

Entertainment-Centric Statistical Analysis of Indoor and Outdoor Auditoriums in Mall Construction Using Visitors Opinions

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Abstract The incorporation of leisure areas into the design of shopping malls has become more important in today's competitive retail market. Environmental quality in green buildings and traditional structures has been examined in a number of researches. There has been a dearth of research comparing the subjective experiences of shoppers in green as well as non-green shopping malls and there has been a lack of research focusing on structures like shopping malls. The purpose of this research is to identify significant variations in spectator preferences between indoor and outdoor auditorium experiences using the analysis of variance (ANOVA) technique. Additionally, the variables influencing the environmental quality and customer satisfaction of shopping mall buildings were examined. Visitors provide their thoughts on a wide range of factors, including the quality of the seats, the sound, the decor and their overall experience. The ANOVA approach is used to separate out significant differences in patron tastes, providing a detailed image of the elements influencing their leisure time. According to the findings, consumers have a greater environmental tolerance level when they recognize that a building is environmentally friendly and their age and/or length of time spent in the building have a role in their assessments of their happiness with the building's environment. Based on the assumption of energy efficiency, this research offers recommendations for improving the interior and outdoor physical environment, serving as a guide for the development and maintenance of environmentally friendly shopping centers.

Keywords: environmental quality, shopping mall, construction, building air quality, relaxing centre

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1. Introduction

A modern stadium is a multi-use structure used for a variety of cultural, religious and sporting events. Numerous stadiums at present act as the location's representatives and generate enormous amounts of income. A stadium's primary function is to serve as a platform stage and venue to obtain sports. The architecture of a stadium needs to provide the comfort for players and the optimal environment for their performance, making comfort for athlete which is a crucial factor [1]. The research considered an international occurrence; Retailer growth frequently demands the form of shopping malls. The quality of the environments and the atmosphere that these multi-user retail spaces generate have a role in inviting visitors to shopping malls and the profitability of the company has evolved into an essential factor. The quantity of retailing centers and multipurpose areas has altered and increased in the largest cities and towns in recent times. These luxurious retail centers and malls have developed over time into central places that attract

customers and vendors from different cities [2]. The study assesses the acoustics in the shop space, which is essential in the twenty-first century when trying to draw consumers with rich multi-sensory experiences. Significant, modern structures and malls consist of specific architectural elements that need acoustics protection. The purpose of shopping mall construction remains to support a high volume of business activity. Malls include characteristics like plazas, vaults, roofing, museums and excessive overhead areas. The richness and aesthetic appeal of the rooms depend on each of them and these factors have an impact on the acoustics [3].

The fundamental component of the mall encompasses restaurants and relaxing sections for food enterprises. The majority of visitors spend time visiting the food court and the hesitant atmosphere might make individuals exhausted and return to the mall earlier. Designers, marketers and owners are working to develop positions that are as comfortable as possible for each person [4]. The output of navigation routes in buildings can be realized with a combination of indoor positioning, path planning and road network design that is facilitated by indoor navigation systems. Implementing an interior management system for

shopping malls that considers the preferences of the consumers which is more important and deserves to be given the highest priority [5]. The prosperity of the shopping industry has a strong relationship with a pleasant and warm shopping atmosphere. Employees and consumers are impacted by a variety of physical features, including interior layout, illumination, acoustics, thermal comfort and indoor air quality. Essential majority of sounds produced at shopping malls are random and irrelevant; they have an enormous impact on profits [6]. The variety of shopping malls is limited to a neighborhood, community, or regional area. The neighborhood complex is the smallest sort of shopping complex and consists of a grocery store as the primary attraction, accompanied by other types of business catering to day-to-day needs such as a pharmacy, shoe repair shop, laundry and dry cleaning [7]. The research goal is to represent the impressions of visitors to the mall's architecture through analysis of its interior as well as outdoor spaces. Furthermore, describing hygiene includes the interior air quality of a shopping mall and identifies certain key elements.

