organization. If organizational units which have high degrees of within-group consensus are clustered further away from the TMT, this shows that the locus of consensus is not the TMT for that organization. In our example, it is interesting to note that the TMT has a relatively low degree of within-group consensus, and some of the departments with high degrees of within-group consensus formed two clusters away from the TMT, which indicates that the locus of consensus may not be the TMT's view of the strategic means. Each department has a separate perception about the best way to reach organizational goals (strategic means), and that view is very different from what the TMT thinks, especially for some of the teams such as Business Development and Operations.

### 4.2 Content and Degree of Within-Group Strategic Consensus

To investigate these separate views that cause the shifted locus, we need to have a closer look at each management team. The PCA step of our methodology provides the biplots for each team, where we can observe the views of each individual team member on the strategic means. The biplot of the TMT was already provided in Figure 1 as an example. Figure 3 illustrates the biplots of two teams, one closer to and one further away from the TMT, namely Sales and Operations (the illustration of SCM using all the teams are available upon request).

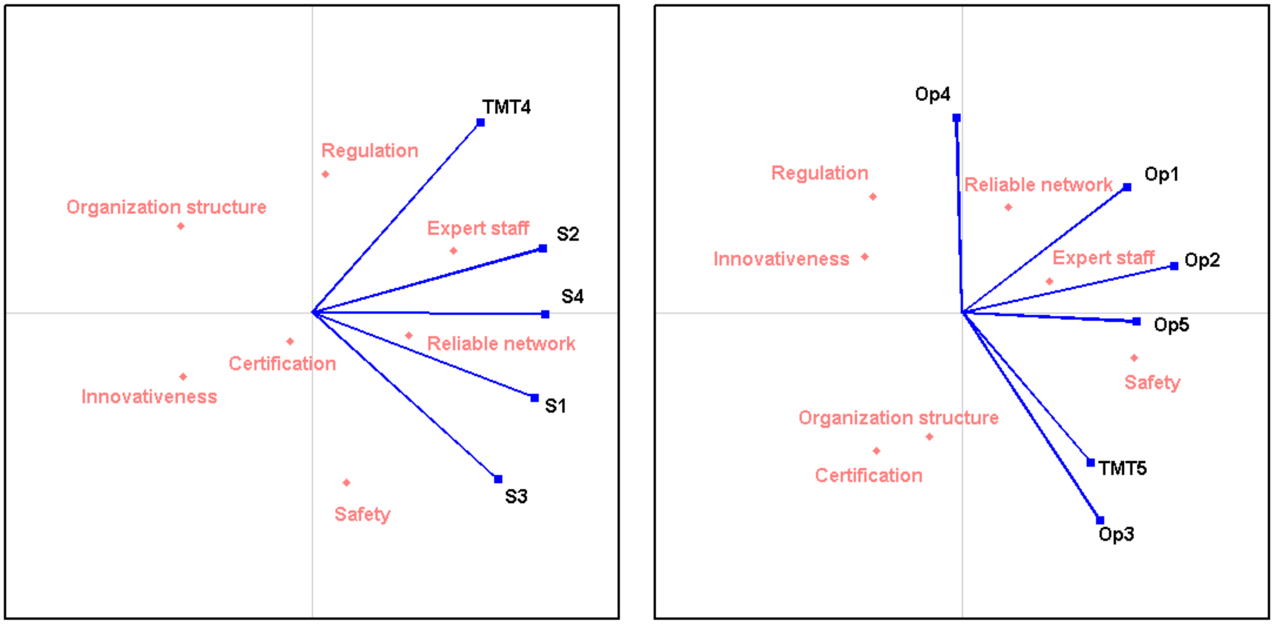


Figure 3. PCA biplots representing the degree and content of strategic consensus within the Sales (left) and Operations (right) departments

As the projections of the strategy items on the first principal component corresponds with the best representation of the overall view of the group (the view of the prototypical group member), we can examine the differences in the views that cause the divergence. Based on the projections of the strategy items on the first axis in Figure 1 and Figure 3, we see that the TMT values ‘Expert Staff’, ‘Certification’, and ‘Reliable Network’ as the top three strategic means. The Operations department which is located quite far away from the TMT in Figure 2 values ‘Safety’ as the most and ‘Certification’, ‘Innovativeness’, and ‘Regulation’ as the least important strategic means. Hence this contradiction in the content causes a low degree of between-group consensus with the TMT, making the Operations department drift apart from the TMT in Figure 2. On the other hand, the Sales department values ‘Expert Staff’ and ‘Reliable Network’ as the most, and ‘Innovativeness’ and ‘Organization Structure’ as the least important strategic means, exactly as the TMT does. Consequently it has a high between-group consensus with the TMT, and is thus depicted very close to the TMT in Figure 2.

