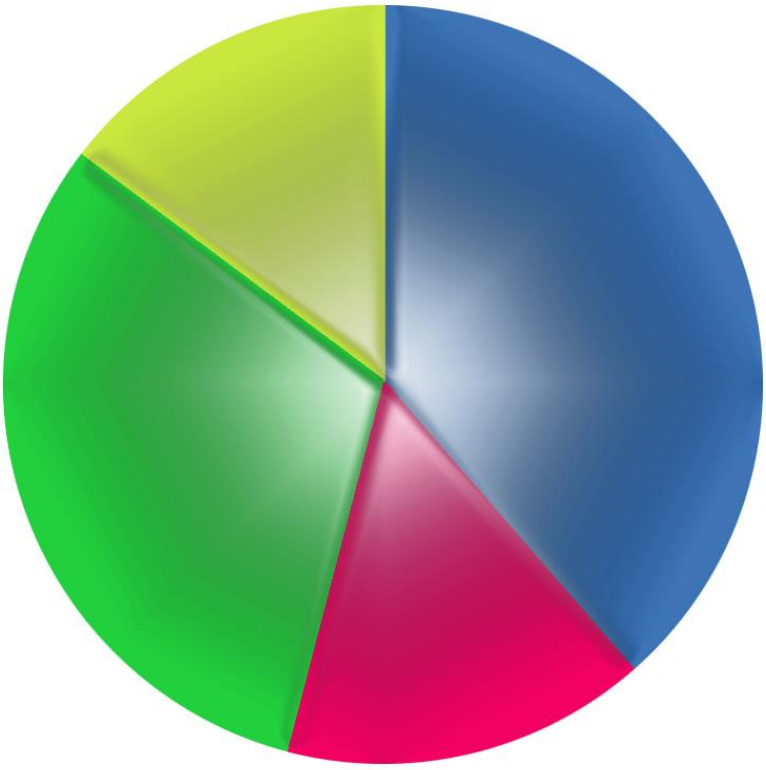

Using Conjoint Analysis to Study the Factors Important to University Students in Nigeria When They Select a Laptop Computer

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ABSTRACT

The use of laptops is rampant among undergraduates because it affords students easy access to the virtual library of the internet in addition to storage facility for soft copies of their academic work. This study reported on in this article assesses students' preferences for different brands of laptops based on conjoint analysis. The relative importance of attributes was calculated using part-worth based on a sample of 150 students under a fractional factorial design. Part worth estimates revealed that the brand and processing speed are the most important attributes when selecting a type of laptop among undergraduates in Nigeria.

INTRODUCTION

Woodruff (1997:142) proposed a conceptual definition of value as a customer's perceived preference for and evaluation of those product attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situation. The attributes that motivate a customer's initial purchase of a product may differ from the criteria that connote value during use right after purchase, which may differ from the determinants of value during long-term use (Parasuraman,1997) This explains the rationale behind continuous launching and re-launching of products and services humorously described as 'new and improve' .

A company develops new products to respond to changing customer needs, gains competitive advantage, meets technological changes, diversifies risks and increases sales and profits. However, developing and introducing new products is frequently expensive and risky

(Pride and Ferrell, 2008). A major breakthrough of conjoint analysis in product research is in new product development and repackaging of existing products. It could be used to measure, analyze, and predict customers' responses to new products and also to estimate the price customers will be willing to pay. Developing the right new product is, therefore, crucial.

If a new product must succeed, it must consist of the desired attributes that the customers want. It should be able to satisfy their needs and it should be planned. The planning process involves the stages of new product development which include idea generation, ideas screening, concept development and testing, business analysis, prototype development, test marketing and commercialization (Bearden, Ingram and LaForge, 2007). The two critical stages where conjoint analysis could be useful are the concepts of testing and test marketing. Concept development and testing involve a description of the proposed product including its features and its probable price and presenting it to appropriate target consumers through a survey (Kotler and Keller, 2006). This allows companies to model and test different product options to evaluate likely market preferences and potential share, revenue and profit, all based on what customers' really value. It provides opportunity for companies to determine customers' initial reaction to a product idea before investing resources in its production.

The result of concept testing can help a company better understand the product attributes and benefits that are most important to potential customers. Test marketing allows the product prototype to be available in certain geographical areas considered to be representative of the market to study consumers' response to it. The aim is to determine the extent to which potential customers will buy the product. This enables a company to put new products and their supporting marketing programmes through validating tests prior to full-scale product launches. Usually, when testing the viability of new products, potential consumers are asked to indicate how important some attributes are to them.

