Stats 140XP: Final Project

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Explore the GLOBE

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Contents

Abstract

We wanted to answer two main questions: which leadership qualities do countries tend to view similarly and if countries align their perceptions societal practices and values. For determining leadership qualities and similar countries, we used principal component analysis (PCA) then k-means clustering to create four "clusters" of countries with similar leadership beliefs. We used the _____ method to _____. We found that _____. We also looked at _____. In the future, we recommend looking into _____. Some limitations to our project are _____.

Problem Statements

1. Which characteristics or traits do countries tend to group together when determining "good" leadership values?
    - Which countries have similar perceptions of these leadership values?
2. Do societal practices and societal values align?
    - If they do not, which practices and values deviate most significantly?

Description of Dataset

The data set we have chosen to analyze is the **Dana Landis Leadership** dataset, which comes from the GLOBE Research Survey. The data provided in the folder had survey results for (1) leadership and (2) societal and culture data and a PDF describing the nature of the survey, but nothing more. To glean more information, we found the two questionnaires (alpha and beta) described in the informational PDF to get the original questions asked in the surveys. While we do not have a "codebook" in a traditional sense, the original questions asked may help guide us in understanding what each variable means and how the survey represents respondents answers numerically. The survey is on a 1 to 7 scale, with 1 being a negative response, 4 a "neutral" score, and 7 positive.

Here is a look at 6 full and complete observations from the leadership survey:

Here is a look at 6 full and complete observations from the social and cultural survey:

Description of Variables

Visualization and Exploratory Data Analysis

Analysis

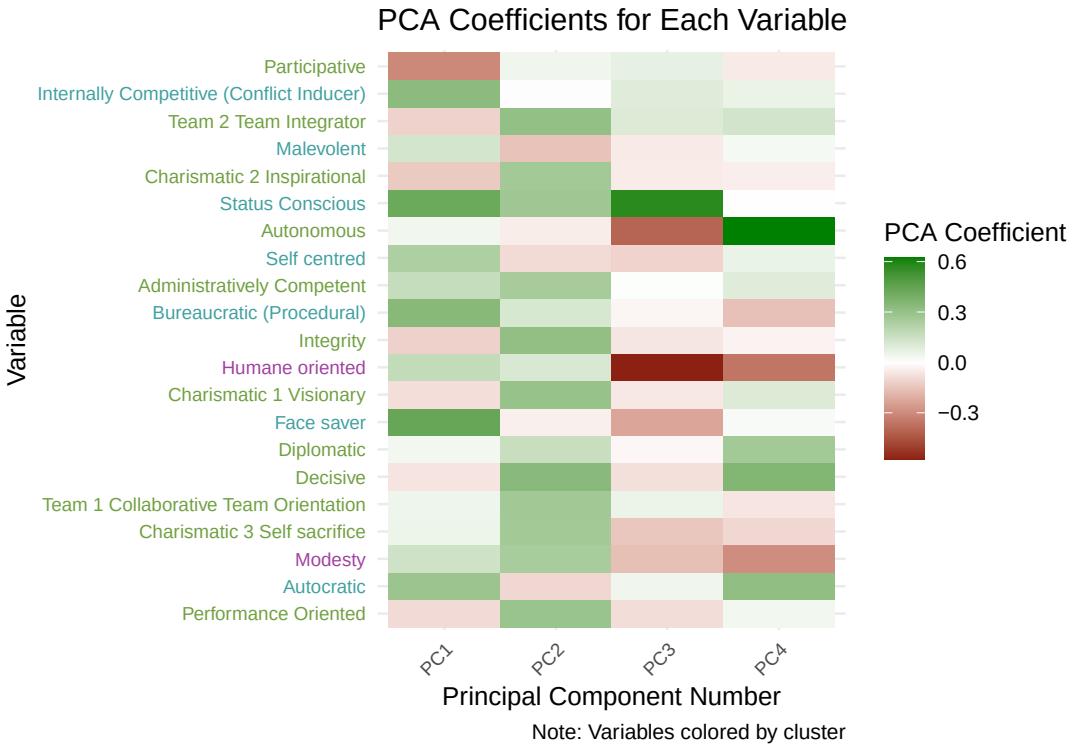
Leadership Values

For the leadership values problem statement, the first objective is to collapse the data into the first four principal components through principal component analysis (PCA). PCA finds the directions which capture the most variability (spread) in the data–the first four account for the maximum variation. PCA allows us to visualize trends in the leadership values: countries tend to have similar sentiments about variables that "point" in the same direction (had principal component values that aligned).

