Application of Chi-Square Test to Determine Architectural Impact on Church Patronage

Dr. J. A. OLANUSI, SAMUEL S. A.
Department of Architecture, Joseph Ayo Babalola University Keji Arakeji Osun State Nigeria.

DOI: https://dx.doi.org/10.47772/IJRISS.2023.7646

Received: 07 May 2023; Revised: 01 June; Accepted: 05 June 2023; Published: 02 July 2023

ABSTRACT

This paper provides a crucial analysis of chi square test. The concept of chi square test as well as the various and varying scales of disparity in chi square test availability are discussed. The Chi-square is the most commonly used significance test for categorical variables in the social sciences as well as architecture The tool has been employed as a means of assessing the relationship between two categorical variables as tabulated against each other in a contingency table. The test compares the actual values in the cells of the table with those that would be expected under conditions of independence (i.e., if there was no relationship between the variables being considered). Expected values are calculated for each cell by cross-multiplying the row and column proportions for that cell and taking as a share of the total number of cases considered. The chi square tool has been used to ascertain whether or not relationship exist between architecture and church patronage. The result is in the affirmative indicating that the reason for observed growth could be a combination of the spiritual as well as the physical aesthetic evocation of the church buildings and its environment. Therefore recommends professional architectural design for church patronage and growth.

Keywords: Christianity, Church Worshippers, frequency, hypothesis, Pentecostalism, significant difference, test of independence, variables.

INTRODUCTION

According to Kothari (2009). Chi square is a non-parametric test of statistical significance for bivariate tabular analysis (also known as cross breaks). Any appropriately performed test of statistical significance impacts the degree of confidence in accepting or rejecting a hypothesis. Typically, the hypothesis tested with chi square is whether or not two different samples (of people, texts, whatever) are different enough in some characteristic or aspect of their behaviour that can be generalised from samples that the populations from which they are drawn are also different in behaviour or characteristics. A non-parametric test, like chi square, is a rough estimate of confidence; it accepts weaker, less accurate data as input than parametric tests (like t-tests and analysis of variance, for example) and therefore has less status in the pantheon of statistical tests. Nonetheless, its limitations are also its strengths; because chi square is more 'forgiving' in the data it will accept, it can be used in a wide variety of research contexts. Chi-Square is the most commonly used significance test for categorical variables in the social sciences. It was developed by Karl Pearson around 1900 as a means of assessing the relationship between two categorical variables as tabulated against each other in a contingency table. The test compares the actual values in the cells of the table with those that would be expected under conditions of independence (i.e., if there was no relationship between the variables being considered).

The chi-square test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories. Questions for resolution are; do the numbers of individuals or objects that fall in each category differ significantly from the number expected? Is this difference between the expected and observed due to sampling error, or is it a *real* difference? It is

commonly used to compare observed data with data expected to be obtained according to a specific hypothesis.

Sanders(2009) stated that the chi-squared distribution (also chi-square or $?^2$-distribution) with *k* degrees of freedom is the distribution of a sum of the squares of *k* independent standard normal random variables. It is one of the most widely used probability distributions in inferential statistics, e.g., in hypothesis testing or in construction of confidence intervals When there is a need to contrast it with the noncentral chi-squared distribution, this distribution is sometimes called the central chi-squared distribution.

The chi-squared distribution is used in the common chi-squared tests for goodness of fit of an observed distribution to a theoretical one, the independence of two criteria of classification of qualitative data, and in confidence interval estimation for a population standard deviation of a normal distribution from a sample standard deviation. Many other statistical tests also use this distribution, like Friedman's analysis of variance by ranks.

The chi-square distribution results from the sums of square normal variables, and is a special case of the gamma distribution. There are numerous chi-square distributions, such as the non-central chi-square distribution, chi distribution and non-central chi distribution. However, the most common is the central chi-square distribution, used in assessing patronage and church growth which is what this discussion focuses on. The chi-square distribution allows only non-negative numbers and is positively (right) skewed. The curve is specified by the degrees of freedom (df) which is the number of unconstrained variables whose squares are being summed and must be positive. As the degrees of freedom get larger, the chi-square distribution approaches the normal distribution. The mean of the curve is the degrees of freedom, and the standard deviation is calculated as the square root of 2*df. The peak of the curve occurs at df-1.

