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PHYSICAL ENVIRONMENT OF MUSEUMS AND VISITORS' SATISFACTION: A CASE STUDY OF FIVE MUSEUMS IN SHARJAH, UAE

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ABSTRACT:

This study explores the impact of internal design and external physical environment of museums on visitors' satisfaction. This study collected primary data in May-June 2019 through a questionnaire survey given to 285 visitors at the top five museums in Sharjah, UAE – Sharjah Museum of Islamic Civilization, Sharjah Museum of the Line, Sharjah Museum of Art, Sharjah Museum of Antiquities and Sharjah Aquarium. Inferences are drawn using Structural Equation Modeling (SEM) based on Smart PLS software. Findings reveal that some of the internal museum environments such as temperature, scent, colors, layout & method of display, and some of the exterior environments such as exterior decor signage, surroundings environment, entrance and museum facade, are statistically significant for shaping visitors' satisfaction. The findings will help policy-makers and museum administrators around the world, particularly in Sharjah, to design ideal internal and external physical environments of museums so that more holidaymakers visit them.

INTRODUCTION

Museums are a global cultural platform, reflecting the progress of humanity, civilizations and societies over millennia, and their establishment is essential to preserve the heritage, civilizational and cultural artifacts of any country. The objective is to make a museum a place that attracts tourists and visitors, and to develop the tourism industry. Cultural heritage is a major component of cultural identity, and museums have an important and significant role to play in

documenting, promoting awareness of the importance of preserving cultural heritage and promoting scientific research in the field of preservation and documentation.

Museums deal with different segments or aspects of society. The presence of these museums in the countries in which they are located has very important implications for the preservation of human memory and artifacts for future generations, so interior design must be taken care of in all respects, whether in functional or esthetic terms, to attract visitors. Redesigning the museums is the preserve of many antique exhibits. In particular, what the ancestors have left us throughout the ages of legacies, experiences and things that represented their ways of life and habits. In modern times, museums have become a major architectural type, with designers having a great opportunity to show their artistic vision in the processing of architectural facades that fit with the displayed style, as well as using technology to build with the right materials, construction methods or display-style equipment to create a structure integrated museum building (Han, Lee & Hyun, 2019).

Museums are one of the most important institutions to which service institutions and characteristics of services apply, since museums require the visitor to be present as a condition of service provision and not of service management. The fact that the visitor is present at the museum means that its location is of great importance because this is what makes it possible to see the institution's contents and enjoying a unique experience, so the museums are very interested in choosing its internal and external physical environments to make it more attractive to tourists. Many studies have even linked visitors' satisfaction with many features related to the physical environment but can also affect it, such as overcrowding within the museum, which results in long waiting periods and not enjoying what is inside. The museum's content view is one of the most important elements of the physical environment in terms of arrangement and wide spaces that allow the visitor to freely move between sections of the museum, and the museum's design varies according to the type of artifacts it has and what the purpose is (Walter & Edvardsson et al., 2012). The physical environment inside and outside archeological museums is different from those in aquatic, marine or art museums, as their diversity means that there is an emergence of specialized museums, whose designs and internal and external environments are very different.

Museum or cultural building design must consider several considerations and these are linked to visitors' sense of satisfaction (Ferdyn-Grygierek, 2014). First, building design should relate to the type of museum, its views, characteristics, size and scope. The museum should therefore be designed according to the type of people who are likely to visit it, and understanding the critical points of age, level of science, culture and education, visiting hours, etc., since visitors need to also consider external issues like traffic, ease and direction of movement, design features, amenities, etc. (Ferdyn-Grygierek, 2014). Furthermore, the design should relate to the nature of the exhibition. Precisely, this depends on what type of materials and pieces will be displayed in it. Therefore, building design and display of materials should be compatible with materials that went into constructing the museum (Suwaryono et al., 2014).

So the design of museums and their indoor and outdoor environments require attention to the key elements, which are the entrances and exits, the nature of movement within and the walking lines for visitors, reception and exhibition

halls, how to deal with empty spaces, colors, lighting, the lounge rooms and other issues The library, box office and many other items are taken into account when designing the museum to expand its appeal, attract many visitors, actively create visitors' satisfaction and developing an efficient management system. It is very important for the museum administration to know the factors that influence the satisfaction of visitors which will help them to garner even more visitors in the future. This study investigates the influences of internal design and external physical environment of museums on visitors' satisfaction at Sharjah Museum in the United Arab Emirates (UAE).

There is a strong justification for choosing Sharjah Museum as it attracts thousands of visitors each year from different nationalities, representing an important tourist destination for knowledge and culture tourists. Recent statistics indicate that the number of visitors to Sharjah museums reached more than 32,000 from around the world in May and June 2019. The Sharjah government worked to provide an independent management of museum affairs in 2006, which ended in 2017 with the establishment of the Sharjah Museums Authority as an independent government department aimed at offering the highest standards in the field of museums for visitors, citizens and residents of the UAE. The Sharjah Museum provides a variety of facilities such as specialized exhibitions, educational programs, and introducing knowledge to many segments of society. The authority supervises sixteen museums distributed in more than one site, covering most of the Islamic arts, culture, archeology, sciences, aquaculture, history of Sharjah and the wider region. In short, the museum provides a deeper understanding about Sharjah's identity including its natural and cultural heritage.