When we look in detail at the individual managers in Sales and Operations, we observe that the respondent vectors of the Sales department are grouped as a narrower bundle compared to the Operations department; thus the degree of within-group consensus of Sales (0.81) is higher than that of Operations (0.53). Consequently, the members of Sales indeed hold a more similar view about the relative importance of the strategic means than the members of Operations.

The large spread of the vectors in the Operations department is due to the differences in the individual preferences of the team members (see Figure 3). For instance, person 'Op4' prioritizes 'Regulation', 'Reliable Network' and 'Innovativeness' as the most important strategic means, while person 'Op3' considers these three strategic means as the least important ones and 'Safety', 'Organization Structure' and 'Certification' as the most important ones. However, there are some team members who share similar views, such as the manager of the Operations department 'TMT5' and 'Op3' since the angle between them is small. Finally, we notice that the length of vectors of respondents 'TMT5' and 'Op5' are slightly shorter than the rest which all have a length of approximately 1. This means that their preferences are somewhat worse represented in the biplot compared to those of the others. Indeed, two dimensions account for 66% of the variance indicating that the preferences for some members are not perfectly reconstructed in these dimensions. The members of the Sales department hold a stronger shared understanding on strategic means and all are represented adequately in the biplot having lengths very close to 1 since 90% of the variance is accounted for by the biplot.

### 4.3 Assessing the Statistical Significance of Differences in Between-Group Strategic Consensus

Both the biplot and the $\alpha$-measures indicate that Sales has a higher degree of within-group strategic consensus than Operations. However, we do not know whether this difference is statistically significant or not. To find out, we apply the permutation testing procedure that explores the null hypothesis of no difference in the degree of within-group strategic consensus of Sales and Operations, that is, $H_0$ equals $\alpha_{\text{diff}} = 0$. Figure 4 shows the distribution of $\alpha_{\text{diff}}$ under $H_0$ obtained by 9999 permutations. In this figure, the 95th percentile is shown by the dashed line. The observed difference of $\alpha_{\text{diff}} = 0.83 - 0.53 = 0.28$ shown by the solid line turns out to be at the

$98^{th}$ percentile implying $p = 0.02$. Therefore, the null hypothesis of no difference of within-group strategic consensus between Sales and Operations is rejected at the 5% level.

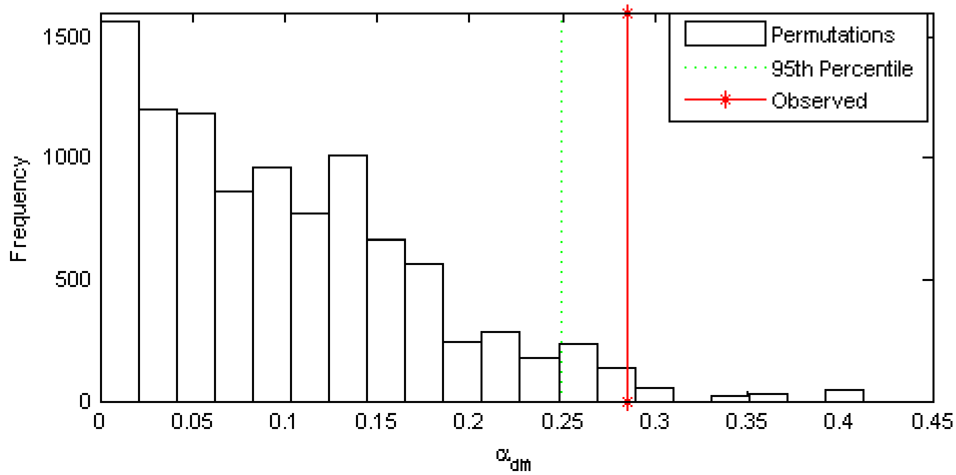


Figure 4. Histogram of permutation test for differences in degree of within-group consensus between sales and operations departments

Further evidence in favor of the validity of our methodology is obtained when comparing our result other common consensus measures such as the standard deviation, squared Euclidean distances, and correlations (see Kellermanns et al., 2010, for details). Table 1 shows that the results remain qualitatively the same.