The most well-known applications of the chi-square distribution are the chi-square goodness-of-fit test to compare an observed distribution to a theoretical one and testing independence between two categorical variables (Pearson's chi-square test). However, many other tests also use the chi-square distribution. It is also an integral part of the F distribution, whose test statistic is the ratio of two chi-square distributions.

The chi square has established features that are unique and made applicable in this study which is that categorical data may be displayed in contingency tables and compares the observed count in each table cell to the count which would be expected under the assumption of no association between the row and column classifications. It may be used to test the hypothesis of no association between two or more groups, populations, or criteria, while observed counts are compared to expected counts. The chi-squared statistic provides a test of the association between two or more groups, populations, or criteria. In the case of Statistic dependences, the calculations use expected and observed counts or frequencies, not proportions. While the ?2short-cut formula applies only to 2×2 tables. Probabilities are available from tables and computing packages.

STATEMENT OF THE PROBLEM

The approximation to the chi-squared distribution breaks down if expected frequencies are too low. It will normally be acceptable so long as no more than 20% of the events have expected frequencies below 5. Where there is only 1 degree of freedom, the approximation is not reliable if expected frequencies are below 10. In this case, a better approximation can be obtained by reducing the absolute value of each difference between observed and expected frequencies by 0.5 before squaring; this is called Yates's correction for continuity.

In cases where the expected value, E, is found to be small (indicating either a small underlying population probability, or a small number of observations), the normal approximation of the multinomial distribution can fail, and in such cases it is found to be more appropriate to use the G-test, a likelihood ratio-based test

statistic. Where the total sample size is small, it is necessary to use an appropriate exact test, typically either the binomial test or (for contingency tables) Fisher's exact test; but note that this test assumes fixed and known marginal totals

Research Questions

The chi-square test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories. It is commonly used to compare observed data with data expected to be obtained according to a specific hypothesis. However, there are pertinent questions to be resolved before the application or test of hypothesis such as: do the numbers of individuals or objects that fall in each category differ significantly from the number expected? and is this difference between the expected and observed due to sampling error, or is it a *real* difference?

Aim

The aim of this study is the application of the chi-square test analysis such that the use of this method is understood for data analysis and to apply it in the determination of significance difference between expected and observed frequencies in one or more categories.

Objective

To highlight the relationship or the independence of church growth due to architecture and to employ the use of chi square as a non-parametric test of independence by

1. Determining if categorical data shows dependence or the two classifications are independent
2. testing the significance of population variance with a specific degree of freedom

Hypothesis:

Ho: Architectural influenced worshippers are not independent

Ha: Architectural influenced worshippers are independent

Justification

Studies have shown that the chi-square test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories. There is the need to know whether the numbers of individuals or objects that fall in each category differ significantly from the number one would expect. Is this difference between the expected and observed due to sampling error, or is it a *real* difference? The knowledge from these is made applicable to various subject areas including architecture.

Architecture is basically channeled towards satisfying the needs and aspirations of the people, through functionality, aesthetics and use of materials. Madaline (2005) observed that in today's economy Creative and new media industries are growing in number and playing increasingly prominent economic and social roles The market value of products is increasingly determined by a product's uniqueness, performance, and aesthetic appeal, making creativity a critical competitive advantage to a wide array of industries

This paper seeks to ascertain if the architectural designs of Pentecostal churches in Lagos state affect their congregational patronage through the use of chi square test while the focus is to explain whether or not two attributes are associated. The scope covers the non-parametric test of independence of chi square and seeks to ascertain the relationship between architecture and church patronage

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue VI June 2023

LITERATURE REVIEW

Wilson and; Hilferty, (1931) stated that the chi-square independence test is used to find out whether there is an association between a row variable and column variable in a contingency table constructed from sample data. The null hypothesis is that the variables are not associated: in other words, they are independent. The alternative hypothesis is that the variables are associated, or dependent. In probability theory and statistics, the chi-squared distribution (also chi-square or *?*²-distribution) with *k* degrees of freedom is the distribution of a sum of the squares of *k* independent standard normal random variables. It is one of the most widely used probability distributions in inferential statistics, e.g., in hypothesis testing or in construction of confidence intervals When there is a need to contrast it with the non-central chi-squared distribution, this distribution is sometimes called the central chi-squared distribution.