LITERATURE REVIEW AND HYPOTHESIS

The physical environment of museums is one of the most important aspects that attracts tourists to make their experience so enjoyable, and those environments that affect the behavior of tourists and their level of satisfaction, which make the visitor appreciate both the design and presentation aspects (Goulding, 2000; Sharif-Askari & Abu-Hijleh, 2018; Lockwood & Pyun, 2020). Researchers differ about the physical environments of museums, including those who called the physical environment and its internal and external division(s), while others called them different names and divisions (Han, Lee & Hyun, 2019; Fisk et al., 2011). The research by Zhang et al. (2018) investigated the mediating role of physical environment on visitors' motivations and constraints and satisfaction with a museum. Their findings showed that physical environment is an underlying basis of visitors' motivations, constraints and satisfaction with a museum. Along with physical environment, the museum's design such as architectural planning and exhibitions also wield a strong influence. For example, shops and café facilities in or around the museum can motivate visitors to see the attractions.

Amalia et al. (2017) studied the influence of the physical environment on tourists at the Indonesian Museum. The highest score for exterior facility on the landscape was 79.8% and the lowest score for the exterior design was 64.5%. Interior facility for layout was the highest at 78.5% and air quality was the lowest at 53.8%. The choice of name earned the highest score of 75.2%, while the number of visits was the lowest at 54.0%. Findings further showed a strong

correlation between physical environment and number of visitors. A study by Kim and Lee (2016) on the Gangwon Regional art museum examined the effects of physical environment on visitors' satisfaction. Their study found physical environment (surrounding facilities, views and human factors) exert a strong influence on it. Han, Lee and Hyun (2019) found a positive influence of external and internal physical environment on tourists' visiting satisfaction.

Since visitors' experience may either rise or fall after visiting a certain destination, Antón, Camarero and Garrido (2018) examined whether the time spent, route, and anticipation of the visit can influence future visitation. Their study revealed that spending more time and anticipating the content in the museum increase perceived satiation and reduce emotional response. However, the attention level reduces and visits become shorter when the content of the museum is not what was anticipated. Redden (2015) stated that the self-reflection component leads to more satisfaction as a visit progress. Understanding visitor satisfaction requires rigorous empirical testing (Pelowski et al., 2017). Visitors' behaviors and preferences contribute to gaining new knowledge and this has been understated (Cappa et al., 2020). As such, museum managers think about restructuring the cultural offerings to produce more economic and social benefits. A higher number of visitors increases the content and memory of the museum experience. More content and visitors may lead to suitable ways to manage museums and increase the number of tourists, which will ultimately benefit the economy and social sustainability of cultural organizations.

Cancellieri et al. (2018) investigated the effects of environmental factors (i.e., gift shop and restaurant/cafeteria) on visitors' evaluation of a museum visit. Their results showed that facilities around the recreational areas such as gift shops, restaurants, etc., positively influence visitors' evaluation about the museum. Also, calligraphy and good daylighting, painting and other exhibitions play significant roles (Huang et al., 2020). For example, different exhibition environments are related to different types of visitor experience at the South Australian Museum in Adelaide, South Australia (Forrest, 2015). Forest in his study included 30 semantic differentials, such as Perceived Atmosphere Instrument to understand Vibrancy, Spatiality, Order and Theatricality about this particular museum. Vibrancy was found to be the strongest predictor of cognitive, behavioral and affective engagement when visiting a place.

As discussed above, the physical environment of the museum has long been recognized as an important factor of the visitor experience. The physical environment consists of two aspects - internal physical environment and external physical environment. The interior environment is one of the most attractive elements for visitors and reflects the best use of the museum's designed inner space. Museum views, scents, temperatures, air quality, overcrowding or overcrowding - all of these elements are of great importance to the visitors' experience. Museums crowded with visitors may prevent the visitor from enjoying his/her experience and lead to an unsatisfactory outcome. Colors and natural and industrial lighting also play a prominent role in making the museum more esthetically pleasing and attractive to visitors. Therefore, this study posits the following hypothesis:

H₁: Internal physical environment of a museum has significant impacts on visitors' satisfaction

Similarly, the museum's external environment is just as important as the interior in affecting the visitors' experience, as the museum's facade is one of the most important parts of the grandeur. Many of the world's museums search for the most beautiful designs that must reflect high quality engineering and esthetic standards. The museum's frontage, surrounding environment and entrances are therefore among the most important elements of the outdoor environment, creating interaction with the surroundings and encouraging an image of luxury and outstanding architecture that impresses the visitors. Based on this, the study suggests the following hypothesis:

H₂: *External physical environment of a museum has significant impacts on visitors' satisfaction*

RESEARCH METHODOLOGY

Sampling and Data collection

Data collected from visitors at the top five museums out of 16 in Sharjah referred to their opinions about the unique design and physical environment. These museums are: Sharjah Museum of Islamic Civilization, Sharjah Museum of the Line, Sharjah Museum of Art, Sharjah Museum of Antiquities and Sharjah Aquarium. They are comprehensively summarized in Table 1.

This study collected primary data in May-June 2019 through distributing Arabic and English versions of the questionnaire among 350 visitors at these five museums. The questionnaire was distributed in cooperation with each museum's management through the reception center, where an introductory briefing was given to people when they arrived there, and it was collected from respondents after the visit in cooperation with the museum's supervisors. After data screening, this study considered 285 samples for final data analysis, which is more than 80% of the distributed questionnaires.

