Original Research Article

Application of Statistical Process Control Tools to Measure and Evaluate the services of Kumasi Technical University Restaurant

ABSTRACT

The study measure and evaluate Kumasi Technical University (KsTU) Restaurant's services using statistical process control tools. Two categories of respondents (members of staffs and students) were engaged in the study. Data was collected from 100 members of staff and 223 students using questionnaires. Statistical tools such as mean, pareto charts and factor analysis were used in the analysis. The results shows that respondents are highly satisfy with the services provided by the restaurant. The survey also found that consumers consider two factors, namely atmosphere and food quality, while evaluating the services offered by a restaurant.

KEYWORDS: Service Quality, Restaurant, Customer, Satisfaction, Loyalty

1. INTRODUCTION

Restaurant according to many scholars is a business which falls under the food and beverage category within the hospitality industry. It is aimed at providing a product (which is prepared food) to customers and a service (which is waiting the customers) by offering the options of food consumption at the premises or packaged and taken away. In other words restaurants provide food and service to customers which should be of high quality to attract them back and even new ones.

Variability has an inverse relationship with quality according to modern definitions. This suggests that a product's or service's quality decreases and vice versa as the variability in critical qualities rises. Quality improvement is the procedure in which changes are made to a product or service when its quality declines. Montgomery (2009) claims is the lessening of unpredictability in procedures, goods, and services. Because quality is and will continue to be a key component of consistent economic growth in the future, Simanova and Gejdos (2015) argue that any organization that wants to satisfy its clients must continually raise the bar for its own goods and services.

Quality is an important determinant of success in all aspects of restaurant service. According to Kurtus, 2022, quality is determined by whether the food and service meet or exceed the hopes of the customer. Customers who patronize restaurants will rate the quality of the restaurant based on how the food was shown in the menu, this implies they look out for some specifications and expects the look, the flavour and the taste, of the food to meet those specifications. Again customers will also go back to restaurants when there is consistency in the food they serve. They want to be assured that they will not be disappointed in any day especially when they recommend the place to someone. On the quality of service, customers will usually watch out for

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prompt and polite or well mannered service. They expect to be accorded all the necessary respect and served on time.

1.1 Statement of Problem

Kumasi Technical University (KsTU) restaurant has been operating for several years. The restaurant is to serve as a training ground for students in Hotel Catering and Institutional Management (HCIM) Department as well as a profitable venture for the university by serving food to staff and students of the university and surrounding communities.

Both functions have not really been fruitfully executed since the restaurant is not too big to house the many students who need this training and patronage by students and staff has also not been the best.

With a capacity of about Seven hundred (700) staff and Twelve thousand (12000) students the patronage of the restaurant on the average stands at about one hundred (100) customers a day and this is woefully inadequate. This is quite unfortunate since within the campus there are no competitors. Some competitors are rather found outside campus, some several miles away, but staff and students would rather commute to these food joints.

This has gone on for several years even though managers of the restaurant have changed over the years. This restaurant could be a very good place for internal generated funds for the university but rather it seems not to be living up to expectation and capacity. There are several questions, such as "what the restaurant seem to be doing wrong?", what are the competitors outside are doing right?, etc.

This, along with other factors, necessitated the conduct of the present study in order to determine the fundamental causes of the aforementioned problems and contribute to enhancing the quality of services provided by the restaurant in order to appeal to more members of the academic community as well as the general public.

1.2 Objectives

1. To evaluate the level of customer satisfaction on perceived service quality at the restaurant.
2. To find out the waiting period to be served
3. To rank the quality of service provided by the restaurant
4. To investigate major factors considered by customers in evaluating service quality

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2. Brief Literature review

2.1 Service Quality

Providing outstanding service quality (SQ) has become essential for survival in the fiercely competitive world of today. (Sun & Pang, 2017). The importance of service quality is a recurring theme in modern literature and business practice This means that customers will be attracted and retained, word-of-mouth will be good, productivity will increase, market share will increase, employee morale will improve, and profitability will rise (Nair & Choudhary, 2016; Ryu & Lee, 2017). Numerous studies in the hospitality industry have revealed a strong link between Service Quality (SQ), Customer Loyalty (CL), and long-term financial performance, as well as between SQ, and Customer Satisfaction (CS) (Arvelo-Pérez et al., 2017; Chen, 2013).

According to Parasuraman, Berry and Zeithaml (1991), an organization's ability to fulfil its customers' expectations is measured by the quality of its service. Services are purchased by customers to satisfy certain demands. People have standards and expectations for how an organization's service delivery satisfies their needs, whether they are aware of them or not. Customers receive services from a business with excellent service quality that meet or surpass their hopes. Once more, there is a connection between higher customer satisfaction scores and the product-based services that are provided (Brady & Robertson, 2001). According to Arokiasamy and Abdullah, (2013) service quality may be determined by the specific interactions a consumer has with service provider. Technical and functional quality are two main categories into which the quality of services can be split (Grönroos, 1984). Technical quality, put simply, is the precision and technically required in the delivery of services, whereas functional quality is the process through which services are provided to customers. According to (Bitner & Hubbert, 1994), service quality is the impression that is created regarding the relative superiority or mediocrity of a service that is offered based on the experience.
Service quality has been conceptualized in light of customer expectations regarding the context and process of receiving services. Today's service companies work to provide high-quality services that satisfy customer needs, especially in a market that is growing more and more competitive (Solimun and Fernandes, 2018). Customer satisfaction has declined in very competitive markets because Customer satisfaction has become crucial for organizations in highly competitive marketplaces due to client loyalty, profitability, and most importantly, business sustainability.