2. Related Works

The study [8] described that the regional retail center offers a wider range of facilities than the smaller, useful company location. The development concentrated on a minimum of one large department store, specialty retail establishments were common, including numerous restaurants along with a theater. The center of the development was a shopping district and there was a reduction in the provision of services to accommodate the urgent day-to-day demands. The company offered and maintained a number of fifteen thousand, perhaps three thousand and fewer. Larger locations can provide alternatives to accommodation, including healthcare facilities and hotels along with business centers. The study [9] examined that the people in a smart shopping mall are able to make use of innovative technology as an integral component of their traditional in-person of shopping experience. The form of the mall was built as an innovative integration of the real and virtual worlds. The Internet of Things (IoT) was integrated into a smart mall that connects the inside and outside of the buildings and comprised the structure of the mall. Shopping mall management and retailers can use the information that customers transmit to get useful customer insights.

The study [10] considered the nations of multifunctional integrated shopping malls that had expanded to satisfy the increasing need of citizens for varied services and convenient shopping due to the country's rapid economic expansion along with greater urbanization. Typical elements of commercial structures, atriums were used in contemporary workplaces, residences and retail centers. In order to improve accessibility in internal common space, shopping mall atriums were surrounded by the surrounding region. Especially around the cooling and heating seasons, such architectural characteristic was accompanied by sophisticated indoor air organization, which has a direct impact on the comfort of the inhabitants and the quality of the interior environment. The study [11] designed the

traditional retail streets had to be replaced by more contemporary forms of retail spaces called malls. People visit malls for dining, entertainment and socializing, along with shopping. Even in confined areas with open spaces, the utilization of malls leads to high traffic volumes and elevated noise levels. The implication reduced acoustic comfort was due to the noisy atmosphere, particularly for shopping mall people. People felt obligated to communicate louder and get agitated if there was a decline in speech accessibility.

The article [12] suggested the urban environment characterized by concentrated and standardized consumption was reflected in shopping malls. The phenomenon of shopping originated with the exchange system and progressed throughout time to include marketplaces, shops, pathways and stores. As a result of social, economic and technical advancements, retail centers were created. According to the findings of the research [13] explained that lighting can affect the customer's recognition of things, operate, experience and experiences. The atmosphere of shopping malls has a big impact on customers' interests and the amount of time they spend inside. In order to give appropriate development, the products attractiveness was raised and the products' actual value was emphasized. The study [14] explained that consumers were able to travel from one store to another inside the same shopping center due to the layout of enormous shopping centers, which were based on the concept of tiny individual businesses linked by common spaces. It can be designed as a gallery, an atrium, or a ring and it can be situated on a single level. The number of people using the common spots varies throughout the entire day. The people that were observed exhibit highly variable tenancy due to their changing activities and varying preferences for the length of time to stay in one spot.

According to the article [15] explained, the primary considerations while choosing a shopping center are its locations, infrastructure offered, the types of buildings used, the layouts and designs, the accessibility of access to specific retailers inside the malls, costs, as well as business practices. Mall locations and amenities were the two most appealing elements to attract consumers and the aesthetics attract more business than any other elements. The primary incentive for visitors of malls was the infrastructure such as, including vehicle parking. Shopping malls' attraction potential has been determined to be derived from five important characteristics: location, design, company structure, integrated tenancy and management. The study [16] explained to incorporate user interactions such as interface design, reliability, consumer peer-peer interactions, relationship involvement, robotics for entertainment and uses similar to robotics equipment and loyalty of shopping malls with innovative technology in malls through social media platforms. Furthermore, the moderating effects of consumer privacy and the facilitator function of personalization had an effect on the relationship throughout interactions with customers and shopping mall loyalty. The study [17] demonstrated the perceive purchase products environment was influenced by the features that distinguish each store's design, which indirectly influences the overall mall patronage and ambiance. The store environment promotes consumption patterns at the retailer and shopping mall levels, while the

perception of the environment mediates the influence at the shopping mall levels. The mall environment acts as a mediator between the impacts of renovation and consumer patterns. The study [18] considered the number of supermarkets in Malaysia and the surrounding area was increasing. In an effort to attract tourists, this growth has led retail centers to enter a competitive market. Due to the competition with other retail establishments in malls, complex management was spending more money to make a shopping center a more enjoyable place for visitors to purchase goods, attract customers and motivate people to stay longer. The majority of merchants consider the design of shopping malls and the way goods were presented has a significant impact on the way customers, such as the experiences, were essential to journeys.

