

# Enhancing Dairy Manufacturing through customer feedback: A statistical approach

**Vineesh D, Anbuudayasankar S P, Narassima M S**

Dept. of Mechanical Engineering,  
Amrita School of Engineering, Amrita Vishwa Vidyapeetham (University),  
Coimbatore, Tamilnadu, India.

Email: vineeshd1@gmail.com

**Abstract.** Dairy products have become inevitable of habitual diet. This study aims to investigate the consumers' satisfaction towards dairy products so as to provide useful information for the manufacturers which would serve as useful inputs for enriching the quality of products delivered. The study involved consumers of dairy products from various demographical backgrounds across South India. The questionnaire focussed on quality aspects of dairy products and also the service provided. A customer satisfaction model was developed based on various factors identified, with robust hypotheses that govern the use of the product. The developed model proved to be statistically significant as it passed the required statistical tests for reliability, construct validity and interdependency between the constructs. Some major concerns detected were regarding the fat content, taste and odour of packaged milk. A minor proportion of people (15.64%) were unsatisfied with the quality of service provided, which is another issue to be addressed to eliminate the sense of dissatisfaction in the minds of consumers.

## 1 INTRODUCTION

In developing countries, the food industries have been drastically changing owing to the standards of living of the consumers [1]. Customer satisfaction has a direct influence over the future of any organization. Customer satisfaction means the fulfillment of needs of the customer by delivering the product or service that the customer expects. Any industry can attain this board only if it is able to effectively afford the goods and services on time without compromise in quality at a competitive price [2]. For this to happen, the processes that act as platform for procurement and production of the products must be streamlined which is achievable by addressing from the root level. Such an attempt was made in this study by constructing a customer satisfaction model with four key constructs with multiple items. The various stages in which the dairy products reach the customer were considered for the development of hypotheses. This is applicable to most of the Fast Moving Consumer Goods. To be market led, an organization has to be customer driven. If each individual customer spends more time with an organization than its competitors then the market share of the organization will also be increased. There are many factors that influence the customer satisfaction level such as product quality, Packaging, Branding, Delivery, etc. For lasting relationships with the customers, the organization should know the need of the customer, serve them better and satisfy them.

The dairy derived customer satisfaction level can also be used as a measure for evaluating the quality of milk and also the future of dairy sector [3]. From the buying behavior of the customers, If they are found loyal to the same brand, then the customer satisfaction is high [4, 5]. Most of the consumers prefer



to buy milk from local farmers rather than packed milk. They thing about the quality, taste of milk will be altered during the processing of milk in the industry. This thinking of customers should be changed by creating awareness among the customers by means of videos or an industry visit during occasions like National Milk Day on 26th November (celebrated in India on the birth anniversary of Dr. Verghese Kurien, the Father of White Revolution). Also, customers must be made aware of the ease of acquiring packaged milk. Customers would start moving towards this only if the industries are able to provide the required products at required time periods to customers which are the only way to attract and sustain customers towards the use of products. By proper forecasting, the sales and thus the timely delivery of products at the right place and the right time can be achieved, which would, in turn, increase the level of satisfaction.

## **2 THEORETICAL FOUNDATION**

The dairy industry plays a vital role in developing the economy of a nation as it is an essential part of routine food and is considered as a chief source of calcium [6, 7]. Milk is one of the important products in the daily life of the Indian consumers, the satisfaction of the customers is essential for the Dairy Sector development. Many types of research have been carried out right from the quality of milk to the packaging, which has been measured to know about the customer satisfaction over the dairy product brand. From the survey analysis, taste and purity of milk have been found to have more impact on customer satisfaction and affect the performance of the product in the market [8, 9]. Price, Quality and delivery have been some of the factors of concern as users have varying preferences [2] i.e. the relative weightages given to these three factors vary among the consumers. Also, it is determined that fresh milk is not as tastier as processed milk. This may be a key point why people tend to prefer ready to use packaged, flavoured milk products [6]. Manufacturers have even started to shift towards preferences of consumers from requirements [10]. Elangovan and Gomatheeswaran (2015) [11] and Ahila and Boopathi (2015) [12] studied the customer behavior towards a specific dairy brand in Tami Nadu region. The authors determined how far the consumers are satisfied with the dairy products of a particular brand and the buying behavior over it. This work was further extended to a specific category of milk to know the customer preference [13]. Also, another study determines the effect of another brand in the region has made a good reputation among the customers.