2.2 Dimensions of service quality

The quality of a product is affected by a variety of factors. Numerous studies have identified various aspects of service quality in the hotel sector. According to Parasuraman, Zeithaml, and Berry (1985), service quality is measured by reliability, responsiveness, assurance, empathy, and tangibles. In the hospitality industry, these dimensions have been widely used and validated (Jiang, Bai, & Law, 2019). However, there are other factors that can affect the quality of a product, such as the materials used, the manufacturing process, and the design. In order to be reliable, a service must be delivered consistently and accurately. The ability to assist clients and deliver fast service is referred to as responsiveness. Assurance is the quality of personnel' expertise, competence, and kindness as well as their capacity to win customers' faith and confidence. Customer care, particular attention, and understanding are all examples of

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demonstrating empathy. Tangibles include the actual buildings, furnishings, and personnel as well as their outward appearance.
According to a number of studies (Jiang et al., 2019; Ueltschy, Laroche, & Tamilia, 2016), these levels of service quality have a considerable impact on customer satisfaction and loyalty in the hotel industry. In particular, Kim and Kim's (2020) study found that all five of the service quality criteria significantly influenced customer satisfaction in the hotel industry. According to a subsequent study by Raza, Tanveer, and Nadeem (2020), customer loyalty in the restaurant industry was most influenced by confidence and empathy.

The intangible nature of services and the subjectivity of client opinions make it difficult to measure and manage service quality in the hotel sector (Moraes, Montemurro, & Pereira, 2020). The Kano model, SERVQUAL, and Importance-Performance Analysis (IPA) are just a few of the studies that have suggested several approaches to measuring service quality in the hotel sector (Moraes et al., 2020; Ueltschy et al., 2016).

2.3 Service Quality in Restaurant Service

In the restaurant business, client satisfaction and loyalty are significantly influenced by service quality. According to Berry, Zeithaml, and Parasuraman (1985), service quality is the extent to which a service satisfies or exceeds the expectations of clients. Depending on a number of variables, including their requirements, preferences, prior experiences, and the sort of restaurant they visit, customers have varying expectations and impressions of the quality of the services they receive. As a result, it's critical for restaurant managers to comprehend and gauge service quality from the viewpoint of the patrons as well as to pinpoint any discrepancies between their views and expectations. The SERVQUAL instrument, created by Parasuraman, Zeithaml, and Berry (1988), is one of the most popular tools for measuring service quality. 22 components make up the SERVQUAL instrument, which evaluates five aspects of service quality: tangibles (physical facilities, equipment, and personnel appearance), reliability (ability to deliver the promised service dependably and accurately), responsiveness (willingness to help customers and provide prompt service), assurance (knowledge and courtesy of employees and their ability to inspire trust and confidence), and empathy (caring, individualized attention given to custom needs). Customers are surveyed to rate their service quality expectations and impressions on a seven-point scale ranging from strongly disagree to highly approve using the SERVQUAL instrument. The difference between expectations and perception scores for each item determines the level of client satisfaction or dissatisfaction with the service. A high degree of satisfaction is indicated by a positive gap score, which indicates that the perception exceeds the expectation, whereas a low level of satisfaction is shown by a negative gap score, which indicates that the expectation exceeds the perception.
The SERVQUAL tool has been used in a variety of service sectors, including restaurants. For instance, the SERVQUAL instrument was used by Bojanic and Rosen (1994) to assess the level of service in restaurants in San Antonio, Texas. They discovered that dependability was the most crucial aspect of customer service quality, followed by tangibles, assurance, responsiveness, and empathy. Additionally, they discovered that there were notable variations in how customers perceived the quality of the service at various kinds of restaurants, including fast food, casual dining, and fine dining. They recommended that restaurant managers utilize the SERVQUAL tool to evaluate patrons' views of the level of service they received as well as to pinpoint their own strengths and limitations in providing high-quality service.

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The SERVQUAL instrument has, however, also come under fire for some flaws, including its generic nature, its lack of validity and reliability across various contexts and cultures, its assumption of a linear relationship between expectations and perceptions, and its disregard for additional factors that may have an impact on customer satisfaction, such as price, product quality, individual factors, and situational factors (Cronin & Taylor, 1992; Dabholkar et al., 1996; Ladhari et al., 2011). Therefore, some researchers have proposed alternative or modified models of service quality measurement for restaurants, such as DINESERV (Stevens et al., 1995), DINESCAPE (Ryu & Jang, 2007) and RESTSERV (Ladhari et al., 2011). These models incorporate specific attributes or dimensions of restaurant service quality that are relevant to customers' expectations and perceptions, however this study utilizes statistical quality control tools to measure service quality at the Kumasi Technical university restaurant. These tools bring out a different perspective of looking rather at the problems that reduces quality which when tackled will increase quality of service at the restaurant.

2.4 Study Area

Kumasi Technical University restaurant was established in the year 1987, formerly located at the JICA center, before moving to its current location at the C block lecture theater ground floor close to gate four (4) of the University. It was set up purposely as a training facility for students of Hotel, Catering and Institutional Management Department while also serving as a source of internally generated revenue for the University, under the supervision of the HCIM department. The restaurant's target group is the staff, students and the general public within the catchment area of the University. The university management in collaboration with the HCIM department employed workers specifically for the restaurant under the supervision of the Head of department and its staff. The staff remuneration is paid by the Controller and Accountant General Department under the Government of Ghana.

With the lofty ideal of bridging the gap between industry and academia, the department aimed to train hospitality students who are competent in both large scale and small scale meal preparation and servicing. This necessitated the establishment of the university restaurant where students could intern or understudy the large-scale preparation of meals in real world settings.

In the daily operations of the restaurant, for example the restaurant currently cooks for an average of one hundred (100) customers a day. The large scale is also serving as a place for teaching and training students on team work in the industry. In food production (kitchen center) there are various sections within the kitchen example, butchery, cold larder, banquette, hot, pastry and pantry, so students are supposed to learn how to work within a team to achieve a goal. For instance a customer visits the restaurant and makes an order for 50 plates of food which needs to be ready in an hour. This scenario definitely needs a collective hand to achieve that within an hour.

