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CONSUMER PREFERENCES FOR MOBILE PHONES AMONGST STUDENTS IN AKOKA AREA OF LAGOS STATE

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Abstract

Over the years after the invention of mobile phones, people are still purchasing and using mobile phones today. However, different people prefer different attributes of mobile phones. The main purpose of this study was to identify the factors that influence consumer preferences on mobile phone purchase. The specific attributes examined in this study were brand, price, colour, quality and warranty. From the purchasing information, the total sample implied that the attribute that influenced their decision to purchase a mobile phone the most was brand name. And as observed, 75% preferred Nokia mobile phones. 82.5% of the respondents purchase mobile phones mainly for calls. As observed, 41.5% showed preference for the highest price (Above N20,000) listed for this survey. It was also observed that all the respondents that participated in the survey use mobile phones. Results showed that the total utility of the product profiles indicated that profile 4 had the highest utility of 19.431, which was the best combination: Nokia, Above N20, 000, Ash, Low quality and has warranty while profile 25 had the lowest utility of 9.631, which was the least combination: Motorola, Below N10, 000, Black, Low quality and no warranty. The results confirmed that brand (44.394%) had the most influence on overall preference for mobile phones. In the research, two product profiles that were not ranked by the respondents were simulated using Maximum Utility, BTL (Bradley-Terry-Luce) and Logit models.

1. Introduction

The goal of any business is to satisfy the needs of its customers, and the mobile phone business is no different. With different countries spending so much money on mobile phone business each year, it is not surprising that all those involved in the sale of mobile phones want to know specifically what pleases their customers. The old marketing motto is sell what you have. But recently, increasing consumer demands has changed the adage to have what sells [11]. To keep up with the ever-changing demand of mobile phones, producers, wholesalers and retailers must supply a product that has the group of attributes most preferred by their customers. However, the main problem is that those in the mobile phone industry do not specifically know who their customers are, where to find these customers or what attributes they prefer in a mobile phone. The aim of this study is to address these issues because knowing what the consumer wants and providing them could benefit all parties involved. Most importantly, marketers would be satisfied knowing their customers preferences, and producers and retailers could go back to selling what they have, because they only have what sells.

Since the GSM launch in Nigeria in August 2001, mobile telephony has rapidly become the most popular methods of voice communication in Nigeria. Growth has been so rapid that Nigeria has been rightly described in various fora as one of the fastest growing GSM markets in the world.

There are several choices when purchasing a mobile phone and consumers often feel bombarded with choice and features when buying a new phone. Currently, Nokia is the worlds largest mobile phone manufacturer, with a global market share of approximately 40% in 2008. Other mobile phone manufacturers include Samsung (14%), Motorola (14%), Sony Ericsson (9%) and LG (7%).

Conjoint Analysis has been frequently used in most type of marketing research. According to [8], conjoint analysis is by far, the most used marketing research method for analyzing consumer tradeoffs. In fact, one study deduced that more than 400 commercial conjoint studies were performed in the 1980s ([7]). Large companies such as Ford, General Foods, General Motors and Xerox have even employed conjoint analysis for research on a wide array of products ([6]).
Conjoint analysis is a better method for determining consumer preferences than other methods of research. Conjoint analysis has been utilized in a number of agricultural studies. For example, Frank [4] evaluated consumer preference for colour, price and Vitamin C content of bell peppers. Using a conjoint analysis, an ordinary least squares regression and a multinomial logit, Frank et al concluded that consumers in this study preferred green bell peppers at a low price

