

SUSTAINABLE KNOWLEDGE PARK

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Abstract

This work examines the Saudi society's concern about education, learning and disseminating knowledge among the people of Saudi Arabia. It also includes the realization of a project that would raise awareness of knowledge and expand appreciation of cultural arts and technology among Saudi societies. Thus, this work has proposed the development of knowledge park that would contribute to bridge the gap between the society's education needs and the availability of public knowledge parks. Five case studies for the development of the knowledge park were examined in this work. In this work, the estimated total project area is 90,000 m², with build area of 23,100 m² and outdoor area of 14860 m². The selected site area is located at Thuwal, northwest of Jeddah, Saudi Arabia. This location is close to the red sea and King Abdullah University of Science and Technology (KAUST). The knowledge park will consist of several facilities including mix building, art center, kidzania park center, motel, marina club, restaurants, maintenance and information center. The proposed knowledge park development will serve as a common place for society where people can utilize educational and entertainment facilities in a sustainable spirit and environment.

Keywords--knowledge park, research center, Saudi Arabia, education, society

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INTRODUCTION

Knowledge is critical for the survival of human beings and for ensuring sustainable development [1]. Since the dawn of human civilization, the creation and application of new knowledge in every sphere of human activity has contributed to the evolution of people's societies and economic welfare [1]. Knowledge will play a key role in shaping economic growth, social development, cultural enrichment and environment empowerment [2]. Nowadays there is much discussion about the concept of 'knowledge society' [3]. This concept has become rather fashionable and suggests that knowledge is the prominent landmark and driver of socio-economic and technological dynamics. The knowledge society involves all nations and peoples in the creation, preservation, dissemination and use of knowledge [4]. It is aimed at alleviating poverty and improving the quality of life without compromising that of future generations [5]. Thus, knowledge is increasingly seen as the key to escaping both poverty and marginalization.

Knowledge Parks are emerging around the world in the quest for sustainable growth and economic development for cities, regions, countries, and businesses [6]. Benneworth et al. [7] work has expressed that knowledge parks are an inexorably regular component of urban development, as it is done to stimulate monetary flourishing by advancing the reconciliation and centralization of learning, innovation and human capital. Furthermore, the work of Díez-Vial I et al. [8] has affirmed that the role of knowledge parks as areas of cultivating scientific knowledge trade and promoting urban sustainability to mankind. Vásquez-Urriago ÁR et al. [9] work has found that the knowledge park is one of the most important development strategy activities for governments and organizations promoting innovation, sustainability and urbanization.

Thus, in this work, a proposal for the development of a sustainable knowledge park in Saudi Arabia is presented. The knowledge park development has aimed to improve the quality of life at Saudi Arabia based on sustainability and urbanization. The new Corniche in Thuwal attracts many tourists from Jeddah and other cities of the Kingdom, due to its splendor and beauty.

Thus, a knowledge park will be developed at this region to further boost its economic activity.

CASE STUDIES

For this work, five case studies were analysed. The selected case studies are :

- Hong Kong West Kowloon waterfront
- Markaz Knowledge City
- The Centre National D'Art et De Culture Georges Pompidou
- The City of Arts and Science
- Al Hussain Public Park in Jordan

Hong Kong West Kowloon waterfront

West Kowloon is a part of Kowloon, Hong Kong situated within the Yau Tsim Mong District (Figure 1). It is principally a stretch of land reclaimed and which has been opened to development in the late 20th century. It has been zoned for mixed commercial, residential and leisure development, and was almost doubled in size with a large reclamation scheme as part of the Airport Core Program. West Kowloon waterfront promenade is along Victoria harbor on the clamation of west of Kwun Chung in Kowloon of Hong Kong. Occupying an area of 36000 square meters, is situated at the southern tip of west Kowloon with its entrance at the junction of Austin Road West and Nga Cheung Road, Tsim Sha Tsui, Kowloon. The promenade has been partially open for public use since 17 September 2005. It was designed by Rocco Design Architects Ltd. West Kowloon water front caters a wide range of physical features like waterfront, harbour tunnel for public transport system, landfill ground and adjacent urban developments. The green terrain at the south is a continuous undulating green lawn by the waterfront filled with leisurely retail and diners. The City Link at the north fuses with the existing neighbourhood and accommodates spaces for living, working and all the commercial activities. The cultural core in the middle unifies all the visual and performing arts facilities. The great canopy over the complex is to be the signature element of the new complex. It will be visible from all parts of Hong Kong and it's harbor will act as a beacon for visitors. In structural terms, the canopy is a giant grid shell structure that derives strength from its double curved shape. This structure design will

withstand extreme wind conditions and is geometrically adjusted for wind tunnel investigation to relieve extreme pressure loads.