Students need to have a fair knowledge on these skills for their growth in the industry when they finally exit the Institution. The University will also make profit from the proceeds of the restaurant as internal generated funds (IGF). The above reasons necessitated the establishment of the Kumasi Technical University Restaurant. That notwithstanding, the restaurant as a human institution also has its challenges in terms of management within the restaurant and the overall university, supervisors, access to capital on time, profit margins and workers salary and daily menu. Based on this background the researchers seek to apply statistical processes and control tools to measure and evaluate the quality of services of KsTU restaurant.

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3. Methodology

The study employed questionnaire as the method of data collection. Two separate questionnaires were designed for staff and students of KsTU. Sample sizes of 100 staffs and 223 students were used respectively.

3.1 Data Description

Data for the study was gathered using questionnaire. There were two categories of respondents and each category had different set of questionnaires. The questionnaire for the staff consist of two parts.Part one sought information on their demographic characteristics and part two consist of questionnaire with a 5 likert scale soliciting information from respondents about the services provided by the restaurant. Questionnaire for the students were closed and open ended 17 questions. One hundred and twenty (120) and two hundred and fifty (250) questionnaire were distributed to staffs and students respectively. One hundred (100) for staff and two hundred and twenty three (223) students valid questionnaires were retrieved and analysed. Cronbach's alpha was 0.88 for all questions and the entire questionnaire, according to the Cronbach's method used to measure reliability. Experts confirmed the validity of the questionnaire as well. The questionnaire therefore met the requirements for validity and reliability to be distributed across the statistical population.

3.2 Data Analysis

In analysing the data obtained, some descriptive analysis was conducted together with some quality control methods most specifically statistical process control tools. A specific Statistical Process Control tool called the Pareto chart analysis was employed to identify the major assigned causes of quality problems in the KsTU restaurant. Factor analysis, a multivariate tool was also utilized to ascertain which factors contributed most to the quality of service at the Kumasi Technical University restaurant.

According to Montgomery (2009), statistical process control is an effective set of methods for tackling issues that may be used to achieve process stability and boost capability by reducing variability.It focuses on locating assigned causes so they may be eliminated, leading to long-term process improvement or variability reduction.The Pareto chart, Flow chart, Check sheet, Cause and effect diagram, Scatter diagram, Histogram, and Control chart are the tools used in statistical process control.

3.3 Pareto Chart Analysis

Pareto analysis is a powerful tool in Statistical Process Control that helps to identify and prioritize the most significant causes of quality problems. By applying the 80/20 rule we can focus on the few factors that account for the majority of the disparity or defects in the restaurant service process. This rule which is the basic principle of Pareto analysis states that 80% of the problems come from 20% of the causes. That is to say a small percentage of the causes have an oversized effect and this is a very essential concept since it can assist in identifying which

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initiatives to prioritize in order to make the most impact. This principle is sometimes referred to as the vital few and the trivial many (Montgomery (2009).
A frequency distribution (histogram) of the attribute data organized by category serves as the basis for the Pareto chart. Data analysis based on the Pareto principle is possible using a Pareto chart. It aids in separating the important few from the unimportant many and is frequently utilized in quality improvement applications outside of the manufacturing sector.
Pareto Chart was used because we were analyzing data about the frequency of problems or causes of problems in the quality of the KsTU restaurant. Even though there may be many problems or causes, we wanted to focus on the most significant ones.

3.4 Factor Analysis

Using the factor analysis technique, many variables can be broken down into a smaller number of factors. The primary goal of factor analysis, according to Johnson and Wichen (2007), is to define, as much as feasible, the covariance relationship among numerous variables in terms of a small number of underlying factors. The underlying constructs or latent variables that produce the observed variables are the factors. The factors vary from one thing to the next, just like the observed variables, but unlike the variables, the factors cannot be observed or measured.

The following argument provides the basis for the factor model: If variables can be grouped according to their correlations, that is, if variables in one subset have high correlations among themselves but low correlations with all other variables in other subsets, then there may be a single underlying factor that gave rise to the variables in that subset. Briefly put, factor analysis uses fewer factors to try to account for differences in the number of original variables.

Even though so many things could contribute to the poor quality of the KsTU restaurant there may be a few underlying factors that are most significant and hence the use of this method. This technique together with the Pareto analysis helps to identify the most essential quality issues that need addressing.

3.5 Factor Analysis Model

Our factor model can be viewed as a sequence of multiple regressions, with each of the observable variables Xi predicted by the values of the unobservable common factors fi.

$$\mathbf{X_1} = \mu_1 + l_{11} f_1 + l_{12} f_2 + ... + l_{1m} f_m + \varepsilon_1$$

$$\mathbf{X_2} = \mu_2 + l_{21} f_1 + l_{22} f_2 + ... + l_{2m} f_m + \varepsilon_2$$

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$$\mathbf{X_p} = \mu_p + l_{p1} f_1 + l_{p2} f_2 + ... + l_{pm} f_m + \varepsilon_p$$

Here, the variable means μ_1 to μ_p can be considered as the intercept terms for the multiple regression models.
The regression coefficients l_{ij} (the partial slopes) for all of these multiple regressions are called factor loadings. Factor loadings are the regression coefficients (partial slopes) for all of these

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multiple regressions. In this case, l_{ij} = loading of the ith variable on the jth factor. These are assembled into a matrix, as shown here:

loading of the *ith* variable on the *jth* factor. These are composed into a matrix as revealed here: matrix

$$L = \begin{pmatrix} l_{11} & l_{12} & \dots & l_{1m} \\ l_{21} & l_{22} & \dots & l_{2m} \\ . & . & & . \\ . & . & & . \\ . & . & & . \\ l_{p1} & l_{p2} & \dots & l_{pm} \end{pmatrix} = matrix\ of\ \ factor\ \ loadings$$

And in conclusion, the errors ε_1 are called the specific factors. Here, ε_1 = *specific factor* for variable *i*. The specific factors are also collected into a vector:

$$\varepsilon = \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ . \\ . \\ . \\ \varepsilon_p \end{pmatrix} = vector\ of\ \ specific\ \ factors$$

In summary, the basic model is like a regression model. Each of our response variables *X* is predicted as a linear function of the unobserved common factors f_1 , f_2 to f_m . Thus, our explanatory variables are f_1 , f_2 through f_m . We have *m* unobserved factors that control the variation among our data. Bear in mind that in general we want m<p.
We will usually decrease this into matrix notation as shown in this form here:

$$\mathbf{X} = \mu + Lf + \varepsilon$$

4. Results and Discussions

The university restaurant is patronized by staff and students of the university. The study engaged these two categories of respondents with two different questionnaires. The analysis is therefore put into two categories, responses from staffs and those from students.

