Stakeholders' visual preferences relationships of Landscape design elements in constructed wetland parks.

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Abstract

Verifying stakeholders' preference elements for public garden projects is one of the development methods in urban projects. Stakeholders' visual perceptions studies of landscape elements in Egypt are limited. The current research used a methodological approach based on a one-on-one photographic questionnaire to investigate the understanding of constructed wetland parks projects, technologies, and Landscape elements' visual perception. The questionnaire is used with different stakeholders engaged in a research project to create a newly constructed wetland park in Egypt. The research is part of a scientific project in Ten Ramadan city. It is a new city located in the northeast of Cairo. The paper highlights the importance of visual perception and preferences for landscape design elements to meet the community's needs. It clarifies that the local community needs to interact with this type of constructed wetland park in Egypt positively. Results may be used to drive community involvement policies and assist government officials, planners, designers in conserving the biodiversity of wetland parks. This paper demonstrates how the significance of landscape elements extends beyond the visual perception of the public park's design, contributing significantly to its visual dimension. Additionally, numerous aspects affecting landscape elements that can help users interact with the park elements will meet the new Egyptian cities' environmental needs associated with the hot climate and the desert nature.

1. Introduction

The participation of the community in the planning and design stages of the public parks ensures the success of the design process by activating users' role as an essential part of the design development (Fernandez-Cañero et al. 2013). Moreover, this participation helped the design team provide users' needs, and expectations (Barbara et al. 2011), particularly for public areas that provide opportunities regarding aesthetic experience, relaxation or playing games, art, music, or other community activates for users. Therefore, it is critical to play engaged participation in the design stages, make a better contribution to urban life, and design adoption (Turan et al. 2016; Rapoport and el Sayegh 2005) focused on the value of the designer discovering, identifying problems, and the importance of the design is appealing to users, supporting their desires, and finally becoming culture-based. Furthermore, (Sanoff 2000) asserts that participatory studies have many benefits (Belčáková et al. 2021), such as developing social capital and increasing a feeling of community. Therefore, one of the research objectives depends on activating the role of the community in the design, development, preservation, and operating environments for people.

Constructed Wetland Park (CWP) integrates engineering water treatment (Alexandros 2020), conservation techniques, and landscape architecture. This approach used engineering wetlands to act as a natural environment (Ezeah et al. 2015; Shutes 2001) to be a new ecosystem in urban and sub-urban areas (Haron 2020). Creating new parks and public spaces with vast ecologic benefits (Anton et al. 2016) turned this technique into a target for many cities and local governments (Yan and Xu 2014). One of most countries, China, adopted that technology and turned it into a national policy (Zhang et al. 2009). Many successful cases have been created in aired and semi aired areas. In Egypt, that technology is used for water treatment and water reuse in agriculture fields (Abou-Elela 2017; Abdel-Shafy 2008). This paper is part of a funded research project to create a new CWP in a new city (10th of Rmandan City) by reusing sewage water toward achieving sustainability. New cities in Egypt that created after 1979. Five generations from that kind of city. Most common factors between all-new cities located in the desert in Egypt, industrial cities, Lake of water resources (Lamei et al. 2009; Attia et al. 2019), Lake of green areas public parks (Mahmoud and El-Sayed 2011), Hot weather and still undergoing not achieve its population targets (Feisal and Haron 2017) The research team and Design team cooperated in investigating stockholder preferences toward that kind of parks. As new kinds of parks in Egypt, our team organized a series of lectures, interviews, and workshops

with stakeholders to understand their preferences (Khalifa and Connelly 2009), needs, and priorities. This paper will highlight the results of stakeholders' meetings for understanding landscape design elements visual preferences in the new CWP. Five international case studies were selected and shown to stakeholders to understand their viewpoints. The selection of case studies depends on several criteria based on the purpose of the workshop of CWP and the stakeholders' category. This approach offers unlimited opportunities for enhancing the stakeholders' engagement and preferences for the CWP design elements. Besides, the purpose of having a CWP should be determined and understood before selecting and preferring the best project for a CWP to meet the project's goal in Egypt.