Conjoint analysis is an experimental approach for measuring customers' preferences about the attributes of a product or service. Though originally developed by psychologist Luce and statistician Tukey (1964) in the field of mathematical psychology, conjoint analysis has since the mid 70's, attracted considerable attention especially in marketing research, as a method that portrays customers' decisions.

Conjoint analysis has been proved to be better than other approaches to understanding consumer preferences and decision-making such as contingent valuation, ordinary surveys and focus group estimates because it provides opportunities for respondents to answer survey questions as if they were placed in a real market situation (Hauser and Rao, 2002 and Kotri, 2006). It also estimates the relative importance of different attributes and the various levels of the attributes of a product. It can produce results that may not be obtained from compositional approach where respondents are asked to directly state their assessment of the importance of the attributes (Orme, 2010). Conjoint analysis is also useful for managing existing products in order to overcome intense competition in the business environment.

Whenever a new product succeeds, competing products are bound to spring up and these products could have a significant impact on profits or market share if a company does not make any change in its products overtime (Kotler and Keller, 2006). Also, the markets are highly

dynamic as what was a profitable product yesterday may not be tomorrow because customers' attitudes and preferences change overtime (Pride and Ferrell, 2008). For a company to maintain its market share, it must seek for ways of improving the product by finding out the attributes that are currently appealing to consumers. Conjoint analysis could also be used to measure customers' level of satisfaction or changes they would like to find in the attributes. In designing the choice-based conjoint questionnaire, the current product is displayed consistently with prospective versions of the product. Analysis of the responses will indicate the action to be taken.

LITERATURE REVIEW

Green and Srinivasan (1978) defined conjoint analysis as any decompositional method that estimates the structure of preferences given overall evaluation of a set of alternatives that are pre-specified in terms of levels of different attributes.

In this study, it is defined as a survey method of data collection and analysis for eliciting preferences for a product. It is based on the premise that the relative values of attributes considered jointly can better be measured than when considered in isolation. Its critical assumption is that preference for an object is a function of the specific attributes of the object rather than the object per se (Min, 2007). Conjoint analysis was introduced in marketing about 40 years ago in a seminal paper by (Green and Rao, 1971).

Conjoint measurement theory was developed in psychology by Luce and Turkey (1964) and was adapted to marketing. Since then, it has become an important marketing research tool that is being used extensively in marketing to analyze consumer trade-offs, understand how customers make purchase decisions and predict consumer behavior as well as determine how people value different features that make up an individual product for the purpose of providing products that better conform with customers' preferences (Green and Srinivasan, 1978; Green, Carroll and Goldberg, 1981; Green and Srinivasan, 1990; Chen and Hausman, 2000; and Green, Krieger and Wind, 2001).

Theoretical Background

Fundamentally, the customer value concept evaluates the value a product offers to a customer, taking all its tangible and intangible features into account. It relates to a trade-off between the benefits the product offers to the customer, and the sacrifices a customer has to make to obtain it (Gale, 1994; Griffin & Hauser, 1993; Best, 2000). Explicitly, customer sacrifices are the overall monetary and non-monetary costs, for example, time, energy and effort, the customer invests in order to get the product or service, or to maintain the relationship with the company. Benefits can be affected by a variety of features: product quality, customer service quality, and experiences based quality. It has also been pointed out that brand creates value to customers.

Achieving higher customer value is positively related to higher profitability (Day and Wensley, 1988; Best, 2000). It should be observed, however, that just bringing a product with a high potential customer value to the market is no guarantee of profit or a high market share. The customer's purchase decision is based on a choice between the competing offers in the marketplace. The attractiveness of an individual product offer should consistently be measured relative to competing products. The conceptual significance of customer value in the marketing literature has not been embraced in industrial market studies because of difficulties with its implementation. One of the challenges is that customer value can be defined at different levels of abstraction (Brown & Dacin, 1997; Kim & Mauborgne, 1997; MacMillan & McGrath, 1996), and as a result, it has to be measured at these different levels (Flint, Woodruff and Gardial, 1997; Parasuraman, 1997). Two abstraction levels of customer value can be identified: The first-order level consists of the trade-off between the perceived benefits and the sacrifices of a product as perceived by the customers at the point of purchase. The second-order level consists of the benefits customers seek to fulfill with the products. This is the level at which customers think about their needs before the purchase. The difficulty is that, these goals and desires at second order level are often vague, therefore, it is hard to assess for the market researcher; especially for new products.