4.1 Demographic Characteristics of Staff of the University

Table 1 below indicates that the majority of respondents (staff members) were men, with a smaller percentage of women.Again it can be observed that there were more non teaching staff compared to teaching staff. From the same table most (55%) of the customers indicated that they were regular customers of the restaurant with 27% visiting the restaurant once a week to eat and majority (41%) spending between Gh¢10- Gh¢20 on the average on food.

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Table 1: Staffs' Demographic Characteristics

Variable	Category	Frequency	%
Gender	Male	59	59.0
	Female	41	41.0
Type of staff			
	Teaching	43	43.0
	Non-Teaching	57	57.0
Regular Customer			
	Yes	55	55.0
	No	45	45.0
Frequency of visit to eat	Once a week	27	27.0
	Twice a week	26	26.0
	Daily	25	25.0
	Once a month	22	22.0
Amount Spent			
	Gh¢10- Gh¢20	41	41.0
	Gh¢21- Gh¢25	32	32.0
	Gh¢26- Gh¢30	21	21.0
	Gh¢31- Gh¢40	6	6.0

4.2 Demographic Characteristics of Students of the University

The table and pie chart below show the age and gender of students.

4.2.1 Age Distribution of Students

The age distribution of the students who participated in the study is displayed in Table 2 below.

Table 2: Age distribution

Age	Frequency	Percentage
18	2	0.9
19	13	**6.0**
20	29	13.0
21	42	19.0
22	46	21.0
23	51	23.0
24	20	9.0
25	11	**5.0**
26	2	0.9
27	1	0.4
29	2	0.9

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30	2	0.9
40	1	0.4
47	1	0.4
Total	223	100.0

The table shows that the majority of respondents are between the ages of 21 and 23. The ages 21 through 22 and 23 years constitute 19%, 21%, and 23% respectively. Less than 10% of respondents are between the ages of 18 and 19 years. The table also shows that 1.7% of respondents are above the age of 30, while 20% of respondents are between the ages of 24 and 30. Overall, the statistics indicate that the bulk of the individuals in this sample are between the ages of 21 and 23.

4.2.2 Gender Distribution

The figure below shows the gender distribution of students who took part in the study. The results shows that most (65%) of the students are males and this is in line with the male female ratios in the student population.

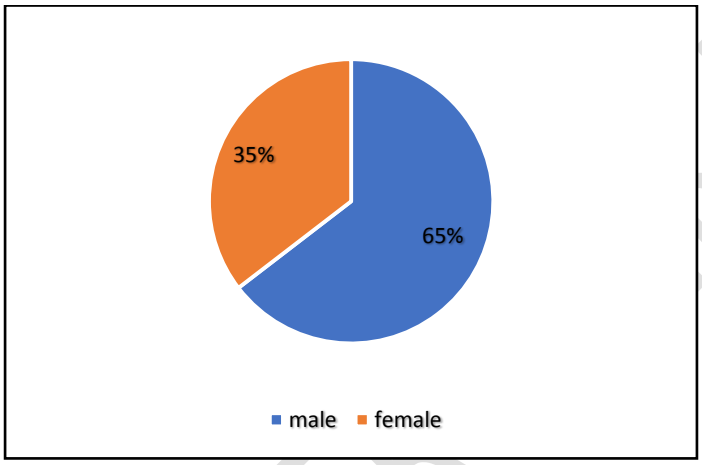

Figure 1: Gender Distribution

4.3 Satisfaction Level of Services Provided by the Restaurant

Table 3 below displays the descriptive statistics of satisfaction level of respondents of the services provided by the restaurant.

Table 3 Descriptive Statistics of Staff Satisfaction of services provided by the restaurant

Variables	Mean	Std. Deviation	Mode
The Food is served hot and fresh	1.40	.512	1
The menu has a good variety of items	1.74	.747	2
The quality of the food is excellent	1.60	.791	1
The food is tasty and rich in flavour	1.78	.811	2
The food meets the price value	1.52	.674	1
The service is excellent	1.76	.922	2
The quality of beverage is excellent	1.53	.611	1
I easily found a seat	1.51	.628	1

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Employees are friendly and courteous	1.61	.680	1
The restaurant is very clean	1.63	.614	2
My food order was correct and complete	1.66	.794	1
Waiters are available when I need him/her	1.66	.670	2
Waitresses were knowledgeable to answer my question about food and beverage	1.56	.795	1
I have not waited too long for waitress to take my order	1.81	.825	2
My order served in reasonable time	1.60	.816	1
the atmosphere of restaurant is excellent	1.62	.599	2
I will patronize this restaurant frequently in future	1.71	.769	1
I am satisfied with the services provided at this restaurant	1.77	.694	2
I will say positive things about the restaurant to other people	1.67	.620	2
I see myself as a loyal customer to this restaurant	1.72	.668	2

Responses from respondents were measured using Likert scale from -1-Very Good , 2- Good, 3- Not Sure , 4- Poor and 5- Very Poor. From the table it can be seen that their responses varied between 1- Very Good and 2- Good for all the variables used to measure the satisfaction level of respondents on the services provided by the restaurant. This implies that respondents view the services provided by the restaurant as good. The data was further subjected to pareto analysis which is a statistical quality control tool.

