THE CONTRIBUTION OF NATURAL AND CULTURAL PARKS IN SUSTAINABLE DEVELOPMENT. AS A CASE STUDY: THE FOUNDATION CULTURAL CENTER STAVROS NIARXOS IN GREECE.

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Abstract

The degradation of the urban environment by human activities, making more urgent the need for creation of natural parks in the built environment, these spaces enhance the quality of life of residents at the same time helping them to come into contact with the natural environment. Many natural parks combining nature with the creation of cultural spaces and developing of various educational activities.

This study refers to the use of the open space in the Faliron Delta area in Athens, with the creation of a natural park, together with the construction of the Cultural Centre Foundation Stavros Niarchos. To carry out this survey, at the international level similar parks combining nature with cultural educational and other actions, have been recorded. Then the survey focus on a case study. A research in situ and interviews took placed. Also it uses statistical data, charts and information during the construction of the project by the Stavros Niarchos Foundation.

The results showed that the utilization of open outdoor spaces in urban environments and their conversion into natural parks and cultural spaces, contribute to the promotion of the natural and cultural environment of the area. The Foundation Cultural Center Stavros Niarchos, after its completion will provide as environmental design standard and promote culture, not only in local level but also in global. Moreover, it will contribute to improve the quality of life of residents and sustainable development not only of the Faliron Delta but also in the wider region.

Key words: *Natural and cultural park, Foundation Cultural Center Stavros Niarchos*

Introduction

Nowadays the need of modern man to regain the lost contact with the natural environment of modern man has become fully understood. This has a result the creation of new green spaces within the urban environment. The design of these areas is based on environmental principles and has as a target the sustainability and quality of human life. Moreover the human relationship with the arts, culture, knowledge and evolution, is needed. Within this framework, in many modern cities around the world natural spaces and parks that combine the natural landscape with a diversity of cultural infrastructures and activities have been created.

In this study, initially, examples parks, which host major cultural centers, at an international level are recorded. Then, the study investigates the use of a large open space in the area of the capital of the Greek state in the Delta of Faliro (former Hippodrome). The specific area remained unused for eight years. Today the construction of the "Cultural Center Stavros Niarchos Foundation" is being completed. The construction of this center combines the natural environment with cultural uses, recreation, sport and education. With the completion of the project, among other things the triptych of Stavros Niarchos Park, National Library of Greece and the Greek National Opera, will have been completed.

Then, the past and present of the situation of the area is recorded and presented, along with assessing the final situation that will occur after the completion of the project. The evaluation gives the possibility to draw conclusions, which are useful for dealing with similar design cases at local and international level.

The hypothesis of the study is related to the use of open spaces in urban environments and their emergence through environmental design of outdoor cultural spaces in places that offer recreation, thus, introducing the natural environment in the city, restoring public life in a society, promoting culture and becoming incentives so residents regain their contact with public spaces. In short, a key challenge is to answer the question whether the "Foundation Cultural Center Stavros Niarchos" that is created in the Greek capital, will be beneficial and whether it will contribute to the sustainable development of the area and improve the quality of life.

Natural Parks and Cultural Infrastructure

This section gives examples of cities where great natural spaces were created, which combine green areas, rest, recreation, sports, meeting places for people and nature in the heart of the city. These areas simultaneously accommodate cultural infrastructures, major cultural centers, museums, and other. The choice of parks is made with the following criteria:

- They belong to the category of open spaces in an urban environment
- They are global destinations with particularly high numbers of visitors per year. So apart from green areas, relaxation and recreation, they are also an important source of economic benefits and create jobs.
- They are located in a central point in the city and are now part of the everyday life of the residents.
- They combine elements of environmental sustainability (green, water, cold materials and other) with a variety of activities and uses (culture, sports, recreation, education).
- They are public gathering places, meeting, they increase the social sense and bring together people with common interests.
- They accommodate major cultural centers, museums, and other.

Central Park in New York

Central Park is located in the heart of Manhattan in New York, has an area of about 3,410 acres. It is the busiest park in the United States with about thirty million visitors a year. It has been declared as a "National and Historic Landmark» (NHL) since 1962. It was designed in 1858 by the American landscape architect and journalist Frederick Lowe Olmstent and the English architect Calvert Vaux. Its construction began in 1858 and was completed fifteen years later in 1873.

The largest proportion of the landscape has been reformed. The lakes are artificial and most of the flora comes from planting. There are many walking trails, two skating rinks for ice (one functions as a summer pool), a Zoo, a Wildlife Refuge, the open Ntelakorte theater, the legendary carousel, castle Belvedere, the puppet theater, seven lakes, and large areas with grass for sports or relaxation and playgrounds.