2. Material And Methods

2.1. Stakeholders and Landscape projects

The benefits of understanding the potentials and challenges of landscape projects are an essential value/s that could affect the design development process. The importance of stockholder participation in studies, planning and decision making before projects design could change some ideas and directions of schematic design (Alexey et al. 2016) to meet the needs of communities and different parties (Soliva et al. 2008). Also could be affected the final project output (Silvia et al. 2019). The engagement between communities and landscape projects could increase the impacts of that type of project in different social, environmental and urban levels (Luyet, et al. 2012). individuals will feel that ownership of project/park that gives caring attitude toward that park (O'Farrell and Anderson 2010) cause the park provide service/s that individuals need it, that process will turn a park from playing function and environmental role to multifunction role /s (Stockdale and Barker 2009) variety of services provided/ing by the park will increase it is value in the community (Berg et al. 2015). Many tools and methods are used/ing in understanding stockholders preferences .understanding the diversity of stakeholders and dealing with every group with practical tools and techniques of engagement are essential to collect the data (Soliva et al. 2008). The research depended on the participatory approach technique that studied individuals' preferences for design, technique, and landscape design elements of constructed wetland parks. A visual preference survey (Karjalainen and Komulainen 1998; Tahvanainen et al. 2001; Zheng et al. 2011) was utilized. Selected individuals and groups were invited to attend a series of workshops from Dec. 2018 to Feb. 2021. These workshops are part of the design processes of the constructed wetland research project as a tool to achieve a multifunction landscape in 10th of Ramadan City, Egypt. These method objectives collect data from stockholders to Understand the needs of the community, recognition the visual preferences of stakeholders and develop the project alternatives to meet the culture and needs of communities (Polat and Akay 2015; Barroso et al. 2012). The first part of the workshops was to provide fundamental information about constructed wetland parks, benefits, challenges, techniques and examples from worldwide. The second part was casual interviews by the research team with individuals and groups to summarize the main issues and key elements that could be investigated in the design development process. The third part is the main stakeholders meeting in Feb. 2021. Stakeholders saw the main case studies and project schematic design. After a brief discussion of each project in the workshop, digital screens were used to display the questionnaire's content and explain the questionnaire's scope, purpose, and objectives by the design team. The questionnaire was then distributed to participants to investigate their preferences for the projects presented and explained at the workshop.

2.2. Stakeholders and Constructed wetland Park

This study investigates stakeholders' preferences that depend on their experience, expectations, which is an important and involved design and planning process, moreover, ensure public participation. For this purpose, our interest is primarily in the preferences among the project stakeholders and constructed wetland park landscape elements design. Therefore, we have focused on those constructed wetland parks which are related to all aspects of the study. Followed table (1) shows the total of five parks that have also been identified and discussed during the workshops. Five case studies selected (Wadi Hanifa, Shanghai Houtan Park, Qunli Storm water Park, Mill River Park, and Lotus Lake National Wetland Park). These cases have common factors affect in the case studies selection criteria like water pollution level, urban and sub urban park, in major city, near residential settlements, multipurpose of project objectives and all case studies got one international design award.

2.3. Case Studies:

2.3.1. Wadi hanifa constructed wetland, KSA

Wadi Hanifa (Hanifa valley) is located in the center of the Arabian Peninsula in Saudi Arabia. The main flood canal passed near Riyadh, the capital of Saudi Arabia. The watershed area was collected about 4400 km2 in 2007. Creating and developing constructed wetland was a part of the valley developing strategy (Alhamid et al. 2007). Transforming valley problems and challenges into a new opportunity was the project's main concept (Haron 2020). That idea made mixing between reviving the pure nature valley with creating a Public Park., the design of that project was integrating a wide range of landscape architecture techniques with water management techniques. The project turned into a tourist attractions destination. The park was designed to be friendly with the cultural nature of Saudi society where there are areas of families with more privacy, areas to interact with nature, barbecue places and shaded areas along the park.

2.3.2. Shanghai Houtan Park, China

This project is located on Huangpu Riverfront in Shanghai, China. It is a regenerative Living landscape project that constructed on a Brownfield of a former industrial spot, previously owned by a steel factory and there were some industrial structures Remaining. The site was highly used as a landfill for industrial materials. The park is 1.6 km in length and 10 to 30 m in width. The park area is around 140000.0 m2. The park project main objective was to design a green Expo, house for a large number of visitors during the expo, illustrate green technologies, transform a unique space to make the Expo an unforgettable experience (Haron and Feisal 2020), and transition into a The aim of the project was to treat the contaminated river water and revive the degraded riverfront and turn it into a delightful facade with aesthetic value.

2.3.3. Qunli Storm water Park, China

Located in Qunli, Haerbin City in China with an area of 300,000 m2, Qunli Wetland Park is designed to work as a green sponge in the city (ASLA 2012).Encircle the existing natural wetland to preserve the natural ecosystem. Minimum earthwork through using cut and fill technique to create a network of ponds and mounds around the circumference of the wetland forming a buffer zone. The network of ponds is used as a water sponge for storing and regulation of storm water. Using the natural filtration processes of wetland grasses found in the ponds of various sizes and depths. The park provides a number of aesthetic and recreational values through an interlinked network of paths, sidewalks, pavilions, skywalks and seating areas to support the community's social activities.