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but containing a large percent of Vitamin C.
Campbell [3] looked at price, colour, size, seediness, blemishes, production region label and organic production to evaluate consumer preferences for Satsuma Mandaris. Using a conjoint analysis and a multinomial logit, Campbell [3] found that consumers preferred a large yellow-orange fruit with no blemishes and no seeds that was organically produced in Alabama and sold at a low price.
Boyle [2] used various response formats including rating, ranks, choosing one to generate preferences for various timber harvesting practices to more environmentally benign timber harvesting based on a survey of residents in Maine. The results of this study indicated that convergent validity of rankings and choosing one of the forest practices could not be established. Adamu [1] applied conjoint analysis in the study of consumer preferences for choosing Nigerian GSM network provider services in Nigeria. Garver [5] used an example of a transportation company client to outline why adaptive choice-based conjoint analysis is a useful tool for developing market segmentation. John [10] used conjoint analysis in the health sector. The results of the conjoint analysis indicated that GSM network in Nigeria should focus more on how to improve their connectivity. The remaining parts of the paper are as follows: section 2 presents the methodology. Section 3 involves the analysis of data, and discussion of the results, and finally, section 4 concludes the study.

2. Methodology

This chapter presents the research methodology for this study. It presents the research design, population of study, sample size and among others. This study is a descriptive research. It attempts to look at consumer preferences for mobile phones in parts of Lagos State. The important task is to establish exactly what consumers want, and conjoint analysis helps researchers do just that. Because conjoint analysis is practical for imitating real-life scenarios and gives the researcher an understanding about consumer preferences ([9]).

Conjoint analysis software generates a profile of which combines levels of these product attributes. Respondents are asked to rank the different combination services into an order of preference. By compiling and analyzing the consumers utility functions for each attribute. Utility, sometimes called part-worths, is the buying preferences for product attributes. It can be a number that shows the consumers preference for that level of the attribute measure utility. The overall utility of concepts is determined by calculating the weighted sum of the attribute-level rankings. Besides, the group utility function (part-worths) can calculate the relative importance. Relative importance of an attribute is the difference between the highest and lowest utility for the attribute.

The general population of the study are students of higher institutions in Lagos State, specifically the students of the University of Lagos and the Federal College of Education (Technical), both located in Akoka area of Lagos.

The sample size used in this study is 250 made up of 150 students resident in the Henry Carr Postgraduate Hall of the University of Lagos and 100 from the Residential Hall of the Federal College of Education (Technical), all randomly selected. There was no conscious discrimination between males and females in the distribution of the questionnaires which were randomly done.

Since not all influential attributes could be included in this study, five major factors were decided on brand, price, colour, quality and warranty with their respective levels given below. As a general rule, the maximum number of attributes allowed in a traditional conjoint analysis is nine ([9]). Green and Srinivasan [7] reported that survey respondents have difficulty assessing more than six characteristics, and also warned against information overload. Table 1 shows the attributes and levels.

Table 1: Attributes and Levels

Attributes	Levels
Brand	Nokia
	Samsung
	Motorola
	Sony Ericsson
	LG
	Others
Price	Below N10, 000
	N10, 000- N20,000
	Above N20,0000
Colour	Black
	Ash
	Others
Quality	Low
	High
Warranty	No
	Yes

Using the full-profile method would result in respondents evaluating all 216 ($6 \times 3 \times 3 \times 2 \times 2 = 216$) hypothetical products. Therefore, a fractional factorial design, which does allow respondents to only analyze a portion of the hypothetical products, was used to reduce the number of products to be evaluated. SPSS Statistics 17.0 software was utilized to develop a more manageable number of hypothetical products. It generated 27 different product profiles combination for ranking by the respondents. The ranking was from 1-most preferred to 27-least preferred accordingly. To better standardize brand, price, colour and other

visible characteristics of mobile phones in this study, card list were used for evaluations. This software allows the production of full profile conjoint design but uses orthogonal array to reduce the size of the task necessary to estimate the respondents preference (utility) function. According to [9], consumers can easily analyze as many as 20 conjoint scenarios. However after 20, the responses become less accurate and less symbolic of their true preferences. SPSS Statistics 17.0 software randomly created 27 product profiles and suggested that number to be sufficient to measure values for all other combinations of attributes. Even though some of these created profiles may seem unrealistic in respect to price and quantity, [12] mention this will not affect the results. While respondents do notice that some profiles are less realistic than others, differences in realism do not appear to affect judgments about purchase likelihoods ([12]).