4.4 Pareto Analysis

A Pareto chart is a graphical representation of data that helps in identifying the most important variables in a dataset. In other words it shows the level of satisfaction respondents attached to a variable in a dataset. The satisfaction level of respondents was measured using Likert scale from -1-Very Good, 2- Good, 3- Not Sure, 4- Poor and 5- Very Poor. The chart below shows their satisfaction level.

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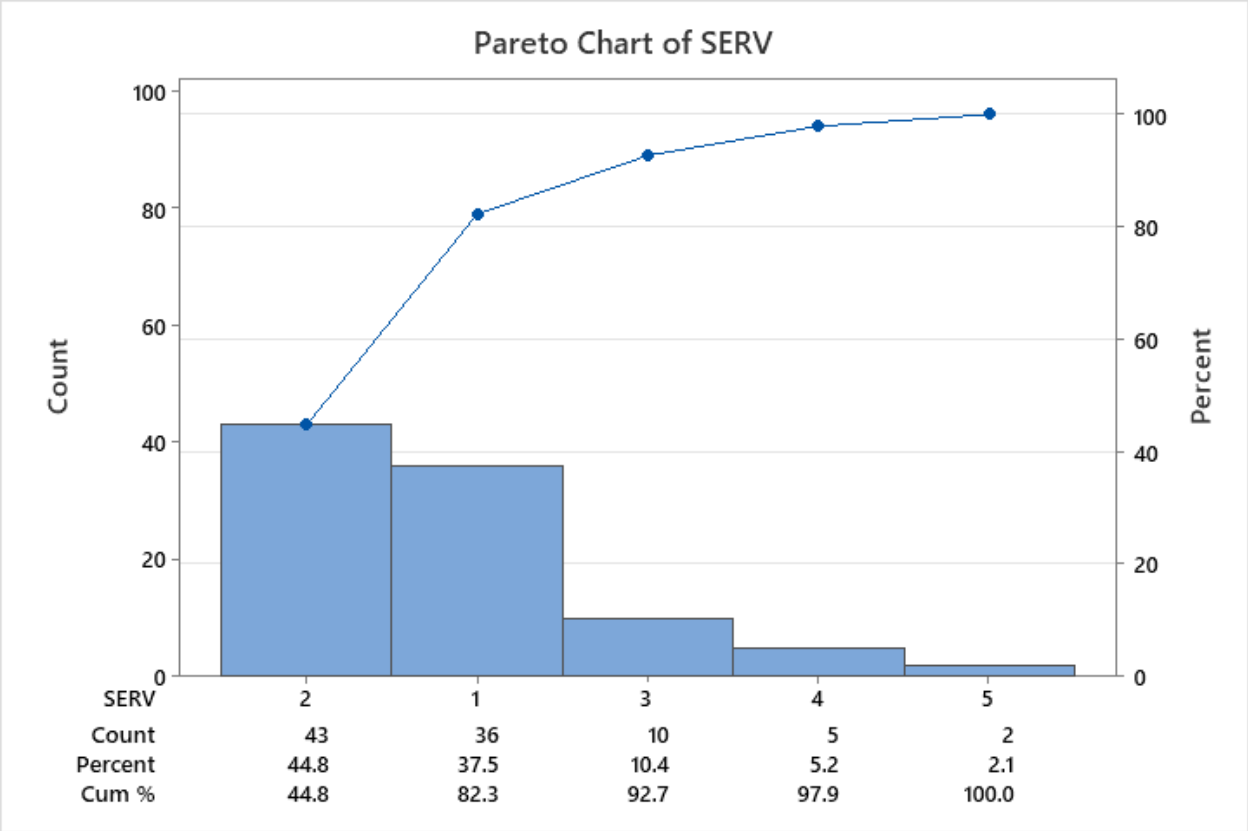

Figure 2: Level of satisfaction of services

From the chart above it can be seen that greater part (82%) of the respondents rated the services provided by the restaurant as Very Good and Good.

4.5 Waiting Time by students

This sought to find out from respondents their waiting time to be served at the restaurant. The results is presented in a pareto chart below. The results from the chart indicate that 36.9% waited between 10 to 14 minutes to be served and 36.5 indicated that they wait between 6 to 9 minutes to be served. This means that cumulatively 73.4% of respondents mainly students waited between 6 to 14 minutes to be served at the restaurant.