2.3.4. Mill River Park and Greenway, USA

The Mill River Park is located in Stamford, Connecticut, USA. Its area is around 33 acres (Verel 2010). The design was a collaborative design by civil engineers, ecologists, and landscape architects along with local community participation. The final master plan consisted of a 28 acres park along with a 3miles long greenway (Gaber 2020). Mill River Park is designed to act as a revitalization project for the historic riverfront. The project design plays an important role in sustaining natural habitats and connecting the city to nature.

2.3.5. Lotus Lake National Wetland Park -Tieling, China

Lotus Lake, located in Tieling City in Liaoning Province in China, Lake surfed from water pollution problems caused by swage and irrigation polluted water. That affected water quality and water quantity in the lake. The project target was to turn the lake and surrounding areas into a national wetland park covered with 4700 ha. The sensitive protected zone will be 629 ha. Increase the habitat, increase biodiversity, and create urban, social, and economic benefits for the city. The park provided a vast list of services to the community with high environmental impacts like water quality, habitats and decreased air pollution and heat island. Social impact like family spaces, health spaces, and educational activity. Economic impact like tourism, increase city land value new jobs created.

Table 1

Comparison of the five case-study of constructed wetland parks.

	Qunli storm water park	Mill River park and greenway	Lotus Lake National Wetland Park	Shanghai Houtan Park	Wadi Hanifa wetlands
location	Qunli, Haerbin China	Stamford, Connecticut, USA	Tieling, China	Shanghai ,China	Riyadh, Saudi Arabia
Area	30 ha	15 ha	629 ha	14 ha	440 ha
Water rescores	Storm water and floods	Mill river and flooding	Lotus Lake and	Huanggpu River	Flood and ground water
Water Pollutions resources	Urban pollutions	Urban and Industrial pollutions	Gray water	Industrial pollutions	Swage and agriculture drainage
Constructed wetland technique	Irritation ponds	Free surfaces canal	Sub- surfaces and free surfaces	Stepped canal Free surfaces	Free surfaces canal
Awards	ASLA 2012	ASLA 2015	ASLA2012	ASLA 2010	Aga Khan 2013

2.4. Methods:

The questionnaire form was as short and straightforward as possible to keep it goal-oriented. There are 12 closed-ended questions in all. There were three sections to the questionnaire (Rahman et al. 2013).

The photograph field approach, which was employed in (Rogge et al. 2007; Sevenant and Antrop 2009) studies, entails displaying photographs of landscape elements like water surface, walkways, sitting areas, plaza function, plant composition, and color in five case studies.

Photographs were uploaded to the park's official website. In February 2021, 14 photographs were chosen and used in this section. The most significant criterion for choosing the advantage of photographs was that they reflected all of the landscape elements in each park's design.

Gender, age, educational attainment, and accommodation were among the questions on the photo questionnaire. In addition, five panoramic photographs of selected parks were placed on the questionnaire form, and respondents were asked to rate the landscape features the design of each shot on A4-size paper in the main and concluding sections of the photo-questionnaire form. In the context of one-on-one interviews, questionnaires were used.

- Section one of the survey questionnaire was designed to identify stakeholders' fields. This section aims to define stakeholders' profiles. Also, this section aimed to ensure public participation by taking stakeholders' preferences /expectations through the survey.
- Section two of the survey questionnaire consists of six questions to evaluate the stakeholders' preference of constructed wetland park design and technique. This section also depicts which type of constructed wetland park is suitable to implement in Egypt (Tencer et al. 2009). Respondents were also asked to choose the most convenient tool to deal with rain and floods and sewage reuse (Anton et al. 2016) in Egypt from the five case studies. The purpose of this part is to increase the knowledge and to learn from these projects.
- The final section of the survey questionnaire consists of six questions depicting respondents preferring the landscape design elements for constructed wetland parks using a photo-questionnaire method (Polat and Akay 2015).

The data were collected, structured, and sorted in an excel file sheet from the questionnaire responses at the end of the process, followed by a statistical analysis using the standard statistical software SPSS (Statistical Package for Social Science), which included in general frequency tables, a Chi-square analysis to determine the relationship between stakeholders’ demographics and stakeholders’ visual perception of CWP design elements, furthermore to determine the relationship between the stakeholders' categories and stakeholders' perceptions of the five case studies.

3. Results

3.1. Demographic characteristics of stakeholders who responded to the questionnaire.

The demographic characteristics of workshop participants and answers to the complete questionnaire are provided in the figure. 1. According to the result, most of those who responded were female (54.9%, female and 45.1% male). Additionally, most participates between the ages of 25 and 35 constituted 45.1% of individuals who responded to the questionnaire. About the level of education, 35.2% held PhDs, and 27.9% were held Bachelor’s degrees. In general, most of the stakeholders reside in new cities, with 58.2%, while 41.8% reside in Cairo.