The chi-squared distribution is used in the common chi-squared tests for goodness of fit of an observed distribution to a theoretical one, the independence of two criteria of classification of qualitative data, and in confidence interval estimation for a population standard deviation of a normal distribution from a sample standard deviation. Many other statistical tests also use this distribution, like Friedman's analysis of variance by ranks. If Z_1, …, Z_k are independent, standard normal random variables, then the sum of their squares,

$$Q = \sum_{i=1}^{k} Z_i^2,$$

is distributed according to the **chi-squared distribution** with *k* degrees of freedom. This is usually denoted as

$$Q \sim \chi^2(k) \text{ or } Q \sim \chi_k^2.$$

The chi-squared distribution has one parameter: *k* — a positive integer that specifies the number of degrees of freedom (i.e. the number of Z_i's)

10.1 Characteristics

Probability density function

The probability density function (pdf) of the chi-squared distribution is

$$f(x;k) = \begin{cases} \frac{x^{(k/2)-1}e^{-x/2}}{2^{k/2}\Gamma\left(\frac{k}{2}\right)}, & x \geq 0; \\ 0, & \text{otherwise.} \end{cases}$$

Where ? (*k*/2) denotes the Gamma function, which has closed-form values for integer *k*.

For derivations of the pdf in the cases of one, two and k degrees of freedom, see Proofs related to chi-squared distribution

noncentral chi-squared distribution	$\sum_{i=1}^{k}\left(\frac{X_i}{\sigma_i}\right)^2$
chi distribution	$\sqrt{\sum_{i=1}^{k}\left(\frac{X_i-\mu_i}{\sigma_i}\right)}$
noncentral chi distribution	$\sqrt{\sum_{i=1}^{k}\left(\frac{X_i}{\sigma_i}\right)^2}$

The Use of Chi Square and its Probability

Sanders (2009) explained that chi-square distribution results from the sums of square normal variables, and is a special case of the gamma distribution. There are numerous chi-square distributions, such as the non-central chi-square distribution, chi distribution and non-central chi distribution. However, the most common is the central chi-square distribution, which is what this discussion focuses on. The chi-square distribution allows only non-negative numbers and is positively (right) skewed. The curve is specified by the degrees of freedom (df) which is the number of unconstrained variables whose squares are being summed and must be positive. As the degrees of freedom get larger, the chi-square distribution approaches the normal distribution. The mean of the curve is the degrees of freedom, and the standard deviation is calculated as the square root of 2*df. The peak of the curve occurs at df-1.

The most well-known applications of the chi-square distribution are the chi-square goodness-of-fit test to compare an observed distribution to a theoretical one and testing independence between two categorical variables (Pearson's chi-square test). However, many other tests also use the chi-square distribution. It is also an integral part of the F distribution, whose test statistic is the ratio of two chi-square distributions.

Chi Square for Large Degrees of Freedom

Calculations of probability associated with Chi square, using the standard algorithm as described by Press et.al involved convoluted algorithms and use of large numbers. Depending on the computer, calculations for probability of Chi square becomes impossible at degrees of freedom between 150 and 300. The program either crashes, or a maximum Chi square value is presented regardless of further changes in probability or degrees of freedom. *For example:* The critical Chi square value for 1 degree of freedom and probability of is 3.84, 2 degrees of freedom and p=0.05 is 5.99.

The Chi-Square Test for Independence

Assumptions are that the data are randomly selected and each population is at least 10 times larger as its respective sample. Also, all expected frequencies are greater than or equal to 1 (i.e., Ei>1.)No more than 20% of the expected frequencies are less than 5.