Before performing PCA, though, we remove the second-order factor analysis variables due to the heavy correlation with the original predictor variables and a more difficult interpretation of these variables. Since our

goal is to understand the relationship between certain leadership characteristics, keeping these complicated variables might reduce our understanding and make interpretation more difficult.

After performing PCA, we perform k-means clustering on the first four principal components to determine the "groups" of leadership characteristics that have similar perceptions. K-means clustering creates k groups that are the "most similar" to the other observations in their groups, minimizing the between-group variability:



Here, we see three clusters: two large clusters and a group of two for the other cluster. The green cluster seems to describe positive characteristics (e.g., participative, inspirational), while the blue cluster appears to describe negative characteristics (e.g., malevolent, self-centered). From this, we note that these "positive" and "negative" characteristics tend to occur together. The third "cluster" (i.e., humane oriented and modesty) did not closely fit with the other groups, leading us to believe that they may be considered separately from the other characteristics.

After considering the leadership characteristics, we cluster countries based on similar perceptions. We do this by using the variables of the countries transformed into the first four principal components, then running k-means clustering on those components. The clustering results segregate the countries into the following segments:

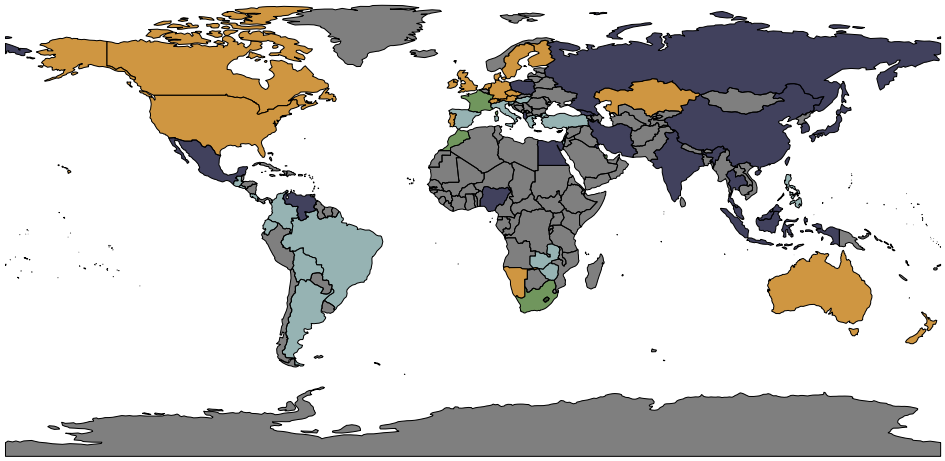
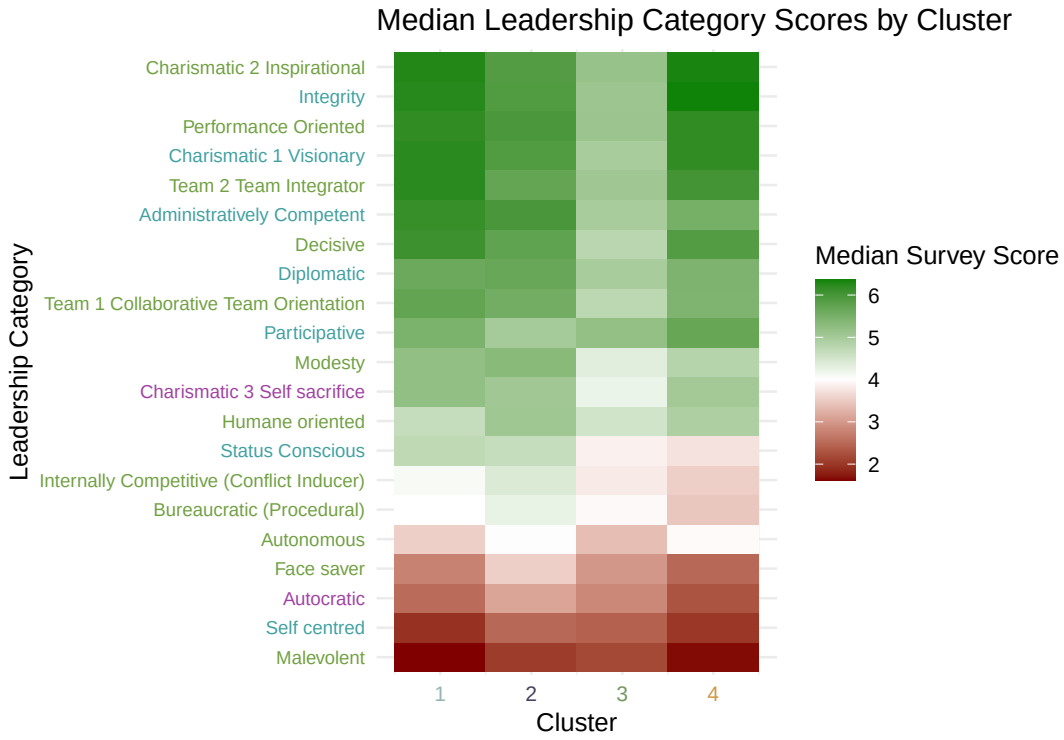