3.2. Percentage of Stakeholder Categories and Responding rates

A survey questionnaire was utilized to measure stakeholders’ virtual perception, such as urban planners, landscape architects, developers, government officers, academicians, and others who have directly affected the CWP design. People whom project decisions can influence are referred to as stakeholders. (Moore and Tully 2018). The average participant scores of the responses in the photo questionnaire were calculated for 122 participants out of 140 persons who attended the workshop. Table 2shows the Percentage of respondent Stakeholders size. The

examination of the table reveals that the total number of participants who responded to the survey was 87%, with unequal responses according to their fields. The 71 academician disciplines had the maximum number of respondents, accounting for 58.2% of all responses. The number of respondents for the researcher, project executive, and citizens were all equal (9) and made up 7.4% of the total. Seven participants from various fields were the lowest population, accounting for 5.7% of all responses.

Table 2
Percentage of respondent Stakeholders size

Stakeholders Categories	Frequency	Response Rate (%)
Government officer	17	13.9
academician	71	58.2
Researcher	9	7.4
Project executive	9	7.4
citizens	9	7.4
other	7	5.7
Total	122	100

3.3. Relationships between Stakeholders preferences and CWP design

Table 3 shows the frequency of the preference rating for the suitability of CWP techniques for Egyptian cities, while figure. 2 clarifies the stakeholders' preferences for CWP design. Referring to the case studies, the analysis was performed to determine the relationship between the stakeholders' preferences, and the case studies design, the type of technique used, the most appropriate projects/techniques to use, and for rains and floods issues in Egypt, and the most appropriate projects for sewage reuse and the drainage of the Nile River in Egypt. Table 3 provides the result, as shown in figure 2. Based on these results, it was determined that:

- The most preferred design was "Qunli storm Water Park" (38.58%). The rest of the parks' results were so close: "Lotus Lake National Wetland Park" (15.61%), "Mill River Park and Greenway" (15.38%), "Wadi Hanifa Wetland" (15.27%), and last was "Shanghai Houtan Park" (15.15%).
- The best technique was the irrigation ponds which were implemented in "Qunli Storm Water Park" with 43.47%, and 15.93% preferred the sub-surfaces and free surfaces techniques that were used in "Lotus Lake National Wetland Park". 14.78% of the respondents frequently were equal for "Shanghai Houtan Park" and "Mill River Park and Greenway" despite the different techniques used in both.
- 40% of the stakeholders considered "Qunli Storm Water Park" suitable for Egyptian cities to use, and 16.43% for "Mill River Park and Greenway", while "Wadi Hanifa Wetlands" and "Lotus Lake National Wetland Park" had the same rate of 14.73%, followed by "Shanghai Houtan Park" at a rate of 14.11%.
- For wastewater tradesmen and water reuse in Egypt, the majority of the respondents (50.55%) considered "Qunli Storm Water Park" the most suitable project for rain and flood issues, followed by 14.11 % for "Mill iver Park and Greenway". The highest preference frequency for sewage issues was 46.12% for "Qunli Storm Water

Park," while the lowest preference frequency was 11.41% for "Shanghai Houtan Park". Finally, the most suitable project for drainage of the Nile River was "Qunli Storm Water Park" with 43.93%, and 13.64% for "Lotus Lake National Wetland Park".

Table 3
Frequency of the preference rating for the five constructed wetland parks

	Qunli storm water park		Mill River park and greenway		Lotus Lake National Wetland Park		Shanghai Houtan Park		Wadi Hanifa wetlands	
	N	%	N	%	N	%	N	%	N	%
The design	336	38.58	134	15.38	136	15.61	132	15.15	133	15.27
The technique	303	43.47	103	14.78	111	15.93	103	14.78	77	11.05
the use in Egypt	258	40	106	16.43	95	14.73	91	14.11	95	14.73
the rains and floods issues in Egypt	369	50.55	103	14.11	90	12.33	73	10	95	13.01
thesewage problem in Egypt	291	46.12	85	13.47	99	15.69	72	11.41	84	13.31
the drainage on Nile river in Egypt	293	43.93	96	14.39	91	13.64	94	14.09	93	13.94

3.4. Relationships between Stakeholders visual perception and CWP design elements

Based on our findings and observation in Table 4 and Fig. 3, the average participant scores of CWP design elements for the selected case studies of each photograph in the photo questionnaire were calculated; it was observed that the highest scores of photographs were the water surface areas40.2%, and the planting 41.8% from the Lotus Lake National Wetland Park. The walkways design photograph from Lotus Lake National Wetland Park and Mill River Park and greenway were most appreciated. Both were given scores of 25.4%, the photograph of the sitting areas from Shanghai Houtan Park was the highest appreciated photograph, with a score of 46.7%, reverse the least appreciated photograph from Mill River park and greenway, with a score of 5.7%. The Plaza design 48.4% and the plants' theme color photograph from Mill River Park and greenway were the most appreciated photographs, reverse photographs from Qunli storm Water Park.