The buying behavior of customers also determines the level of satisfaction which has been reviewed by means of research papers about the factors influencing the customer when buying milk and its products [14, 15]. Brand preference has been identified as a major level of customer satisfaction [16, 17]. As per the current market scenario, each brand is facing competition from the other. In order to sustain in the market, each brand should find out different strategies to increase the level of customer satisfaction and retain their customers. Packaging design on customer satisfaction was studied [18, 19] towards specific age groups and gender. They analyzed the influence of packaging over customer purchase decisions has indirectly affected by their decision of repurchase. Proper use of the available data is always helpful in decision making

Most of the researchers used survey method for collecting the data and analyzed the data by means of Manual calculations [4, 20], weighted average method [21, 22], ANOVA [9], and Chi-square test [23]. Data reduction capability is one of the distinct features of factor analysis [24]. Exploratory factor analysis helps to detect the pattern of variables that possibly will make way for reduction of data. To check the internal consistency of the set of items in a group Cronbach's alpha is used [25]. The reliability of the group of the set of items can be measured using this method. Raw data available could be transformed into useful information or generic, problem specific models for betterment of processes [26]. This is possible by adapting forecasting techniques by integrating the sales and demand data in order to produce to cater the demands of the customers.

## **3 PROPOSED RESEARCH FRAMEWORK**

One of the key purpose of this research is to provide prerequisites to a dairy industry on how to attract and sustain customers. The information about various aspects related to the usage of dairy products were

acquired through questionnaire. The questionnaire consists of four constructs, namely Product Quality, Reliability, Behavioural Attitude and Ease of Procurement with several items in each of the constructs. Each item was measured in Likert 5 point scale from 1 to 5, measuring from “dissatisfied” to “satisfied”. Multi-item approach improves the precision of the questionnaire as several questions are framed to measure each construct [27]. Product Quality checks the qualitative aspects of the product such as the fat content, taste, odour and healthiness. Reliability checks the quality of service, packaging, and purity of milk, which is more likely to be classified under the delivery side rather than the actual quality of the product. Any product, to be sustainable in the market, needs to be readily available to the customer in required specifications. Hence, a construct is designed to measure the ease of procurement of the product. All these factors determine the behavioural attitude of customers.

#### 4 RESEARCH METHODOLOGY

The survey covers 243 valid responses from various parts of south India. From the results of the survey, the analysis was done to understand the mindset of customers towards the use of milk and dairy products, which is displayed in table 1.

##### 4.1 Summary of scores

It is clear that almost more than 50% of the customers are satisfied towards every aspect of the product. Least score for satisfaction was for 44.86% which can be a necessary input for the manufacturers to improve the quality of milk delivered. This is also reflected in the scores of ‘unsatisfied’ for the same item as 31.28% people are unsatisfied with taste and odour of the milk. A possible reason for the taste and odour having the highest proportion of people unsatisfied may be the emergence of flavoured milk and other products that are added to milk and consumed. People tend to gradually develop a higher amount of likeliness towards new products. One item that failed to qualify reliability test and construct validity was the tendency of the customers to alternate if the product that they use regularly was not available. The main cause for the failure of the item is reflected in the results of the construct Ease of Procurement (EP). As the customers are able to obtain the required product with ease at an affordable cost, they are not likely to know about many alternate ways. Also, only a smaller proportion of customers are unsatisfied towards the items measuring the EP. The success rate of any product can be improved by providing satisfactory product in a longer run. This would further reduce the proportion of people being unsatisfied with the product.