Table 1: Regions with Similar Leadership Perceptions

Cluster 1	Cluster 2	Cluster 3	Cluster 4
Argentina	Albania	France	Australia
Bolivia	China	Morocco	Austria
Brazil	Egypt	Qatar	Canada (English-speaking)
Colombia	Georgia	South Africa (Black Sample)	Czech Republic
Costa Rica	Hong Kong		Denmark
Ecuador	India		England
El Salvador	Indonesia		Finland
Greece	Iran		French Switzerland
Guatemala	Japan		Germany (EAST)
Hungary	Kuwait		Germany (WEST)
Israel	Malaysia		Ireland
Italy	Mexico		Kazakhstan
Philippines	Nigeria		Namibia
Slovenia	Poland		Netherlands
Spain	Russia		New Zealand
Turkey	South Korea		Portugal
Zambia	Taiwan		Singapore
Zimbabwe	Thailand		South Africa (White Sample)
	Venezuela		Sweden
			Switzerland
			USA

From the above grouping, we see that regionality (generally) determines a country's respective cluster and leadership perspectives. Cluster 1 tends to describe Latin American and the Mediterranean, Cluster 2 generally includes Asia, and Cluster 4 describes the Anglo regions and northern Europe. The one cluster that appears to be "out there" is Cluster 3, which does not have a particular region associated with it. To visualize the differences between these clusters, we create a heatmap of the median variable values for each cluster:

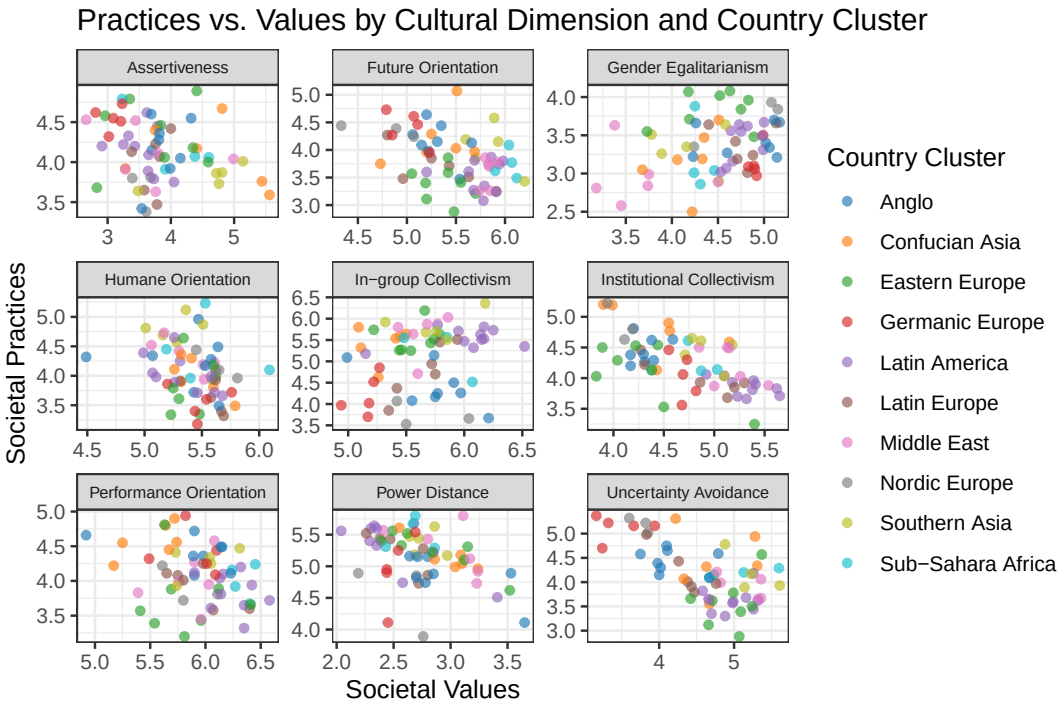


From here, we see that, despite the clustering, the countries tend to agree on beneficial and detrimental leadership qualities; the main difference is in the intensity: clusters 1 and 4 seem to have the strongest responses (most positive and most negative), while cluster 3 does not seem to feel terribly strongly about positive leadership characteristics. The few qualities of intrigue, though, are the ones for which some clusters viewed positively (green) while others viewed negatively (red):

