

THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

Value Analysis and Quality Function Deployment of Some Competing Food Products

Uba, Jimmy Onyedikachi

Student, Department of Industrial and Production Engineering,
University of Ibadan, Nigeria

Oluleye, Ayodeji Emmanuel

Professor, Department of Industrial and Production Engineering,
University of Ibadan, Nigeria

Abstract:

In today's world, and for virtually any product or service; the customer is the king. The world is now different no doubt. Companies must ensure that their products continue to satisfy the consumer while remaining profitable. Most times, companies are faced with competitor(s), thriving to get a larger share of the market, or even sink their competitors, with strategies set in place. Four of the top competitive food products facing this problem in Nigeria were selected for the research work. The study is aimed at the utilization of Value Analysis (VA) and Quality Function Deployment (QFD) to critically analyze selected products with the intent of identifying ways of improvement, reducing the risk of shrinking market share, scheduling improvements and presenting these proposed improvements for implementation.

The product ingredients as well as their functions were identified. Consumer needs were determined using questionnaires. Analysis involved combining Statistical Packages for the Social Sciences and Microsoft Excel and utilization of the principles of value analysis. Quality Function Deployment (QFD) was adopted at the creative stage of Value Analysis to further analyze consumer needs by linking them to the ingredients that meet such needs.

The results indicate that for each competitive pair of products analyzed, a particular product seemed to be gradually taking the other off the market with a larger percentage of consumers being drawn to the superior product. With the focus on improving the less preferred products, using the House of Quality (HoQ) development and the Quality Function Deployment (QFD) process, implementation strategies were reviewed.

From the study, it can be deduced that for the products to be successful in the market. The ingredients with the higher relative weights are to be given more emphasis. Also, it is essential that the voice of the customer is obtained at intervals to ensure that the products satisfy them at any point in time. Methods for enhancing the products based on the need of consumers were recommended.

Keywords: Value analysis, house of quality, profitability, quality function deployment

1. Introduction

Over the years, customer satisfaction derived from a product contributes to the survival and competitiveness of most businesses (Ling and Mansori, 2018). Nevertheless, product developers are often faced with the challenge of optimizing the benefit of a product with minimum cost, striking a balance between customer satisfaction, function improvement and cost reduction (Patel *et al.*, 2015). This can be a major problem when competing products exist. Sometimes, focus is placed on improving the product while neglecting the increasing cost due to either, process, materials or ingredients selection. This may lead to consumer resistance and reduced profitability. Therefore, companies need to consider balancing profitability and pricing policies. While it is important for management not to trade quality for cost, the goal is usually to maximize profit while satisfying the market.

Consumers perceive the quality of a product from different dimensions. These include aesthetic, functionality, price, durability, etc. The preference of a product over another could be as a result of family size, availability of product, income etc. (Ifediora and Ekoja, 2017). Irrespective of the quality desired it is important that it is embedded at the product design stage (Rajeshand Sandeep, 2018). Quality Function Deployment (QFD) has proven to be an important tool that aids in the incorporation of quality required by customers into the technical requirements of products. Also, understanding and improving the functionality of components that enable the improvement of the overall function of a product at reduced cost is important for the mutual benefit of the product developer as well as the consumers.

The Pareto rule states that about 20% of the components in any complex product accounts for about 80% of the cost throughout the rest of its life-cycle (Hasan *et al.*, 2018). In other words, if the components, constituents or materials for a particular product are critically analyzed to know the major components that will bring maximum satisfaction to a customer, unnecessary costs can be taken off, thus increasing the benefits to both customers and manufacturers on the long run. There is always a need to critically study a product to determine ways to improve the benefit to cost ratio. With

the use of value engineering and upon effective analysis products can be made to satisfaction at cheaper rates while delivering more benefits to the consumer, thus, increasing the benefit to cost ratio. This study focused on applying Quality Function Deployment (QFD), and value analysis to selected competitive products to improve customer satisfaction while remaining profitable.