Fig 1. Central Park (http://www.nyctourist.com)

The park area is an oasis for migratory birds and the 10 km long perimeter road is used for jogging, biking and skateboarding, especially on weekends and after 7 pm where the movement of vehicles is prohibited. In the park there is also the Metropolitan Museum of Art. (http://en.wikipedia.org/wiki/Central_Park).

It is noted that the proportion of green areas per inhabitant in New York is 23.10 sq.m. per inhabitant (http:/blog.sustainablecities.net).

Hyde Park and Kensington Gardens in London

One of London's largest parks is Hyde Park, which together with Kensington Gardens cover an area of about 2,529 acres. Green spaces receive between 10 and 15 million visitors per year. They are located in the center of London and extend across an artificial lake called «The Serpentine», which was created by Queen Caroline, wife of George II in 1730, blocking the river West born For centuries the area was used as a hunting place for the royal family.

The park besides being a walking and relaxation area, hosts many activities such as informal football, cricket, softball and others in a specific area that is called «The Sports field», biking, skating, skateboarding, jogging and others, in all paths and roads, lake cruising with rent water bikes, sports center with tennis and tennis club, swimming from June to September (during the Olympic Games of 2012 the triathlon and the 10 km swimming race were held in the park), horse riding, playgrounds, shows, concerts, festivals.

Other notable parts of the park are: the "Speaker's Corner" where speeches and discussions on any matter within the boundaries of noble conduct are permitted , Wellington Arch, Diana's Fountain, Kensington Palace with the relative gardens, monuments and sculptures.

The lake that is included in the park, is a habitat for many birds and insects while the flora includes many species of trees, shrubs and flowering plants (http:/www.royalparks.org).

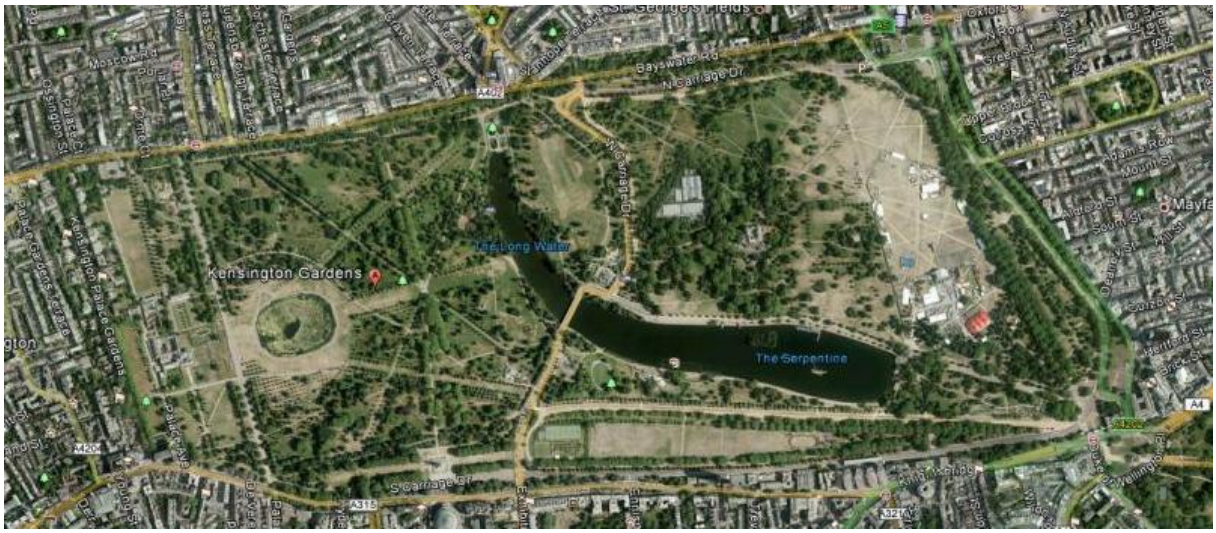

Fig 2. Hyde Park of London (www.google earth.com)

It is noted that the ratio of open spaces, including green areas per inhabited in London is 20.00 sq.m. per inhabited (London Borough of Camden Open Space,, 2008).

Balboa Park in San Diego

The Balboa Park in San Diego of California is one of the US largest urban parks covering an area of approximately 4,855 acres. They are visited by almost 12 million visitors a year.

The plot for the construction of the park had already been secured in 1868 and the first interventions began in 1892. It has been declared as a "National Historic Landmark and» (NHL) since 1977. Today the park is home to numerous cultural, entertainment, educational and sports facilities surrounded by green areas and gardens, Some of them per are indicatively mentioned by category, since the total number exceeds 60.