Table 1: Top five museums in Sharjah

Museums	About the Museum	Why visit the Museum?	Admire the authentic history	No. of visitors
Sharjah Archaeology Museum	Sharjah Archaeology Museum first opened its doors in 1993. It moved to its current location on May 10, 1997.	This museum offers a unique opportunity to explore the rich and deep-rooted history of Sharjah. Reports of many excavations and expeditions have shown that humans have been settled in Sharjah for more than 125, 000 years. The museum sheds light on the lifestyle of the region's inhabitants from the Stone Age up to the rise of Islam.	The museum contains all the archaeological artifacts that were discovered in Sharjah. The mission of the museum is to preserve, interpret, and exhibit all the artifacts that have been found in Sharjah since the beginning of the excavations in 1973 up to the present day.	2016- 44601 2017- 45208 2018- 44265 2019- 37953

Sharjah Art Museum	The Sharjah Art Museum first opened its doors on April 17, 1997.	This unique museum offers art lovers and all visitors the opportunity to admire the art collections and temporary exhibitions hosted and organized by the museum, and also participate in the museum's regular program and workshops.	In this stunning museum, you can visit exhibitions and view permanent collections by renowned artists. You can explore the history of the region through the fascinating masterpieces of local painters and Arab artists who have significantly enriched the Arab art scene.	2016- 41881 2017- 40573 2018- 39694 2019- 35520
Sharjah Calligraphy Museum	The Sharjah Calligraphy Museum first opened its doors on June 12, 2002.	In this museum you learn about the evolution of Arabic calligraphy over the years, through watching beautiful portraits depicting stunning calligraphic texts, letters and shapes.	The museum showcases fascinating masterpieces and creative paintings by local and international artists and calligraphers. It regularly hosts exhibitions, in an attempt to draw local and international attention to the beauty and charm of Arabic calligraphy, and raise public awareness about the importance of preserving our cultural heritage.	2016- 63254 2017- 58289 2018- 57002 2019- 55010
Sharjah Museum of Islamic Civilization	After opening in 1996 in the Heritage, this museum moved to the traditional Souq Al Majarrah building for reinterpretation and redisplay. This museum opened on June 6, 2008.	At Sharjah Museum of Islamic Civilization, history becomes visible with thousands of rare and important Islamic artifacts depicting the timeless achievements of Islamic civilization and its universality. It main purpose is to show the Islamic faith, discoveries and culture, science, and cherish the beauty of Islamic art.	The new Sharjah Museum of Islamic Civilization exhibits more than five thousand exquisite Islamic artifacts from all over the Islamic World spread over seven spacious galleries.	2016- 90705 2017- 85647 2018- 91857 2019- 102154
Sharjah Aquarium	This museum opened in June 16, 2008.	Explore the fascinating hidden world of the deep sea with its amazing creatures. Enjoy a close-up look at the local fish species and learn about Sharjah's historic coasts and ports.	These aquariums shed light on the lively, mysterious and colorful world of the deep sea, they reflect the diverse marine creatures living in our marine environment. This museum contains almost 100 species comprises with moray eels, clownfish, delicate seahorses, sea rays and reef sharks.	2016- 36091 2017- 35274 2018- 39915 2019- 32601

Measurement of Variables

This study determines the variables is two ways. Firstly, it follows the deductive approach that has been employed in many other studies in related fields, and reviewed to ensure the credibility of model building and changes based on

scientific studies for monitoring purposes (Table 2). These studies were conducted in service establishments such as museums, hotels, restaurants or tourist resorts, and others were undertaken in service establishments such as shopping malls. Secondly, it follows the inductive approach where the interview method was used to reveal the study variables in the minds of visitors. Interviews were held with 25 visitors at museums and these people were either of foreign or Arab nationality. The discussions ranged from 5 to 8 minutes, during which many tourists prefer museums to be calm places.

Table 2: Determinants of the variables of the study

Researcher / year	Variables of the physical environment	Field of study
Han, H., Moon, H., & Hyun, S. S. (2019)	- *Internal physical environment* (air quality, plants & pictures, background music, basic amenities, layout & furniture, temperature, lighting, style of decor) - *External physical environment* (outdoor leisure/recreation facilities, architectural style, exterior décor/signage, entrance, natural surroundings).	The study was applied to 5-star hotels, and it dealt with the connection between the internal and external physical environments and guests' satisfaction and intention to return.
Odeh, M. R., & As'ad, H. A. R. (2014)	- *Ambient conditions* (color, music, scent, temperature, lighting, air quality). - *Design factors* (furnishings, style of décor, equipment, and layout). - *Social factors* (personal, noise, signs & symbols, artifacts).	The study focused on the connection between ambient conditions, design factors, and social factors and their effect on consumers' buying behaviors (satisfaction, spend more money, spend more time, unplanned purchasing) in the shopping malls.
Goulding, C. (2000)	- *Socio-cultural:* (Cultural identification, Conversation and story of building, theme and story, variation of stimulus. Social interaction). - *Cognitive:* (creativity, engagement and involvement, imagination and reflection, authenticity) - *Psychological orientation:* (Scene setters, routing and mapping). - *Physical and environmental:* (Crowding, Seats, and Noise).	This study was conducted in museums, and it dealt with the process of linking the dimensions of the museum environment and their impact on the behavior of visitors to it.
Walter, U., & Edvardsson, B. (2012)	(Physical and intangible artefacts) - *Interior (*furniture and decoration, the room, seating, people, lighting, music and color). (Customer placement) - *Placement of customers (*Placement of guests in comparison to other guests). - *Exterior (Descriptions* of the place, the landscape, the building and the facade, the view Total frequency of occurrence).	This study was conducted on restaurants, the purpose of which was to analyze and describe factors in the physical environment that help to build excellent service experiences for customers in these places.