**Table 1.** Summary of scores

Items	Satisfied	Balanced	Unsatisfied
Fat Content	50.41	22.73	26.86
Taste Odour	44.86	23.87	31.28
Healthiness	56.61	20.66	22.73
Quality of service	51.03	33.33	15.64
Packaging	54.32	27.57	18.11
Purity	51.03	25.10	23.87
Duration of usage	52.05	30.74	17.21
Recommend to Others	52.05	29.10	18.85
Price	60.49	25.10	14.40
Availability	54.73	25.93	19.34
Likely to alternate	57.38	21.72	20.90

##### 4.2 Reliability and Construct Validity

Table 2 shows the responses of customers for the different constructs. The table also shows the results of Reliability test and Exploratory Factor Analysis (EFA). EFA is performed to check the construct validity. From the values of factor loadings, it is clear that all items have passed the construct validity

test as all the values are higher than 0.5. Varimax extraction was used as the relationships between the items were unknown. Factors having Eigen values greater than 1 were extracted. Four factors, each with multiple items loading similarly were extracted. Factors having similar loading pattern are considered to measure similar items which are also evident from the table. Cronbach's alpha values are all greater than 0.5 indicating that all the developed items are reliable [27].

**Table 2.** Reliability and Construct Validity

Dimensions	Measured Items	Factor Loading	Cronbach's value	Eigen Value	% Variance
Product Quality (PQ)	PQ1	Fat Content	0.6636	0.515	2.285
	PQ2	Taste Odour	0.6529		
	PQ3	Healthiness	0.7006		
Reliability (R)	R1	Quality of service	0.6756	0.503	1.284
	R2	Packaging	0.6823		
	R3	Purity	0.5480		
Behavioural Attitude(BA)	BA1	Duration of usage	0.6864	0.546	1.151
	BA2	Recommend to Others	0.7480		
		Price	0.6755		
Ease of Procurement(EP)	EP1	Availability	0.7235	0.541	1.085
	EP2				

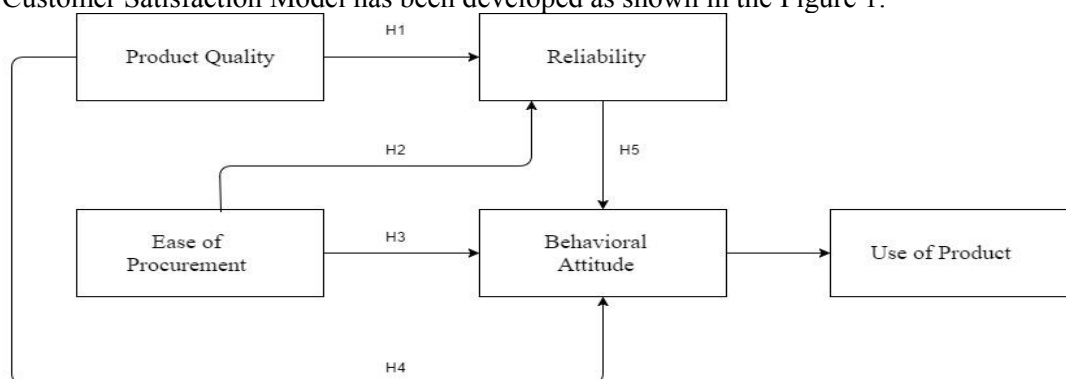
Table 3 indicates the sustainability of the items, which is evident through Kaiser-Meyer-Olkin Measure (KMO) of Sampling Adequacy as the obtained greater than 0.5. Significance value ('p' value) obtained through Bartlett Test of Sphericity is less than 0.001, indicating a strong relationship between the variables.