1.1. Objectives

The main objective of this work is to use value analysis and QFD to identifying and proposing improvements with respect to some selected products. The secondary objectives are:

- Identification of constituents of the selected products as well as their functions
- Determination of the voice of the customer by the use of questionnaires and the development of the House of Quality (HOQ); and
- Make recommendations on how to improve the value of the selected products.

1.2. Significance of the Study

This research focuses on proffering a solution to a challenge associated with competitive products. It provides ways in which fewer performing products could increase customer's demand of their product while maintaining an improved level of profit and market share. The findings of this study, could provide cheaper, better quality, more beneficial products while maintaining profitability.

1.3. Scope of Study

This study covers the analysis of some selected competitive products in a bid to improve competitiveness and through value addition. The drivers are the voice of the customer and organizational performance.

2. Literature Review

2.1. Value Analysis

Value analysis entails achieving the basic as well as the most desired function or property of a product at the least possible cost (Pires, 2015; Gunnam and Eneyo, 2016). It focuses on value improvement of products by improving the overall function of that product through analyzing the individual constituent of such product and improving the functions of the ones that can help improve the overall function of the product at minimum cost.

2.2. Quality Function Deployment (QFD)

QFD is a cost management approach that incorporates customer satisfaction into the development of a product. It blends customer needs into the technical requirement of a product at the product development stage (Hauser, *et al.*, 2010). It involves getting data from customers about their needs (usually called voice of customer), and using it to determine the technical specifications that will satisfy the stated needs. The collected information is analyzed on the house of quality at the design stage of the product. QFD has been used in the design of many products in order to achieve a balance between customer satisfaction and cost-effectiveness (Maritan, 2015).

2.3. Selection of Competitive Products

Nigeria has one of the biggest markets in Africa and has a lot of consumers ready to accept products that can effectively and efficiently satisfy them while also being cost-effective (Delloitte and Touche, 2014) The competitive products selected for this study are among the top food products sold in the Nigeria market. The different categories include beverage, tomato paste, seasoning and yoghurt drink. The selected product pairs are labelled as:

- Beverage 1 and Beverage 2
- Tomato Paste 1 and Tomato Paste 2
- Seasoning 1 and Seasoning 2
- Yoghurt 1 and Yoghurt 2

2.3.1. Beverage 1 and Beverage 2

Ifediora and Ekoja (2017) found that Beverage 1 and Beverage 2 had to focus on the improvement of their promotional and market strategies in order to enjoy higher demand and loyalty by their customers. In a bid to maximize profits and provide customer satisfaction, Beverage 1 has diversified its production process through the production of a Ready-To-Drink (RTD) product. On the other hand, Beverage 2 is known for constant change and re-launching of its products in a bid to meet the ever-changing need of customers. Generally, consumers are unpredictable as their loyalty may depend on existence of competing products. This underlines the challenge of predicting consumer behaviour given the evolving product development scenarios.(Nnabuko, 1998).

2.3.2. Tomato Paste 1 and Tomato Paste 2

Tomato Paste 1 and Tomato Paste 2 are among the top brands of tomato paste in the Nigerian market. Although Tomato Paste 2 was introduced into the market before Tomato Paste 1, the latter seem to have outperformed the former with 50%-60% of the market share. On the other hand, Tomato Paste 2 takes about 15% of the market share (Omosomi, 2016). The large market share enjoyed by Tomato Paste 1 has been attributed to its aggressive advertisement, and regular

determination of customer needs. For an example, during the design of Tomato Paste the voice of the customer was captured and this led to the advent of tomato paste packaged in sachets in Nigeria (Alam and Goyal, 2007).

2.3.3. Seasoning 1 and Seasoning 2

Seasoning 1 is presently the main brand in the seasoning market in Nigeria has over 60% of purchasers lean toward it as their main seasoning flavor. Seasoning 1 is characterized by its ease of use, quick dissolution property and its rich profound flavor. Seasoning 2 stands as the major competitor of seasoning 1 in the market.

2.3.4. Yoghurt 1 and Yoghurt 2

Yoghurt 1 and Yoghurt 2 are made by two top yoghurt producing companies in Nigeria. (Beverage Industry news, 2019). With an increase in Yoghurt 1 demand, the makers introduced various blends to the market in order to satisfy the customers. Yoghurt 2 on the other hand, is known for its thickness, refreshingly creamy texture, and attractive packaging.