Fisk, R. P., Patricio, L., Lin, J. S. C., & Liang, H. Y. (2011)	- Ambient factor (Pleasant air quality, Pleasant music, Pleasant odors, Comfortable lighting,) - Design factor (Organized layout, Pleasing color scheme, Attractive facilities).	This study was conducted on customer service departments in a group of service companies, and its purpose was to demonstrate the impact of the service environment on customer satisfaction, customer emotion & behavioral intention.
Zhang, H., Chang, P. C., & Tsai, M. F. (2018)	- *Physical Environment* (PhE) (Architectural planning, Exhibition and marketing, External environment and accessibility, Entrance and ticketing, Site planning, Shop and café).	This study was undertaken in museums, to show the impact of the physical environment on visitors' behavior in the museum.
Han, H., Lee, S., & Hyun, S. S. (2019)	- *Internal museum environment* (temperature, lighting, air quality, layout, style of décor, spatial arrangement, allocation of space, signs & descriptions) - *External museum environment* (architectural style, exterior décor/signage, surroundings, entrance).	This study was done on museums, the focus being on the impact of the internal and external environment on the involvement and knowledge value, and visitors' satisfaction and loyalty.
Ferdyn-Grygierek, J. (2014)	- *Indoor environment parameters* (temperature, relative humidity, CO_2 concentration).	One-year indoor environment parameters, namely temperature, humidity, and CO_2 concentration were presented.
Jeong, J. H., & Lee, K. H. (2006)	- *Physical characteristics of the museum environment* (Exhibition environment, ambient environment, museum size).	The effects of physical environment on visitors' satisfaction were investigated on 30 museums in Seoul, South Korea.
Sharif-Askari, H., & Abu-Hijleh, B. (2018)	- *Indoor environmental* (Indoor exhibition temperature, lighting and indoor air quality, spaces in the museums, relative humidity).	The aim of this paper was to examine quality of the indoor environment in the museums' exhibition halls.
Ryu, K., Lee, H. R., & Kim, W. G. (2012)	- *Quality of physical environment* (interior design and decor, background music, dining areas, employees).	This study tests the influence of food service quality (service, food and physical environment) on restaurant image, customer satisfaction, behavioral intentions, and perceived value for the customer.
Fowler, K., & Bridges, E. (2012)	- *Both the provider and customer perceptions of the service environment* (Attractive, Comfortable, Interesting, Motivating, Easy to move around in). - *Customer Perceptions of service environment,* (Merchandise selection, quality and price; interest, comfortability, attractiveness of the store; knowledge of employees & courtesy of clerks).	The relationships between service environment, provider-customer interaction, and service provider mood were examined. The moderation effect of mood is evaluated for the relationship between service environment and provider-customer interaction.
Lockwood, A., & Pyun, K. (2020)	- *Servicescape* (Aesthetic quality, Functionality, Atmosphere, Spaciousness, Physiological conditions).	This study was conducted on upmarket hotels to understand the detailed processes to measure customers' perceptions.
Suwaryono, I. L., Rosinta, F., & Soeling, P. D. (2014)	- Ambient condition. - Layout and function. - Signs, symbols and artifacts.	The study was conducted at the National Museum in Jakarta to improve the experiences of visitors at the museum.

Finally, this study considers the variables that are applicable to the museum context. For the internal museum environment, eight variables were measured utilizing 24 questions, and for the external museum environment, five variables were measured via 13 questions. The dependent variable (visitors' satisfaction) was measured by answers to five questions. The details of all questions are summarized in Table 3.

Table 3: Measurement of variables

Construct	Dimensions	Code	Item
Internal Museum Environment (IME)	Temperature (T)	T1	Temperature of this museum is convenient.
		T2	Temperature of this museum makes me feel comfortable.
		T3	I feel that the temperature in this museum is convenient.
	Scent (SC)	SC1	Scent in this museum makes me feel pleasant and refreshed.
		SC2	The scent in the facility is pleasant.
		SC3	The scent in this museum gets my attention.
	Air quality (AQ)	AQ1	Air quality of this museum makes me feel the tour will be enjoyable.
		AQ2	This museum can described as having good air quality.
		AQ3	The quality of air in this museum is good.
	Lighting (L)	L1	Lighting of this museum attracted my attention.
		L2	Lighting of this museum makes me feel comfortable.
		L3	Temperature of this museum can be easily borne.
	Style of decor (SD)	SD1	The decor of the museum was pleasing to me.
		SD2	This museum is decorated in an attractive fashion.
		SD3	The interior design of the museum attracts my attention.
	Colors (C)	C1	The colors used in the museum are fashionable.
		C2	I see that the colors in this museum's design are cool and nice.
		C3	The colors in this museum attracted my attention.
	Layout & display (LD)	LD1	The layout of the museum was impressive.
		LD2	This museum's layout makes it easy to get to where you want to go.
		LD3	I tend to rely on museum displays in order to stay longer.
	Noise and Crowd (NC)	NC1	The museum seemed very crowded to me.
		NC2	I feel comfortable while at the museum
		NC3	There were a lot of visitors in the museum.
External Museum Environment (EME)	Architectural style (AS)	AS1	Architectural style of museum is attractive.
		AS2	The architectural style of the museum is proportional to the purpose of the museum.
		AS3	Museum decorations are visually appealing.
	Exterior decor signage (EDS)	EDS1	There are enough signs about the content and sections of the museum.
		EDS2	Enough symbols were put in place for the content and sections of the museum.