Step 1: A claim is made regarding the independence (or dependence) of two variables.

H0: The row variable and column variable are independent.

H1: The row variable and column variable are dependent.

Step 2: Select a significance level, a, and find the **critical value of chi-square.**

Step 3 divide the $(O-E)^2$ value by the corresponding expected frequency for each cell

To get $(O-E)^2/E$

Framework Application/ Study Area

Adesanya, **(**2012) observed that Lagos state is a metropolitan area which originated on islands separated by creeks, such as Lagos Island, fringing the southwest mouth of Lagos Lagoon while protected from the Atlantic Ocean by long sand spits such as Bar Beach, which stretch up to 100 km east and west of the mouth. From the beginning, Lagos has expanded on the mainland west of the lagoon and the conurbation,

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue VI June 2023

including Ikeja and Agege, now reaches more than 40 km north-west of Lagos Island. Some suburbs include Ikorodu, Epe and Badagry, and more local councils have recently been created, bringing the total number of local governments in Lagos to 57.

Lagos being the most populous of all the cosmopolitan cities in Nigeria with predominantly Christians, harbours more church buildings, most of which are Pentecostals.

The first attempt to introduce Christianity to the geographical area later known as Nigeria was in Benin/Warri areas of Niger Delta in the 15th Century. It was carried out by the Catholic Portuguese Missionaries. However, the attempt was a failure because of some factors already clearly stated by some eminent scholars like Ryder, Ade Ajayi, Erivwo, Lamin Sanneh and Peter Clarke.

According to Ade- Ajayi (1965), the C.M.S. was the largest and the most significant in this period. Being part of the established Church and based in London. It had the greatest influence in the British government. They established their mission in Badagry in 1845. and they led the expansion into the Yoruba country. In other words, the C.M.S. (Anglican) played a prominent role in the evangelization of Nigeria. Apart from the Anglican mission, the Methodist, Baptist and Catholic denominations also made their impact felt in Nigeria before the end of the 19thc. However. the contribution of each mission to this common factor was not equal in men, material, and length of service or significance.

The European Christian Missionaries made a second attempt to Christianize Nigeria in the 19th century. The Christianization of the country between the 19th-21st centuries came in two phases. The first phase was led by the Methodist mission in September, 1842 under the leadership of Thomas Birch Freeman who entered Abeokuta through Badagry which became an entreport to Yoruba land. The town of Abeokuta became the "sunrise within the tropics". This development was followed closely by Henry Townsend, a missionary of the Church Missionary Society (Anglican), who equally settled in Abeokuta in December, 1842. The missionaries were given a rousing welcome and hospitality by Sodeke, the traditional ruler of Abeokuta. These earlier missionaries were followed by the Baptist and Roman Catholic in the evangelization of Yoruba land. The Christian Missionaries equally visited the Eastern part of Nigeria almost at the time they visited Yoruba land. The Christian missionary enterprise was delayed in the Northern part of the country because of religious and political factors.

Pentecostalism came into limelight in the twentieth century. This has grown exponentially since its establishment. Africa has been part of this growth and Nigeria takes a major role in this. Since Lagos has the highest population of Christian Pentecostals (2007 list of Pentecostal Churches), it is important to know the particular areas of influence of church architecture to worshipers, and the extent of these influence. The consumer decision process as discovered by Sloan, (2009), is a theory of consumer behaviour. Taking the product in this theory to be the church building, and the consumer as church patronage, while the price stands for the attraction from architectural designs. According to this theory, the consumer recognizes a need, searches for information about products or services that meet that need, evaluates the alternatives, makes a purchase, and evaluates the purchase probably based on functional and aesthetic satisfaction.

Achunike (2004) asserts that "Pentecostals have a very high sense of aesthetics. This is evidenced in the architectural beauty of their churches and their interior decorations." Pentecostalism has succeeded tremendously in influencing the aesthetic set-up of the mainline churches in Nigeria. Ijatuyi and Ajenifujah-abubakar (2014) were of the view that an in-depth study of users' needs, demands, satisfaction and preference by the planners and designers, and a maintenance and management program incorporated into the proposal for the design, redevelopment or renovation of spaces are essential.