The respondents of this survey were asked to rank the items, rather than rate them, according to their order of preference. Some respondents prefer rating scales because they are quicker and more convenient to complete. The respondents were reminded that the products had different brands. They were asked to only take into consideration brand, price, colour, quality and warranty of the product when ranking each item.

A total of 250 survey questions were distributed. However due to inaccuracy, grudge and non-response, 200 were properly filled, 41 were not properly filled and 9 were not returned. The survey consisted of the 27 product profiles and 18 purchasing and demographic questions. On average, the self-administered questionnaire took 20 minutes to complete.

3. DATA ANALYSIS AND RESULTS

The data from the 200 usable respondents was inputted in SPSS Statistics 17.0 software. A command syntax on conjoint was used to run the analysis. It was used to obtain the utility scores, coefficients, relative importance, correlations and reversals. Also based on the command syntax, the market simulation to know how each respondent would choose among alternative products was gotten. Plots indicating the summary utilities and importance summary were gotten.

Table 2: Utilities (part-worths) for the factors

		Utility Estimate	Std. Error
Brand	Nokia	3.466	.581
	Samsung	.667	.581
	Motorola	-1.442	.581
	Sony Ericsson	.256	.763
	LG	-.003	.763
	Others	-2.944	.763
Colour	Black	.244	.404
	Ash	.194	.404
	Others	-.438	.404
Price	Below N10,000	1.550	.350
	N 10,000-N20,000	3.101	.700
	Above N 20,000	4.651	1.050
Quality	Low	2.125	.606
	High	4.250	1.213
Warranty	No	1.842	.606
	Yes	3.683	1.213
	(Constant)	5.312	1.375

Table 2 shows the utility (part-worth) scores and their standard errors for each factor level. Higher utility values indicate greater preference. There is no inverse relationship between price and utility. In this case, the higher price (Above N 20,000) corresponded to higher utility while the lower price (Below N10, 000) corresponded to a lower utility. This indicates that most of the respondents preferred mobile phones with higher price.

For the brand, Nokia had high utility (3.466) compared to the other brands where Others had the lowest utility (-2.944). For the colour, black had a higher utility (0.244) than the other two (Ash and Others).The table shows that high quality had the highest utility (4.250) while low quality had the lowest utility (2.125). The presence of warranty had a higher utility (3.683) than when it is not included (1.842). The constant (5.312) is used when finding the total utility for any combination from the product profile generated. Since the utilities are all expressed in a common unit, they can be added together to give the total utility of any

combination.

The utilities of the 27 different product profiles ranked by the respondents are given below: *Table 3: Total utility of the product profiles*

Profiles	*Brand*	*Price*	*Colour*	*Quality*	*Warranty*	*Constant*	*Total Utility*
1	3.466	3.101	0.194	2.125	3.683	5.312	17.881
2	−2.944	4.651	0.244	2.125	1.842	5.312	11.23
3	0.667	4.651	−0.438	4.25	1.842	5.312	16.284
4	3.466	4.651	0.194	2.125	3.683	5.312	19.431
5	−1.442	3.101	0.244	4.25	1.842	5.312	13.307
6	3.466	1.55	0.244	2.125	1.842	5.312	14.539
7	0.256	4.651	0.244	2.125	1.842	5.312	14.43
8	0.667	1.55	−0.438	2.125	1.842	5.312	11.058
9	−1.442	4.651	−0.438	4.25	3.683	5.312	16.016
10	0.256	3.101	−0.438	2.125	1.842	5.312	12.198
11	0.667	3.101	0.244	4.25	3.683	5.312	17.257
12	−0.003	4.651	0.244	2.125	3.683	5.312	16.012
13	−2.944	1.55	0.194	4.25	1.842	5.312	10.204
14	−1.442	3.101	0.194	2.125	1.842	5.312	11.132
15	−1.442	4.651	0.194	2.125	1.842	5.312	12.682
16	3.466	4.651	−0.438	4.25	1.842	5.312	19.083
17	3.466	3.101	0.244	4.25	1.842	5.312	18.215
18	−0.003	1.55	0.194	4.25	1.842	5.312	13.145
19	−1.442	1.55	−0.438	2.125	3.683	5.312	10.79
20	−2.944	3.101	−0.438	2.125	3.683	5.312	10.839
21	0.667	1.55	0.244	2.125	3.683	5.312	13.581
22	0.256	1.55	0.194	4.25	3.683	5.312	15.245
23	−0.003	3.101	−0.438	2.125	1.842	5.312	11.939
24	0.667	3.101	0.194	2.125	1.842	5.312	13.241
25	−1.442	1.55	0.244	2.125	1.842	5.312	9.631
26	3.466	1.55	−0.438	2.125	1.842	5.312	13.857
27	0.667	4.651	0.194	2.125	1.842	5.312	14.791