3. Indoor and Outdoor Environmental Quality of the Shopping Mall

3.1. Indoor Air Quality (IAQ) and Ventilation Systems

In order to make certain that employees as well as customers enjoy a safe and comfortable environment, shopping mall air quality monitoring involves gathering extensive values of a variety of air contaminants and interpreting the data. To reduce people's risk of exposed to secondhand smoke, shopping malls should enforce stringent no-smoking laws on their premises. To prevent the accumulation of dust and allergies, the common spaces of the shopping mall should be cleaned and maintained at regular intervals. This consists of the flooring, carpets and the furnishings. Integrating air quality monitoring devices allows for continual evaluation of the levels of indoor air quality. Monitoring for pollutants such as particulate matter, carbon dioxide, volatile organic compounds (VOCs) and other contaminants can be a part of this process. A sufficient equilibrium between mechanical and natural air is maintained through ventilation. Negative air pressure and cross-ventilation can be made easier by designing with the orientation of the building in a mental state. Mechanical components that breathe at controlled pressures are used in controlled ventilation to regulate air pressure [19].

3.2. Lighting and Acoustic Conditions of the Shopping Mall

The main intention of sound pressure levels is to assess the acoustic environment. The organization depends on human-caused noise as well as natural sounds. In significant environments, people's sound is dominant; numerous techniques appear to predict the noise intensity generated by multiple individuals communicating in the same region. The number of people speaking, the size of the rooms and the corresponding absorption area affect the noise intensity. Thus, it is impractical to regard sound pressure levels as the room's inherent acoustic characteristics. These consist of the room's acoustic characteristics; the reflection duration is one of the elements connected to the comparable absorption area.

The most significant prevalent metric for assessing the noise levels in different places is intensity. The effects of noise throughout mall pulmonary arteries and food courts are covered in a number of materials. People constitute the most frequently visited and most important locations in malls in terms of acoustics due to their elevated noise level as well as occupancy.

Lighting has been regarded as the most attractive category of light due to its distinct characteristics of consistently rotating structures, which are beneficial for its dynamic role in illumination-created places, along with its great effectiveness and the difficulty associated with establishing effective daylighting. The different parties involved in the design and usage of the building tend to use various criteria to determine lighting performance. The lighting in an interior has been planned; it makes the place easier for humans to work and the directional aspects of the light make it easier for occupants to recognize features. The quality of life of people who utilize interior areas in the building can be improved by increasing the amount of natural illumination in such rooms. Increasing the use of daylighting could contribute to the environment by decreasing the energy consumed and the ensuing pollutants [20].

3.3. The Major Component of Shopping Malls

The essential elements of shopping malls are considered and these components include the location of shopping malls, architectural activities, property management, promotional activities, the leasing strategy and tenancy terms. Figure 1 depicts the major component of shopping malls.



Figure 1. Major Components of shopping malls

3.3.1. Location

The business of retail in malls has acknowledged the value of features like food courts, cinemas, anchor stores, anchor shops, and branded stores as some of the draws for customers to visit malls. Shopping complex managers are

nevertheless cognizant of the importance of choosing the ideal site for their businesses. Numerous malls seem to be operating below par, and studies have linked this to a number of issues, consisting of poor location economic analysis, poor site selection, and competition from other retail formats, high product prices, and poor tenancy selections. Malls close to bus stops, metro stations, and places where people may stroll are more appealing to the general population. Shopping malls must thus be located close to transportation hubs and stations for trains. Issues with location include the market region, ease of access, distance between shopping centres, and availability of infrastructure for transportation and communication, and mix of tenants [21].

3.3.2. Architectural Activities

The architecture of contemporary shopping centers seems more relaxed and designers use luxurious materials, a diverse range of tenants and elegant design elements. Elevators, sunlight, store layouts, interior architecture, high ceilings, flooring, carpets and toilets are examples of design features. Each of these attributes influences the customers and has a good effect on the environment. In addition, to provide a pleasant as well as peaceful atmosphere, convenient facilities along with a secure retail space are essential for protecting the environment and attracting visitors [22].

