

A Study on Mathematical Statistics to Evaluate Relationship between Attributes

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I. Introduction

The **goodness of fit** of a statistical model describes how well it fits a set of observations. Measures of goodness of fit typically summarize the discrepancy between observed values and the values expected under the model in question. Such measures can be used in statistical hypothesis testing, e.g. to test for normality of residuals, to test whether two samples are drawn from identical distributions (see Kolmogorov–Smirnov test), or whether outcome frequencies follow a specified distribution (see Pearson's chi-squared test).

When an analyst attempts to fit a statistical model to observed data, he or she may wonder how well the model actually reflects the data. How "close" are the observed values to those which would be expected under the fitted model? One statistical test that addresses this issue is the chi-square goodness of fit test. This test is commonly used to test association of variables in two-way tables (see "Two-Way Tables and the Chi-Square Test"), where the assumed model of independence is evaluated against the observed data. In general, the *chi-square test statistic* is of the form.

$$\chi^2 = \sum \frac{(\text{observed} - \text{expected})^2}{\text{expected}}$$

II. Objective Of Research

1. To study the test of goodness of fit to find relation between location and frequency of visit.
2. To study the test of goodness of fit to find relation between location and customer service provided by Future group.
3. To study the test of goodness of fit to find relation between frequency of visit and customer service provided by Future group.

III. Scope

- 1) The researcher has made an attempt to collect data which is representative of central and western part of South Mumbai. This scope of study was taken due to logistical problem and also Mumbai is and miniature of Maharashtra.
- 2) Here after, the researcher will include whether study is restricted to one brand, one company, specific age group etc.
- 3) The scope of this research is to identify the buying behaviour of customers of Central. This research is based on primary data and secondary data. This study only focuses on urban buying behaviour of customers.
- 4) The study does not say anything about rural buying behaviour of customer because rural norms/status/attitude & acceptance of the rural customers differs with urban customers.
- 5) The scope of study was only restricted to only chi square test of goodness of fit.

IV. Hypothesis

Hypothesis 1

H₀-There is no relationship between location & frequency of visit.

H₁-There is a relationship between location & frequency of visit.

Hypothesis 2

H₀ - There is no relationship between location and customer service provided by Central.

H₁ – There is a relationship between location and customer service provided by Central.

Hypothesis 3

H₀ - There is no relationship between frequency of visit and customer service provided by Central.

H₁ – There is a relationship between frequency of visit and customer service provided by Central.

V. Data Collection

Primary Source:

The primary data was collected by means of a survey. Questionnaires were prepared and customers of the Central at two branches were approached to fill up the questionnaires. The questionnaire contains 20 questions which reflect on the type and quality of services provided by the Central to the customers. The response of the customer is recorded on a grade scale of strongly disagree, disagree, uncertain, agree and strongly agree for each question. The filled up information was later analysed to obtain the required interpretation and the findings.

Secondary Source:

In order to have a proper understanding of the customer service of Central a depth study was done from the various sources such as books, magazines; a lot of data is also collected from the official websites of the Central and the articles from various search engines like Google, yahoo search and answers.com. the concept of test of goodness of fit was also referred from reference books.

VI. Research Instrument

To collect the appropriate data the researcher has used the questionnaire as the research instrument. The questionnaire so formed includes both open ended and close ended questions. Close ended questions were used so that appropriate statistics could be calculated. Open ended questions were used to find out the reviews of the respondents so that a proper recommendation could be made by the researcher.

VII. Research Design

The research design is exploratory as well as descriptive when it comes to evaluating customer perception of customer service of the Central. Descriptive research answers the questions who, what, where, when and how.

VIII. Sampling Plan / Sampling Technique

8.1 Sampling Plan

Since it is not possible to study whole universe, it becomes necessary to take sample from the universe to know about its characteristics.

Contact Method: Personal Interview.

8.2 Sample Size

The survey was conducted in the city of Mumbai with two branches of Central, with 100 customers as respondent.

IX. Testing Of Hypothesis

The researcher has made an attempt to test the hypothesis using chi square test.

X. Research Limitations

- The study was restricted to test of goodness of fit only for chi- square test of independence
- The study is only for the Central confined to a particular location and a very small sample of respondents. Hence the findings cannot be treated as representative of the entire retail industry.
- Respondents may give biased answers for the required data. Some of the respondents did not like to respond.
- Respondents tried to escape some statements by simply answering “neither agree nor disagree” to most of the statements. This was one of the most important limitations faced, as it was difficult to analyse and come at a right conclusion.
- In our study we have included 100 customers because of time limit.