In view of these essentialities in aesthetic appreciation, Ukpong (2006) observed that many Christians now pay attention to the beautification of their churches, and many priests and ministers in the mainline churches now pay more attention to their public decorum and posture. The appreciation of church structure and its environment is buttressed further by Wolf (2008), who observed that worshippers and users prefer nearby, attractive buildings and larger open spaces. Increasing public preference and satisfaction of church buildings and its environment depends on the establishing appropriate aesthetically satisfying structure and landscape giving attention to different age groups and their needs. The perception of church worshippers with regards to the environmental aesthetics of a church worship centre can lead to its acceptance or rejection.

Looking at the above influences of pentecostalism on mainline churches, it is obvious that pentecostalism is a force to reckon with in contemporary Christianity. It has created permanent impact on the churches, and the Christian faith and practice cannot be the same after the explosion of Pentecostalism due probably to physical creative aesthetic factors.

Creative and new media industries are growing in number and playing increasingly prominent

economic and social roles; The market value of products (architectural designs) is increasingly determined by a product's uniqueness, performance, and aesthetic appeal, making creativity a critical competitive advantage to a wide array of industries; including the churches.

Definition of Architectural aesthetics

One of the simplest and most effective definitions of architecture is the art and science of buildings. This definition suggests that architecture can be created from either of or both sides of art or science. The Vitruvian principles of architecture are based on three core elements towards satisfying good architecture. These are *firmitas, utilitas and venustas (Greek words in italics)* Tractinsky and Eytam (2012). These Greek words can be translated as *firmitas*– the strength and durability of the building; *utilitas*– the functionality of the building and its suitability for the needs of its intended users; and venustas- the building's beauty. Art and beauty are synonymous and contain the basic ingredients a designer needs in creating pleasant forms. According to Benzu (2010), form and function are the most important factors in the design of buildings and form show buildings aesthetic dimensions. This however does not mean aesthetics cannot be studied from the interiors of a building. The entirety of this study is based on the philosophy behind beauty in other words known as aesthetics-aesthetics in buildings.

Zhang (2009) defines aesthetics as a branch of philosophy associated with art and beauty that is concerned with how individuals perceive objects or make judgments based upon information received as five human sensory inputs and it is also associated with affect or mood and emotional feelings (Jordan, 2001). Zhang claimed that it is this perception and affective/emotional connection that makes aesthetic concerns that much important because it serves as a bridge between a product and the user's emotion and feeling. This study agrees with Jenkins (2012), position of what beauty is; 'beauty is that which arises when qualities like color, form and shape are combined in a way that pleases the aesthetic senses and intellect', which usually means combining and utilizing one or more elements and principles of design. The functionalist and formalist perspectives are still being argued as encompassing when studying aesthetics. However, Hansson's (2008) idea of a dualistic approach is adopted for this study, which supports that for a building's form to be aesthetic, it must have satisfied the function for which it was designed. Shiner (2011), concurs and adds that when building aesthetics is overwhelming, the few mistakes in the buildings function may be overlooked. Weber (1995), affirms that buildings aesthetics can be experienced and judged with little or no knowledge of the functions.

According to Hekkert (2006) the word aesthetics is coined from the Greek word *aesthesis*, which refers to sensory perception and understanding of sensuous knowledge. However, the word was later used

by the German philosopher Baumgarten, to mean gratification of the senses or sensuous delight. Most works of art are produced to delight the senses, especially the visual sense, this makes people refer to the word aesthetics as that which relates to art, especially the visual art. This study is concerned with aesthetics in buildings and within the context of this research; architectural products in the form of buildings are viewedas visual art (like in painting, sculpture and photography), and are assessed based on the features of buildings external facades. However, taking a cue from Plato and Aristotle, the function of art is pleasure and for this reason every work of art was created (Jenkins, 2013). Aristotle argues further that the pleasure arrived at from a work of art is directly proportional to the aesthetic value of the art. Therefore, beyond visual stimulation and evaluation, the emotions of viewers must also be evoked in a positive notion (Quigley 1996, Broudly 2002), for this is the essence of architecture as art.