Table 1: Permutation tests for comparison of within-group consensus between Sales and Operations departments

| Measures | Sales | Operations | Difference | *p*-value |
|---|---|---|---|---|
| $\alpha$ | 0.8141 | 0.5291 | 0.2850 | 0.0201 |
| Standard deviations | -1.2231 | -1.8147 | 0.5915 | 0.0097 |
| Squared Euclidean distance | -23.6 | -47.0667 | 23.4667 | 0.0236 |
| Correlations | 0.5786 | 0.1595 | 0.4190 | 0.0236 |

The permutation test can also be used to test whether two groups have a different correlation with the TMT, for example, $r_{diff} = r(\text{TMT, Sales}) - r(\text{TMT, Operations})$. The results show that this difference was significant at the 10% level ($p = 0.08$), but not at the 5% level. We conclude that there is some evidence albeit not very strong that the Sales department is indeed more aligned with the TMT compared to the alignment of Operations with the TMT. Figure 2, too, suggests that Sales is closer to the TMT than Operations.

### 4.4 Assessing the Effectiveness of the Strategic Intervention

The above findings were presented to the TMT of the company and we experienced that the visual features of our methodology made our results more understandable for the managers. They were especially surprised by the low within-group consensus of their own team, the TMT, on the strategic means. Consequently, they decided to organize a semi-structured half-day strategic intervention facilitated by a professional consultant and an academic. The intervention was aimed to enhance their shared understanding on the strategic means.

After this strategic intervention, we collected the prioritizations of TMT members again, with the aim to measure the effectiveness of the strategic intervention to illustrate this particular application of the SCM methodology. Post measurement showed that the degree of within-group consensus of the TMT increased after the intervention ($\alpha_{post} = 0.81$), compared to the degree of consensus before the intervention ($\alpha_{pre} = 0.55$). Therefore, we tested the null hypothesis that there is no difference in the degree of consensus between pretest and posttest, against to the alternative that the consensus has increased. The results showed that the degree of consensus increased significantly at the 5% level from pretest to posttest ($p = 0.04$).

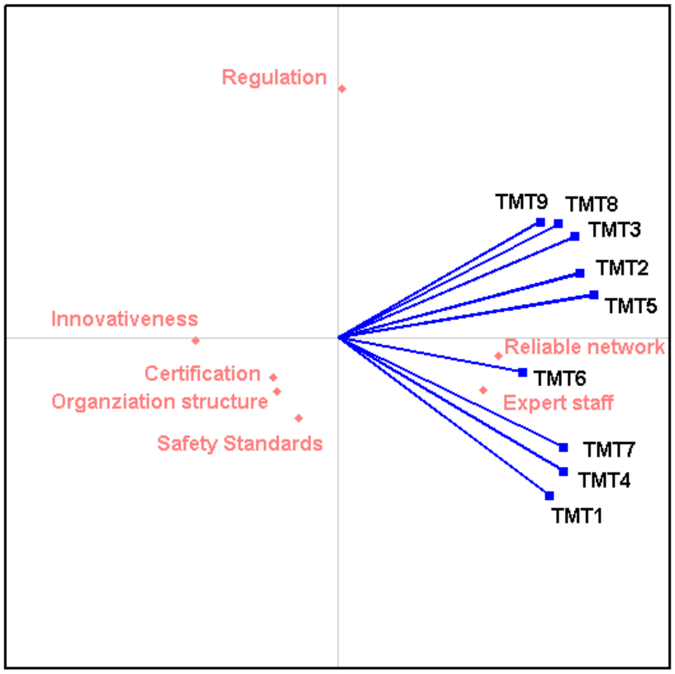


Figure 5. PCA biplot of TMT after the strategic intervention

The content of the consensus is visualized in Figure 5. Compared to the biplot on Figure 1, a higher consensus is observed for high valuation of ‘Reliable Network’ and ‘Expert Staff’, whereas the TMT agrees on lower importance of ‘Innovativeness’. Thus, the application of the SCM allows us to conclude that the strategic intervention has been effective in increasing the degree of consensus on the desired content for the TMT in this organization.

## 5 DISCUSSION

We proposed a set of complementary methodological tools, called strategic consensus mapping (SCM), to quantify the degree of consensus not only within but also between groups, to visually inspect the content of consensus within a group and alignment between groups, and to test whether longitudinal or cross-sectional differences in the degree of within- or between-group consensus are significant. The use of SCM is illustrated with a field study which also includes a strategic intervention, responding to the call to advance the methodological tools to test the effectiveness of strategic interventions (Hodgkinson *et al.*, 2006; Hodgkinson and Healey, 2008).