3. Methodology

The stages involved in carrying out this research and the steps involved in the application of value engineering on the selected products are explained in this section.

3.1. Stages in the Research

The stages in the research include:

3.1.1. Information Stage

At this stage, information about the various products which were used for the analysis were obtained. This includes the type of materials used for the production of the products, product packaging (aesthetics) and ingredients.

3.1.2. Function Stage

The functions of the component and ingredients of the products were obtained. Also, the interrelationships between components were determined in order to:

- Develop a better understanding of the products;
- Identify the basic and secondary functions of the product and process; and
- Stimulate the creativity needed in other stages.

3.1.3. Creative Stage

This entails innovative, and critical review of the information obtained. The various products were critically analyzed at this stage through customer needs assessment and preference. The customers' voice was gathered using questionnaires administered to 100 consumers. There were three categories as follows:

- Questionnaire 1: was used to survey the consumers in order to determine their needs and what they would love to see in products. The recipients of this questionnaire ranged from youths to adults across different ages.
- Questionnaire 2: was administered to determine the hierarchical importance of the needs of the consumer based on preferences (Importance Rating). The ranking was based on the result of the statistical analysis of Questionnaire 1.
- Questionnaire 3: was administered to determine the satisfaction a consumer gets in a product as compared to the competitive product. The result was used in the Customer Competitive Assessment part of the House of Quality.

Out of about 110 questionnaires that were distributed to obtain the voice of the customer, 97 customers responded. The rating and ranking of needs were used to generate the House of Quality (an aspect of the creative stage of the study). The House of Quality enabled the voice of the customers to be effectively linked with the technical attributes (in this case, the ingredients) responsible for meeting the various needs. The areas of improvements were determined from the information provided in the House of Quality.

Statistical Package for the Social Sciences (SPSS) and Microsoft Excel were used to analyse of the questionnaire set. In addition, Quality Function Deployment (QFD) was used to analyze the voice of the customers.

3.1.4. Evaluation Stage

At this stage, comparison of the alternatives with respect to product benefits to the consumer and costs were analyzed. The information used at this stage is obtained from the House of Quality in the Quality Function Deployment.

3.1.5. Presentation Stage

The summary of the application of research is simplified and presented in a manner that the reader can easily understand.

3.2. Application of Quality Function Deployment at the Creative Stage

The Quality Function Deployment is a critical tool used in the research work. It was used to analyse the various results in such a way that decisions about the modification of the products are easily made. The questionnaires were analyzed in the following manner:

- Using Statistical Package for the Social Sciences (SPSS), the results of Questionnaire1 were analyzed and filled in the Voice of Customers (VOC) section of the House of Quality.
- The result of Questionnaire 2 was filled in the Importance Rating section of the HOQ.
- The result of Questionnaire 3 was filled in the customer competitive assessment section.
- The technical requirements section of the products in the house of quality was filled with the details of the products packaging and ingredients.
- The relationship matrix was fixed based on the interrelationship between the importance rating and the technical requirements of the products. The symbols used to show the extent of relationship are as follows:

- is used as a strong relationship with a value of 6
- ⊙ is used as a moderate relationship with a value of 3
- is used as a weak relationship with a value of 1

The values apportioned to each relationship was used for determination of the technical attributes.

i. In respect of the technical attribute matrix, the relationships between technical requirements (ingredients) were considered. The following relationship grades were used: a strong positive correlation, positive correlation, strong negative and negative correlation. Symbolic representations are as follows:

- +++ used for a strongly positive correlation
- ++ used for a positive correlation
- - - used for a negative correlation
- ▼ used for a strongly negative correlation

The technical attribute matrix was filled using both the importance rating (Questionnaire 2) and the relationship matrix. Equation 3.1 was used to calculate the absolute importance (weight) of the technical requirement in QFD. The importance rating as well as the relationship weight were used.

$$AbsoluteImportance = \sum(Importancerating \times Relationshipweight) \dots \dots \dots 3.1$$

In order to calculate the relative importance (weight) which gives an overview of the technical requirements to be improved, equation 3.2 is used.

$$RelativeImportanceRating = \frac{Absoluteimportanceofthetechnicalrequirement}{\sum Absoluteratingofallthetechnicalrequirements} \times 100 \dots \dots \dots 3.2$$

Using the filled House of Quality (HoQ), the value of the technical attribute is used to determine the areas where improvement can be made in respect of the products.