|	EDS3	The signage in the museum is large enough to be seen.
Surroundings (SU)	SU1	Plants/flowers make me feel happy.
	SU2	The surroundings outside the museum are comfortable to see.
	SU3	External squares and parking spaces are wide.
Entrance (E)	E1	Entrance decor is attractive.
	E2	The museum's entrances are wide.
Museum Facade (MF)	MF1	Museum facade is visually appealing.
	MF2	The museum facade reflects the value of the content and exhibits.
Satisfaction (S)	S1	The overall feeling I get from this museum is one of satisfaction.
	S2	I will advise others to visit this museum.
	S3	I like to stay in this museum for as long as possible.
	S4	This museum deserves people to stay in it for a longer period of time.
	S5	The time spent was truly enjoyable in this museum.
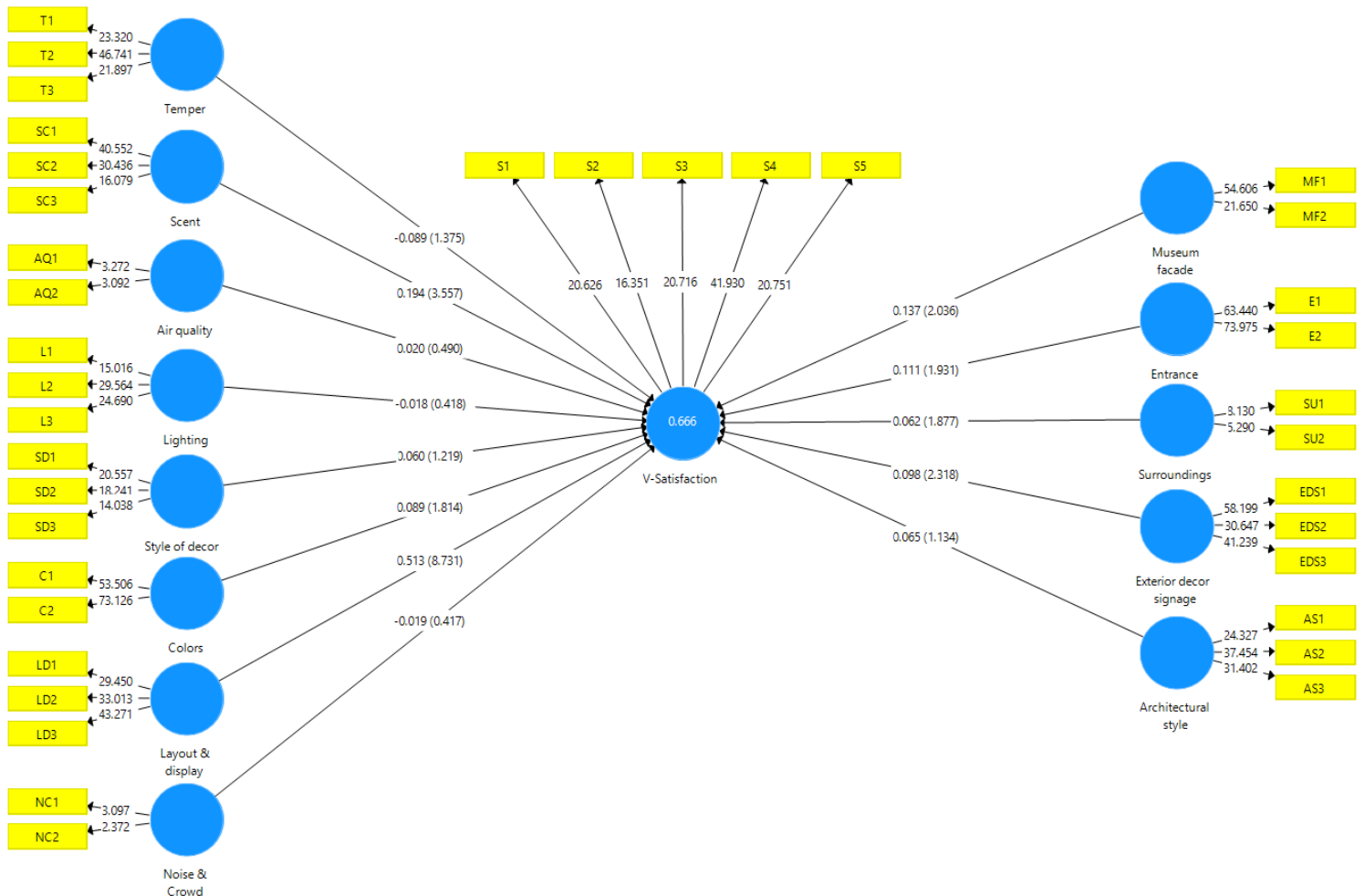
Figure 1: Structural Equation Modeling Framework

Analysis of Data

To draw inferences, this study relies on Structural Equation Modeling (SEM) based on Smart-PLS software. Figure 1 represents the structural model with the exogenous variables which are: internal museum environment (temperature, scent, air quality, lighting, decor, colors, layout and display, and noise and crowd) and external museum environment (architectural style, surroundings, entrance, exterior decor signage, and museum facade) on the endogenous variable (visitors' satisfaction).