3.3.3. Property Management

The function of a property manager in a retail mall is complex and entails supervising multiple areas to guarantee the efficient operation, maintenance and general health of the establishment. Develop and manage administration, servicing and capital enhancement budgets. Plan incentives as well as discounts attract visitors to improve the entire experience of shopping and analyze tenant performance on a regular basis to determine which companies are succeeding and which are struggling. Establish initiatives to support working people and attract inventive ones [23].

3.3.4. Promotional Activities

Malls have been promoting their deal and prices more aggressively in recent years. During economic uncertainty, the opportunity for sales promotions, price reductions and the immediate impact of having limited voluntary money are essential factors. Furthermore, considering customer spending is affected by their assessment of the regularity and significance of the mall's marketing, eliminating prices encourages mall sponsorship movement. The most popular forms of marketing that increase the number of times people visit the mall as well as the amount consumers spend are price-oriented promotions and mall-wide specials. The shopping mall's advertising campaigns and the communication initiatives in the mall work together to enhance the mall's reputation. Merchants improve their marketing activities during recessions, emphasizing practical aspects such as safety, dependability, durability rather than the well-being and standing of the store [23].

3.3.5. Leasing Strategy

A vital aspect of shopping malls in everyday operations includes specialty leasing. Leaseholders gain from the shorter lease commitment to a physical retail location and property owners value the revenue that short-term rentals generate in a shopping center. Specialty leasing introduces customers to new experiences and gives consumers a greater incentive to visit shopping centers with constantly evolving retail and service offerings. Specialty leasing businesses in commissioner-owned shopping centers and identifies steps to enhance the overall service model to maximize current business development possibilities. It refers to the short-term rental of various spaces in a shopping center, such as food machines, wall restaurants, trolleys, convenience stores, mobile shops, advertising and temporary storage leases. Examples of advertisement surfaces include elevator doors, walls, escalator railings, floor labels, posters, panels and audio marketing [24].

3.3.6. Terms of tenancy

A shopping mall consists of an integration of various retail tenants such as, the sustainability of a mall is determined by the selection of shopping centers as well as the distinctiveness and range of the tenant mix. Tenant selection in shopping malls handles the main attraction of shopping malls, which is the availability of a large range of tenants and goods in one place at a price that is exceptional with stand-alone stores. In others, providing a large assortment of shops reduces the perceived cost of going shopping at every time [25].

3.4. Statistical Analysis of Indoor and Outdoor Auditoriums in Mall Construction

To determine the effect value of the parameters while considering every potential variable combination that can include an influence on the system, the analysis of variance (ANOVA) is utilized. Finding the ratios that each parameter contributes to the performance characteristic is the major objective of ANOVA, another statistical method. ANOVA can also be used to confirm the outcomes of the technique as it shows the relative relevance of the influencing variables on the solution. A number of studies used the ANOVA techniques to establish the design parameters of heat exchangers and conduct performance analysis. The experimental design approach was used to determine the ideal concentric heat exchanger design parameters with injector turbulent elements and it looked for the way multiple injector-shaped turbulent aspects with varying numbers, diameters and angles affected pressure loss along with heat transmission. The factors that use the technique to sort them according to priority have the biggest effects on the ideal insulating thickness and the Grey Relational Analysis (GRA) is a significant statistical analysis technique that is distinct from ANOVA. Generally speaking, the GRA model makes it possible to determine the ideal parameters for the purpose functions and evaluate many objective functions simultaneously. Using the ANOVA approach, F-test values, F_{factor} gets

calculated as the ratio of the regression mean square and the mean square error. A coefficient qualifies as significant if the computed F-test value exceeds the F value obtained from the applicable standard confidence table. The following equations (1) through (4) can be applied to determine the F values, degree of freedom (DOF), mean of squares (MS) and sum of squares (SS) for each component.

$$F_{factor} = \frac{V_{factor}}{V_{factor}} \quad (1)$$

$$V_{factor} = \frac{SS_{factor}}{DOF_{factor}} \quad (2)$$

$$DOF_{factor} = K - 1 \quad (3)$$

$$SS_{factor} = \frac{\sum \beta_{factor}^2}{N} - \frac{(\sum \beta_i)^2}{N} \quad (4)$$

Where the superior F_{factor} number implies that the parameter has a stronger influence on the solution, the F_{factor} indicates the factor is related to the reaction and values represent the factor's variance with error, V_{factor} and V_{error} . The sum of squares owing to each factor, the number of factors' degree of freedom, the S/N ratio at the SS_{factor} and the sum of squares due to each factor the number of tests, the repeating number of β_i , N each level's factor and the S/N ratio at the i th level of the factor are represented by β_{factor} , and i denotes the i th level of the factor. The definition of a factor in these equations indicates the name of each distinct component.