4. Results and Discussion

4.1. Generation of House of Quality

The results of the various ratings and analyses are now presented.

4.2. Beverage HoQ

In making the decisions relating to product design, the HoQ for beverages represented by figure1 was created based on the results from the ranking and rating of various beverage criteria (customer preferences).

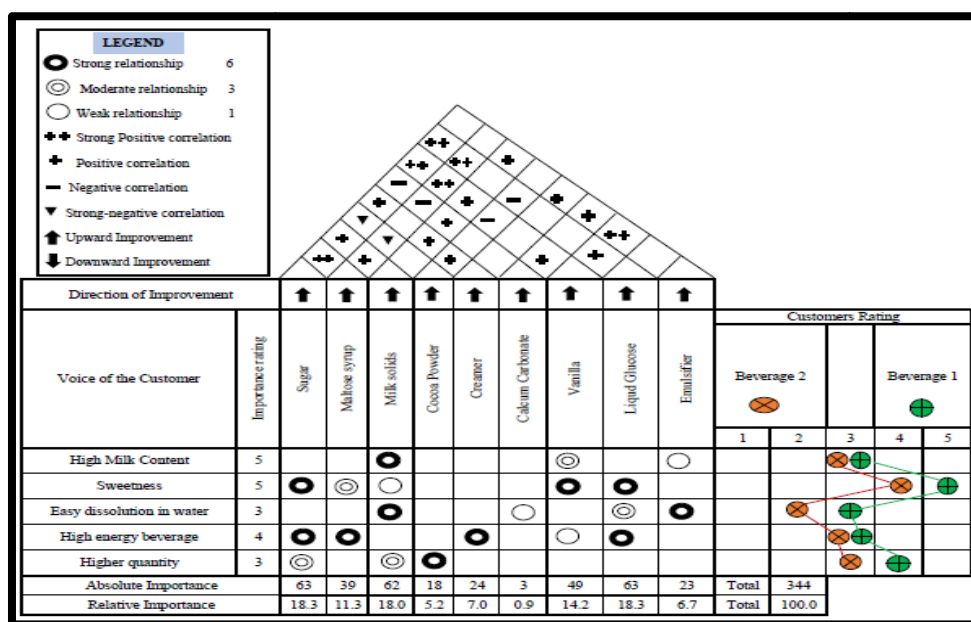


Figure 1: House of Quality for Beverages

It can be observed that from the customer’s rating, Beverage 2 is less preferred compared to beverage 1. From the customer’s voice, beverage 1 outperforms Beverage 2 in the areas of sweetness, easy dissolution in water and quantity. The major ingredient that tends to contribute more to achieving what customers’ desire are sugar and liquid glucose with

weights of 18.3 each. This is followed by the milk solids (weight of 18.0). Among all the ingredients listed calcium carbonate has the least weight of 0.9. For both beverage brands to provide more satisfaction to their customers, and particularly, for the less preferred Beverage 2 to increase both value and subsequent demand, some action is required. Increase in liquid glucose, and sugar contents for the provision of increased level of energy and sweetness is paramount. The organization may want to consider other ingredients that provide same level of satisfaction and improved safety (human health) as substitutes for higher level of ingredient content required. Also, the milk solids and vanilla contents should be increased in order to provide higher milk content, aiding easy dissolution in water.

4.3 Tomato Paste HoQ

Figure 2 shows the HoQ for the tomato paste prepared for proper analysis and efficient product design to suit the consumers' need.