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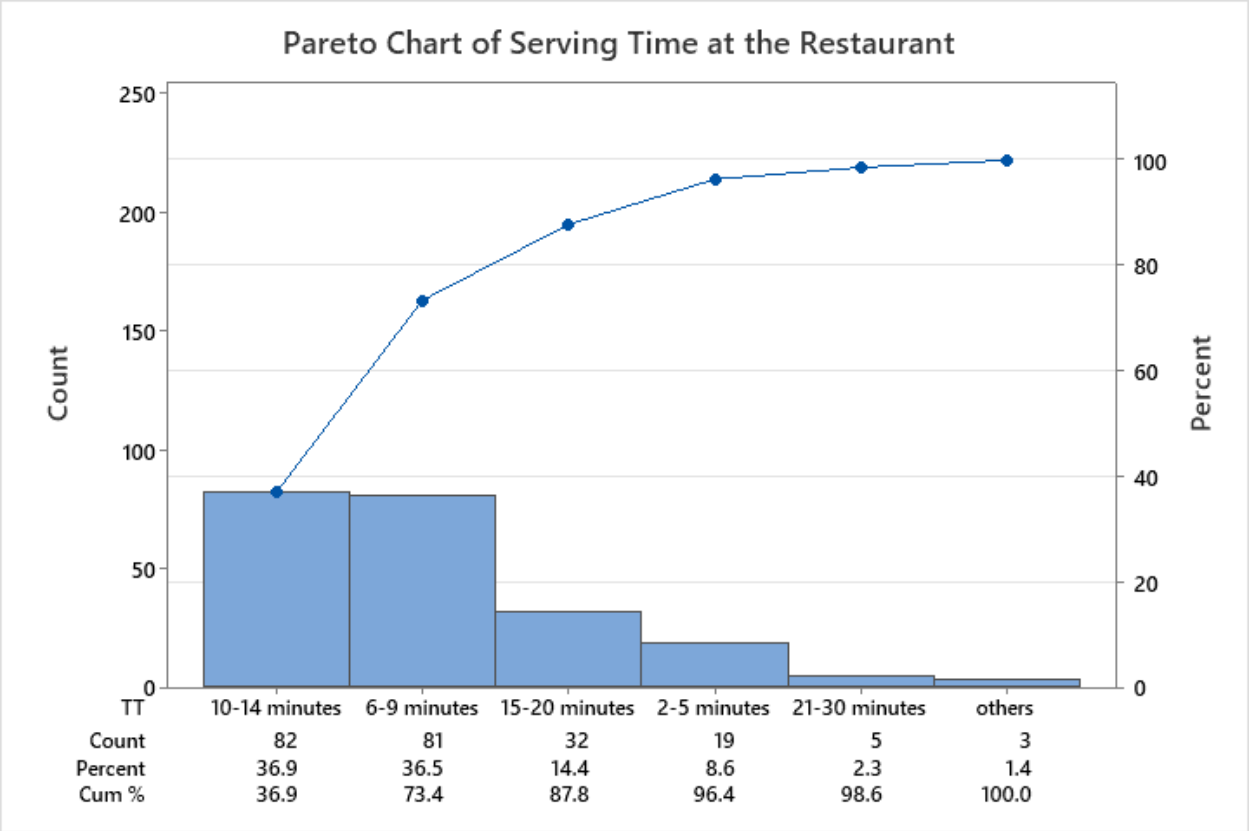

Figure 3: Waiting time at the restaurant

4.6 Ranking of the Restaurant

Respondents were asked to rank the restaurant using a five (5) point Likert scale ranging from 1= Very Good , 2= Good , 3=Not Sure , 4= Poor , and 5=Very Poor. The results are shown in the pareto chart in Figure 4.

Figure 4 shows that 52% of respondents gave the restaurant a Good rating, and 23.8% gave it a Very Good rating. This suggests that overall, 75.8% of respondents gave the eatery a Good rating.

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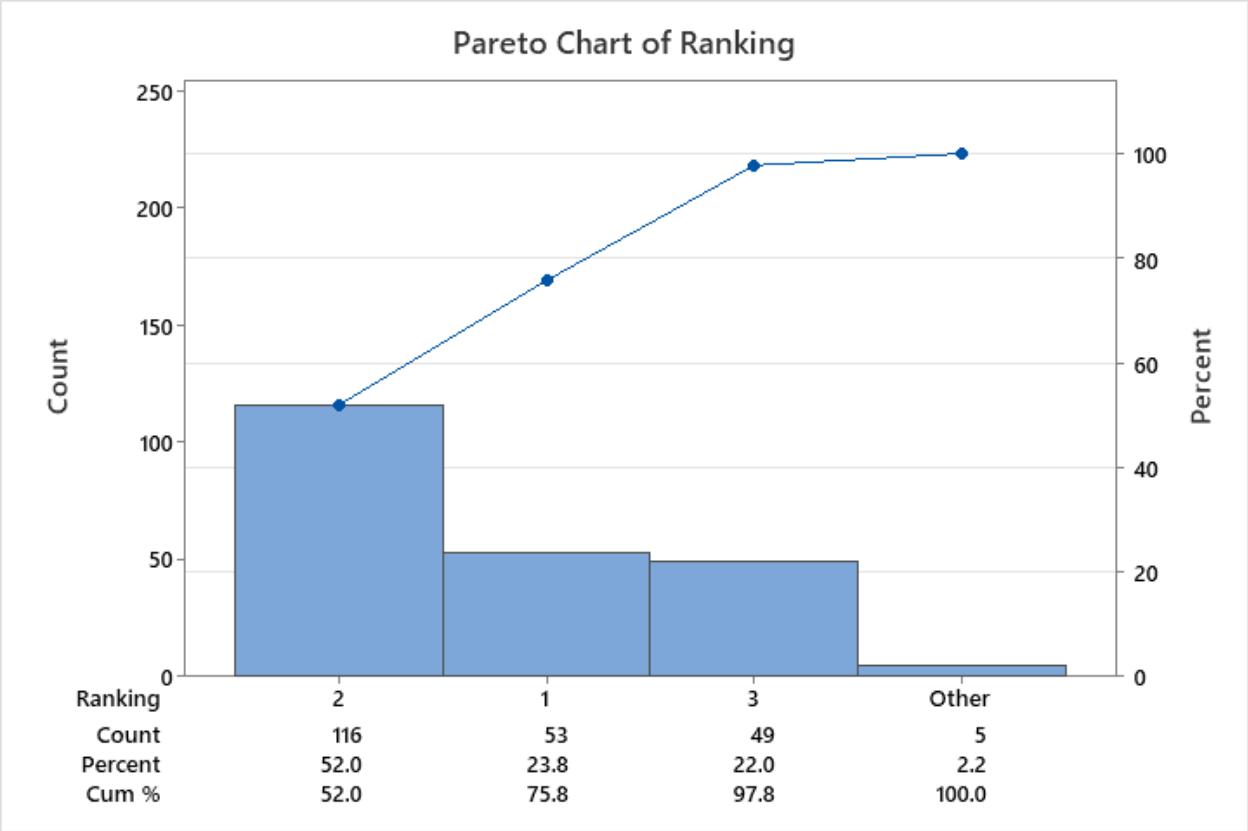

Figure 4: Ranking of the restaurant

4.6 Factors considered by customers in evaluating service quality

Factor analysis and principal component extraction were also employed to determine whether the statements in question represented distinguishable elements that contributed to customer satisfaction of the services provided by the restaurant.
The study adopted the three main steps in factor analysis. The first step was to assess the suitability of the data for factor analysis, followed by factor extraction and factor rotation and interpretation.