4. Results and Analysis

In this section, we discuss shopping mall visitors, the subjective rating of the loudness in the mall, the people's comfort rating and internal evaluation of the time spent in the malls. An analysis of the visitors visit the shopping mall at the difference between weekdays and weekends.

4.1. Visitor's Analysis of the Shopping Mall

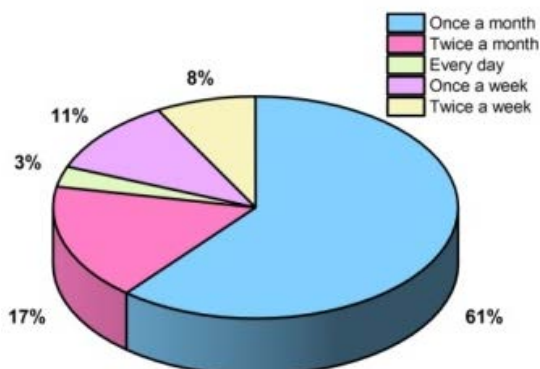


Figure 2. Pie chart for visitor's analysis

Figure 2. displays the individuals who visit the shopping mall and conduct shopping inside the mall, the Table 1 indicates that 3% of the participants visit the mall every day. 11% denotes the number of visitors who visit the shopping mall once a week, 8% represents the individuals who visit the shopping mall twice a week, 61% denotes the people who visit the shopping mall once a month and 17% represents the individuals visit the mall twice in every month.

Table 1. Visitor analysis of the shopping mall

Duration	Percentage (%)
Once a month	61
Twice a month	17
Every day	3
Once a week	11
Twice a week	8

4.2. Loudness of the Shopping Mall

A selection of inquiries is demanded to determine whether there are any statistics available that rate the amount of volume and noise can be found in the various mall locations. As an outcome, Table 2 presents the analysis results, which demonstrate that 21% of respondents selected calm and 2% selected extremely calm of the respondents, 7.5% selected loud or extremely loud, while 26.5% indicated the noise levels were moderate. The noise level in the shopping center was considered fair or neutral overall, with a rating of 50%. Figure 3. depicts the loudness of the shopping mall.

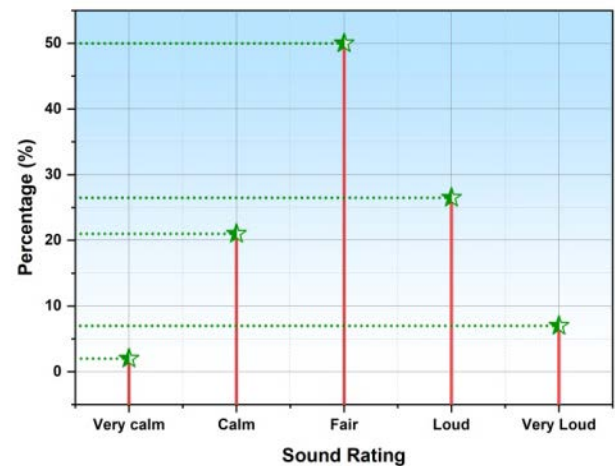


Figure 3. Evaluation of loudness in the shopping mall

Table 2. Evaluation of loudness in the shopping mall

Sound Rating	Percentage (%)
Very calm	2
Calm	21
Fair	50
Loud	26.5
Very Loud	7

4.3. People's Comfort Rating in the Shopping Mall

The findings of an evaluation conducted on which day and which sources provide the most comfortable

environment for shoppers at the mall are shown in Figure 4 and Table 3. After Sunday, which attracts the greatest number of shoppers, Thursday is the day that draws the second-largest customers to the shopping center overall. Sunday is the last day of the weekend and the vast majority of shoppers at the mall are relaxed; the play area is the most popular destination.