XI. Data Analysis

Hypothesis 1:

H₀-There is no relationship between location & frequency of visit.

H₁-There is a relationship between location & frequency of visit.

Table 1: observed values

Frequency of visit	Location		
	Yes	No	Total
Twice a week	6	5	11
During special offers	12	13	25
Once a week	7	2	9
Whenever need arises	41	14	55
Total	66	34	100

Source: Survey

Table 2: Expected values:

Frequency of visit	Location	
	Yes	No
Twice a week	$11/100 \times 66 = 7.26$	$11/100 \times 34 = 3.74$
During special offers	$25/100 \times 66 = 16.5$	$25/100 \times 34 = 8.5$
Once a week	$9/100 \times 66 = 5.94$	$9/100 \times 34 = 3.06$
Whenever need arises	$55/100 \times 66 = 36.3$	$55/100 \times 34 = 18.7$

$$\chi^2 = \sum \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$$

$$= \{[6-7.26]^2/7.26\} + \{[5-3.74]^2/3.74\} + \{[12-16.5]^2/16.5\} + \{[13-8.5]^2/8.5\} + \{[7-5.94]^2/5.94\} + \{[2-3.06]^2/3.06\} + \{[41-36.3]^2/36.3\} + \{[14-18.7]^2/18.7\}$$

$$= 0.22 + 0.42 + 1.23 + 3.56 + 1.46 + 0.37 + 0.61 + 1.18$$

$\chi_{cal} = 9.05$

D.F. = (rows-1) (columns-1)
 = 3 x 1
 = 3

$\chi^2_{critical}$ at 5% level of significance and 3 degree of freedom = 7.816

$\chi_{cal} > \chi^2_{critical}$

Therefore reject H_0 .

Therefore, there is a relationship between location and frequency of visit.

Hypothesis 2:

H_0 - There is no relationship between location and customer service provided by Central.

H_1 - There is a relationship between location and customer service provided by Central.

Table 3 Observed values:

Customer service provided	Location		
	Yes	No	Total
Strongly disagree	5	3	8
Disagree	11	5	16
Neither disagreeNor agree	25	15	40
Agree	21	9	30
Strongly Agree	4	2	6
Total	66	34	100

Source: Survey

Table 4: Expected values

Customer service provided	Location	
	Yes	No
Strongly disagree	$8/100 \times 66 = 5.28$	$8/100 \times 34 = 2.72$
Disagree	$16/100 \times 66 = 10.56$	$16/100 \times 34 = 5.44$
Neither disagreeNor agree	$40/100 \times 66 = 26.4$	$40/100 \times 34 = 13.6$
Agree	$30/100 \times 66 = 19.8$	$30/100 \times 34 = 10.2$
Strongly Agree	$6/100 \times 66 = 3.96$	$6/100 \times 34 = 2.04$

$$\chi^2 = \sum \frac{(\text{Observed}-\text{Expected})^2}{\text{Expected}}$$

$$= \{[5-5.28]^2/5.28\} + \{[11-10.56]^2/10.56\} + \{[25-26.4]^2/26.4\} + \{[21-19.8]^2/19.8\} + \{[4-3.96]^2/3.96\} + \{[3-2.72]^2/2.72\} + \{[5-5.44]^2/5.44\} + \{[15-13.6]^2/13.6\} + \{[9-10.2]^2/10.2\} + \{[2-2.04]^2/2.04\}$$

$\chi^2_{\text{cal}} = 0.72$
 D.F. = (rows-1) (columns-1)
 = 4 x 1
 = 4

χ^2_{critical} at 5% level of significance and 3 degree of freedom = 9.49

$\chi^2_{\text{cal}} < \chi^2_{\text{critical}}$
Therefore reject H₁.

Therefore, there is no relationship between location and customer service provided by Central.

Hypothesis 3:

H₀ - There is no relationship between frequency of visit and customer service provided by Central.

H₁ – There is a relationship between frequency of visit and customer service provided by Central.