Figure 1. Hong Kong west Kowloon waterfront

Markaz Knowledge City

Markaz Knowledge City (MKC) is the innovative initiative of Jamia Markaz (Figure 2). MKC is a versatile project with the most modern infrastructure to enhance knowledge and redefine a value based living at Malabar, Kerala. At the first phase of MKC the project occupies 125 acres of land, a township including the Sharia City which contains the Academic City, the Healthcare City, the Commercial City and the Residential Enclave. Spread over 125 acres of lush greenery, the Markaz City is one of the enormous projects in South India, located at Kaithapoyil, just 45 Kms from Calicut City. Markaz City is conceived as an integrated city that provides infrastructure for high-class academic institutions, residential facilities, health and hospitality facilities, recreation and leisure facilities, social and physical infrastructure support to promote the city as a center of international excellence. The MKC has implemented several carbon footprint reduction ideas such as rainwater harvesting and water recycling, solar powered lighting for outdoor common areas and roads, cycle tracks throughout the campus, LEED gold standard in building design and construction, and large open spaces on campus with spectacular views of the surroundings.



Figure 2. Markaz Knowledge City

The Centre National D'Artet De Culture Georges Pompidou

The Centre National D'Artet De Culture Georges Pompidou (Figure 3) is dedicated to the transmission of today's architecture, in all its forms. Conveniently, it is located in the

Buaubourg district at the heart of Paris and occupies an area of 100,000 m². The centre was designed by Renzo Piano and Richard Rogers in 1971, and features avant-garde forms and scales. The building height is 42 meters with 166 meters long and 60 meters wide. It consists of eight floors, including three underground ones. The centre hosts a large public library, theatres, cinemas and a musical research institute as well as one of the largest museums in the world which welcomes up to 25,000 visitors daily. The Pompidou Centre broke the mold with its construction 'inside out.' The main concept is to expose all the functional parts outside of the building. A walkway is installed between the frames on the west façade as well as an escalator on the outside of the frame. The interior spaces were freed by placing all the walkway and functional system outside. Each level of the five floors represents 7500 m² with no column, pipes, stairs and walls except for fire pipes for safety wise. There was no doubt that this curious design represents a vivid piece of experimental architecture. The Center Pompidou's fourth and fifth floors are home to the Center for Industrial Design and the Musée National d'Art Moderne, one of the largest international collections of modern art in Paris. Bibliothèque Publique d'information, France's largest library, occupies the center's third, second and first floors. The ground level hosts a temporary exhibition and an open public space connected to the outside court. The square in front of the center is full of street performers and urban youth culture, making it a vibrant and lively area. It is the link between the center and the city. It has a gentle slop introduced to the entrance and displays the city's live and thus the façade's outer walkway. The exterior hanged walkway also reflects the meeting points between the center and the city, in fact the entire façade is a public space where access is freed without constraints. In the rest three underground floors, concert halls and car parks are accommodated.

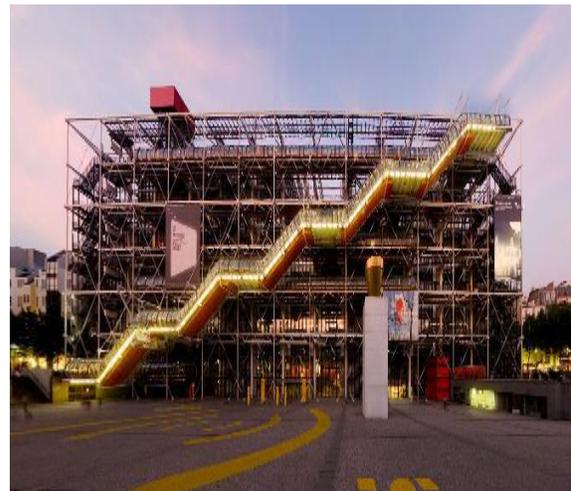


Figure 3. Markaz Knowledge City

The City of Arts and Science

The City of Arts and Sciences (Ciutat de les Arts I de les Ciències) (Figure 4) is the hitech quarter of Valencia designed by Santiago Calatrava in 1991. It is a large-scale urban recreation centre for culture and science which also incorporates L'Oceanogràfic, an underwater city designed by the late Felix Candela. Set in the old dried-up river bed of the Turia, midway between the old city of Valencia and the coastal district of Nazaret, the City of Arts and Sciences covers an area of 350,000 m². The complex comprises five futuristic structures, including Opera house and performing arts centre - El Palau de les Arts Reina Sofia, Imax Cinema, Planetarium and Laserium - L'Hemisfèric, Walkway / Garden - L'Umbracle, Science museum - El Museu de les Ciències Príncipe Felipe, and Open-air oceanographic park - L'Oceanogràfic.