Table 4
Frequency of the preference rating for various landscape design elements for the five constructed wetland parks (N = 122)

	Qunli storm water park		Mill River park and greenway		Lotus Lake National Wetland Park		Shanghai Houtan Park		Wadi Hanifa wetlands	
	N	%	N	%	N	%	N	%	N	%
water surface area	11	9.0	35	28.7	49	40.2	11	9.0	16	13.1
walkways	20	16.4	31	25.4	31	25.4	24	19.7	16	13.1
sitting areas	25	20.5	7	5.7	12	9.8	57	46.7	21	17.2
Plaza design	7	5.7	59	48.4	13	10.7	35	28.7	8	6.6
planting	17	13.9	14	11.5	51	41.8	16	13.1	24	19.7
plants theme color	9	7.4	45	36.9	32	26.2	18	14.8	18	14.8

3.5. Relationships between Stakeholders demographics and Stakeholders visual perception of CWP design elements

A Chi-square analysis was used to determine the relationship between stakeholders' demographics and stakeholders' visual perception of CWP design elements (Polat et al. 2011). For the Chi-square analysis, relations were identified between users' age, education, stakeholders' categories, and Accommodation, as shown in Table 5.

Table 5
(Chi-square analysis) Relationships between stakeholders' demographics and CWP design elements.

CWP design elements	Demographic characteristics of the participants									
	Gender		Age		Education		Stakeholders Categories		Accommodation	
	χ^2	P	χ^2	P	χ^2	P	χ^2	P	χ^2	P
water surface area	4.173[a]	0.383	16.796[a]	0.399	17.971[a]	0.326	19.360[a]	0.499	3.234[a]	0.519
walkways	4.968[a]	0.291	17.973[a]	0.325	10.656[a]	0.830	17.890[a]	0.595	7.940[a]	0.094
sitting areas	2.151[a]	0.708	22.258[a]	0.135	19.653[a]	0.236	15.981[a]	0.718	16.129[a]	0.003
Plaza design	6.780[a]	0.148	17.961[a]	0.326	12.207[a]	0.730	14.406[a]	0.809	5.806[a]	0.214
planting	2.606[a]	0.626	19.639[a]	0.237	15.863[a]	0.463	18.721[a]	0.540	3.426[a]	0.489
plants theme color	2.365[a]	0.669	32.234[a]	0.009	14.428[a]	0.567	48.159[a]	0.000	3.858[a]	0.426
P -value *** 0.01 ** 0.05 * 0. 10.										

3.6. Relationships between Stakeholders Categories and Stakeholders visual perception of CWP design elements

The table below is the crosstab performed to determine the relationship between the stakeholders' categories and stakeholders' perceptions of the five case studies. Based on these findings, it was concluded that the participants' stakeholder categories reflected a distribution reflective of the city's general population. However, involvement was significantly higher among people aged 16 to 30.

Table 5. Relationships between Stakeholders Categories and Stakeholders visual perception of CWP design elements (N = 122)

Stakeholders categories		Qunli storm water park		Mill River park and greenway		Lotus Lake National Wetland Park		Shanghai Houtan Park		Wadi Hanifa wetlands	
		Count	%	Count	%	Count	%	Count	%	Count	%
Government officer	water surface areas	1	0.8	5	4.1	7	5.7	1	0.8	3	2.5
academician		7	5.7	16	13.1	31	25.4	6	4.3	11	9.0
Researcher				6	4.9	2	1.6	1	0.8		
Project executive				3	2.5	3	2.5	2	1.6	1	0.8
citizens		1	.8	4	3.3	2	1.6	1	0.8	1	0.8
other		2	1.6	1	0.8	4	3.3				
Government officer	walkways	4	3.3	5	4.1	3	2.5	4	3.3	1	08
academician		10	8.2	18	14.8	21	17.2	12	9.8	10	8.2
Researcher		1	0.8	3	2.5	3	2.5	2	1.6		
Project executive		1	0.8			3	2.5	2	1.6	3	2.5
citizens		1	0.8	3	2.5	1	0.8	2	1.6	2	1.6
other		3	2.5	2	1.6			2	1.6		
Government officer	sitting areas	4	3.3	1	0.8	1	0.8	10	8.2	1	0.8
academician		16	13.1	4	3.3	8	6.6	30	24.6	13	10.7
Researcher		2	1.6	2	1.6			3	2.5	2	1.6
Project executive						1	0.8	7	5.7	1	0.8
citizens		2	1.6			1	0.8	3	2.5	3	2.5
other		1	0.8			1	0.8	4	3.3	1	0.8
Government officer	Plaza design	1	0.8	9	7.4	3	2.5	4	3.3		
academician		6	4.9	34	27.9	5	4.1	20	16.4	6	4.9
Researcher				5	4.1	1	0.8	3	2.5		
Project executive				4	3.3	1	0.8	3	2.5	1	0.8
citizens				4	3.3	3	2.5	2	1.6		
other				3	2.5			3	2.5	1	0.8
Government officer	Planting	1	0.8	3	2.5	6	4.6	3	2.5	4	3.3