Museums and Research Libraries (accompanying museums): natural history, Human, Photographic Arts, Aerospace, Automotive, Art, Model Railway, and other.
Gardens: Cacti, Australian, California Plant, Roses, and other.
Performing arts: Marionette Theatre, Children's Theatre, Art of Cultural Dances, Symphony Youth Orchestra and other.
Attractions: Visitors Center, Carousel, Zoo, United Nations Building, Miniature Railway and other.
Leisure: Dance Schools, Gyms, Tennis Association, Golf, Activity Centre (tennis, volleyball, table tennis and other), which hosts tournaments, Elderly Activity Room (board games, walking, arts, dancing and other), Center of Traditional dances and other.

Also included are sixty-five km of hiking trails of varying difficulty and landscape, multipoint wireless internet access, 3 parks for dogs, scouts facilities, parking, restaurants, cafes and others.

It is noted that in the park there are very old trees, and in some cases rare trees and groves that make up an urban forest in the center of San Diego. The majority of the original trees were planted by American botanist, gardener and landscape architect Kate Sesions, also known as "Mother of Balboa Park" which was a pioneer in using and promoting the trade fo many native California flora species.

Fig 3. Balboa Park in San Diego (www.google earth.com)

In 1892 she asked to be granted 30 acres in the park to create a nursery and in return she would plante 100 trees annually in the previously barren park and 300 trees per year in other parts of San Diego. The inheritance of that agreement today, includes numerous cypresses, pines, oaks, eucalyptus trees and other species cultivated in the gardens of Kate Sessions and originate from seeds from around the world (www.balboapark.ork/).

Buen Retiro Park in Madrid

The Buen Retiro Park or El Retiro is located in the center of Madrid with an area of approximately 1,415 acres. The park was part of the royal property until 1868 and then became a public space.

It could be described as an open-air sculpture museum, as the visitor has the opportunity to admire many statues, sculptures, fountains and monuments, such as the colonnade that is dedicated to the memory of the King of Spain, Alfonso the 12th. There are also, remnants of the palace Aires Retiro which function as museums hosting paintings and military exhibits. Just in front of the monument of the king, in the middle of the area a large rectangular lake that one can cross by rowing in a rented boat has been created.

Walking paths branch out and disappear into the vegetation, while one can visit them by horse carriage. Two other lakes and some waterways combine with monumental sites and numerous admirable, elaborate gardens.

In the park sports activities are hosted. There are, one football field, six tennis courts, two handball and one basketball courts. Finally, from May to October, every Sunday the Symphony Orchestra of Madrid gives free concerts in the park area. Every year a book fair, is organized and everywhere one can find marionette shows and all kinds of street performers (http://en/wikipedia.org/wiki/Buen_Retiro_Park).

Fig 4. Buen Retiro Park (www.google earth.com)

It is noted that the proportion of green areas per inhabitant in Madrid is 14 sq.m. per inhabited (http://blog.sustainablecities.net)

Golden Gate Park in San Franscisco

The Golden Gate Park is located in San Franscisco California. It receives 13 million visitors a year and its area is approximately 4,115 acres. Similar in shape to the Central Park of New York but larger in area and with a sea front of about 800 meters in the Pacific Ocean.

The need for creation of a large park emerged from 1860 and ten years later the construction began by William Hammond Hall. They planted trees with dominant species of eucalyptus (Eucalyptus globulus), pine (Pinus Radiata), (Sequioa Sempervirens) and cypress (Cupressus macrocarpa).

In the area there are two large lakes, Stowe and Sprekels lakes and eight smaller. Some of the numerous bird species that one may encounter are herons, hawks, sparrows, woodpeckers, pygmy and others.

Sports facilities include golf, soccer, polo, softball, archery, handball, basketball, tennis, swimming pools and also include the Kezar stadium that is hosting professional American football and lacrosse games. Those places are also open for events, exhibitions, concerts, concerts and others.

Also, there are playgrounds and carousels for visitors, flower nurseries (tulips, roses, and other), the famous Botanical Garden of San Francisco with more than 7,500 plant species, the Japanese Garden and the Garden of Shakespeare for flower enthusiasts and others.

Also it is worth mentioning that the museum "De Yang", with collections of objects from many corners of the planet and the "Academy of the California Science", a natural history museum that was renovated from 2005 to 2008, was equipped with solar power generation systems, glass surfaces shell that exploit natural light and solar energy from recycled steel, timber structures and environmentally controlled treatment and origin sources are also hosted in the park. As a result, the

museum uses at least 30% less energy than the requirements of the relevant legislation (www.golden-gate-park.com/).