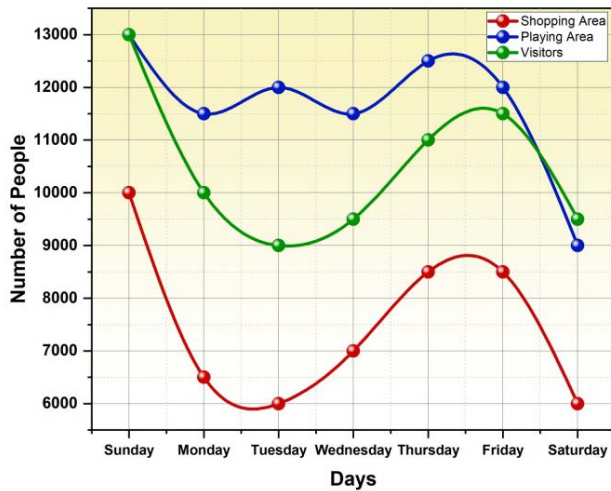


Figure 4. Comfort rating of the people

Table 3. Comfort rating of the people

Days	Number of People		
	Shopping Area	Playing Area	Visitors
Sunday	10000	13000	13000
Monday	6500	11500	10000
Tuesday	6000	12000	9000
Wednesday	7000	11500	9500
Thursday	8500	12500	11000
Friday	8500	12000	11500
Saturday	6000	9000	9500

4.4. Evaluation of the Time Spent in the Mall

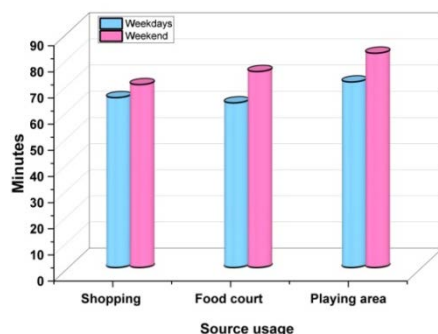


Figure 5. Evaluation of source usage in the shopping mall

Figure 5. demonstrates that on weekdays, 71% of people, including children, visit the play area at the shopping mall. This compares to 65% of people who spend their time shopping and 63% of people spend their time in the food court. Consequently, on the weekends, 70% of people use their time to go shopping, 75% of people use their time to eat at the food court and 82% of people use their time to play in the play area of the shopping mall. Table 4 represents the evaluation of the retail mall's implementation of sources.

Table 4. Evaluation of source usage in the shopping mall

Source usage	Minutes	
	Weekdays	Weekend
Shopping	65	70
Food court	63	75
Playing area	71	82

5. Discussion

In this paper, we investigate the entertainment-centric statistical analysis of indoor and outdoor auditoriums in mall construction using visitors' opinions. The analysis focuses on indoor as well as outdoor auditoriums in malls. A shopping mall is located in the business center of the metropolis, with consideration provided to issues of loudness and acoustic comfort, as well as the impact of those variables on the shopping mall's individuals. Around the most significant shopping periods of each year, like weekends, shopping malls can get highly congested, which leads to lengthy contours, trouble obtaining parking and an overall difficult shopping experience. It is difficult to provide a customized shopping experience at shopping malls designed to appeal to a wide range of customers.

6. Conclusion and Future Work

In today's competitive shopping mall, relaxation zones have become more vital in designing shopping malls. A shopping mall is a large, enclosed retail facility that includes a variety of enterprises, amenities and attractions. These complexes are intended to provide customers with a convenient and varied shopping experience. Environmental quality in conventional and sustainable structures has been studied. Shopping malls offer a variety of goods, services and entertainment alternatives to provide a thorough and pleasurable shopping experience. Even though the growth of e-commerce has presented issues for conventional malls, many are adjusting by incorporating technology, emphasizing experiential shopping strongly and putting a lot of effort into community involvement to stay relevant in the ever-evolving retail scene. Retailers provide special events, deals and promotions to attract customers. The current research employs an ANOVA approach to find significant consumer preference differences between indoor and outdoor auditorium experiences. The section on results includes a study of the mall's visitors. The mall's volume, how comfortable patrons are there and the amount of time people spend inside are evaluated. For the mall, create a smart phone application with promotions, maps and other useful information.

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