METHODOLOGY

Conjoint Analysis (CA) is designed on the view that consumers values are based on the utility offered by products' attributes. It involves a series of interrelated stages which can be classified into three main steps. The first step in conducting CA is to identify suitable attributes and levels as motivators for consumer choice. The second is to select an investigational design and to formulate a survey instrument to collect conjoint data. Finally, CA involves choosing an apt composition model and estimating buyer part-worth utilities (Harrison, Ozayan and Meyers, 1998).

Selection of Product Attributes and Their Levels

Product profile consists of different attributes and levels and such attributes form the basis for decision criteria that a respondent uses to choose a product or a service. According to Lancaster's model of consumer behavior, the theory of brand preferences states that goods are valued for their attributes and that differentiated products are merely different bundle of attributes (Ara, 2003). Hence, researchers can assess the cognitive component of the preference by analyzing attributes. Therefore, the attributes and their levels have to be selected with care as it influences the accuracy of the results and the relevance of the stimuli (Mclennon, 2002). After selecting the attributes and their levels, they have to be triangulated to define the product profile. In this study, four key informants, (a research officer, a dealer in laptops, head of IT department, and a marketing agent) were used to identify the critical attributes and their levels for consumer evaluation. The identified attributes and levels for laptops are given in the Table 1 below.

Table 1: Choice Based Conjoint of Laptops

If you were in the market to buy a laptop today and if these were your only alternatives, which would you choose?					
Brand Name	**HP**	**Dell**	**Sony**	**Toshiba**	**None**
Micro Processor	1 Core2 Duo 2.13GHz	1 Core2 Duo 1.6 GHz	1 Core 2 Duo 3.06 GHz	1Core5 2.4 GHz	If these were my only choice I'd defer my purchase.
Screen size/weight	13.3" 3.0lbs	16" 4.5lbs	15.4" 6lbs	17.3" 7lbs	
Hard Drive	2 GB Solid State	128 GB Solid State	320 GB	320 GB	
RAM	2 GB	4 GB	2 GB	4 GB	
Price (N)	120,000	150,000	100,000	60,000	

Population of the Study

The population of the study is all the Universities in Nigeria where students buy and own laptop.

Sample Size and Sampling Technique

Sampling is the act of taking fractional part of the population upon which inferences are made about the parent population. There is a great disparity in preferences among /individuals. Conjoint analysis focuses essentially on single subject. To generalize these results, a judgmental sample of subjects from the target population is selected so that group results can be examined.

The size of the sample in conjoint studies varies greatly. Cattin and Wittink, (1982), stated that the sample size in commercial conjoint studies usually ranges from 100 to 1,000 with 300 to 550 being the typical range. Akaah and Korgaonkar, (1988), found that smaller sample sizes (less than 100) are typical. Hence, sample size should be large enough to ensure reliability. A sample size of 150 consisting of 80 students from Covenant University, Ota, Ogun State and 70 students from Yaba College of Technology Yaba, Lagos State was judgmentally considered for this study. A convenience sampling technique was adopted in selecting and administering the questionnaires to the respondents. This procedure is representative, non-subjective and allows drawing a representative sample as the population under study is finite.

Pilot Study

According to Polit et al (2001: 467), a pilot study refers to feasibility studies which are 'small' scale versions or trial runs done in preparation for the major study. Baker (1994: 182-3) describes a pilot study as the pre-test or 'trying out' of particular research instruments. One of the advantages of conducting a pilot study is that it might give advance warning of what might happen in the main study, or whether the developed research instruments are appropriate.

De-Vaus, (1993: 54) gave the following reasons for conducting pilot studies.

- developing and testing adequacy of research instruments
- assessing the feasibility of a (full scale) study
- establishing whether the sampling frame and techniques are effective.
- identifying logistical problems which might occur using proposed methods
- estimating variability in outcomes to help determine sample size
- collecting preliminary data.

In a research, it is imperative to pre-test the measuring instruments; questionnaires, and interview guides. Respondents will be pre-tested on their ability to answer questions or recall certain kind of words used by the researcher. After the pre-test, the researcher will often use survey instruments based on the comments by the respondents from the pilot study.