academician		11	9.0	7	5.7	27	22.1	10	8.2	16	13.1
Researcher				1	0.8	5	4.1	2	1.6	1	0.8
Project executive		2	1.6	2	1.6	3	2.5			2	1.6
citizens				1	0.8	6	4.9	1	0.8	1	0.8
other		3	2.5			4	3.3				
Government officer	plants theme color			7	5.7	6	4.9	1	0.8	3	2.5
academician		4	3.3	27	22.1	19	15.6	9	7.4	12	9.8
Researcher		1	0.8	2	1.6	3	2.5	3	2.5		
Project executive				4	3.3	2	1.6			3	2.5
citizens				5	4.1	2	1.6	2	1.6		
other		4	3.3					3	2.5		
A scale from 1 (lowest degree) to 5 (highest degree).											

4. Discussion

One of the study's objectives is to use stakeholders' virtual preferences for landscape elements to enhance urban environments in Egypt by integrating these elements into CWP design. As a result, numerous studies have explored the importance of visual variety in developing landscape features for users, with varying findings that help maximize the positive influence of these aspects on park users, such as the water surface area and planting on landscaping and design. Our study's findings also corroborate those of earlier studies. However, the results indicate that stakeholders preferred the park with the most significant water surface area (Lotus Lake National Wetland Park), owing to the character of Egyptian culture, which is attracted to water bodies for a living (Hamimi et al. 2019; Allam and Allam 2007), and habitation.

The findings indicated that stakeholders' virtual preferences for (Lotus Lake National Wetland Park and Mill River Park and greenway) were comparable because the walkways were aligned and parallel to the water surface areas, with a strong visual relationship to the water surface and walkways. Additionally, the dynamic landscape element design and the quality of the finishing materials were comparable (Abd El Aziz 2016.).The length of the walkways in the Wadi Hanifa wetlands Park, the absence of potential functions for the walkways, and the lack of visual design resulted in boredom and decreased stakeholder preference. Apart from the use of attractive theme colors, respondents' prefer the design of the most intimate, environmentally friendly seating areas tailored visually with the design of walkways.

For seats, the design of the sitting areas in Shanghai Houtan Park obtained the most virtual preference due to their consistency with and suitability for CWP design and their use of distinguishing theme colors. An innovative park design that incorporates more intimate areas that represent attractive visual patterns, diverse seating areas for individuals and groups, and a sense of social belonging (Moussa and Mahmoud 2017), whereas the Mill River Park

and greenway keep sitting areas away from water surface areas, and the lack of attractive seating design results in being the least visually attractive.

Stakeholders appreciate smooth and horizontal plazas. Thus, the plazas in Mill River Park and the greenway gained the most preferred, as they were aesthetically integrated with the design of the water surfaces and the variety of planting. Reverse the result of not preferring the plazas at Qunli Storm Water Park. The greener, visibly extended, and denser component (Sowińska-Świerkosz and Michalik-Śnieżek 2020) was preferred by stakeholders due to the nature of the need for individuals to feel green in Egypt cities that lack urban green surfaces (Ayman et al. 2011), as well as the requirement for shade in Egypt's climate (Zayed 2016). Mill River Park and greenway had less preference due to the lake's dense planting, the use of fewer shade trees, and the project's location.

The variety of theme colors used throughout the Mill River Park and greenway and the visual diversity contributed to its selection as the most significant preference ratio. Additionally, multiple tree formations create a visual connection between the tree theme colors and the water surface areas, enhancing the project's attractive appearance. Qunli storm Water Park received low aesthetic preference due to a lack of theme colors variation and a lake that did not visually attract Egyptian users.