- Status Conscious
- Internally Competitive (Conflict Inducer)
- Bureaucratic (Procedural)
- Autonomous

Societal Practices and Values

To determine whether societal practices and societal values align, we first create scatterplots of societal values against societal practices for each of the nine cultural dimensions:



Note: Countries with missing country clusters were excluded.

From the scatterplots above, we note that societal practices and societal values do not always align. For instance, in the case of the Humane Orientation cultural dimension, there does not appear to be any correlation between practices and values at all, with societal practices in this dimension varying from less than 3.5 to more than 5.0 on the survey's seven-point scale even though societal values were rated relatively similarly across all of the surveyed countries. In some other cases, such as for the Uncertainty Avoidance cultural dimension, there appears to be a negative correlation between practices and values, as indicated by the general trend of scores for practices in this dimension decreasing even as scores for values increase. This negative correlation might suggest that, rather than aligning, societal practices and societal values are in fact in conflict.

To quantify the observations we made from our scatterplots above, we fit simple linear regression models for each of the nine cultural dimensions, using the societal values rating as the predictor and the societal practices rating as the response. In other words, we fit the model:

$$y = \beta_0 + \beta_1 x$$

Where x is the societal values rating and y is the societal practices rating for each of the nine cultural dimensions. Additionally, we performed t-tests for each dimension, to test the hypotheses $H_0 : \beta_1 = 0$ and $H_1 : \beta_1 \neq 0$. For this, we employed the *Bonferroni correction* to change the significance threshold from $\alpha = 0.05$ to $\alpha = \frac{0.05}{9} \approx 0.0056$ since maintaining a significance level of $\alpha = 0.05$ would increase the experiment-wise error rate: $P(\text{Any False Positive}) = 1 - P(\text{No False Positives}) = 1 - 0.95^9 \approx 0.3698$. The table below shows the values of β_1 that we obtained and the corresponding p-values. Cultural dimensions for which the p-value is lower than the corrected $\alpha \approx 0.0056$ are indicated with green shading.

As shown above, most of the β_1 values obtained were negative, including all three values that were significant at the $\alpha = 0.56\%$ significant level as calculated using the Bonferroni correction. This means that, as the rating for the societal values of a cultural dimension increase, the rating for the societal practices of that cultural dimension actually decrease. In other words, rather than being aligned, societal practices in fact run counter to societal values.

Table 2: Results of Simple Linear Regression by Cultural Dimension

Cultural Dimension	Coefficient Value	p-value
Uncertainty Avoidance	-0.6199	0.0000
Institutional Collectivism	-0.5251	0.0000
Power Distance	-0.4991	0.0006
Future Orientation	-0.4725	0.0009
Humane Orientation	-0.5944	0.0116
Gender Egalitarianism	0.2437	0.0124
Performance Orientation	-0.3459	0.0268
Assertiveness	-0.1507	0.0414
In-group Collectivism	0.4393	0.0991

Conclusions

Suggestions for Further Research

Regarding the leadership investigation, some further research we may consider is investigating *why* Cluster 3 differs so greatly from the other three clusters. In Cluster 3 we have France, Qatar, Morocco, and South Africa (Black Sample). Understanding why these countries are so different may help us see if there is an underlying link. Similarly, we may want to consider the differences between South Africa's Black and White samples and Germany's East and West samples. Since the survey was conducted in 2006, Apartheid and the Berlin Wall, respectively, may play a role in any potential differences. Ultimately, the above two suggestions relate to us considering the country's framework: looking at other indices (such as a freedom index, government approval ratings, or a happiness index) could shift us from an unsupervised learning situation (just understanding relationships between variables) to a model-building mindset in which we might determine which characteristics seem to have associations with more freedom/approval/happiness.

For both leadership and the societal analyses, further research may be conducting more surveys to look at the potential changes in ideology and perspectives over time to understanding the changing dynamics at both the national and global level.

Limitations

While promising, there are a few issues with the data we have to consider. First, the number of observations: 62 observations is a rather small dataset, which suggest that any analysis will likely be limited. Also, the data silences are important and should not be overlooked. Why were certain countries not surveyed?