The above result in Table 3 shows that: Profile 4 has the highest utility of 19.431, which is the best combination:

- Nokia, Above N20, 000, Ash, Low quality and has warranty Profile 25 has the lowest utility of 9.631, which is the least combination:
- Motorola, Below N10, 000, Black, Low quality and no warranty.

The range of the utility values (highest to lowest) for each factor provides a measure of how important the factor was to overall preference. Factors with greater utility ranges play a more significant role than those with smaller ranges.

Table 4: Averaged Importance Score

Brand	44.394
Colour	14.410
Price	16.270
Quality	14.177
Warranty	10.749

Table 4 provides a measure of the relative importance of each factor known as an importance score or value. The values are computed by taking the utility range for each factor separately and dividing by the sum of the utility ranges for all factors.
It shows that brand is 44.394%, colour (14.410%), price (16.270%), quality (14.177 %) and warranty (10.749%). The values thus represent percentages and have the property that they sum to 100. The results show that brand has the most influence on overall preference. This means that there is a large difference in preference between product profiles containing the most desired brand and those containing the least desired brand.
The results also show that warranty plays the least important role in determining overall preference. Price plays a significant role but not as significant as brand.

Table 5: Correlations between observed and estimated preferences

	Value	Sig.
Pearson's R	.923	.000
Kendall's tau	.801	.000

Table 5 displays two statistics, Pearson's R and Kendall's tau, which provide measures of the correlation between the observed and estimated preferences. The Conjoint procedure computes correlations between the observed and predicted rank orders for these profiles as a check on the validity of the utilities.
When specifying LINEAR models for price, quality and warranty, we chose an expected direction (LESS or MORE) for the linear relationship between the value of the variable and the preference for that value. The conjoint procedure keeps track of the number of subjects whose preference showed the opposite of the expected relationship.

RUNNING SIMULATIONS

The real power of conjoint analysis is the ability to predict preference for product profiles that were not ranked by the subjects. These are referred to as simulation cases. Simulation cases are included as part of the plan, along with the profiles

from the orthogonal design. In this research, two product profiles that were not ranked by the respondents were simulated. They are (Table 6):
Profile 1: Nokia, Above N20, 000, Black colour, High quality and has warranty.
Profile 2: Samsung, Above N20, 000, Other colour, Low Quality and has warranty.
The command syntax from conjoint file indicating running the simulation is the same as that of the utility scores, coefficients, relative importance, correlations and reversals since the product profiles that are to be simulated were already included in the phone plan of the orthogonal design.

Table 6: Preference Scores of Simulations

Card Number	ID	Score
1	1	21.606
2	2	17.207

Table 7: Preference Probabilities of Simulations

Card Number	ID	Maximum Utilitya	Bradley-Terry-Luce	Logit
1	1	70.3%	55.4%	71.6%
2	2	29.8%	44.6%	28.4%

a. Including tied simulations

b. 200 out of 200 subjects are used in the Bradley-Terry-Luce and Logit methods because these subjects have all nonnegative scores.

