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Multivariate Analysis Of Mobile Phone Preferences Among Graduates: A Case Study Approach

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Abstract
Today, mobile phones serve not only as communication tools but also as multifunctional devices capable of handling various tasks. Due to evolving customer needs and preferences, the mobile phone market remains highly competitive and constantly changing. This study identified and explored the factors associated with the mobile phone preference of the graduates of the Faculty of Science, University of Kelaniya, Sri Lanka. A questionnaire was designed to collect the data, and an online survey was conducted. Considering recently passed-out graduates, 338 were selected for the study based on a simple random sampling procedure. The data collected were analyzed using SPSS and RStudio. Basic features, camera features, performance and updated technology features, durability with safety standards, marketing strategy, pricing strategy, and brand were identified as the prominent factors associated with the mobile phone preference of the respondents using Factor Analysis, and each factor was further explored using Latent Class Analysis to investigate the hidden patterns among the respondents. Due to time limitations, this study was conducted as a case study, but using the same methodology, it can be extended to find the factors associated with the mobile phone preference of mobile users in Sri Lanka.

Keywords: *Factor Analysis, Latent Class Analysis*

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I. Introduction

The evolution of the mobile phone has been a long journey over many decades. The mobile telecommunication industry has grown tremendously. In the telecommunication industry, the mobile phone has become an efficient and reliable mode of communication, connecting people within and across countries. The mobile phone is a fundamental and integral part of human life.

Nowadays, the mobile phone is not just a communication device but also a multifunctional tool that makes life easier. Innovative features and applications are continuously being added and updated to meet customer requirements. As a result of changing customer needs and preferences, the mobile phone market is highly competitive and dynamic.

Marketers have identified techno-centric customers as the most promising segment of the mobile phone market. Graduates can be considered one such customer segment. This study focuses on analyzing the mobile phone preferences of graduates in the Faculty of Science, University of Kelaniya, Sri Lanka. Although the study focuses on a limited group of graduates to identify factors influencing mobile phone preferences, this research can be extended to understand the preferences and decision criteria of graduates across Sri Lanka. The same methodology can be applied to gain better insight into the Sri Lankan phone market. The results will be highly valuable, especially for advertisers and phone sellers, as they can align their strategies with customer preferences.

II. Objectives

The mobile phone market is becoming increasingly competitive day by day. It is very important for advertisers as well as phone sellers to identify the factors that highly influence customers.

Researchers in other countries have identified factors affecting mobile phone purchase decisions based on their respective markets. However, in Sri Lanka, no similar research has been conducted to gain better insight into the local phone market. Even though this study was carried out with a limited group of people, the same methodology can be used to better understand the phone market in Sri Lanka.

The main objective of this study is to identify the factors associated with mobile phone preferences among graduates of the Faculty of Science, University of Kelaniya. In addition to this main objective, investigating patterns related to mobile phone preferences was also considered as a sub-objective to gain a deeper understanding of the identified factors.

III. Methodology

This study focused on factors associated with mobile phone selection among graduates of the Faculty of Science, University of Kelaniya. An online questionnaire was sent directly to randomly selected recent graduates of the Faculty of Science, University of Kelaniya, and data were collected. Multivariate techniques were used to analyze the data. Factor Analysis (FA) was conducted to identify the factors associated with mobile phone preferences. Furthermore, Latent Class Analysis was used to investigate the hidden patterns associated with customer preferences.

IV. Sampling Design (If Primary Data Is Used)

All primary data were gathered through an online survey, and a structured questionnaire was designed as a Google Form. The email addresses of the selected graduates were obtained from the book of the list of graduates issued at the convocation each year. The questionnaire link was sent via email to the selected graduates.

V. Statistical Design (If Primary Data Is Used)

This study employed a structured statistical design to analyze the factors influencing mobile phone selection among graduates of the Faculty of Science, University of Kelaniya. Primary data were collected using a structured online questionnaire designed as a Google Form. The questionnaire covered multiple variables, including demographic details, mobile phone preferences, and key selection factors.

