Statistical Techniques for Use Case 2: Employee Engagement & Survey Analytics

Advanced statistical techniques for understanding and improving employee engagement through data-driven insights.
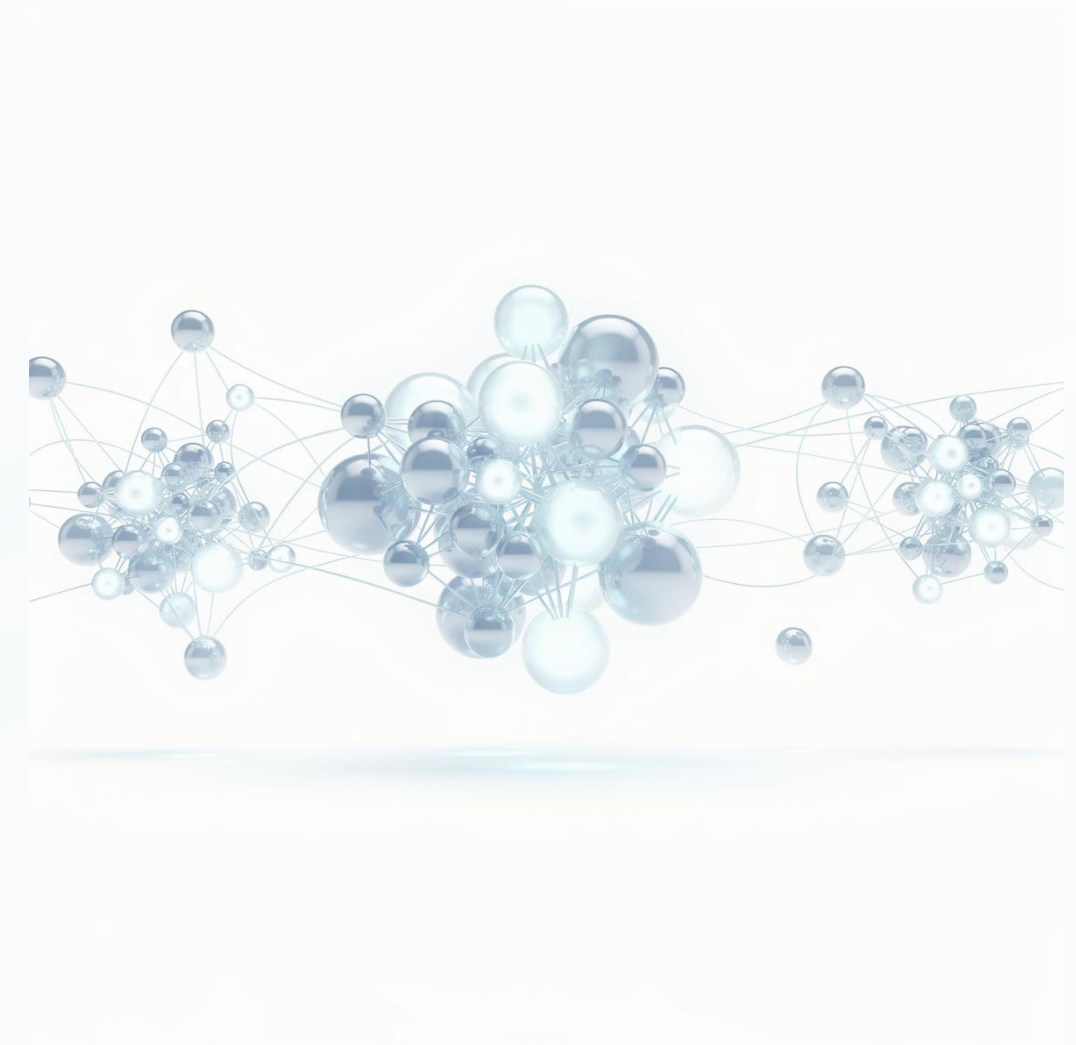
Exploratory Factor Analysis (EFA)

What EFA Is For

EFA identifies latent constructs behind correlated survey items. The key question: Are these survey items measuring one concept or several?

This technique reveals the underlying psychological dimensions that survey questions are actually capturing, helping researchers understand whether engagement is a single unified concept or composed of multiple distinct factors.