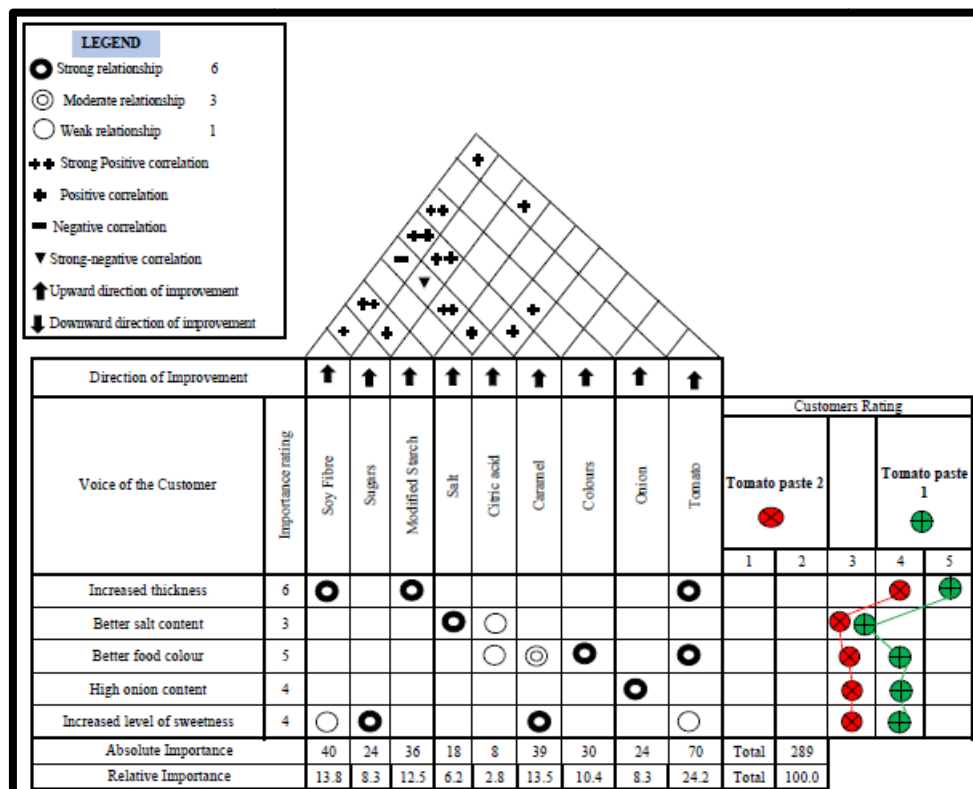


Figure 2: House of Quality for Tomato Paste

It can be observed from the customer's rating that Tomato Paste 1 was rated to give better satisfaction, compared to Tomato Paste 2. Only about 25% of the respondents preferred Tomato Paste 2. The relative importance in Figure 4.2 shows tomato to have the highest weight of 24.2 among the ingredients followed by soy fibre and caramel which have weights of 13.8 and 13.5 respectively. Citric acid has the least weight of 2.8. The roof of the HoQ shows the correlation of each ingredient. (A legend has been provided for easy interpretation).

To improve the demand for Tomato, paste 2, it may be necessary to increase its value by increasing the tomato content and simultaneously increasing the soy fib relevel in the product. This will help to improve both the thickness of the product and colour. Increase in these ingredients may lead to an increase in cost, however, this can be regulated by examining other non-essential production costs. Also, the consumers could be educated on how they could receive more value for money, even when prices change.

4.4. Seasonings HoQ

Figure 3 shows the house of quality for both Seasonings 1 and 2. From the customer ratings Seasoning 1 is preferred.