The collected data were downloaded as an Excel file and analyzed using SPSS and RStudio. Factor Analysis (FA) was conducted to identify the key factors influencing mobile phone preferences, and Latent Class Analysis (LCA) was applied to explore hidden patterns within customer preferences. Since the study focused on the mobile phone market in Sri Lanka, data from graduates living abroad were excluded from the analysis.

VI. Geographical Area (If Primary Data Is Used),

The primary data for this study were collected from graduates of the Faculty of Science, University of Kelaniya, Sri Lanka. The geographical area for this study is limited to Sri Lanka, with a specific focus on the graduates who completed their studies at the University of Kelaniya. As the survey was conducted online, respondents were selected from a diverse range of locations within Sri Lanka.

Graduates who were residing abroad at the time of the survey were excluded from the data collection process, as the focus was on the mobile phone preferences of graduates living within Sri Lanka.

VII. Results

Factor analysis is a method of reducing many attributes into a few factors, and this method allows for interpreting the attributes in a simple and interpretable structure. In this study, to find the factors associated with a mobile phone preference, factor analysis was employed.

Validity of the factor analysis

To identify whether the variables are sufficient and correlated enough for factor analysis, all data were initially tested using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test, as shown below.

Table VII.1 KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.836
Bartlett's Test of Sphericity	Approx. Chi-Square	7351.033
	df	903
	Sig.	.000

The above table (Table 7.1) presents the test results of the KMO test and Bartlett's test. The KMO test indicates whether enough items are predicted by each factor. If the KMO value is greater than 0.6, it is acceptable, and for values greater than 0.7, it is considered good. Here, the KMO value is 0.836, which is good. Bartlett's test should be significant (i.e., a significance value of less than 0.05), meaning that the variables are highly correlated enough to provide a reasonable basis for factor analysis. According to the Bartlett's test value, the test is significant. Therefore, based on both test results, it is suggested that the data are appropriate for the factor analysis process.

Table VII.2 The total variance is explained table

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	12.097	28.132	28.132
2	3.761	8.747	36.879

3	**2.762**	**6.424**	**43.304**
4	**2.142**	**4.982**	**48.285**
5	**1.781**	**4.143**	**52.428**
6	**1.656**	**3.851**	**56.279**
7	**1.557**	**3.620**	**59.899**
8	1.282	2.981	62.880
9	1.211	2.817	65.697
10	1.132	2.633	68.330
11	1.089	2.533	70.863

Table 7.2 presents a part of the table showing the total variance explained by the factors. As shown in Table 7.2, there are seven factors with eigenvalues (a measure of explained variance) greater than 1.0, which is a common criterion for a factor to be considered useful. This suggests that seven factors are useful. These factors cumulatively explain approximately 60% of the total variance.