For the first step, this study estimates the measurement model to ensure internal reliability of the constructs and in the second step, checks the effects of the independent variables on the dependent variable (Hair, Hult, Ringle & Sarstedt, 2017). Internal reliability denotes the ability to measure the concept that is intended to be measured (Sekaran & Bougie, 2013). For internal reliability, loading of items should be above 0.70 but sometimes 0.60 is accepted, Cronbach's alpha (α) and composite reliability (CR) should be greater than 0.70, and average variance extracted (AVE) greater than 0.50 (Hair et al., 2017). Additional to indicator loading, α, CR, and AVE, discriminant validity ensures the variability of the constructs is understood (Ramayah et al., 2016). Discriminant validity can be done through two types of test, namely HTMT (heterotrait and monotrait) and Fornell and Larcker's criteria (Ramayah et al., 2016; Henseler et al., 2015).

Results and Analysis

Demographic Profile of the Respondents

The respondents indicate diverse demographic characteristics of visitors at the museums in Sharjah. IT shows most of the visitors are women (Table 4). The results indicate that (11.4%) visitors were students from schools and universities in Sharjah and the United Arab Emirates, whose age groups up to 29 years. The 50 year and over age group represents the majority of visitors at the rate of 26.9%. It is worth noting here that schools and universities organize student trips to museums as part of their cultural programs to promote an awareness and appreciation of cultural values among those in the age group below 29 years. These represent 22.6% of the total respondents. Most visitors are from other countries and they account for more than 67%.

Table 4: Respondents' Demographic Profiles

Category	Criteria	Frequency %
Gender		
	Male	47.9
	Female	52.1
Age		
	20 ≤	9.7
	20 - 29	12.9
	30 - 39	22.7
	40 - 49	22.8
	50 ≤	26.9
Education		
	Junior high school or below	10.5
	High school	23.5
	College or university degree	57.4
	Master's degree or above	8.6

Nationality

Arab visitors	32.7
Foreign visitors	67.3

Measurement Model Analysis

Four items were removed due to a poor loading below 0.6. The remaining items were loaded between 0.686 and 0.976 (see Table 5) which is satisfactory. Following the recommendation by Ramayah et al. (2016), items were removed to increase CR and Cronbach's alpha. A weak loading below does not contribute to constructing measurements (Awang, 2012; Hair et al., 2017).

Table 5: Assessment of the Measurement Model

Constructs	Indicators	Indicator reliability (Loading >0.60)	Convergent validity (AVE >0.50)	Internal consistency reliability	
				Composite reliability: 0.7-0.9	Cronbach's alpha: 0.6-0.9
Internal Museum Environment (IME)	T1	0.811	0.679	0.863	0.766
	T2	0.884			
	T3	0.774			
	SC1	0.862	0.673	0.860	0.755
	SC2	0.855			
	SC3	0.737			
	AQ1	0.976	0.715	0.883	0.800
	AQ2	0.868			
	L1	0.780	0.679	0.864	0.764
	L2	0.850			
	L3	0.840			
	SD1	0.837	0.628	0.835	0.709
	SD2	0.795			
	SD3	0.742			
	C1	0.912	0.857	0.923	0.835
	C2	0.940			
	LD1	0.825	0.693	0.871	0.782
	LD2	0.840			
	LD3	0.832			
	NC1	0.958	0.752	0.857	0.709
	NC2	0.765			
External Museum Environment (EME)	AS1	0.813	0.714	0.884	0.801
	AS2	0.862			
	AS3	0.860			
	EDS1	0.924	0.792	0.920	0.869
	EDS2	0.857			
	EDS3	0.888			
	SU1	0.918	0.790	0.882	0.738
	SU2	0.859			
	E1	0.913	0.837	0.911	0.805
	E2	0.917			
	MF1	0.919	0.795	0.886	0.746
	MF2	0.864			
Satisfaction (S)	S1	0.770	0.566	0.867	0.808
	S2	0.686			
	S3	0.768			

S4	0.827
S5	0.703

The values of all constructs have AVE which are within the acceptable range of 0.566 to 0.857, and both α ranged between 0.709 and 0.869. CR was between 0.835 and 0.923. Thus, according to Fornell and Larcker (1981) and Hair et al. (2017), measurement validity confirmed the constructs.

Structural Equation Modeling Analysis

In the SEM-PLS approach, to evaluate the model, coefficient of determination (R^2) and the effects (f^2) are the most common methods reported (Cohen, 1988; Hair et al., 2014). As a rule of thumb, the values of R^2 are 0.26, 0.13, and 0.02 and these respectively refer to substantial, moderate, and weak (Cohen, 1988). Results of the structural model with values and path coefficients are depicted in Figure 1, where it is revealed that exogenous latent variables (temperature, scent, air quality, lighting, style of decor, colors, layout and display, and noise and crowd, architectural style, exterior decor signage, surroundings, entrance, and museum façade) can explain 66.6% of the variance in visitors' satisfaction in Sharjah's museums. Hence, visitors' satisfaction has a substantial predictive ability according to the selected variables.