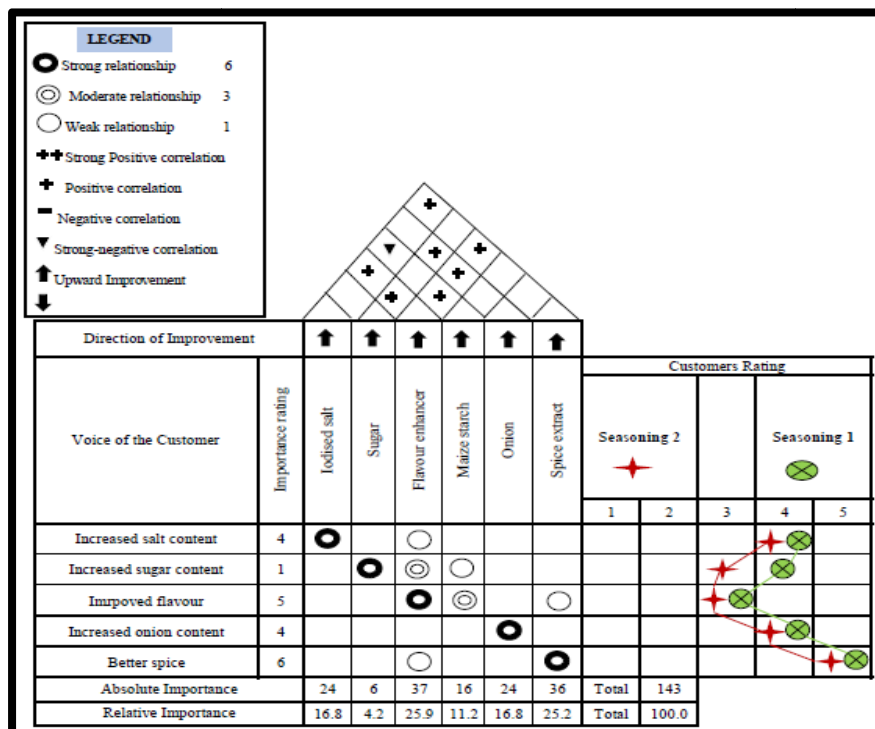


Figure 3: House of Quality for Seasonings

The relative importance shown in figure 3 indicates that flavor enhancer had the highest weight of 25.9, followed by spice extractor (25.2), iodized salt (16.8) and onion content (16.8). The least weight is that of sugar (4.2). To improve both seasoning 1 and 2, customers demand for improved flavor enhancer needs to be given more attention and improved upon. This is evident as flavor enhancer has the highest relative importance rating while both seasonings are on the average based on the customers' rating.

4.5. Yoghurt HoQ

Figure 4 shows the HoQ for the yoghurt drinks previously rated and ranked in order to provide insights and subsequent efficient product design that will suit the consumer needs.

