CHAPTER THREE

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Activity component

+ Human component

→ Spacial component

CHART 3-1: PROJECT COMPONENTS

Human component

- Visitors
  - Tourists
  - Students
  - VIP

- Worker
  - maintainer
  - vendors
  - Guides
  - Botanists
  - Administration
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Exhibition
- Desert climate plants exhibit
- Tropical climate plants exhibit
- Mediterranean climate plants exhibit
- Temperate climate plants exhibit
- Polar climate plants exhibit
- General exhibit
- Special exhibit

Educational
- Giving lectures
- Holding eco-conferences
- Storing biome information
- Storing DNA specimen samples
- Educating about ecology
- Educating about Eco-friendly practices
- Researching reproduction of endangered plant

Research
- Research and Development
  - Modern research
  - Crops Research
- green biotechnology research
  - Tech plant cells and tissues
  - Gene techniques
- Land and Water Research
- Commercial research
CHAPTER THREE

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Spatial components

Primary
- Exhibitions
- Educational research

Secondary
- Commercial services
- Administration

Exhibitions
- Tropical plants exhibition
- Desert plants exhibition
- Mediterranean plants exhibition
- Temperate plants exhibition
- Polar plants exhibition

Research
- Research and Development Department
  - Modern research
  - Crops Research
- Department of green biotechnology research
  - Tech plant cells and tissues
  - Gene techniques
- Land and Water Research department
- Department of Plant Protection Research

Educational
- Lecture halls
- Conference hall
- Library
- Specimen archive
- 4d cinema
- Workshops
- Research facility
Tourists in Sudan:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Tourists</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>126030</td>
</tr>
<tr>
<td>2000</td>
<td>203122</td>
</tr>
<tr>
<td>2000</td>
<td>241312</td>
</tr>
<tr>
<td>2000</td>
<td>300562</td>
</tr>
<tr>
<td>2002</td>
<td>552322</td>
</tr>
</tbody>
</table>

TABLE 3-1: TOURISTS IN SUDAN

Assuming 25% of tourists will visit the project

= 1071830 x 25% = 267957 per year

= 730 visitors per day

Sudan’s population will reach 41000000 by 2025 if 5% of them visited the project.

each year = 2050000 visitors per year = 5300 visitors per day
5300 + 730 = 6030 visitors per day

- **Restrooms:** 3 per 100 people. 
  
  6030 ÷ 100 x 3 = 180 people
  
  Area = 180 x 1.8 = 325 sqm

- **Refreshment stands:** each stand 4 sqm, each exhibit has 2 stands so 2 x 4 x 4 = 32 sqm

- **Cafes & restaurants:** 25% of visitors = 1507
  
  1 m per visitor = 1507 sqm

- **Souvenir shops:** 5 shops 40 sqm each = 200 sqm

- **Mosque:** for 15% of visitors = 904 x 1 = 904 sqm
  
  Total area = 2976 sqm

Employee facilities:

* **Workshops:**

  (Gardening, water & electricity, Waste management, general) 2 of each = 8 (30 seat) workshops, each one 150 sqm

  8 x 150 = 1200 sqm


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- **Shops:** 9 * 100 = 900 sqm

Research facility: 310

**Area Study:**

<table>
<thead>
<tr>
<th>Zone Name</th>
<th>Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhibitions</td>
<td>11653 m^2</td>
</tr>
<tr>
<td>Research</td>
<td>2837.5 m^2</td>
</tr>
<tr>
<td>Educational</td>
<td>5217 m^2</td>
</tr>
<tr>
<td>Commercial</td>
<td>2837.5 m^2</td>
</tr>
<tr>
<td>Administrative</td>
<td>500 m^2</td>
</tr>
<tr>
<td><strong>Total Site Area</strong></td>
<td><strong>47815 m^2</strong></td>
</tr>
</tbody>
</table>

**Table 3-2: Area Study**

**Chart 3-4: Area Study**
Khartoum State Climate Data:  

<table>
<thead>
<tr>
<th>Month</th>
<th>Avg. Min Temp</th>
<th>Avg. Max Temp</th>
<th>Avg. Rain (mm)</th>
<th>Relative Humidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>16</td>
<td>32</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>February</td>
<td>17</td>
<td>34</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>March</td>
<td>19</td>
<td>37</td>
<td>0</td>
<td>13.0</td>
</tr>
<tr>
<td>April</td>
<td>23</td>
<td>40</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>May</td>
<td>26</td>
<td>42</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>June</td>
<td>27</td>
<td>42</td>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>July</td>
<td>26</td>
<td>38</td>
<td>48</td>
<td>31</td>
</tr>
<tr>
<td>August</td>
<td>25</td>
<td>36</td>
<td>72</td>
<td>42</td>
</tr>
<tr>
<td>September</td>
<td>25</td>
<td>38</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>October</td>
<td>25</td>
<td>40</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>November</td>
<td>21</td>
<td>36</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>December</td>
<td>17</td>
<td>33</td>
<td>0</td>
<td>23</td>
</tr>
</tbody>
</table>

**Comparative Weather Analysis: -**

To control the indoor environment, we must know the worst possible outside environment then designs a system able to achieve stability even in that condition.