Understanding Factor Analysis Output

Factor Loadings Matrix

Shows how strongly each survey item relates to underlying factors. Loadings above 0.40 indicate strong associations.

Scree Plot

Visual representation of eigenvalues helping determine the optimal number of factors to retain in the analysis.

Parallel Analysis

Statistical technique comparing observed eigenvalues against random data to identify meaningful factors.

Item	Factor 1	Factor 2
Eng1	0.78	0.12
Eng2	0.74	0.10
pos1	0.15	0.81

Interpreting EFA Results

Correct Interpretation

> "The analysis suggests a two-factor structure representing 'Work Engagement' and 'Perceived Organizational Support'. This indicates engagement is multidimensional rather than a single construct."

Rotation methods like oblimin allow factors to correlate, reflecting real-world psychological relationships.
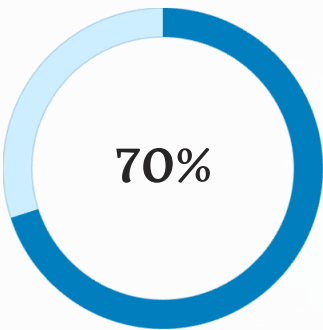
Common Mistakes to Avoid

- Treating factors as objective truths rather than interpretive constructs
- Ignoring cross-loadings that suggest item complexity
- Naming factors without theoretical justification

Reliability Analysis: Cronbach's Alpha
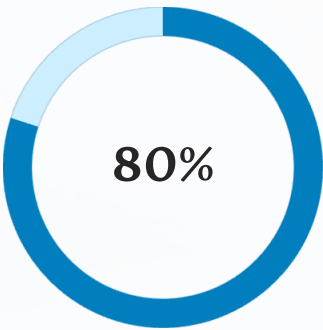
Purpose

Cronbach's alpha assesses internal consistency, answering the critical question: Do these items measure the same underlying construct?

This statistical measure evaluates whether survey items hang together as a coherent scale, ensuring measurement reliability before drawing conclusions.
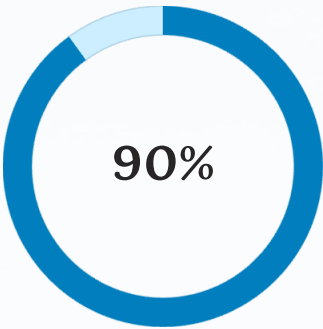
70%

Acceptable

Minimum threshold

80%

Good

Strong reliability

90%

Caution

Possible redundancy

Interpreting Reliability Results

01

Review Overall Alpha

Cronbach's alpha = 0.82 indicates good internal consistency for the OCB scale.

02

Examine Item Deletion

Alpha if item deleted: ocb4 → 0.86 suggests that this item may not be well aligned with the underlying construct.

03

Make Informed Decisions

Consider both statistical evidence and theoretical relevance before removing items.

Correct Interpretation: "The OCB scale shows good internal consistency (α = 0.82). Removing item ocb4 would slightly improve reliability."

- **Don't assume high alpha means validity**

- **Don't drop items blindly without theory**

- **Don't ignore content relevance**

Principal Component Analysis (PCA)

What PCA Is For

PCA reduces many correlated variables into fewer components, answering: How can we summarize engagement dimensions efficiently?

Unlike EFA, components are mathematical rather than psychological constructs. PCA is used for data reduction, not theory testing.

48%
Component 1
Variance explained

22%
Component 2
Additional variance

Correct Interpretation: "Two components summarize team engagement data, capturing overall engagement intensity and leadership-related experience."