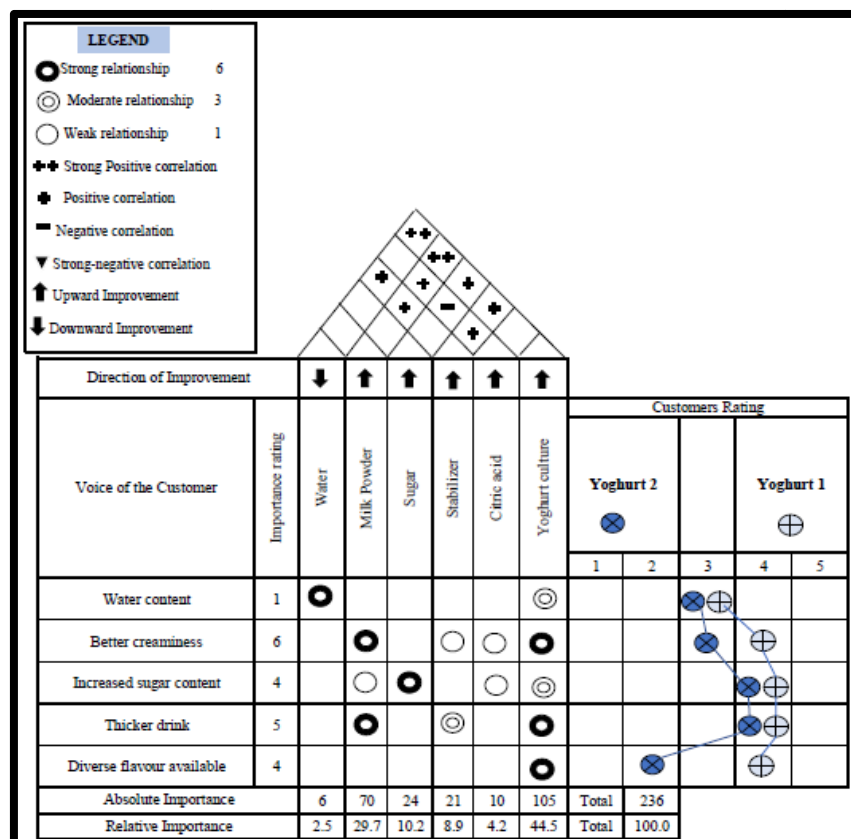


Figure 4: House of Quality for Yoghurt Drinks

The relative importance shows that the yoghurt culture has more weight in any further design, followed by the milk powder (weight of 29.7), then the soy fibre (12.0). The ingredient with the least weight is water, with a weight of 2.5. Furthermore, the rating of the two competitive beverage products were compared in order to determine the possible areas of improvement.

However, the creaminess of Yoghurt 2 can be improved by increasing the culture content. Also, to satisfy a larger percentage of the available market, Yoghurt 2 makers should diversify by making other flavoursof the drink as practiced by makers of Yoghurt 1.

5. Conclusion and Recommendation

The study was aimed at critically analyzing the selected products with the intent of identifying ways of improvement, and making necessary recommendations to improve market share through the use of Quality Function Deployment. Four paired categories of products were selected for analyses. The categories include beverages, tomato pastes, seasonings and yoghurt drinks. The constituents of these products were obtained at the information stage of the research as well as their functions (function stage of the study) which provided necessary information for further analysis. The analysis of the House of Quality developed for the products aided in identifying ingredients required for enhanced customer satisfaction. Invariably this will enable the products to remain competitive in the market.

6. References

- i. Alam, T. and Goyal, G. 2007. Packaging and storage of tomato puree and paste. *Stewart Postharvest Review*. 1. 1 – 8.
- ii. Beverage Industry News. 2019. *Hollandia yoghurt touts its other uses*.
- iii. <https://beverageindustrynews.com.ng/index.php/tag/hollandia-yogurt/> Accessed September 2, 2020.
- iv. Chintal, B., Anup, P., and Vivek, P. 2015. Product design and value engineering. Ghandi road, Ahmedabad: AtulPrakashan.
https://www.researchgate.net/publication/280632497_PRODUCT_DESIGN_AND_VALUE_ENGINEERING
- v. Deloitte and Touche. 2014. So, Nigeria is the Largest Economy in Africa: Now What? Deloitte and Touche.
- vi. Gunnam, S. C., and Eneyo, E. S. 2016. Quality function deployment and value engineering application in smart phone cost management. *International journal of emerging engineering research and technology*. 4.16:1-8
- vii. Hasan, Z., Rezwan, A., Islam, R. and Dutta, A. 2018. Defect reduction by total quality management in a crackers manufacturing system. *World Scientific News*. 98: 150 – 171
- viii. Ifediora, C. and Ekoja, G. 2017. Comparative analysis of consumers' patronage of beverage food drinks in Enugu State, Nigeria. *International Journal of Scientific and Engineering Research*. 8. 6: 1744 – 1767.
- ix. Ling, C. and Mansori, S. 2018. The effects of product quality on customer satisfaction and loyalty: Evidence from Malaysian engineering industry. *International Journal of Industrial Marketing*. 3 (1): 20-35
- x. Maritan, D. 2015. Practical Manual of Quality Function Deployment. Springer.
- xi. Nwabuko, J. 1998. *Marketing management (1st edition)*. Enugu: Precision printer.
- xii. Omosomi, O. 2016. The recent tomato crisis, household consumption and disposal incomes. *Business Day Intelligence*. Retrieved Nov. 23, 2019, from <https://businessday.ng/wp-content/uploads/2016/10/Tomato-consumer-survey.pdf>
- xiii. Pires, A. 2015. An Approach about the Value Analysis Methodology. Proceedings of 2100 Projects Association Join Conference 3. 16 – 21.
- xiv. Rajesh, A., and Sandeep, G. 2018. Analysis of quality enabled factors in the product design stage of a production system life cycle: a relationship modeling approach. *International Journal of Management, Science and Engineering Management*. 13.1: 65-73