5. Conclusion

According to official reports, wetland parks offer an innovative technique for Egyptian cities, particularly those with a scarcity of parks and public parks in a country facing water scarcity. The adoption of this approach is beneficial for the development of some solutions to the water reuse issue. While the technique is novel in Egyptian reality, it benefits urban and environmental systems. The participation of stakeholders in the study process resulted in the emergence of new needs or a rearranging of existing ones, which may be consistent with the academic and research vision of the research project but may differ in some aspects.

Age and educational changes have resulted in different stakeholder preferences that are culturally and scientifically distinct for each group. These preferences are generally reflected in the park's requirements for each group. Elders preferred seating areas, whereas youth prioritized activity spaces and plazas. At the same time, the representatives of government organizations' focused on the cost and function of the landscape elements against other criteria. The challenges presented by this type of project include gauging stakeholders' responses to the project at various phases and gauging user satisfaction with the architect decisions. The cultural and social differences between the designer and the user have a significant role in project acceptability. The experiment was a great reality in the area under examination. It was discussed by the government agencies responsible for the city's development, which resulted in the creation of appropriate plans for integration between the project and the metropolitan area, which are currently being studied with the cooperation of the city administration. This development results from the methodological approach of including stakeholders in the research, design process, and solution creation, and they are ultimately responsible for decision-making. Additionally, the bureaucracy responds negatively to this method of engagement between society and government entities. Specific legal and administrative complications are a substantial impediment to this type of active participation.

One of the essential tools to be employed in Egypt's development process remains the performance and stakeholder perception questionnaire. As a result of the research, it is recommended that a series of questionnaire surveys be conducted among stakeholders on comparable projects. Additionally, enhancing the development of ideas and theses for the development of Egyptian urban areas, but only after their promotion in a local context and studies of spatial and temporal variables for each thesis, taking climatic conditions into account during the design process

and selecting plants appropriate for hot and dry climates. To choose and develop social activities and spaces that are culturally compatible with Egyptian society. Seats and walkway areas are designed to meet the demands of Egyptian families with children aged five and older. They considered stakeholders' needs for cost-effective development and operation of park projects—expansion of water reuse projects and green technologies due to their positive influence on human and environmental health. Encourage applied research in this area due to Egypt's water scarcity.

Declarations

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Competing Interests

“The authors have no relevant financial or non-financial interests to disclose.”

Author Contributions

“All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Hayam M. Omayer], and [Ahmed Haron]. The first draft of the manuscript was written by [[Hayam M. Omayer] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.”

Data Availability

“The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.”

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50. **Statements and Declarations**