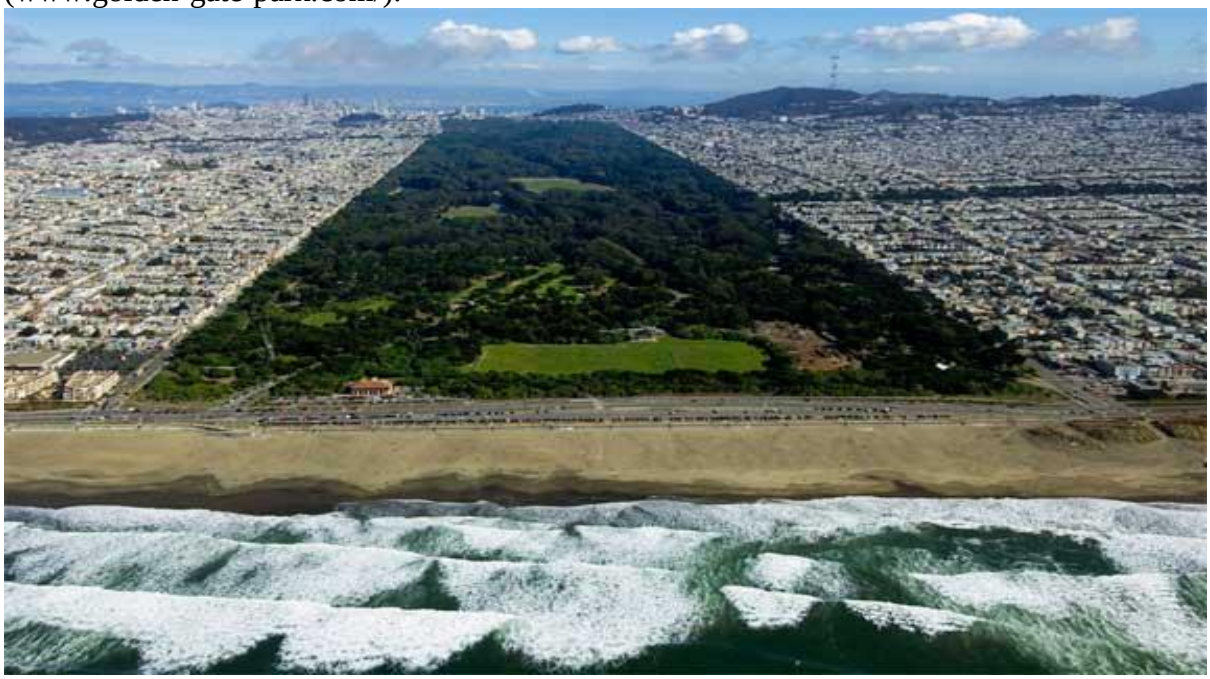

Fig 5. Golden Gate Park (www.chamoismoon.com)

It is noted that the proportion of green areas per inhabitant in San Francisco is 32.00 sq.m. per inhabited (www.chamoismoon.com).

Case study: Foundation Cultural Center Stavros Niarchos (FCCSN)

In 2006 the "Stavros Niarchos" Foundation announced its intention to finance the construction of FCCSN. In 2007 the architectural office Renzo Piano Building Workshop (RPBW) was chosen for project planning. In 2009 the preliminary design was presented to the Prime Minister and the Greek people and the contract with the Greek Government, which was ratified by law by the Greek Parliament was signed. In 2011 the excavation works began.

The Stavros Niarchos Foundation Cultural Center will be a complex of urban outdoor green space, education, culture and entertainment due to the fact that it combines a communal Park of 170 acres with a building that will host the new National Library (NL) and the New National Opera (NO).

The project will be implemented only at the expense of the Stavros Niarchos Public Benefit Foundation and after the completion of the works it will be delivered to the Greek Public (www.snf.org).

The area that has been chosen for the project is the "urban void" that was created after the relocation of the old Hippodrome, which operated there since 1925, to the new facilities at Markopoulo for the needs of the Olympic Games of 2004. During the Olympics Games the area was used as parking space for guests of the Olympic facilities of Faliro Bay (Tae Kwon Do, tennis Beach Volley). Since then it remained unused. The Esplanade, a very wide pedestrian 1 kilometer road, passes over the Poseidon Avenue, bridging this plot with the sea.

The plot is located within the boundaries of the Municipality of Kallithea and is about 4.5 km. from the center of Athens and 3.5 km. from the center of Piraeus. It is located in the residential area

of the Municipality of Kallithea and in the east it borders with the limit of Paleo Faliro and Neas Smirnis municipalities, while in the south and southwest it borders with the Olympic Pole of Faliro.