This study evaluates the influences of internal and external physical environments of museums on visitors' satisfaction. For internal physical environment, temperature (T), scent (SC), colors (C) and layout & display (LD) exert significant impacts on visitors' satisfaction. Inside temperature (T) highlights a negative significant relationship with visitors' satisfaction at the 10% significance level (T→S, β -0.089, $p < 0.10$), meaning visitors want more comfortable temperatures, especially when the outside temperature in Sharjah is very high. Inside scent (SC) shows a positive significant relationship with visitors' satisfaction at the 1% significance level (SC→S, β 0.194, $p < 0.01$), meaning visitors want the museum to have a good fragrance. Inside colors (C) show a positive significant relationship with visitors' satisfaction at the 5% significance level (C→S, β 0.089, $p < 0.05$), meaning visitors want comfortable color matching in the museum. Inside layout & display (LD) indicates a positive significant relationship with visitors' satisfaction at the 1% significance level (LD→S, β 0.513; $p < 0.01$), suggesting visitors want an easy-to-follow layout where they can find what they are looking for. However, for the internal physical environment, air quality (AQ), lighting (L), style of decor (SD) and noise and crowd (NC) did not emerge as being significant.

Table 6: Assessment of the Structural Equation Model

Path Relationship	Coefficient	Std. Error	P-values	Decision
T → S	-0.089	0.065	0.085	Significant***
SC → S	0.194	0.054	0.000	Significant*
AQ → S	0.020	0.040	0.312	Not Significant
L → S	-0.018	0.042	0.338	Not Significant
SD → S	0.060	0.049	0.111	Not Significant
C → S	0.089	0.049	0.035	Significant**
LD → S	0.513	0.059	0.000	Significant*
NC → S	-0.019	0.046	0.338	Not Significant
AS → S	0.065	0.058	0.128	Not Significant
EDS → S	0.098	0.042	0.010	Significant***

SU → S	0.062	0.033	0.030	Significant**
E → S	0.111	0.057	0.027	Significant**
MF → S	0.137	0.067	0.021	Significant**

Notes: *, ** and *** indicate significant at 1%, 5% and 10% level.

Referring to the external physical environment, exterior decor signage (EDS), surroundings (SU), entrance (E) and museum facade (MF) have significant impacts on visitors' satisfaction. Exterior decor signage (EDS) shows a positive significant relationship with visitors' satisfaction at the 10% significance level (EDS→S, β 0.098; p < 0.10), meaning visitors want there to be enough content and sections in the museum. Surroundings (SU) shows a positive significant relationship with visitors' satisfaction at the 5% significance level (SU→S, β 0.062; p < 0.05), revealing that visitors want better views of the surroundings and wide parking spaces. Entrance (E) shows a positive significant relationship with visitors' satisfaction at the 5% significance level (E→S, β 0.111; p < 0.05), indicating visitors want better-looking and attractive entrances. Museum facade (MF) shows a positive significant relationship with visitors' satisfaction at the 5% significance level (MF→S, β 0.137; p < 0.05), meaning visitors want visually appealing museum facades. However, with reference to the external physical environment, architectural style (AS) was not found to be significant.

Data and Model Diagnostic Tests

Discriminant Validity

Bold diagonal values in Table 7 represent the square roots of the AVE which is greater than the inter-correlation among variables. Consequently, this result confirmed the discriminant validity of the measure with Fornell-Larcker's criterion.

Table 7: Variable Correlation and Square Root of AVE

Constructs	AQ	AS	C	E	EDS	LD	L	MF	NC	SC	SD	SU	T	S
AQ	**0.924**													
AS	-0.081	**0.846**												
C	0.044	0.137	**0.926**											
E	0.067	0.253	0.391	**0.915**										
EDS	-0.088	0.290	0.206	0.129	**0.890**									
LD	0.009	0.306	0.330	0.517	0.171	**0.832**								
L	-0.086	0.290	0.309	0.182	0.145	0.308	**0.824**							
MF	-0.070	0.636	0.101	0.335	0.251	0.215	0.219	**0.892**						
NC	-0.049	-0.013	0.065	0.087	0.002	0.086	0.086	-0.060	**0.867**					
SC	0.033	0.466	0.178	0.295	0.209	0.397	0.321	0.390	0.020	**0.820**				
SD	-0.041	0.124	0.350	0.378	0.066	0.484	0.260	0.148	0.027	0.198	**0.792**			
SU	-0.087	0.061	0.064	0.045	0.060	0.091	0.024	-0.040	0.040	0.046	-0.094	**0.889**		
T	-0.026	0.594	0.282	0.371	0.390	0.429	0.344	0.488	0.026	0.401	0.310	0.067	**0.824**	
S	0.016	0.420	0.373	0.532	0.281	0.732	0.296	0.394	0.035	0.524	0.415	0.118	0.434	**0.752**

The result of the HTMT values (see Table 8) is lower than the recommended value of 0.85 as suggested by Henseler et al. (2015). Hence, given the HTMT values, all the variables differ from each other which confirm the discriminant validity.