Scree plot

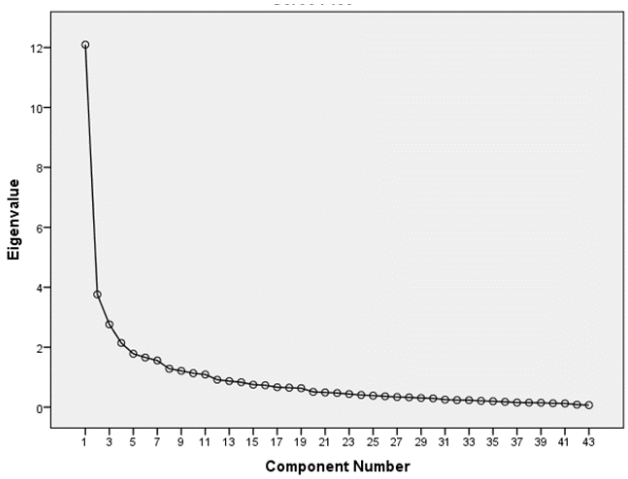

Figure VII.1 Scree Plot

Figure 7.1 shows the scree plot of Eigenvalues which could be used for several factors to be retained in an exploratory factor analysis. The point where the slope of the curve is leveling off (the "elbow") is the number of factors that should be generated by the analysis. According to the above chart is difficult to point out where the scree begins. After about the 7th component, the scree plot slightly flattens out to some extent and there is a slight bend after about the 11th component which is the clearer break point when compared to the breaking point about the 7th component. Therefore both cases were concerned with identifying the best model.

Goodness of fit of the factor solution

To simplify the factor loadings and to obtain a clear and simple structure, rotation is needed. There are two main types of rotation: **orthogonal** (assumes no correlation between factors) and **oblique** (allows correlation between factors). In this analysis, **Varimax** (orthogonal) and **Promax** (oblique) rotations were applied to both the 7-factor and 11-factor model to get an interpretable model. Since both rotation methods yield similar factor loadings, selecting the most suitable method is challenging. There is no rule of thumb for choosing between orthogonal and oblique rotations in such cases. However, Tabachnick and Fidell (2007) suggest performing oblique rotation and examining the correlation matrix factor. If correlations exceed **0.32**, indicating at least **10% overlap in variance**, oblique rotation is recommended unless strong reasons favor orthogonal rotation. In this study, more than **10% of correlations exceed 0.32**, justifying the use of **Promax rotation.** The seven-factor model was selected as it provides a more interpretable structure. According to the correlation matrix, more than 10% of correlations exceed 0.32, indicating sufficient overlap in variance among factors. Based on this, Promax rotation of the 7-factor model was selected.

Table VII.3 Factor interpretation

Factor	Attribute	Factor Loadings
Factor 01 Basic features	Battery life	.943
	Weight of the phone	.906
	Charging hours	.869

Factor	Attribute	Factor Loadings
	Larger memory capacity	.676
	Phone Size	.653
	Ease of use physically	.624
	Dual SIM	.608
	Color screen	.543
	Bluetooth / infrared facilities	.514
	Screen Size	.483
	Security type of the current phone	.477
	Operation system friendliness	.365
	Availability of Audio and video recording	.338
Factor 02 Camera features	Availability of Back camera	.903
	Back Camera Quality	.876
	Availability of Front Camera option	.871
	Quality of the Front Camera	.741
	Number of cameras available	.654
Factor 03 Performance and updated technology features	Number of features available	.875
	Operating System (eg Android / Windows)	.761
	Network Quality (eg 2G,3G,4G)	.726
	Latest Technology	.701
Factor 04 Durability with safety standards	After-sale service	.828
	Safety standards of the phone in terms of radiation	.764
	Guarantee and warranty	.740
	Physical Durability	.617
Factor 05 Marketing strategy	Advertisement	.810
	Celebrity Influence	.769
	Media reviews	.707
	Recommendation of someone	.624
	2nd hand market/post-purchase behavior	.525
Factor 06 Pricing strategy	Special offer	.797
	Price	.764
	Method of payment	.589
Factor 07 Brand	Country of origin	.886
	Brand image	.749

According to the communality value of each factor, the range of the extraction is spread over 0.812 to 0.366. Communalities are the estimates of common variance among the derived factors.

Assessing model fit

The last step involves assessing the goodness of fit of the model. According to the residual matrix, about 66% of residuals in the model have absolute values less than 0.05. Therefore we can presume a good model fit. Finally, around 60% of the total variance is explained by the seven-factor model which is a good result.

VIII. Conclusion

The main conclusions obtained from the analysis are summarized as follows:

The factors associated with the mobile phone preferences of graduates of the Faculty of Science, University of Kelaniya, are Basic features Camera features, Performance and updated technology features, Durability with safety standards, Marketing strategy, Pricing strategy, and Brand

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