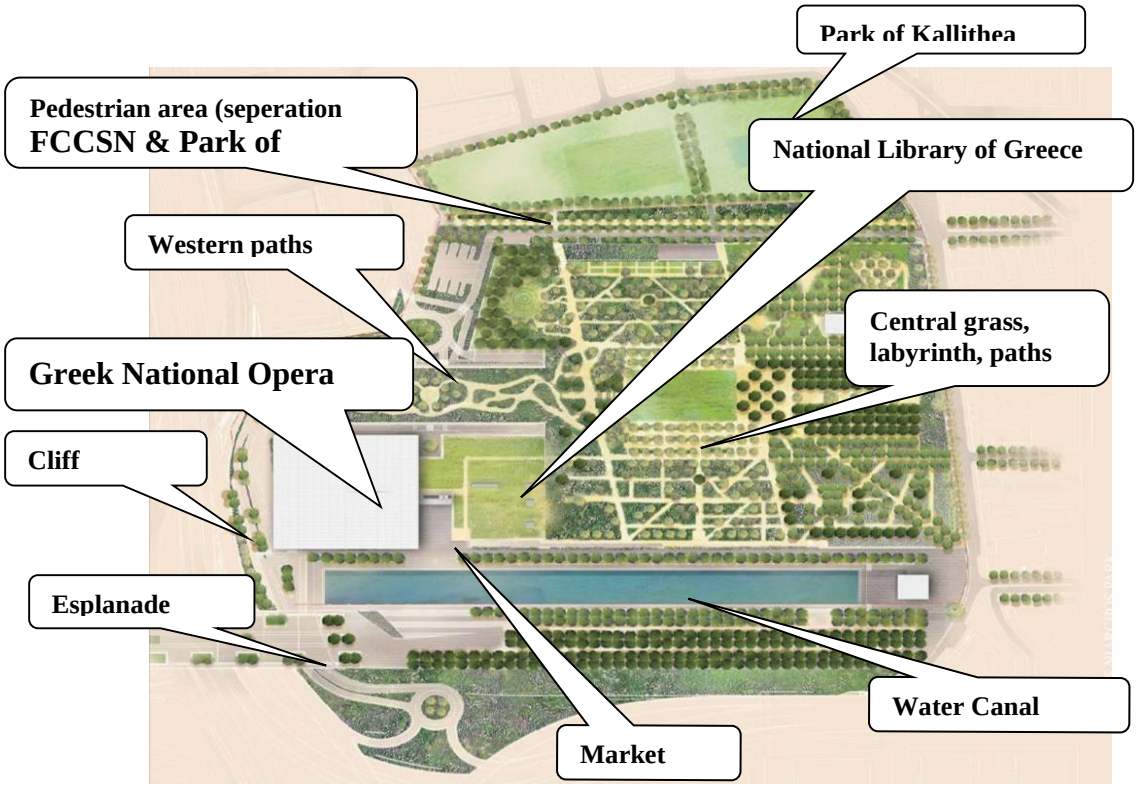

Fig 6. The FCCSN (http://www.snf.org/)

Park "Stavros Niarchos"

The 85% of the area of FCCSN will be occupied by the Stavros Niarchos Park. The central idea is development in the form of a hill , starting from the northwest side of the field (to the city) and ascending along a parabolic curve to the northwest side (to the sea) where the buildings of the National Library and Opera have been installed.

Gentle slopes from 2% to 7% were created, at the point where the hill is climbing over the buildings, creating the green roof. Continuing south, the hill reaches a maximum height of 32 meters and leads to "the cliff", a series of retaining walls that surround and hold the hill forming simultaneously the boundaries of the Park.

Layout design and Activities Park

The layout design of the park "Stavros Niarchos" corresponds to the different ecology that exists in the North and South ends of the park. The southern edge of the park will be affected by the wind, as it rises 32 meters above the city. The design and selection of plants in this area meets these conditions. Each area of the park has a different climate, feeling and program. The northern part of the Park includes an avenue for creating shaded areas for play and meditation.

This area includes specialized games that will offer an opportunity for children to play, while at the same time will encourage the social development of children through creative collaboration and the development of curiosity. At the northern part of the park, a paved space will be constructed.

Fig 7. Park (In the background, the energy roof and left the Canal and Esplanade) (http://www.snf.org/)

The central area of the grass is suitable for concerts, festivals, games, outdoor dining and is flanked on each side by rows of trees with olive trees. The trees are resistant to wind and drought and offer shade and space more cooler than the area of lawn.