**Table 3.** KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.694
Bartlett's Test of Sphericity	Approx. Chi-Square	192.057
	Df	55
	Sig.	.000

#### 4.3 Hypothesis testing

To study the significance of dependence between two parameters, Chi-square test is been used versatile. The alternate hypothesis assumes that there is a significant dependence between the parameters while the null hypothesis assumes that there is no significant dependence. Based on the previous researches a Customer Satisfaction Model has been developed as shown in the Figure 1.



**Figure 1.** Customer Satisfaction Model

The following are the proposed Hypothesis:

H1: Product Quality has a positive influence on Reliability

H2: Ease of Procurement has a positive influence on Reliability

H3: Ease of Procurement has a positive influence on Behavioural Attitude

H4: Product Quality has a positive influence on Behavioural Attitude

H5: Reliability has a positive influence on Behavioural Attitude

Cross tabulation chi-square test was performed for all the proposed hypothesis and the dependencies were determined. There is an important assumption that when a cross tabulation is performed, the percentage of cells having an expected count less than 5 should not exceed 20% to prove that the tested constructs are interdependent.

**Table 4.** Cross tabulation between PQ and R

		R			Total
		Balanced	Satisfied	Unsatisfied	
PQ	Balanced	Count	40	33	86
		Expected Count	30.7	46.9	86
	Satisfied	Count	31	83	122
		Expected Count	43.5	66.5	122
	Unsatisfied	Count	16	17	36
		Expected Count	12.8	19.6	36

**Table 5.** Cross tabulation between EP and R

		R			Total
		Balanced	Satisfied	Unsatisfied	
EP	Balanced	Count	45	44	100
		Expected Count	35.7	54.5	100
	Satisfied	Count	30	84	122
		Expected Count	43.5	66.5	122
	Unsatisfied	Count	12	5	22
		Expected Count	7.8	12	22

**Table 6.** Cross tabulation between EP and BA

		BA			Total
		Balanced	Satisfied	Unsatisfied	
EP	Balanced	Count	49	36	100
		Expected Count	44.7	46.7	100
	Satisfied	Count	49	69	122
		Expected Count	54.5	57	122
	Unsatisfied	Count	11	9	22
		Expected Count	9.8	10.3	22

**Table 7.** Cross tabulation between PQ and BA

		BA			Total
		Balanced	Satisfied	Unsatisfied	
PQ	Balanced	Count	47	30	86
		Expected Count	38.4	40.2	86
	Satisfied	Count	49	66	122
		Expected Count	54.5	57	122
	Unsatisfied	Count	13	18	36
		Expected Count	16.1	16.8	36

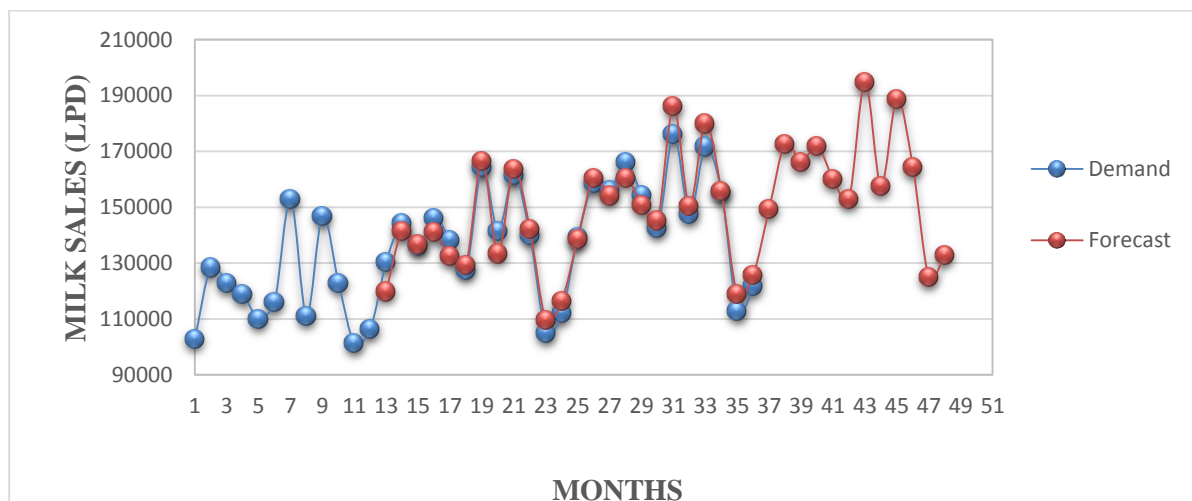
**Table 8.** Cross tabulation between R and BA