Table 4 displays the correlation matrix which shows that there is sufficient correlation among the variables since all the coefficients are > 0.30. This suggests that factor analysis may be a viable option for data analysis. In order to assess if factor analysis was necessary, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the Bartlett's test statistic were utilized and the results is shown in table 5. According to the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy rule, variables can be categorized into minor underlining elements. The correlations between the variables are explained by distinct dimensions if the value is strong, typically closer to 1. According to Table 5, the study's data have a Kaiser-Meyer-Olkin Measure of Sampling Adequacy value of 0.816, which is very close to 1. It follows that specific dimensions can be found to describe the relationships between the variables. Another technique used to assess whether or not the correlation coefficients between the variables are typically significant is Bartlett's test of sphericity. The p-value for the test should be low (around 0.00) for typically

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high correlation coefficients between the variables. The Bartlett's test of sphericity has a p-value of 0.000 which indicates that there are often high correlations among the variables. The two aforementioned findings imply that factor analysis is a good technique for data analysis.

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Table 4: Correlation Matrix

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
R2	.406																		
R3	.623	.472																	
R4	.384	.705	.711																
R5	.620	.492	.527	.488															
R6	.205	.627	.476	.725	.463														
R7	.316	.239	.234	.279	.183	.246													
R8	.207	.350	.395	.500	.346	.458	.210												
R9	.104	.216	.308	.429	.337	.397	.381	.400											
R10	.411	.471	.441	.524	.470	.448	.286	.495	.328										
R11	.362	.548	.585	.698	.636	.577	.188	.372	.594	.485									
R12	.400	.447	.351	.437	.306	.341	.075	.320	.349	.526	.464								
R13	.362	.316	.616	.568	.375	.515	-.056	.434	.445	.304	.464	.323							
R14	.397	.263	.347	.344	.361	.231	.062	.209	.353	.338	.440	.649	.472						
R15	.435	.358	.360	.476	.345	.394	.105	.087	.480	.286	.520	.524	.628	.726					
R16	.401	.386	.358	.429	.269	.327	.169	.064	.302	.465	.362	.228	.514	.384	.615				
R17	.374	.483	.455	.576	.352	.428	.352	.289	.612	.476	.581	.512	.499	.549	.698	.569			
R18	.375	.429	.382	.447	.366	.370	.124	.295	.429	.415	.553	.417	.437	.558	.531	.540	.593		
R19	.292	.467	.448	.537	.415	.425	.066	.281	.554	.472	.651	.456	.583	.468	.574	.556	.580	.572	
R20	.478	.359	.550	.463	.282	.185	.145	.224	.246	.435	.409	.507	.488	.636	.626	.514	.627	.470	.482

a. Determinant = 1.184E-7

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Table 5: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.816
Bartlett's Test of Sphericity	Approx. Chi-Square	1459.387
	df	190
	Sig.	.000

Table 6 : Total Variance Explained

Component	Initial Eigenvalue			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.130	45.648	45.648	9.130	45.648	45.648
2	1.853	9.267	54.916	1.853	9.267	54.916
3	1.313	6.565	61.480	1.313	6.565	61.480
4	1.173	5.863	67.343	1.173	5.863	67.343
5	1.025	5.125	72.469	1.025	5.125	72.469
6	.880	4.399	76.868			
7	.823	4.117	80.985			
8	.724	3.622	84.607			
9	.547	2.733	87.340			
10	.512	2.561	89.900			
11	.366	1.831	91.731			
12	.349	1.743	93.474			
13	.298	1.492	94.966			
14	.218	1.091	96.057			
15	.188	.939	96.997			
16	.170	.850	97.847			
17	.137	.687	98.534			
18	.128	.641	99.175			
19	.101	.506	99.682			
20	.064	.318	100.000			

Table 6 shows the eigenvalues and total variance explained. The type of factor analysis extraction method used in this study was principal component analysis. Before extraction, the data set contained twenty linear components. After extraction and rotation, the data set comprises five distinct linear components with eigenvalues greater than one. The five recovered components explained 72.469% of the variation. It is recommended that the retained components explain at least 50% of the overall variation. According to the eigen value greater than one criterion, the number of elements examined by customers in evaluating the quality of service provided by the restaurant cannot exceed five.

To be more certain about the number of factors to consider, a plot of Eigen value against their corresponding components is plotted in a scree plot shown in the figure 5 below