Table 8: Value of Heterotrait-Monotrait Ratio (HTMT)

Constructs	AQ	AS	C	E	EDS	LD	L	MF	NC	SC	SD	SU	T	S
AQ														
AS	0.093													
C	0.056	0.165												
E	0.084	0.315	0.478											
EDS	0.119	0.348	0.238	0.155										
LD	0.056	0.389	0.411	0.652	0.203									
L	0.111	0.365	0.378	0.234	0.182	0.404								
MF	0.076	0.832	0.125	0.427	0.316	0.282	0.300							
NC	0.061	0.064	0.106	0.122	0.062	0.153	0.171	0.070						
SC	0.053	0.599	0.226	0.386	0.261	0.517	0.433	0.517	0.070					
SD	0.066	0.155	0.442	0.472	0.078	0.635	0.343	0.187	0.096	0.255				
SU	0.100	0.079	0.104	0.056	0.076	0.124	0.062	0.051	0.140	0.068	0.123			
T	0.074	0.750	0.348	0.460	0.479	0.568	0.457	0.637	0.126	0.514	0.413	0.092		
S	0.052	0.528	0.455	0.651	0.340	0.866	0.376	0.517	0.082	0.669	0.515	0.156	0.540	

Note: Heterotrait-Monotrait Ratio (HTMT) discriminate at (HTMT < 0.85 or 0.90)

The Effect Size (F^2) Value

Another important criterion for assessing the structural model in PLS-SEM is the effect size (f²) (Cohen, 1988). The predictive exactness significance of the R² values is tested by the F significance test (Hair et al., 2017). More specifically, the purpose of assessing f² after determining the change in R² helps us to understand if the effect of a specific exogenous variable on the endogenous variable is weak, moderate or substantial (Urbach & Ahlemann, 2010). The f² values of 0.02, 0.15, and 0.35 represent the small, medium, and large effect, respectively (Cohen, 1988). Table 9 presents the f² for each individual exogenous variable where layout & display (LD) shows a large effect while exterior decor signage (EDS), entrance (E) and museum facade (MF) show individual moderate effects on visitors' satisfaction.

Table 9: The Effect Size of the Exogenous Constructs

Latent Construct Relation	F²	Effect Size
T → S	.012	No effect
SC → S	.075	No effect
AQ → S	.001	No effect
L → S	.001	No effect
SD → S	.007	No effect
C → S	.017	No effect
LD → S	.426	Large
NC → S	.001	No effect
AS → S	.006	No effect
EDS → S	.024	Medium
SU → S	.011	No effect
E → S	.022	Medium

MF → S	.029	Medium

Cross-validated redundancy (Q^2)

If Q² value is greater than 0 this means a certain endogenous construct has predictive power on endogenous variables (Hair et al., 2016). In contrast, a Q² value lower than zero means exogenous variables lack predictive power (Hair et al., 2017). Table 10 shows that the predictive relevance of the endogenous latent variables is greater than 0, meaning the model of this study has adequate predictive ability.

Table 10: Predictive Relevance of the Endogenous Latent Variables

Exogenous Constructs	SSO	SSE	Q² (=1-SSE/SSO)	Results
Visitors' Satisfaction	1425.0	939.137	0.341	Q² > 0
				The variable explaining gives predictive relevance

Discussion

The study explored the influence of museums' physical environment on visitors' satisfaction and specifically in the top five museums located in Sharjah, United Arab Emirates. Examined here were the features influencing visitors' satisfaction based on internal and external physical environments of museum. For the former, temperature (T), scent (SC), colors (C) and layout & display (LD) are found to be significant in their effect on visitors' satisfaction. For the latter, exterior decor signage (EDS), surroundings (SU), entrance (E) and museum facade (MF) are found to wield a significant impact on visitors' satisfaction. Similar findings were also shown by Sharif-Askari and Abu-Hijleh (2018), Sharif-Askari and Abu-Hijleh (2018), Lockwood and Pyun (2020), Han, Lee and Hyun (2019); Zhang, Chang and Tsai (2018), and Goulding (2000).

It is worth noting here that Powell and Kokkranikal (2015) explored the motivations of visitors at the Imperial War Museum in the UK. Their study found intrinsic motivation influences visiting compared to extrinsic triggers. For instance, on a good day the opportunity is highly appealing to visitors than the actual collections for the average visitors. However, it is an important point that when people decided to visit somewhere, where will they go? Are they interested in visiting a museum? If they like to go to museums, which museum they will choose and why? These are important issues for museum administrators around the world who want to know how to attract more visitors. This study empirically demonstrated that a few external and internal environmental variables are the major drivers of visitors' satisfaction, and it creates a good opportunity for museum administration teams and policymakers in charge of cultural and heritage matters. Previous studies on visitor satisfaction have mainly focused on the elements of the physical environment of art museums by looking at the surrounding factors, viewing factors, and human factors (Kim & Lee, 2016). Furthermore, the present research has found that foreigners constitute the majority of visitors but older people and school/university students in Sharjah and elsewhere in the United Arab Emirates make up a large percentage of visitors.

Conclusions

This study empirically highlights the importance of internal and external physical environments in influencing the visitors' satisfaction with five museums in UAE. Based on the Structural Equation Modeling (SEM), the findings reveal that some of the internal physical environment such as temperature, scent, colors, layout & method of display, and some of the exterior features such as exterior decor signage, surroundings environment, entrance and museum facade, are statistically significant for shaping visitors' satisfaction in the context of museum. This study will help museum administrators in UAE as well as museum administrators around the world to design their institution so that it will attract more visitors. To make the findings of the study universally applicable, it is suggested that research on this topic be conducted in many other places around the world and to make cross-cultural comparisons. It is also recommended to build on the variables used in this model to explore what variations in results may mean in terms of visitor numbers and what they appreciate.

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