R			BA			Total
			Balanced	Satisfied	Unsatisfied	
R	Balanced	Count	45	35	7	87
		Expected Count	38.9	40.6	7.5	87
	Satisfied	Count	53	71	9	133
		Expected Count	59.4	62.1	11.4	133
	Unsatisfied	Count	11	8	5	24
		Expected Count	10.7	11.2	2.1	24

From tables 4 to 8 it is found that all the hypothesis passed the tests proving that all the proposed hypothesis have dependencies. All the performed tests consisted of only 1 out of 9 cells which had expected count less than 5 i.e. only 11.1% cells had expected count less than 5, which is less than 20%, the required criteria for proving that the constructs are interdependent. It is evident from H1 that the product is reliable if the product quality meets the expectations of the customers. Apart from the product quality, ease of procurement also determines reliability as people prefer products that are readily available (H2); customer centric market has several competitors who can provide the required products as and when required. Reliability is one of the significant factors influencing the behavioural attitude of people (H5).

#### 4.4 Forecasting

Dairy industries can be classified under perishable goods. The manufacturers of such goods need to be highly focusing on predicting the customer demand as the products need to be delivered in a shorter duration of time after they are produced. Also, no Work In Progress is allowed after each shift as the machines involved in each processing line have to be cleaned to avoid spoilage of products. Monthly demand data of a dairy production company was obtained for a period three years. From the data, it was found that the demand had seasonality factor in addition to level and trend [28]. Hence, Winter's method was implemented to forecast the demand for next twelve months. Figure 2 shows the graph displaying the demand and forecast data.

**Figure 2.** Monthly sales forecast using Winter's model

## 5 RESULTS AND DISCUSSIONS

In the present study, constructs were developed to measure various aspects of products' quality and availability and how they influence the consumers from using those products. These act as inputs to the companies by providing them the information about consumers' views towards various aspects of their



products. Product quality, an unnegotiable factor which was determined by three key items, fat content, taste & odour, and healthiness. It was found that 26.86% and 31.28% of the respondents were unsatisfied with the fat content and taste & odour of the milk that they consumed. These two aspects remain a big issue to be addressed by the producers because of the emergence of several flavored milk products with enriched taste & odour which attract people and also milkmaids which make people feel that the normal milk they consume has a lesser fat content as the milkmaids sold contain condensed milk which appears thicker than the customary milk. Though quality products are provided, it is of much importance that they reach customers as and when they require. In this customer centric market, ease with which the products are being delivered are as equally important as the quality of the product. Hence a construct with items to measure the ease of procurement was developed, which proved to be significantly influencing the reliability of the product. Ease of procurement may be interpreted as the ease with which the product is made to be available to the customers, considering the purchase power of consumers. It was evident that only a minor proportion, 19.34% and 20.9% of people were unsatisfied with the availability and price of products. This seems an area of concern for the manufacturers to ensure that the products become available to customers at ease. Increasing costs of all goods and services always lie as a threat to manufacturers to sustain themselves in the market, as competitors are always prepared to attract customers with better products. The “Duration of usage” construct indicates that the consumers have been using the product for a longer duration of time as only 17.21% of people show dissatisfaction towards this construct. Retaining customers is the most critical aspect of any business as sustainability of any business is indispensable. A good proportion of customers turned up positive when asked about their recommending of the product to others, indicating the trust they have developed on the products over years. Also, only 15.64% people were unsatisfied with the quality of service provided, yet, companies need to eliminate the sense of dissatisfaction among customers completely. Packaging of the products are satisfactory among majority of the customers which ensures that the entire delivery chain handles products safely. 54.32% of people are satisfied with the packaging of products purchased. Reliability of the product is measured by two items, duration for which the people have been using the product and how far the consumers are ready to recommend it to others. It is obvious that people would recommend the products to others only if they have enough satisfaction on the product. Also, consumers tend to use the products for a longer period only if they are satisfied. One item that failed to load significantly was regarding the customers’ choice to go for alternatives in case of unavailability of the regular dairy products. This probably would be due to the fact that the consumers are not aware about other alternate products owing to the regular availability of their regular dairy products, which is evident from the results of the construct “ease of procurement”. Both these constructs hence determine the reliability of the product. It is both the quality of the actual product and the quality of service offered for the product that determines the reliability that the consumers get towards that product. Reliability is further extended as a measure that influences the behavioural attitude of the users, which leads to the actual use of the product. Shortcomings and upsides are part of all businesses, as the former helps to understand the areas of improvement while the latter helps to determine the success of their products.