The pedestrian area leading from the North East corner and continuing to the West will have the appropriate width for the passage of fire trucks and large trucks that will carry the stage for the performances on grass.

The amphitheater stairs in the southern edge of the grass form the 5% slope of the site, creating spaces for performances and movies.

The Mediterranean Garden will have a wide variety of plants. Visitors will be informed of the Greek horticultural tradition in a garden where oregano, thyme, lavender, rosemary and other native species will be prominent.

The area of the western paths will include flower beds with fruit and vegetables and a maze for meditation, small concerts and shadow theater after sundown. The maze will be surrounded by a low wall and steps-seats for spectators as is customary in traditional Greek amphitheatres.

On top (on the car roof of the building), footpaths will lead walkers to the view of the bay. In the center of this place, ten major trees provide shade and define a concentration space.

The roof of the National Library and one part of the roof of the National Opera will be planted with a type of grass that can withstand in drought and needs minimal watering.

The green ratio in the study area (Kalithea, Muschato, Nea Smyrni and Paleo Faliro) is only 0.6 sq.m. per inhabited and after the implementation of the Stavros Niarchos Park, the ratio will be double, 1.2 sq.m. per inhabited (BCG, 2016).

Space Environmental Design - Better microclimate

Planting playa a very important role in shaping of the environmental behavior of the study area. Before the construction of the project, the area included some scattered eucalyptus trees on the perimeter of the land while the remaining area was covered with materials of sand and gravel. The artificial green space that will emerge will incorporate elements of a natural landscape, it will be a real hill.

The way that the natural elements (ground - planting - water), have been taken into account (Ventourakis and Tavaniotis, 2012) during the project design and formation of the outdoor area is summarized in the following new features, which among others, influence the microclimate conditions of the area:

- Cooling in the summer months. More than a thousand trees will absorb water which evaporates consuming energy and giving moisture to the atmosphere by reducing the temperature in the nearby residential environment.
- Soil Shade with a consequent the reduction of the absorbed solar energy which contributes to the phenomenon of heat island. At the same time the phenomenon of glare caused by light from existing materials of sand and gravel is addressed
- Protection from the wind and drought through planting of shrubbery. Halting of strong winds blowing in the area through row planting in different directions from the North-South axis.
- Filtering the air from circulating microparticles and pollutants from floating dust due to the deceleration of the wind, which is deposited on the foliage of plants and rinsed with the first rain.
- The water channel covering 12,000 sq.m. will absorb large amounts of solar energy due to the high heat capacity of water, while cooling the atmosphere. Also it will collect rain water in times of heavy precipitation by acting as a flood protection project. Also, the fountains on the north side of the park will operate as cooling elements.
- Providing conditions of thermal and visual comfort for visitors of the Park in all areas
- The terrain in the north is designed to work as a retention basin to a rainfall allowing the water to drain slowly from the park. The use of permeable materials in most trails (compacted soil) for the gradual absorption of water also contributes to this. The gentle slopes contribute to the protection of soil erosion.
- The water needs for the irrigation of the park will be covered by non-potable water. This is achieved by drilling water, rainwater, and gray (wastewater from laundry, kitchen, bathroom taps and showers) and black water (wastewater from toilet and waste disposal). There will be a waste water collection and treatment system for the water to be reused. The black water after treatment will be stored in a tank of 160 m^3 for firefighting needs while gray water is used for irrigation. For the channel, sea water from boreholes will be used.
- The green roofs of the Opera, the car park building and the library, contribute to the gradual absorption of water while operating as insulation. The roof of the National Library and part of the roof of the National Opera will be planted with a type of grass that can withstand in drought and needs minimal watering.
- The arrangement of trees creates a noise protection shield from increased noise levels observed in the area due to the large avenues that surround the plot.
- The green significantly reduces the reflectance of solar radiation from the ground.

Results form the survey in situ and interviews

A method of personal review (Mayors of the area and Department of Technical Donations to the Foundation Stavros Niarchos) and a survey in situ take places in order to collect information and data. The results are summarized below:

- The municipality of Paleo Faliro will not participate in any stage of construction and in any way, and they have not asked to be supporting projects that involve or facilitate the work.
- At construction of the project participate a research group from abroad and a group offices in Greece.
- The Greek public is not involved during a construction of the project.

During the survey in situ before the start of the project it was found that:

- The project take places in an open area which formed urban void.
- The area borders with closed avenues (towards the sea side and the municipalities of Paleo Faliron and Nea Smirni) and land uses are mainly general residence and offices (to the side of Kallithea and Muschato). The area is densely populated and has a parking problem
- Noise pollution and air pollution (due to avenues).
- Accessibility to public transport only by bus
- Reduced green areas limited to trees that were at the boundaries of the plot.
- The access to the area was difficult for pedestrians, cyclists and vehicles.
- During the night the area was dark and the accessing it was dangerous.
- There is no communication with the seafront.