Aesthetics in Buildings

Goldman, (2001) posits that applying aesthetics to buildings and related architectural structures is a complex phenomenon, and aesthetics in buildings can be studied from either of two vital factors. These are extrinsic and intrinsic factors to visual design. Extrinsic factors comprise structural integrity, cost, the nature of building materials, and functional utility of the building. While the intrinsic factors are elements of visual interest that are perceptible and can be evaluated in buildings. However, Sanoff (1991), opines that buildings have certain qualities that give them a high probability of evoking a strong image in any given observer. Characteristics like shape, color, or arrangement enable the making of vividly identified mental images of the environment. Buildings are also objects with features that can transmit nonverbal messages and can be subjected to visual experience of an observer for aesthetic judgment. Buildings can be judged based on their physical features especially along how pure the lines are, color, texture, form and size. Benzu (2010) suggests that the philosophy of aesthetics can be easily learned by designers when the elements and principles of design are followed. In Broudly's (2002) aesthetic concept model, when sensory factors (line, color, texture, shape/form and light/shade) and formal factors (unity, symmetry, proportion, scale, balance and rythm) are well combined alongside the technical skill of the designer, expressive aesthetics (that borders around moods, emotions, affects) of observers come alive.

Global Architecture & Indigenous Influences

The civilisation, medieval and renaissance era birthed new forms and even more magnificent styles of architecture through Europe. The architecture of the Greek, Roman and Byzantine empires had similar techniques yet different styles with elements such as long rows of large columns, vaults and orders, domes as coverings, artistic paintings, ornaments and mosaic tile finishes revealed the political and religious supremacy of that era. The master builders of that period designed buildings and constructed structures with strong Islamic, Christian (Gothic) and Buddhist cultural influences. In later years, these influences became predominant with public buildings in different regions around the world. Other styles of architecture such as the Persian, Indian and Japanese architecture are also dis-tinctive styles developed from Arab and Asian building cultures whose building elements and techniques have been preserved for centuries and are important elements of today's global architectural landscape.

In Africa, like other aspects of its culture, the architecture is exceptionally diverse and most ethno linguistic groups had their own architectural traditions. Egyptian architecture (Nubian – one of the most ancient in the world), Sahelian, Ethio-pian and Ashanti are few examples of distinctive architectural styles with strong cultural influences. Like most architectural traditions elsewhere, African architecture reflects numerous external influences. Traditional, Islamic Christian and Colonial influences shaped building forms in different regions and form important parts of the African architectural landscape. Today, African cities such as Timbuktu and Djenne (Mali) are World Heritage Sites and the uniqueness of the preserved architecture of these cities draws thou-sands of visitors to the regions and could be compared to the drawing of worshippers to Pentecostal churches.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue VI June 2023

RESEARCH METHODOLOGY

The information is as contained in architectural design and congregational patronage in Nigerian churches and used here by permission, data was collected from primary sources through field survey carried out on A stratified sampling technique with existing text books, periodicals, journals, internet search engine i.e., e - libraries, were consulted for this study structured questionnaires.

Research Design

Information as primary data by Adesanya (2012) was used as secondary source of data analysed by the use of chi square.

Research Population

According to the primary author 1000 questionnaires were distributed randomly to five Pentecostal churches in Lagos metropolis which formed the basic input for this analysis

Sampling Technique

The questionnaires were administered individually and in confidence through e= mail and personal contact with a yes and no answer

DISCUSSIONS

The following hypothesis need to be restated in order to demonstrate the use of chi square as a non-parametric test capable of showing whether or not relationship exist between two attributes in this case architecture and church patronage. Testing the null hypothesis as stated that Architectural influenced worshippers are independent. Its alternate which is contrary that Architectural influenced worshippers are not independent, determines the significance or otherwise of church membership attraction to the nature of architectural design and environment using chi square test of independence as shown in Table 1.0 while the rate or frequency of occurrence is indicated in Table 2.0