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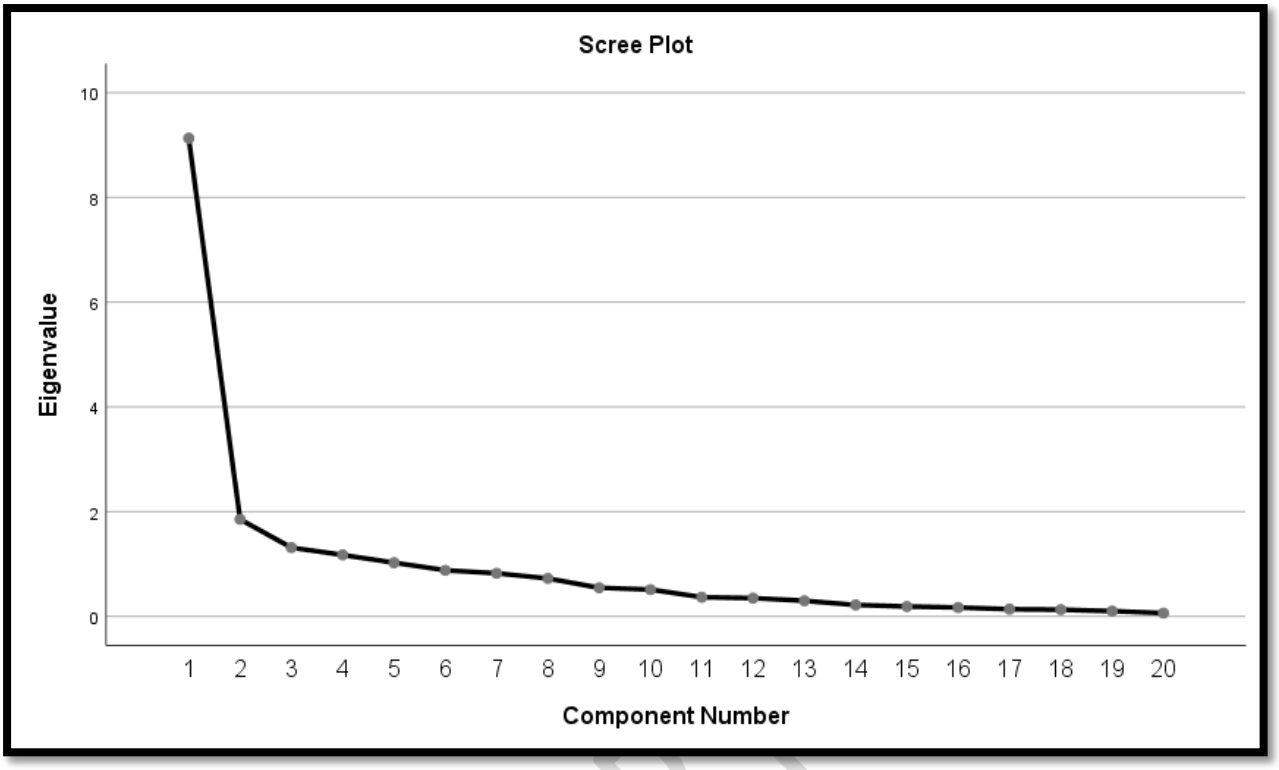

Figure 5: Scree plot of eigenvalues

From Figure 5, it appears that considering five factors will be appropriate. This is because the elbow point of the scree plot shows six points which confirmed the Eigen value greater one factors.

A rotational component matrix was developed using Equamax and the Kaiser Normalization approach in order to arrive at a final factor solution that would adequately explain the correlations between the initial variables. This is specified in the Table 7

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Table 7: Rotational component matrix

Variables	Components				
	1	2	3	4	5
The menu has a good variety of items	.214	.180	.227	**.823**	.164
The quality of the food is excellent	.220	**.628**	.093	.351	.126
The food is tasty and rich in flavour	.288	**.574**	.084	.544	.001
The food meets the price value	.357	**.769**	.082	.242	.098
The service is excellent	.140	**.560**	.168	.472	.071
The quality of beverage is excellent	.258	**.808**	-.030	.032	.075
I easily found a seat	.045	.150	-.018	.164	.918
Employees are friendly and courteous	-.100	**.713**	.362	-.057	.098
The restaurant is very clean	.496	.437	.234	-.363	.410
My food order was correct and complete	.155	.492	.405	.280	.279
Waiters are available when I need him/her	.427	**.659**	.232	.096	.103
Waitresses were able to answer my questions about food and beverage	.235	.270	**.805**	.145	.017
I did not wait too long for waitress to take my order	**.619**	.498	.081	.124	-.292
My order was served in reasonable time	.542	.055	.061	.178	-.061
The atmosphere of restaurant is excellent	**.821**	.122	.314	.156	-.001
I will patronize this restaurant frequently in future	**.783**	.122	-.090	.306	.128
I am satisfied with the services provided at this restaurant	**.687**	.292	.315	.083	.350
I will say positive things about the restaurant to other people	**.**597	.289	.304	.111	.087
I see myself as a loyal customer to this restaurant	**.659**	.446	.209	.006	-.021

From the table 7, it can be seen that the first component has high loadings on five variables and may be considered as the 'Atmosphere in Restaurant. The loading cutoff point for the purposes of this study is 0.60. The second component also has high loadings on the three variables and may be considered as 'Quality of food'. The other three components have high loading on only one variable and cannot be classified. Despite the initial index of five factors only two factors have emerge from the factor analysis and these factors can be classified as ' Atmosphere in restaurant and Quality of food.

5. Conclusions and recommendations

An assessment of customer satisfaction at the restaurant found that the majority of customers were satisfied with the level of service they received. This suggests that the restaurant is doing well in meeting customer expectations in terms of service quality. However, the restaurant should continue to monitor customer satisfaction levels and make improvements where necessary to maintain high levels of customer satisfaction. The findings on the waiting period to be served showed that the average waiting period is within an acceptable range. This indicates that the restaurant is doing well in managing its resources and providing efficient service to its customers. Nevertheless, the restaurant should continue to manage the waiting time to ensure that it remains within acceptable limits and do not negatively impact customer satisfaction.

The ranking of the quality of service provided by the restaurant shows that the restaurant consistently provides high-quality service. This is a positive finding that suggests that the restaurant is meeting or exceeding customer expectations in terms of service quality. The restaurant should continue to maintain and improve its service quality to ensure that it remains competitive and meets customer needs. The investigation of major factors considered by

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customers in evaluating service quality indicates that friendly and attentive staff, timely service, and food quality are among the most important factors considered by customers. This highlights the importance of these factors in ensuring customer satisfaction and loyalty. The restaurant should continue to focus on these factors, in order to ensure that its service quality remains high and that it meets the needs of its customers.

Overall, the findings suggest that the restaurant is doing well in meeting customer needs and expectations in terms of service quality. However, the restaurant should continue to keep an eye on customer satisfaction levels, manage waiting times, maintain and improve service quality, and focus on important factors such as staff friendliness, timely service, and food quality to ensure continued success and customer loyalty.

Contrary to the initial perception that there must be a problem that is yielding to the low patronage at the KsTU restaurant, the results have shown otherwise that customers are pleased with the services being provided at the Kumasi Technical University restaurant. In view of this we recommend further research to look at the surrounding competitors to find out what they are doing that is attracting most of the staff and students of the university.

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