DECODING CONSUMER PREFERENCES: A FACTOR ANALYSIS STUDY USING R ON U.S. PRODUCT PERCEPTION SURVEYS

1. Background

A consumer electronics startup in San Diego launched a nationwide survey to understand how Gen Z and Millennial users evaluate wearable tech products. The marketing team had collected data on 30 different product perception variables, but the volume of attributes made it difficult to derive strategic messaging. They approached us to run factor analysis in R to distill these attributes into actionable preference segments.

2. Objective

- To reduce 30 perception attributes into key latent constructs using R
- To identify psychographic patterns across consumer subgroups
- To guide repositioning of brand messaging and feature communication based on factor groupings

3. Data Used

Source: U.S. nationwide online survey (March 2024) conducted via Qualtrics

Sample Size: 1,150 responses from consumers aged 18–35 **Variables**:

- 30 5-point Likert items assessing product preferences
- Categories included: usability, innovation, price sensitivity, aesthetics, and brand trust

4. Methodology

4.1 Data Preparation

- Cleaned responses for inconsistencies and standardized item scales
- KMO = 0.87 → Strong sampling adequacy
- Bartlett's test $p < 0.001$ → Satisfied factorability assumptions

```
library(psych)

KMO(survey_data)
```

cortest.bartlett(survey_data)

4.2 Factor Extraction

- Used Principal Axis Factoring (psych::fa)
- Scree plot and parallel analysis suggested 5 factors

fa_model <- fa(survey_data, nfactors = 5, rotate = "varimax", fm = "pa")

4.3 Factor Interpretation

Based on loading scores:

1. **Utility & Ease of Use**
2. **Tech Innovation Appeal**
3. **Style & Design**
4. **Price-Consciousness**
5. **Brand Confidence**

4.4 Segment Profiling

- Created factor scores per user
- Used K-means clustering on factor scores to group consumers into preference segments
- Created 4 target personas for marketing based on dominant factors

5. Results Summary

Factor Name	Items (Avg)	Cronbach's α	Example Items
Utility & Ease	7	0.83	“Easy to operate”, “Quick setup”
Innovation Appeal	6	0.86	“Feels futuristic”, “New tech”
Style & Design	5	0.81	“Looks modern”, “Color options”
Price-Consciousness	6	0.78	“Worth the price”, “Affordable”
Brand Confidence	6	0.80	“Trust brand”, “High reliability”

- Factors explained **74.2%** of total variance
- Clear segmentation into 4 consumer groups with distinct dominant factors

6. Interpretation and Recommendations

- Segment 1 (34%): Price-sensitive pragmatists → push affordability and durability
- Segment 2 (28%): Aesthetic seekers → emphasize color variants and form factor
- Segment 3 (22%): Tech-enthusiasts → highlight latest innovations and features
- Segment 4 (16%): Loyalists → double down on brand storytelling and trust metrics
- Recommend targeting innovation and affordability segments through distinct ad sets
- Reduce perception surveys to 12 key items mapped to the 5 core factors

7. Deliverables

- **Report** (28 pages):
  - Factor loading tables
  - Scree plots, correlation matrices, K-means cluster visualizations
  - Segment personas with psychographic profiles
- **R Scripts**:
  - consumer_factor_model.R
  - segment_consumer_profiles.R
  - survey_reduction_tool.R
- **Marketing Recommendation Deck**:
  - 12-slide PPT summarizing personas and messaging strategy

8. Business Outcome

- Company used factor-informed segmentation to launch 3 differentiated ad campaigns
- Achieved **19% lower cost per click (CPC)** compared to their prior campaigns
- Data-driven insight led to the design of a new budget variant aimed at Segment 1
- R-based model retained for future quarterly surveys