## 6 CONCLUSIONS

Dairy products have become an inevitable ingredient in everyday life. Dairy manufacturers have to continuously track the increasing demand-supply gap and try to bridge the gap and meet consumers’ requirements. Most of the dairy products, being perishable, mandate manufacturers to produce exactly to suffice the demand, failing which, leads to insufficient goods or excess inventory. Former leads to unsatisfied demand whereas latter results in additional inventory cost. Suggestions to solve these issues that have been discussed in this paper could be useful for the manufacturers. Forecasting demand based on sales may be useful to understand the trend in sales and to identify the seasonality in sales, i.e. seasonal behavior in sales over any time period. The inputs and feedback provided by consumers deliver valuable information to the manufacturers about the areas that require improvement. It makes it easier for the manufacturers to address specific areas in production process as well as delivery of products.

Also, the areas which make most of the consumers satisfied are equally important as they need to be enhanced.

## REFERENCES

- [1] Trung T Q, Giam D Q, Hai V T, Thao L P, Hang N T T, Son L T K and Linh B T M 2014 Factors influencing milk consumption of rural households in Northern Vietnam. *Greener journal of business and management studies* vol 4 pp 31-40
- [2] Venugopalan J, Sarath V S, Pillai R J, Krishnan S A and Anbuudayasankar S P 2014 Analysis of decision models in supply chain management *Procedia engineering* vol 97 pp 2259 – 2268
- [3] Gavojdian D, Voia S O, Sauer M, Albulescu M, Sauer I W, Dragomir C, Janku D and Padeanu I 2016 Study on Milk and Dairy Products Consumers Preferences in Timis and Caras-Severin Counties from Romania. *Scientific papers: animal science and biotechnologies* vol 49 pp 170-173
- [4] Chhajed R 2016 Impact of brand awareness on consumer/brand loyalty: a study of packaged milk brands in Surat city, Gujarat *International journal of research in computer application & management* vol 6 pp 70-75
- [5] Kumar A and Babu 2014 Factors influencing consumer buying behavior with special reference to dairy products in Pondicherry state. *Journal of research in management and technology* vol 3 pp 65-73
- [6] Alwis A D, Edirisinghe J C and Athauda AMTP 2009 Analysis of factors affecting fresh milk consumption among the mid-country consumers *Tropical agricultural research and extension* vol 12 pp 103-109
- [7] Yayar R 2012 Consumer characteristics influencing milk consumption preference: The Turkey case *Theoretical and applied economics* vol 7 pp 25-42
- [8] Savitha S P 2017 A study on consumer preference towards AMUL product in Madurai city *International journal of current research and modern education* vol 2 pp 41-46.
- [9] Joseph S and Seema A 2016 A Study on improving the market share of Milma milk - with special reference to customer satisfaction and dealer satisfaction, Kerala *International journal of business and management invention* vol 5 pp 75-106
- [10] Kresic G, Herceg Z, Lelas V and Jambrak A R 2010 Consumers behaviour and motives for selection of dairy beverages in Kvarner region: a pilot study *Journal for dairy production and processing improvement* vol 60 pp 50-58