t-Tests for Engagement Differences

Statistical Significance

Determines if differences are unlikely due to chance

Effect Size

Measures practical magnitude of differences

Actionability

Assesses whether findings warrant intervention

Applied to attitudinal outcomes, t-tests reveal whether engagement differs meaningfully between groups. The critical distinction: statistical significance doesn't always equal practical importance.
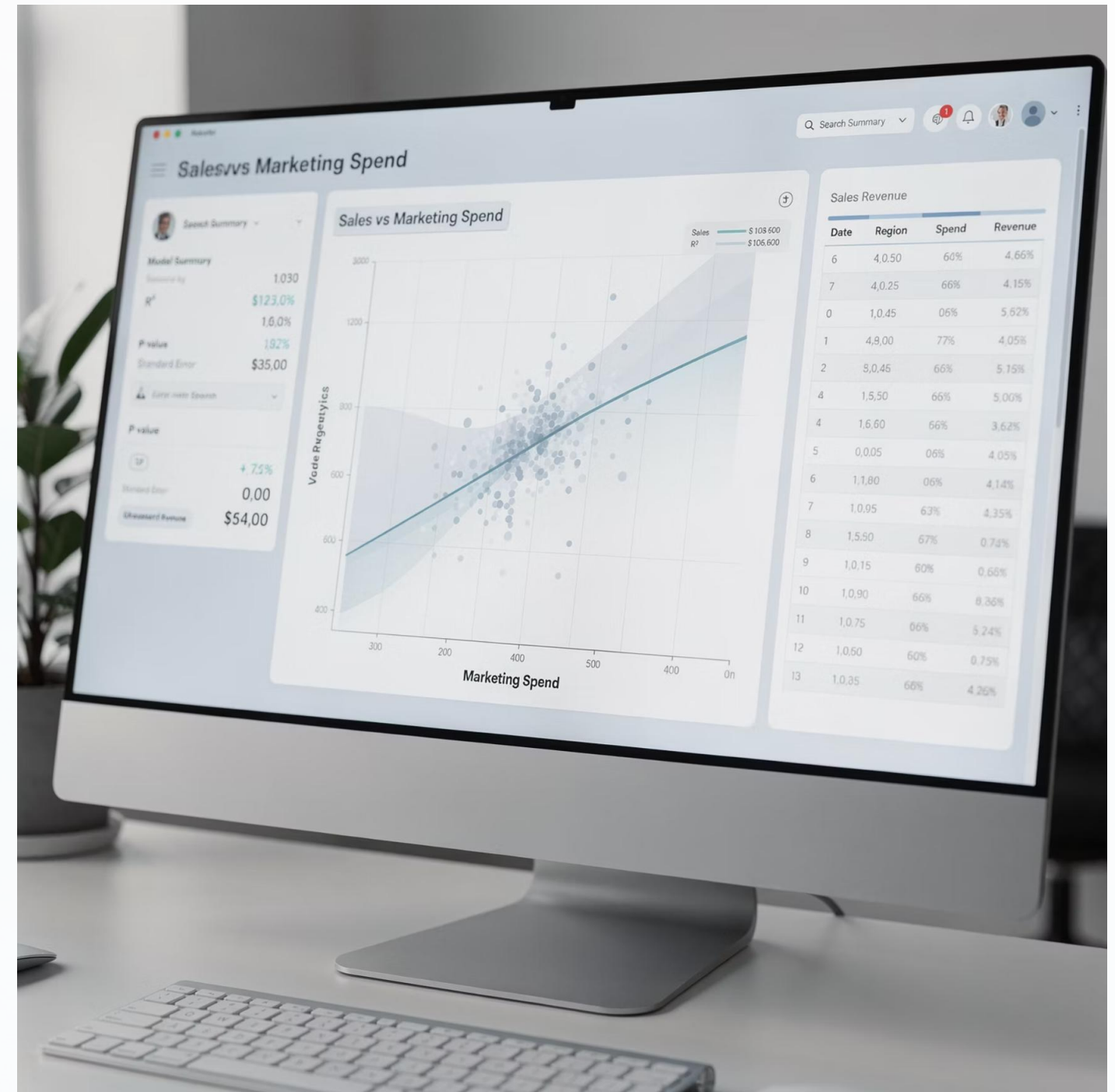
Correct Phrasing: "Although engagement differs statistically by location, the effect size is small, suggesting limited practical relevance."

Multiple Regression: Engagement Drivers

Key Interpretation Focus:

- **Standardized coefficients** reveal relative importance of predictors

- **Model fit** indicates overall usefulness of the analysis

- **HR relevance** identifies actionable intervention levers

Key Takeaways

1 **Use EFA to uncover multidimensional constructs**

Don't assume survey items measure a single concept - let the data reveal underlying structure.

2 **Assess reliability before drawing conclusions**

Cronbach's alpha ensures items hang together, but remember it doesn't guarantee validity.

3 **Distinguish statistical from practical significance**

Effect sizes matter more than p-values when determining actionable insights.

4 **Focus regression results on HR interventions**

Identify the strongest predictors that organizations can actually influence through policy and practice.