Table 7 above gives the predicted probabilities of choosing each of the simulation cases as the most preferred one, under three different probability-of-choice models. The Maximum Utility Model determines the probability as the number of respondents predicted to choose the profile divided by the total number of respondents. For each respondent, the predicted choice is simply the profile with the largest total utility. The BTL (Bradley-Terry-Luce) Model determines the probability as the ratio of a profile's utility to that for all simulation profiles, averaged across all respondents. The Logit Model is similar to BTL but uses the natural log of the utilities instead of the utilities. Across the 200 subjects in this study, all three models indicated that simulation of profile 1 (Nokia, Above N20, 000, Black colour, high quality and has warranty) would be preferred by the respondents.

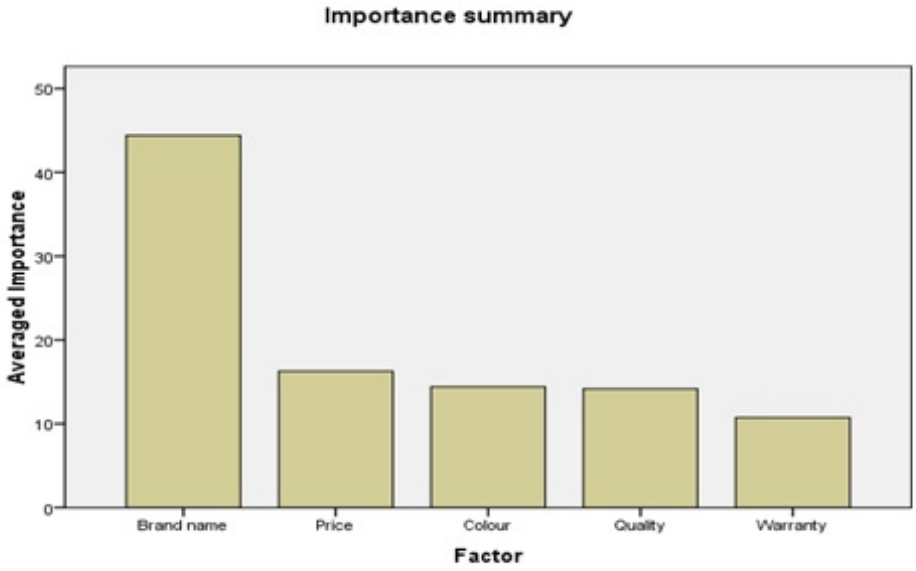

Fig. 1: Importance summary for the five factors (or attributes) From the above Figure 1, it can be seen that brand name is the ultimate factor (or attribute) for the purchase of a mobile phone. Price is also a significant factor for the purchase of a mobile phone while warranty is the least factor.
From the purchasing information, the total sample implied that the attribute that influenced their decision to purchase a mobile phone the most was brand name. And as observed, 75% preferred Nokia mobile phones. 82.5% of the respondents purchase mobile phones mainly for calls. As observed, 41.5% showed preference for the highest price (Above N20,000) listed for this survey. It was also observed that all the respondents that participated in the survey use mobile phones.

4. CONCLUSION

Since not all influential attributes could be included in this study, five major factors were decided on brand, price, colour, quality and warranty. In this study it would not have been practical for respondents to evaluate 216 full profiles. A fractional factorial design, which does allow respondents to only analyze a portion of the hypothetical products, was used to reduce the number of products to be evaluated. SPSS Statistics 17.0 software was utilized to develop a more manageable number of hypothetical products. It generated 27 different product profiles combination for ranking by the respondents. The ranking was from 1-most preferred to 27-least preferred accordingly.