A pilot study was conducted across a sample of 30 respondents, 15 from Covenant University and 15 from College of Technology, Yaba. The pretest was to ascertain the perception of students about preferences for new laptops. The retrieved questionnaires were analyzed employing six attributes (factors) of laptop at two levels which were considered to form the basis for drafting a questionnaire for the actual field work.

Survey Design

An analysis involving conjoint designs includes all the variables that can be assumed to have an effect on customers' total utility of the choice situation/alternative. The choice of the several integrated conjoint segmentation methods makes the estimation of the conjoint utilities and the segmentation simultaneously.

This study about the students' preference for laptop was, therefore, decided to contain only those factors (independent features/variables) that most influence the preference of the

customers. Basically variables such as brand, cost, size of screen, storage capacity, speed of processor, and quality of the laptop was taken into consideration.

Choice of Two Levels

A pre-test of the study was done and some slight changes in the attributes levels were made based on the students' comments which were further analyzed using the factor analysis of principal component. Consequently, two major/influential attributes were extracted. These two principal factors form the levels of attribute used for the factorial design. This results to a factorial design of 6 factors at two levels. (See Table 2 below.) However, a fractional factorial design eliminated the number of cards from 64 potential files to 12 with 4 hold outs. This type of orthogonal creation of full profile cards means that the variables are assumed to be independent from each other.

Table 2: Factors with their Respective Levels:

FACTORS	LEVEL 1	LEVEL 2
Brand of Laptop	Popular Brand	Unknown Brand
Cost of Laptop	Less than N100,000	N100,000 and Above
Screen size of Laptop	Small Screen	Large Screen
Storage Capacity	Low Memory	High Memory
Processor	Low Speed	High Speed
Quality/Money back guarantee	Money Back Not Guaranteed	Money Back Guaranteed

The holdout cases are generated randomly and judged by the respondents but are not used by the conjoint analysis to estimate utilities. They were used to check the internal validity of the model. An analysis of the hold out cards shows the conjoint model's ability to predict the ranking/rating of the hold out profiles. Consequently, each respondent was asked to rank 12 alternatives. (See orthogonal design questionnaire ranked by respondents in Appendix 1).

DATA ANALYSIS

Each set of factor levels in the orthogonal design represents a different version of the student's preference/ value for laptop. On the basis of their perception of the combinations, they ranked the twelve options.

After the analysis of the data using the conjoint procedure, a utility score, part-worth, for each factor level is calculated. Then utility scores, analogous to regression coefficients, provide a quantitative measure of the preference for each factor level, with larger values corresponding to greater preference.

Part worth are expressed in a common unit which allows them to be summed up to give the total utility, or overall preference, for any combination of factor levels. The part-worth, then, constitutes a model for predicting the preference of any product profile, including profiles referred to as simulation cases, that were not actually presented in the experiment. The information obtained from this analysis is used in determining student's perceptions or judgments in this paper.

The two levels of the attributes, that is, 'popular or unpopular', 'small or large screen' are mutually exclusive events. The disparity between each of them is the same; therefore the standard error is the same. Table 3 below shows the utility (part-worth) scores for each factor level. Higher utility values indicate greater preference. Expectedly, there is an inverse relationship between cost and utility, with higher cost corresponding to lower utility (as larger negative values mean lower utility). A popular brand of laptop corresponds to a high utility, as anticipated.

Since the utilities are all expressed in a common unit, it is added together to give the 'total utility' of any combination. For example, the total utility of a laptop of popular brand, small screen, cost less than #100,000, high memory, high speed processor and whose money back is guaranteed is:

Utility (Popular brand) + utility (Small Screen) + utility (Cost less than N100,000)+ utility(High Memory) + utility(High Speed) + utility(Money back guaranteed) + constant *or* 0.688 + 0.371 +0.115 + 0.233 + 0.444 + (-0.292) + 4.5 = 6.059

Table 3: Result of Conjoint Analysis

Attributes	Percentage %	Attribute Level	Part-worth/Utility Value
Brand	20.42	Popular	0.688
		Unknown	-0.688
Screen	14.04	Small screen	0.371
		Large screen	-0.371
Price	11.46	Less than N100,000	0.115
		N100,000 and above	-0.115
Storage Capacity	17.64	High memory	0.233
		Low memory	-0.233
Processor	20.06	High speed	0.444
		Low speed	-0.444
Quality	16,38	Money back guaranteed	0.292
		Money back not guaranteed	-0.292
		(Constant)	4.500

Relative Importance

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. The utility range for each of the six factors is as stated in table 3 above.