Figures

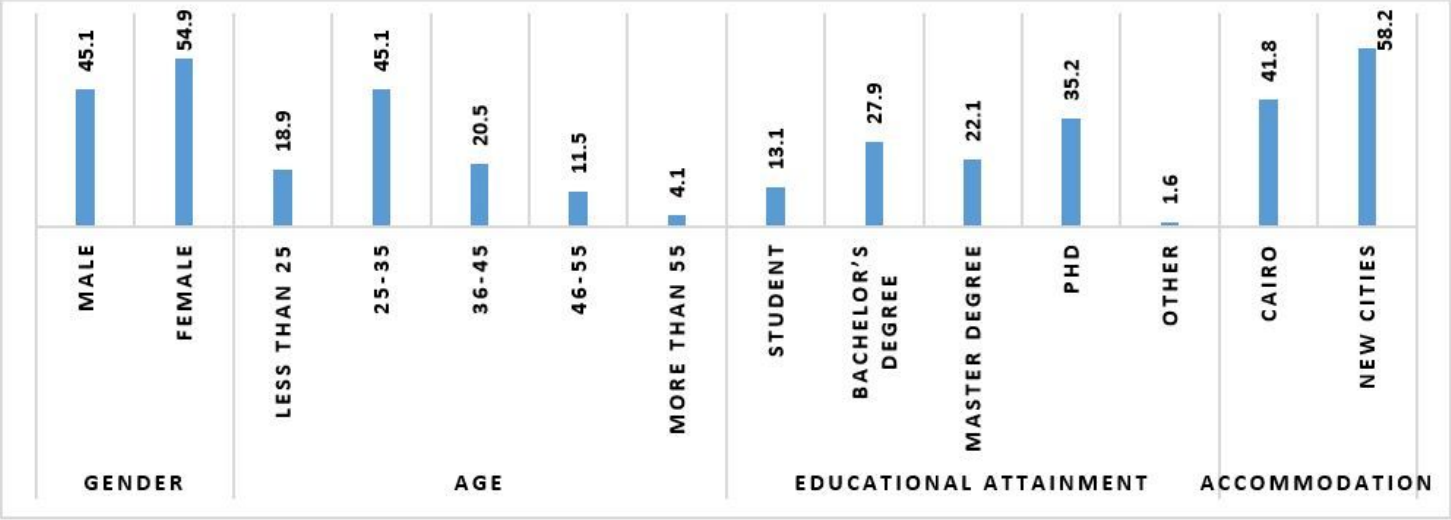

Figure 1

Profile of the stakeholders

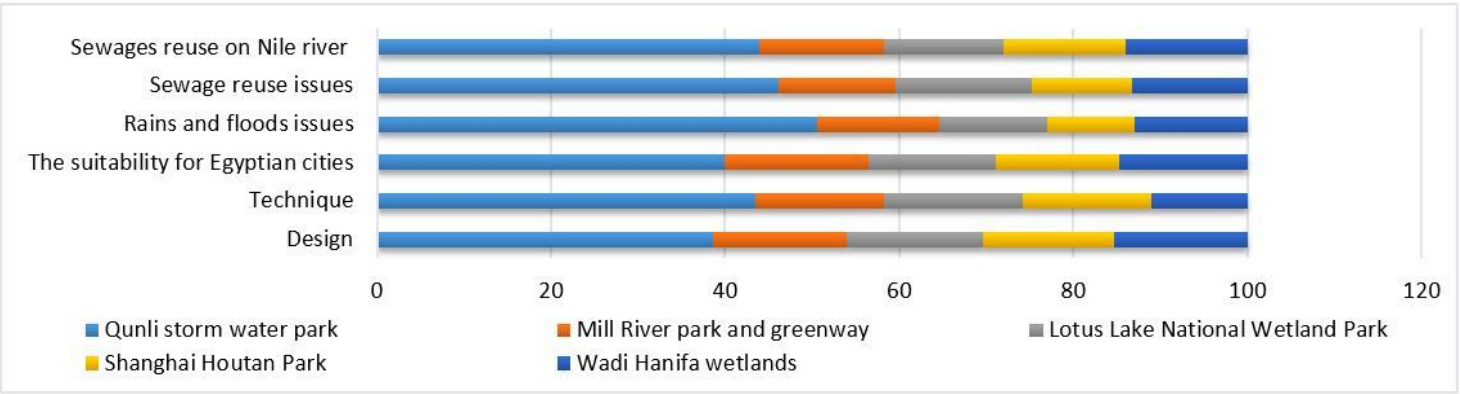

Figure 2

Stakeholders’ preferences for CWP design

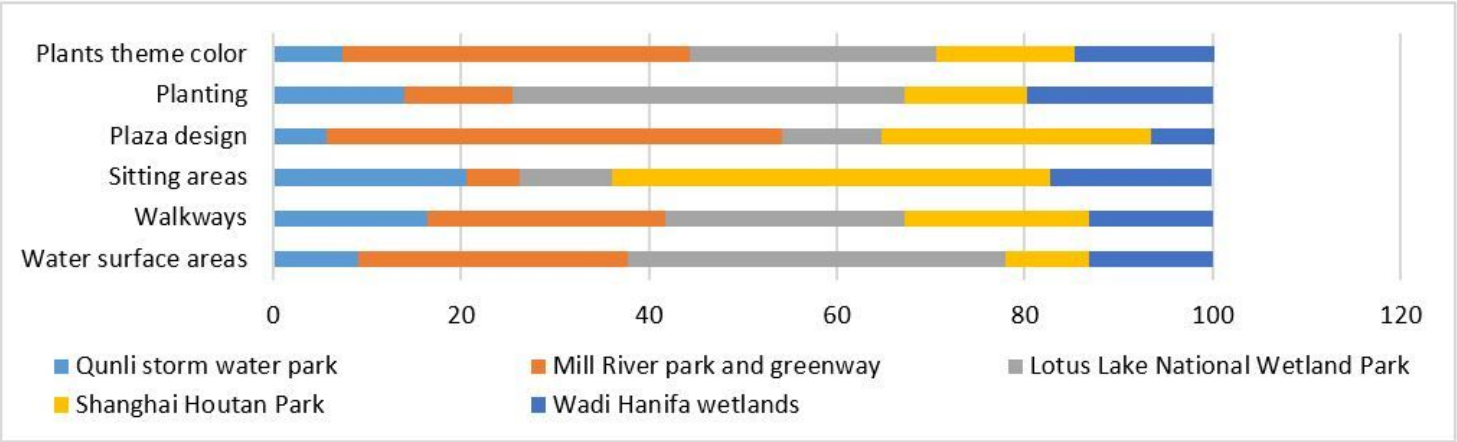

Figure 3

Stakeholders’ preferences for CWP design elements