Table 1.0 Classification of Worshippers

Category of worshippers	**1-2 years membership**	**2-4 years membership**	**4-6 years membership and above**	TOTAL
Architectural influenced worshippers	200 (180)	150 (180)	50 (40)	**400**
Non-Architectural influenced worshippers	250 (270)	300 (270)	50 (60)	**600**
Total	**450**	**450**	**100**	**1000**

Source: field survey Adesanya (2012)

Expected frequency for the above classification are as follows

Expected frequency = row total for the row of that cell x column total for the column of the cell

Grand total

FR = Fr x Fc/N

For architectural influenced members (category A)

Years 1-2 400 X 450/1000 = 180

Years 2-4 400 X 450/1000 = 180

Years 4-6 400 X 100/1000 = 40

For non architectural influenced members (category B)

Years 1-2 600 X 450/ 1000 = 270

Years 2-4 600 X 450 /1000 = 270

Years 2-4 600 X 100/1000 = 60

Hence the expected frequency values are **180, 180, 40, 270, 270, 60**

To obtain the chi square value we apply the formula as follows

$$X^2 = (O-E)^2/E$$

Table 2.0 Frequency Table

Category	**OBSERVED FREQUENCY**	**EXPECTED FREQUENCY**	**(O-E)**	$\frac{(O-E)^2}{E}$
For architectural influenced members **(GROUPS A)**	200	180	20	2.22
	150	180	-30	5.00
	50	40	10	2.50
For architectural influenced members **(GROUPS B)**	250	270	-20	1.48
	300	270	30	3.33
	50	60	-10	1.66

Source: computational analysis by research group (2013)

Hence the $X^2 = 16.2$

Degree of Freedom

DF =(C-1) (R-1) OR (3-1) (2-1) =2

The table value of X^2 **for** 2 levels of freedom at 5 percent level of significance is 5.991. The calculated value of chi square is much higher than this table value which means that the calculatedvalue. cannot be said to have arisen just because of chance. It is significant hence we reject the null hypothesis and accept the alternate hypothesis which means that there is a relationship between attraction of

membership to beautiful architectural design and its environment. Bankole (2002), noted that the purposes for tourists visiting particular recreational locations such as the United Arab Emirate or Paris in France were mainly sightseeing, accounting for 45% of household demand for tourism followed by visits for leisure.

RECOMMENDATION

The chi square test is no doubt the most frequently used test, but its correct application is

equally an uphill task. Every user must be careful while applying the test and must be familiar with the rationale of this important test before using it and drawing inferences in respect of the applicable hypothesis. It should be borne in mind that the test is to be applied only when the individual observations of sample are independent which means that the occurrence of one individual observation (event) has no effect upon the occurrence of any other observation (event) in the sample under consideration. Its application could be extended to the determination of hypothetical theories and researches for conclusive results with a high levels accuracy such as is being applied to determine church growth and patronage.

There is a growing awareness of the economic importance of architecture in Nigeria especially in the economic sector of banking but there is need to find out the influence of architecture in the religious space of worship to enhance a possible influence of architecture on the growth of the church using chi square as a veritable statistical assessment tool.

CONCLUSION

This study discussed the chi square as a statistical tool and examined the condition under which it is applicable. It employed the use of secondary data on one thousand worshippers which were randomly selected in Lagos state of Nigeria to determine their influence of worship as regards architectural environment. It reveals the significance of the attraction of worshippers to the architecturally designed place of worship through the use of chi square test of independence. The study revealed that there is significant relationship between architecture and church membership growth although several factors are accountable for church patronage and growth but architectural consideration happens to be one of them. The perception of the residents living adjacent to recreational sites established that they experience positive and sometimes negative patronages regardless of the season of the year. Hence there is an emotional attraction between visual aesthetics church patronage and growth as provided by architectural buildings and its open space environment.