Table 4:

Importance Value

	Percentage
Brand	20.415
Screen	14.037
Cost	11.455
Storage	17.642
Processor	20.064
Quality	16.387

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. The values which represent percentages sum up to 100. The calculations, it should be noted, are done separately for each respondent, and the results are then averaged over all of the respondents.

The results show that laptop brand and its processor's speed are the most influential values for overall preference. This means that a student would rather prefer a laptop brand with high speed processor. The results also show that cost and screen size are least considered by students.

Table 5 below displays three statistics: Pearson's r = .934 which measures the degree of correlation between the attribute levels within a factor, whereas Kendall's tau-c, (0.857) is a measures of the correlation between the observed and the predicted preferences of the rank-order variables under study. Conjoint procedure computes correlations between the observed and predicted rank order for the profiles as a check on the validity of the utilities.

Table 5: Correlations

	Value	**p-values**
Pearson's R	.934	.000
Kendall's tau-c	.857	.001
Kendall's tau for Holdouts	.273	.109

The test statistics show very high overall correlations (very strong positive relationship with the correlation coefficient r as 0.934 and Kendall's tau-c 0.857 for all the conjoint models. This indicates a good and efficient model fit. The fitness and efficiency of a conjoint model is an indication of the models ability to replicate reality and hence the validity is guaranteed and authenticated.

Also the Kendall's tau-c statistics for the four holdouts cards confirms the general picture of the model's reliability at (0.273). It shows a cross-validity test about the model's ability to predict the ranking of the hold out profiles. That is, it confirms the validity and general picture of very reliable models.

The p-values of (0.000 and 0.001) given in the second column are test statistic to test the internal consistency among the attribute levels.. The p-values are less than the level of

significance of 0.05 hence we reject the null hypothesis of inconsistency among the attribute level and conclude that the attribute levels of the factors under study are internally consistent. The significant result of this test is an attestation of the model's high reliability

CONCLUSION

Three features of laptop stand out as motivator of purchase behavior among undergraduates in Nigeria: the brand, storage capacity and speed of the processor. This is supported by the strong positive correlation coefficient (r) at 0.934 which is also a proof of conjoint as a reliable estimator. The concept of conjoint analysis is faced by consumers in real life when they compare different product/service offerings and hence, a realistic consumer choice procedure. It can be used to improve consumers' perception/preference for products and services.

This paper examined the application of conjoint analysis within the customer value concept using the laptop market among Nigerian students at two colleges. The results of the tests which identified brand and speed of processor as determinant features have revealed that conjoint analysis is a powerful tool for identifying the importance of different product attributes in creating value for customers. Using this information, it is possible to develop optimal laptop configurations for students at the universities in Nigeria. Models based on the results of conjoint analysis has predictable capacity to spot the response of the market to changes in existing product configurations or price before the actual production decision is made.

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Note: Title graphic by Carole E. Scott

APPENDIX 1

The questionnaire which was ranked by the respondents

Full Orthogonal Design

Factors S/No	BRAND	COST	SCREEN SIZE	STORAGE CAPACITY	PROCESSOR	QUALITY
1	Unknown Brand	N100,000 and Above	Big Screen	Low memory	Low Speed	Money back guaranteed
2	Popular Brand	N100,000 and Above	Big Screen	High memory	High Speed	Money Back not guaranteed
3	Popular Brand	N100,000 and Above	Small Screen	Low memory	High Speed	Money back guaranteed
4	Unknown Brand	Less than N100,000	Small Screen	High memory	High Speed	Money back guaranteed
5	Popular Brand	Less than N100,000	Big Screen	High Memory	Low Speed	Money back guaranteed
6	Unknown Brand	N100,000 and Above	Small Screen	High memory	Low Speed	Money back not guaranteed
7	Unknown Brand	Less than N100,000	Small Screen	High memory	High Speed	Money back not guaranteed
8	Popular Brand	N100,000 and Above	Small Screen	Low memory	Low Speed	Money back not guaranteed
9	Popular Brand	N100,000 and Above	Big Screen	High memory	Low Speed	Money back guaranteed
10	Unknown	N100,000 and Above	Small Screen	Low memory	High Speed	Money back guaranteed
11	Unknown Brand	Less than N100,000	Small Screen	High Memory	Low Speed	Money back guaranteed
12	Popular Brand	Less than N100,000	Big Screen	High memory	High Speed	Money back guaranteed


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