- [11] Elangovan N and Gomatheeswaran M 2015 A study on consumer behavior towards various brands of milk and milk products with special reference to Thudiyalur town at Coimbatore district in Tamil Nadu *International journal of multidisciplinary research and development* vol 2 pp 595-601
- [12] Ahila D and Boopathi C 2015 Consumer behavior on Aavin milk and dairy products in Pollachi taluk of Tamil Nadu *International journal of commerce, business, and management* vol 4 pp 774-778
- [13] Ramesh L and Poornima S 2016 Consumer brand preference towards pasteurized milk in Gudalur town *International Journal of research in commerce and management* vol 7 pp 6-13
- [14] Ahmed W, Hussain S, Rabnawaz A, Jafar R M S, Saqib Z A, Ullah S, JianZhou Y 2016 Client Intentions and Buying Behavior with Regard of Dairy Products-Review *Journal of economics and sustainable development* Vol 7 pp 88-95
- [15] Klaudia and Janka 2015 Literature review on factors influencing milk purchase behavior *International Review of Management and Marketing* vol 5 pp 9-25
- [16] Geeta 2015 Brand preference of packed milk- A study of urban consumers in Rohtak district. *International journal of enhanced research in management & computer applications* vol 4 pp 29-35
- [17] Mahadira F and Purwanegara M F 2014 A study of brand consumption and consumer satisfaction towards fast-moving consumer goods *Journal of business and management* vol 3 pp 61-75



- [18] Khuong M N and Hong T M 2016 The Impact of Product Packaging Design on Consumer Repurchase Intention — A Study of VinaMilk, Vietnam *International journal of innovation, management, and technology* vol 7 pp 219-223
- [19] Angieszka and Iwanicka A 2015 The effect of age, gender and level of education on the consumer's expectations towards dairy product packaging *British food journal* vol 118 pp 100-118
- [20] Palanivel V and Muthukumar C M 2014 A Study on Consumer Satisfaction of Arokya Milk Product at Palacode Taluk in Dharmapuri District *Global journal for research analysis* vol 3 pp 4-6
- [21] Njarui D M G, Gatheru M, Wambua J M, Nguluu S N, Mwangi D M and Keya G A 2011 Consumption patterns and preference of milk and milk products among rural and urban consumers in semi-arid Kenya *Ecology of food nutrition* vol 50 pp 240-262
- [22] Anand V V, Panchanatham N and Rajasekaran B 2013 Consumers' Brand Preferences and Brand Loyalty - An Empirical Study with Special Reference to Packaged Milk *International research journal of business and management* vol 5 pp 45-56
- [23] Gopalakrishnan S and Karthikeyan A 2014 Study on consumer satisfaction towards dairy milk chocolate with special reference to Uthamapalayam city *Journal of business and management* pp 54-57
- [24] Carmines E G and Zeller R A 1979 Reliability and Validity Assessment. Thousand Oaks, CA: Sage
- [25] Gliem J A and Gliem R R Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales.
- [26] Nair P R, Raju V, Anbuudayasankar S P Overview of Information Technology tools for Supply Chain Management. CSI 2009. Pune, 2009.
- [27] Narassima M S, Anbuudayasankar S P, Vasudevan S K, Abhinavaram J 2017 Physicians and Users Perceptions Towards Wearable Health Devices *Indonesian journal of electrical engineering and computer science* vol 5 pp 234-242
- [28] Kumar U D, Pandian A A and Nachiappan S P Supply Chain Optimization at Madurai Aavin Milk Dairy