A command syntax on conjoint was used to run the analysis. It was used to obtain the utility scores, coefficients, relative importance, correlations and reversals. Also based on the command syntax, the market simulation to know how each respondent would choose among alternative products was gotten. Plots indicating the summary utilities and importance summary were gotten. It can be said that conjoint method helped to analyze and prioritize the needs of consumer preferences for mobile phones with considerable accuracy. The goal of any conjoint survey is to assign specific values to the range of options buyers consider when making a purchase decision. Armed with this knowledge, marketers can focus on the most important features of products or services that are most likely to strike a balance with target buyers.

This helped to understand what common attributes of mobile phones that could significantly influence consumers choice to purchase and to predict how consumers would react to changes in mobile phones existing value proposal. Conjoint analysis validly determined the specific attributes that influence consumers preferences for particular brands of mobile phones over others. The study was limited to elements within the sample frame owing to constraints of funds, time factor and personnel with which to carry out the study. In using conjoint analysis, the current study suggests that three levels for each product attribute should be used. The results are much more informative for three attribute levels.

For further development of the present study, it is advisable to utilize a cardlist of 16-18 product profiles to obtain a valid and remarkable result from respondents. This research, along with possible future research on consumer preferences for mobile phones, could benefit everyone in the mobile phone industry. From retailers knowing which brand to carry in their stores, to distributors knowing where to send specialized brands like Nokia and finally to the researchers developing new methods- everyone in the industry can profit from knowing specifically what mobile phone attributes their consumers prefer.

References

[1] Adamu, M., Adeyosoye, A. E., and Adewunmi A. (2009), Consumer Preferences for GSM Network Provider Services in Nigeria: STCPMS, Proceedings of International Statistical Institute conference, Durban, South Africa, 1-6.

[2] Boyle, K. J., Thomas, P. H., Mario, F. T., and Brian, R. (2001) A Comparison of Conjoint Analysis Response Formats.American Journal of Agricultural Economics, Vol 83,441-454.

[3] Campbell, B. L., Nelson, R. G., Ebel, R. C. Dozier, W. A., Adrian, J. L. and Hockema, B. R. (2004). Fruit Quality Characteristics That Affect Consumer Preferences for Satsuma Mandarins. HortScience 39(7): 1664-1669.

[4] Frank, C. A., Nelson, R. G., Simonne, E. H., Behe, B. K. and Simonne, A. H. (2001). Consumer Preferences for Colour, Price, and Vitamin C Content of Bell Peppers. HortScience 36(4): 795-800.

[5] Garver, M. S. (2011), Data Use: Adaptive Choice is a Good Choice. Quirk's Marketing Research Media, DOI: 20110702, pgs 22.

[6] Green, P. E., Carroll, J. D. and Goldberg, S. M. (1981). "A General Approach to Product Design Optimization via Conjoint Analysis," Journal of Marketing 45(3): 17-31.
[7] Green, P. E., Srinivasan, V. (1990). Conjoint Analysis in Marketing: New Developments with Implications for Research and Practice. Journal of Marketing 54(4): 3-20.
[8] Green, P. E., Krieger, A. M. and Wind, Y. (2001). Thirty Years of Conjoint Analysis: Reflections and Prospects. Interfaces 31(3): S56-S73.
[9] Hair, J. F. Jr., Anderson, R. E., Tatham, R. L. and Black, W. C. (1998). Multivariate Data Analysis, 5th ed. Upper Saddle River NJ: Prentice-Hall.
[10] John, F. P., Hauber, A. B., Marshall, D., Lloyd, A., Prosser, L. A., Regier, D. A., Johnson, F. R. and Mauskopf, J. (2011), Conjoint Analysis Applications in Health - A Checklist: A report of the ISPOR Good Research Pracitices for Conjoint Analysis Task Force. Value in Health, 14, 403-413.
[11] Maynard, D. N., ed. (2001). Watermelons: Characteristics, Production, and Marketing. ASHS Horticulture Crop Production Series, Alexandria, VA.
[12] Moore, W. L., and Holbrook, M. B.(1990). Conjoint Analysis on Objects with Environmentally Correlated Attributes: the Questionable Importance of Representative Design. Journal of Consumer Research 16(4): 490-498.