REFERENCES

1. Achunike**,** H. The Influence of Pentecostalism on Catholic Priests and Seminarians in Nigeria, Africana First Publishers Limited, Onitsha 2004.
2. Ade- Ajayi, J. F (.1965) Christian Mission in Nigeria 1841-1891 The Making of a New Elite, London: Longman,
3. Benzu (2010). Aesthetic Components of Architecture. Retrieved from http://www.architecture-student.com/aestheticcomponentsofarchitecture.html.
4. Broudly, H.S. (2002). Exploring architecture as an art form: Architecture and Aesthetics. Architeacher. Retrieved from http://www.architeacher.org/aesthetics/archi-elements1c.html
5. Carboro N.C (2007) Regional Technology Strategies (RTS), Creativity in the Natural (assed 5-07-2009) te: Growing Arkansas' RTS, Creative Economy NC http://www.arkansasarts.com/programs/ArkansasCreative.pdf
6. Hansson, S. O. (2009). Aesthetic Functionalism. Accessed from http://www.contempaesthetics.org/newvolume/pages/article.php?articleID=324%20Mon,%2017%20Oct202005%2000:00:00%20-0700. Retrieved on 4th July 2015.

7. Goldman, A. (2001). The Aesthetic. In B. Gaut and D. McIver Lopes (Eds.), The Routledge companion to aesthetics. pp. 181-192. Routledge, London.
8. Hekkert, P. (2006). Design Aesthetics; principles of pleasure in design. Journal of psychology science. 48 (2). 157-172.
9. Hilferty, M.M. (1931) "The distribution of chi-squared". Proceedings of National Academy of Sciences, Washington, 17, 684–688.
10. Kothari, C. R. (2009**)**. Research Methodology- Methods and Techniques (2rd edition, pp. 376- 379 New Delhi. New Age International Publishers.).
11. Jenkins, S. (2012). Understanding aesthetics: Understanding the Importance of Aesthetics in Design. Retrieved from https://www.lynda.com/Design-Techniques-tutorials/Understanding-aesthetics/114323/147035-4.html.
12. Jordan, P., W., & Green, W., S., (2001). Pleasure with Products: Beyond Usability. Taylor ,and Francis, London.
13. Quigley, T. R. (1996). Summary of "The Aesthetic Hypothesis" by Clive Bell. Retrieved from http://timothyquigley.net/vcs/bell-sum.html. Retrieved on 16th November, 2015.
14. Sanders. M.A (2009.) "Characteristic function of the central chi-squared distribution". Retrieved 2009-03-06
15. Sanoff, H. (1991). Visual research methods in design: Van Nostrand Reinhold, New York.
16. Shiner, L. (2011). On aesthetics and function in architecture: The case of the spectacle art museum. The journal of aesthetics and art criticism. 69(1). DOI:10.1111/j.1540-6245.2010.01444.x. Access on 7th April, 2013.
17. Sloan, A. E (2009). Step Right Up: Using Consumer Decision Making Theory to teach Research Process in the Electronic Age. pp131-134 The Pew Forum on Religion and Public Life.http://pewforum.org/surveys/pentecostal/countries,
18. Tractinsky, N. & Eytam, E., (2012). Considering the aesthetics of Ubiquitous displays. Cognitive technologies. Kruger, A., & Kuflik, T., (eds). Ubiquitous Display Environment. DOI 10.1007/978-3- 642-27663-7_6,
19. .Ukpong, D. P, The Phenomenology of Pentecostalism in Nigeria – A Theological and Wilson, Ecclesiological Reflection, Rome 2006.
20. Weber, R., 1995. On the aesthetics of architecture. Aldershot: Avebury.
21. Zhang, P. (2009). Theorizing the relationship between affect and aesthetics in the ICT design and use context. Proceedings of the 2009 International Conference on Information Resources Management, (pp 1-15). Dubai, United Arab Emirates.
22. Zhang, P. & Lin, (2011). Affective Appraisal of Residents and Visual Elements in the Neighbourhood: A case Study in an Establishing Suburban Community. Elsevier, Landscape and Urban Planning, 101, 11-21.