Table 5: Observed values

Customer service provided	Frequency of visit				Total
	Excellent	Good	Average	Fair	
Twice a week	3	2	3	2	12
During special offers	3	12	7	2	24
Once a week	1	2	6	0	9
Whenever the need arises	4	26	19	6	55
Total	11	44	35	10	100

Source: Survey

Table 6: Expected values

Customer service provided	Frequency of visit			
	Excellent	Good	Average	Fair
Twice a week	12/100x11=1.32	12/100x44=5.28	12/100x35=4.2	12/100x10=1.2
During special offers	24/100x11=2.64	24/100x44=10.56	24/100x35=8.4	24/100x10=2.4
Once a week	9/100x11=0.99	9/100x44=3.96	9/100x35=3.15	9/100x10=0.9
Whenever the need arises	55/100x11=6.05	55/100x44=24.2	55/100x35=19.25	55/100x10=5.5

$$\chi^2 = \sum \frac{(\text{Observed}-\text{Expected})^2}{\text{Expected}}$$

$$= \{[3-1.32]^2/1.32\} + \{[3-2.64]^2/2.64\} + \{[1-0.99]^2/0.99\} + \{[4-6.05]^2/6.05\} + \{[2-5.28]^2/5.28\} + \{[12-10.56]^2/10.56\} + \{[2-3.96]^2/3.96\} + \{[26-24.2]^2/24.2\} + \{[3-4.2]^2/4.2\} + \{[7-8.4]^2/8.4\} + \{[6-3.15]^2/3.15\} + \{[35-19.25]^2/19.25\} + \{[2-1.2]^2/1.2\} + \{[2-2.4]^2/2.4\} + \{[0-0.9]^2/0.9\} + \{[6-5.5]^2/5.5\}$$

$\chi^2_{\text{cal}} = 22.98$
 D.F. = (rows-1) (columns-1)
 = 3 x 3
 = 9

χ^2_{critical} at 5% level of significance and 9 degree of freedom = 16.92

$\chi^2_{\text{cal}} > \chi^2_{\text{critical}}$
Therefore reject H₀.

Therefore, there is a relationship between frequency of visit and customer service provided by Central.

XII. Findings Of The Report

- Central is undoubtedly number one retailer in India. It has built very emotional & cordial relationship with its customers.
- They are also intending to build long term relationship with all its stakeholders which are very essential for successful business venture.
- In order to attract customer they should provide good parking facility

- Cleanliness and hygienic environment is also the major concern for Central. Management needs to be focus on it.
- Store layout should also be developed in an efficient manner so that customer can get things easily.
- According to research I found that most of the people were affected & attracted with offers and schemes. So, Central should employ those people who are well trained to provide information to customer regarding new things to enhance its customer services.
- Consumer chooses malls to shop because they all want variety and brands. According to customers it is economical as compared to other places.
- We can also say that location, variety conveniences and economical products are not the only thing which attracts the customer but good customer service is one of the crucial factors that attract customers.

XIII. Conclusion

- As most of the retail industries did market research before entering into market. Same thing was done by Central. Location, market, consumer perception analysis was done by Central.
- In one year, much more diversification was done in it. And to retain customers they use many loyalty programs & IT techniques.
- Central, a part of future group is a hypermarket offering a huge array of goods of good quality for all at affordable prices. Central with over 214 outlets in different part of India is present in both the metro cities as well as in small towns.
- Central can attract more customers by different variety and assortments.
- They can improve customer satisfaction by providing home delivery services.
- We can conclude that Central has one of the major retail industries in India.
- Working environment is good and also the various facilities are provided to increase the customer services.
- There exist a healthy & strong relationship between employees and managers.
- The employees accept their responsibility wholeheartedly and perform the services in well manner that satisfied the customers.

XIV. Recommendations

- Advertising is the basic and most prominent tool to increase the awareness of product. So, Central should use this tool to increase their share in the market.
- Retail business is successful only when they have a good customer services. Customer loyalty can only be gain by providing good or satisfied services to the customers.
- Most respondents take on the spot decision of buying different products because of the various attractive products displays. So pretty combination with good services should be done to retain customers.
- Quality plays a major role because most respondent said that they want a quality product and that's also the one of the reason for most of the respondents sticking to particular brand.
- Customers are very price conscious they are having many options in the market. The following steps should opt :-
- Should follow more of high low pricing rather than everyday low pricing
- Should go for a weekly coupon system as it holds more of the loyal customers.
- Should provide good customer services so that customer likes to visit again.
- There should be a proper assortment of various product categories.
- Proper training should be provided to the customer so that they can deal with customer efficiently
- Various offers can be provided to them to attract new customers.
- Quality in product should be reached up to mark.

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