Each step of SCM is complementary in such a way that the output of one procedure is input for the subsequent one. First, Principal Component Analysis generates a within-group visualization of the degree and content of consensus, quantifies the degree of within-group consensus, and produces the prototypical group member which is an input for the correlational between-group measure. The between-group measure then serves as an input for multidimensional scaling, which visualizes the degree and locus of between-group consensus. The final step, permutation testing, utilizes the difference of within- and between-group measures to assess the significance of differences in strategic consensus. The SCM approach has implications for research in strategic management concerned with strategic consensus and strategic interventions as well as for the practice of strategic management.

### 5.1 Implications for Research in Strategic Consensus

The core contribution of the SCM methodology are the possibilities it provides to research in strategic management for more fine-grained and extended analysis of strategic consensus – within groups as well as between groups. In doing so, it complements earlier conceptual analyses (Kellermanns et al., 2005; Markoczy, 2001; Wooldridge and Floyd, 1989) of the multifaceted nature of strategic consensus by providing the methodological tools needed to follow up on these conceptual analyses with empirical studies. With these tools to operationalize the different facets of strategic consensus in place, future research may take research in the antecedents of consensus formation, the link between different facets of within-group consensus and group performance, and investigation of the effect of between-group alignment on organizational performance to the next level and develop and deepen our understanding of the role of strategic consensus in the strategy process. Moreover, empirical research using this methodology can test the effectiveness of specific strategic intervention methods.

Note that ordinal data needs to be treated with care when employing the SCM methodology. In this case, 'ordinary' PCA should be replaced by Categorical Principal Component Analysis (CatPCA). Both provide a similar output and the overall the differences between CatPCA and PCA are mostly negligible, but CatPCA is the more appropriate technique for ordinal data (see Linting *et al.*, 2007, for a discussion). We may also note that the two fundamental procedures of the proposed methodology, PCA and MDS, are based on the idea of representing multivariate data in lower dimensions. By their very nature they search for low dimensional representations that show the most important but not all information. The advantage is that noise and unimportant relations tend to be removed from the representation. At the same time, they also may lose some information that could only be visible in higher dimensions. This may be so for PCA solutions for a long list of strategy items or groups with many members. Both situations are unlikely in strategic consensus research. The two dimensional MDS solution showing the similarity of the groups will become more of a compromise as the number of groups grows. For large organizations with many organizational units, this situation could occur. However, bad fitting groups can be easily detected by checking the MDS diagnostics. The between-group measures and their significance can provide a valuable support of the visual representation of the MDS map in these cases.

Although clearly our concern here is with strategic consensus, we may note that the SCM methodology also holds promise for research in group consensus on other matters than strategic priorities. Research in shared cognition (e.g., shared mental model; Mathieu et al., 2008; Mohammed, Ferzandi, and Hamilton, 2010) has outlined the importance of shared understanding of the team and the task for team performance and SCM may also contribute to these areas of research. In similar vein, research in intergroup relations in organizations (Brett & Rognes, 1986; van Knippenberg, 2003) may benefit from the SCM methodology to map shared understanding between interdependent organizational groups beyond issues of strategic priorities alone.

### 5.2 Managerial Implications

This study has important implications for practitioners, both those considering the use of strategy workshops and those investigating the consensus within their companies and/or groups. Companies invest significant amounts of resources in strategic interventions, but their effectiveness is seldom, if ever, assessed (Hodgkinson and Healey, 2008). SCM can be used to evaluate whether a particular strategic intervention has been effective. In addition to the testing of the effectiveness of strategic interventions, the results of SCM can also serve as a diagnostic tool to detect where and on which issues lack of strategic consensus exists and thus be the starting point of an intervention to increase consensus.

When looking into strategic consensus within an organization, the between-group visualization provides an intuitive, easy-to grasp means to capture the strategic alignment of teams, which then allows for taking action accordingly, just like the within-group visualizations can help identify the strategic content that the members of a group do (not) agree on. This information can be used as input, for instance to better inform employees about the strategy via a (strategy) newsletter or strategy workshops (Van Riel, Berens and Dijkstra, 2009). Such an ability to identify these issues enables organizations to carry out policies to increase strategic consensus in a more targeted, cost-effective, and productive way.

### 5.3 Conclusion

Strategic consensus has become a prominent concept in strategy process and strategy implementation research. The strategic consensus mapping (SCM) methodology proposed here is closely aligned with the conceptual analyses of strategic consensus and will help research break new ground in more fine-grained and extended analysis of strategic consensus' multifaceted nature. As such, the current study extends a clear invitation to researchers in strategic management to adopt this new approach in the study of strategic consensus.

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