Figure 4. The City of Sciences and Arts

Al Hussain Public Park in Jordan

Al Hussain Public Park in Amman, Jordan, created in memory of the Late King Hussein, covers 280,000 m² of a hillside (Figure 5). By accommodating a cultural village, sports fields, memorial building, historic passageway, decorated gardens, amphitheatre, circular yard, automobile museum, children's museum, traffic park, the park provides cultural, educational and recreational places for the public. On the eastern side of the village there is a coffee shop and two restaurants with a view overlooking the city. Designers made sure that only natural stones are used and metallic elements. Part of the building was covered with a sand hill and plants to lessen the effect of the massive stones and to give the impression that the building is merging in with the surroundings.



Figure 5. Al Hussain Public Park in Jordan

PROGRAM ASSUMPTION AND SPACE DETAILS

For the development of knowledge park, the estimated total project area is 90,000 m², with build area of 23,100 m² and outdoor area of 14860 m². Table 1 shows the details of the build area. Based on Table 1, the build area will comprise of several facilities such as mix building, art center, kidzania park center, motel, marina club, restaurants, maintenance and info center.

Table 1. Build area

Facility	Users	Total current area	Circulation area	Gross area
Mix use building	2600	3205m ²	960 m ²	4160 m ²
Art center	1243	2318m ²	700 m ²	3020 m ²
Kidzania park center	2132	3196 m ²	960 m ²	3600
Motel	315	2771.5 m ²	830 m ²	3600 m ²
Marina club	573	3106 m ²	930 m ²	4030 m ²
Restaurant courts	-	2400 m ²	720 m ²	3120 m ²
Maintenance	222	745 m ²	225 m ²	970 m ²
Total buildable area	7098	15,766 m ²	5325 m ²	23100 m ²

The details of the outdoor area is shown in Table 2. Based on Table 2, the outdoor area comprises of outdoor event halls, galleries, passageway, outdoor marina, and shops.

Table 2. Outdoor area

Space	Quantity	Users	Area	Net Area
Outdoor event halls	2	500	530 m ²	1060 m ²
Galleries	2	300	330 m ²	660 m ²
Passageway	1	-	4300m ²	4300 m ²
Outdoor marnina	-	-	8600 m ²	8600 m ²
Shops	20	-	12 m ²	240 m ²
Total area			14860 m ²	

SITE SELECTION AND ANALYSIS

Jeddah is located in Saudi Arabia's Makkah province in the middle of the east coast of the Red Sea. It comprises an area of 5,460 km² which is 2.24 percent of the total area of Saudi Arabia, 2,250,000 km². The urban area of Jeddah is 1,765 km², which represents 0.08% of the total area of Jeddah. The selected site is located in the northwest of Jeddah (80 km), in the area called Thuwal, in front of the red sea next to King Abdullah University of Science and Technology (KAUST) (Figure 6). At the location, KAUST and the sea are on the north and east side, the achievement road is on the south side, while there is a vacant land on the west side. The total area of the site is 90,000 m². The site is surrounded by different categories of areas, which are educational from the east, business (economic) from the west, residential from the south, religious and business from the far west, and governmental from the southwest.



Figure 6. The selected Site

DESIGN OF KNOWLEDGE PARK

Sustainable knowledge park will include multi-stage public spaces that accommodate mixed use buildings consisting of convention centers, public libraries, technology institutes, and innovative and research centers, including kidsania park centres, art centres, marina clubs, hotels, auditoriums with small art galleries, restaurants, and admin buildings. The sustainable knowledge park project aims at combining sustainability, innovation and education with entertainment, as well as creating urban spaces for public interaction and adding positive value to the city and its surroundings. The project represents an opportunity for users to practice, experience and perform different activities of sustainable, educational, and training, where people of different ages who are interested in this knowledge can be trained and more knowledgeable in different ways of edutainment approaches. The master plan of the proposed knowledge park is shown in Figure 7.



Figure 7. Proposed Knowledge Park

The proposed knowledge park will be built with the following features such as green roofs, sustainable pedestrian, solar panel, wind catcher, wind turbine and seawater energy based air conditioning system. The structure will comprise of space frame steel structure and steel frame as it provides strong resistance and economic efficiency. Furthermore, it provides column-free space, aesthetic appearances offering flexibility and adaptability. In addition, glass reinforced gypsum will be used for an ideal complex design that characterizes by low cost, versatility, strength, durability, and lightweight. In addition, glass reinforced gypsum (GRG) will be used for an ideal complex design characterized by low cost, versatility, strength, durability, and lightweight. Furthermore, GRG can be manipulated in any design and texture, making it extremely versatile and it is also flame resistant.

CONCLUSION

This work has proposed a design plan for the development of a sustainable knowledge park in Saudi Arabia. The proposed knowledge park will be developed at Thuwal, which is located 80km from Jeddah, Saudi Arabia. This site is next to the Red Sea and is also close to King Abdullah University of Science and Technology (KAUST). The knowledge park will include several facilities such as mixed building, art centre, kidsania park centre, motel, marina club, restaurants, maintenance and information centre. This proposed project will be able to combine sustainability, culture and education with entertainment, which will be the first example of its type in the city, and it will be considered one of the precursor projects in Jeddah.

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