Rating Benefit of FCCSN

In 2010, the Stavros Niarchos Foundation appointed «The Boston Consulting Group – BCG», with the benefit assessment study of the FCCSN. The study was published in the FCCSN site and presents a particular interest regardingthe benefits that arising from the construction of the project. The main findings that are summarized, are: economic, environmental and social benefits. These results refer to the basic pillars which determine the sustainable development of an area or a project (BCG, 2011).

Economic benefits

During the period time 2012-2016 (BCG, 2016).

- The project bring directly millions of euros in economic activity in Greece, while the total contribution (direct, indirect and inductively benefits) of the construction of FCCSN to the Greek economy is around 1,120 billion euros
- About 13,600 people have employment to support the construction of FCCSN
- The state has approximately €57 million additional tax revenue during the construction phase.
- The project has supported industries and construction sectors, which are in recession, which will involve about 80% of the total economic benefits.

During the operation of the FCCSN (BCG, 2016).

- The project will bring directly 140 millions of euros in economic activity in Greece

- The operation of FCCSN is expected to create 819 permanent jobs (including new jobs in the GNO and NLG). Also, 2319 additional jobs are expected to be create due to indirect and inductive effects.
- The state is expected to have approximately 19 million euros additional tax revenue annually.
- The FCCSN is expected to enhance local businesses due to increased traffic in the surrounding area.
- In the long term, the operation and the FCCSN programs will significantly contribute to the local economy and culture.

Environmental benefits

- The FCCSN will cover the need for more open green spaces, doubling the green area per inhabited for municipalities Kallithea, Moschato Nea Smyrni and Paleo Faliro.
- With about 170,000 square meters of green, over a thousand trees and thousands of shrubs and bushes, the area of the former Hippodrome will be transformed into a unique and aesthetically pleasing environment with significant benefits for the local community.
- It will improve air quality by absorbing about 11,000 kg of CO_2 emissions per year.
- It will reduce the temperature in the park about 2 ^oC relative to the temperature in the surrounding urban area.
- The FCCSN will be a model of environmental sustainability in Greece and will act as a reference point for all future infrastructure projects.
- It will be one of the first public buildings in Greece that will receive the internationally recognized certification of "green buildings» LEED (Leadership in Energy and Environmental Design).
- Construction methods will be based on environmentally friendly standards.
- They will use recyclable materials and will take all measures to prevent erosion, design sediment formation and diffusion of dust suppression.
- At least 95% of construction wastes have recycled.
- In FCCSN, energy-efficient activities will contribute to saving approximately 2,750 tons of CO_2 per year. Furthermore, it rational use of water will be made (BCG, 2016).

Social Benefits

- The open operation of FCCSN will help remove social barriers that prevent people from participating in cultural and educational activities.
- The special partnership between the public and private sector that is applied in the case of FCCSN can be used as a model for similar public donations which have as target the development of social infrastructure - the particular partnership is characterized by high transparency, a strong administrative structure and the existence of an organization, which will be ready for operation already before the project is handed over to the Greek public.
- The FCCSN will promote the image of the Greek society as an inclusive society, ensuring that all visitors will have access to the facilities and will be able to take advantage of the activities that are offered.
- The access to the facilities will be ensured by the existence of specially shaped ramps, elevators with sound messages and special buttons for people with visual problems, reserved parking

spaces and toilets for People with Special Needs (PSN) and by forming the area in a way that does not allow for slopes above 5% to exist.

- The National Library has available special equipment that allows disabled people to have access to all digital material.
- Appropriate infrastructure in the National Opera will optimize the performance of hearing aids for persons that have hearing problems.
- The internet site of FCCSN has been specifically designed to be used by the persons with visual problems.
- The FCCSN will support the development of human resources, offering a large number of free cultural and educational programs and events, which are designed specifically for different social groups (such as children, students and old people).
- The FCCSN will cover the need for the Greek participation in arts and culture by removing social barriers and by offering a wide range of free programs and activities at appropriate times and days during the year.
- The most modern technologies will be incorporated in the design of the National Opera, which will host international performances, giving the opportunity to many artists for further improvement and development. The National Opera will broaden and educate the public of the Opera, offering both a wide range of cultural programs in order to attract visitors of all social groups and to familiarize them with opera, theater and orchestras, and innovative activities for children. Moreover, the National Opera in FCCSN will have a dance school.
- The National Library is a versatile library of the future, which will play a double role: it will continue to be a study and research center for students and academics but also will provide a wealth of educational and cultural programs for children and adults, resulting in increase readability. In addition, it will facilitate access to the treasures of Greek cultural heritage through the use of modern Information Techology tools.
- The Stavros Niarchos Park will provide education through entertainment programs for environmental awareness. In addition to this, it will organize educational and cultural programs, aimed at improving the knowledge level of the visitor about the Greek history and culture.