**Solar Radiation Chart:**
Max solar irradiance 2500 kWh/m² min  
solar irradiance 600 kWh/m²

**TABLE 3-3: Khartoum State Climate Data**

**Comparative Weather Analysis: -**

To control the indoor environment, we must know the worst possible outside environment then designs a system able to achieve stability even in that condition.

**Solar Radiation Chart:**
Max solar irradiance 2500 kWh/m² min  
solar irradiance 600 kWh/m²

<table>
<thead>
<tr>
<th>Biome</th>
<th>Averages in each biome</th>
<th>Khartoum Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temperature</td>
<td>Avg. Rad.</td>
</tr>
<tr>
<td></td>
<td>max</td>
<td>min</td>
</tr>
<tr>
<td>polar</td>
<td>37.5</td>
<td>12.5</td>
</tr>
<tr>
<td>temperate</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>tropical</td>
<td>34</td>
<td>16</td>
</tr>
</tbody>
</table>

**TABLE 3-4: CLIMATE Comparative**
**Optimum Orientation:** Depending on the amount of irradiance required each biome will be orientated towards the red side if more irradiance is needed and to the yellow if less is desired.

**Prevailing Winds:** Wind is needed to remove hot air from the greenhouses, the most frequent winds blow at 45°NE with speeds from 10-20k.

**Optimum Orientation:** From the climate analysis to reduce the need for mechanic cooling and heating during the summer and winter, the optimum orientation for each exhibit is as shown in the table.

<table>
<thead>
<tr>
<th>Climate</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediterranean climate</td>
<td>120°</td>
</tr>
<tr>
<td>Polar climate</td>
<td>150°</td>
</tr>
<tr>
<td>Temperate climate</td>
<td>90°</td>
</tr>
<tr>
<td>Tropical climate</td>
<td>60°</td>
</tr>
</tbody>
</table>

*TABLE 3-5: Optimum Orientation*

All angles written in the table are from the north.
MAIN ENTERANCE
PARKING GRERENAL
EXHIBIT TROPICAL
EXHIBIT DESERT
EXHIBIT
MEDITERRANEAN EXHIBIT
TRMOERAT EXHIBIT
POLAR EXHIBIT SERVICES
GIVING LECTURES
HOLDING ECOCONFERENCE
Reading Archiving
Watching movies
Workshops
Researching facility Services
Research and development
Green biotechnology research
Land and water research
plant protection research
Services
Shopping Eating
food Drinking
coffee
Mechanic services

CHART 3-5: FUNCTIONAL RALATIONS
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**Circulation Charts:**

**General Circulation Chart:**

[Diagram of circulation charts showing flow from Tutti ring road to main barking, conference hall, main lobby, restaurant, entertainment, tropical climate, temperate climate, Mediterranean climate, ad. barking, and research and administration.

**CHART 3-6: Circulation Charts**

[Diagram of users movement from public, researchers, staff entering main entrance, control point, exhibitions cafeteria, laboratories cafeteria, landscape, main lobby, and control and services.

**CHART 3-7: Users Movement**
CHART 3-8: Bubbles Relations Diagram
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SITE SELECTION

PROPOSAL 1
TOTI ISLAND

The site is located in the east of the Nile in Sudan Smart (according to plan for the future) to the island of alligator now.

10.00 HICTARES
DISTANCE FROM CITY CENTER: 10 km

PROPOSAL 2
UM DOM SMART ISLAND

Currently it can be reached through a large Totti Khartoum by public transport from the naval station, and according to plan for the future by a Tutti bridge Marine Tutti bridge Omdurman

5.00 HICTARES
DISTANCE FROM CITY CENTER: 3.5 km
### TABLE 3-6: SITE A Neighborhoods

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>%</th>
<th>Tutti island site</th>
<th>Eltomsah island site</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nearest area of the project</td>
<td>15%</td>
<td>10%</td>
<td>13%</td>
</tr>
<tr>
<td>Site job</td>
<td>15%</td>
<td>13%</td>
<td>12%</td>
</tr>
<tr>
<td>Neighborhoods</td>
<td>8%</td>
<td>5%</td>
<td>7%</td>
</tr>
<tr>
<td>Accessibility</td>
<td>10%</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td>The dimension of the city center</td>
<td>7%</td>
<td>4%</td>
<td>6%</td>
</tr>
<tr>
<td>Availability of infrastructure services</td>
<td>10%</td>
<td>8%</td>
<td>10%</td>
</tr>
<tr>
<td>Panoramic</td>
<td>20%</td>
<td>19%</td>
<td>20%</td>
</tr>
<tr>
<td>Cultural monuments</td>
<td>15%</td>
<td>0</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>64%</td>
<td>92%</td>
</tr>
</tbody>
</table>

### TABLE 3-7: SITE B Neighborhoods

### TABLE 3-8: SITE COMPARATIVE
**CHAPTER THREE**

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**GENERAL SITE:**

- Distance from city center: - 3 kilometers
- Total area: -4 HICTARES

Accessibleness: Currently the site can be accessed by public transport from the Arab market station either by future planning for the island Totti can access the site of bahri bridge Totti and Omdurman bridge Totti.