Conclusions

From the above texts, we have many conclusions that answer our research questions which have been raised in the beginning of the study. At the international level, the survey has shown that in many cases open spaces in urban environments have been exploited and promoted to places that offer recreation.

These areas introduce the natural environment to the city, restore public life in society, and the same time foster culture through cultural infrastructures. The parks that have been presented, show common configurations and interventions such as:

- The planting is primarily based on native species.
- There are the water elements like ponds, fountains, channels and other.
- There are different types of sports facilities.
- They can accommodate cultural events, exhibitions, concerts and other.
- They have areas for children's activities, game, educational activities and other.
- They encourage environmental awareness.
- They have facilities for the use of people with disabilities.

In this way they create advantages that help these areas to fulfill their role, since they manage to:

- They affect the microclimate of the area.
- They create a sense of thermal and visual comfort to the user.
- They can attract visitors of all ages.
- They serve the need for contact with nature in the city center.
- They push towards sporting activities.
- They enhance the socialization and participation in joint activities.
- They do not exclude special social groups.

Regarding the case study, the construction and operation of FCCSN is expected to have positive effects on the economy, environment and society. The formation of the area into a recreation and culture space will positively affect investment, consumption and job creation, with a proportionate impact at the surrounding areas.

Economic benefits will arise from the initial investment and the costs that will be required for construction, as well as from the operation of the project and visitors that will be attracted and the tax revenue that will be created.

The environmental impacts have to do with increasing the green area nearby, reducing CO_2 emissions, the use of renewable energy sources (RES) and improving air quality. Social effects include promoting a social model that is addressed on equal terms to all members of society, and pays particular attention to people with disabilities, educational and cultural activities of the National Library and the National Opera, the recreational and educational role of free programs that will be organized throughout the project.

The Stavros Niarchos Park will act as a magnet pole for people that seek contact with the natural environment. The design creates several separate recreational areas (central grass, west paths, labyrinth, pedestrian separation road from the park of Kallithea) combined harmoniously through scents and colors of the Mediterranean (gardens with herbs, olives, myrtle, pine and other).

Visitors can participate in a variety of activities (concerts, film screenings, open-air theater performances, exhibitions, festivals and other) to be informed about Greek horticultural tradition, enjoy the shade of numerous trees or wander the numerous paths and grass. The area of the Esplanade and the Channel are suitable for running, cycling and other sports activities. The free access to all of the above is an important factor in the quality of life of the residents.

The creation of such an area of green space brings significant environmental benefits to the local community and by extension to Athens. The green area is able to absorb large amounts of carbon dioxide while enriching the atmosphere with oxygen and moisture. Green, water features (fountains, Channel), cold materials help to improve the microclimate of the area. The rational use of water, (the rain water collection system, treatment and reuse of water) the flood protection that is offered by the terrain, the Channel, the roof energy, all these contribute to sustainability.

The construction of the building that will host the National Library and the National Opera automatically gathers important cultural uses and enables the outdoor space to promote culture. The project acquires metropolitan character since it attracts visitors from around the world. The National Opera can accommodate performances from all the world while the National Library will be open to readers of all ages with an enhanced library, various educational programs, events and seminars, digitized material, business center, workstations, connecting with other libraries around the world and all this under the ambience of natural light which, thanks to its bioclimatic design,

will spread throughout the building. Special equipment and suitable formulations are provided for the full participation of people with disabilities in all activities.

The whole project design incorporates the principles of bioclimatic design in both the open space and the built part. Concepts such as, insulation and sun protection, planting, natural light, water, use of RES, the terrain, the use of cold and permeable materials, orientation, all them have been taken into account into the design parameters and are combined appropriately, in order to contribute significantly to the successful results.

Consequently, the Foundation Cultural Center Stavros Niarchos, is based interventions that are fully harmonized with the environment, and it can be developed into a global cultural center. Based, therefore, on the conclusions reached by the survey, the Foundation Cultural Center Stavros Niarchos is beneficial and it will help to protect the environment, economy, society and culture, in others words it will contribute to the sustainable development of the wider region of the capital of Greece.

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