Khartoum 2030

Towards An Environmentally-Sensitive Vision for the Development of Greater Khartoum, Sudan

Gamal M. Hamid and Ibrahim Z. Bahreldin[1]

Abstract: Over the past century, Greater Khartoum witnessed five urban planning schemes geared to direct its growth and development for an average of two decades each. Those master and structure plans addressed primarily its land use and transportation issues with some attention paid to environmental issues. This study develops an alternative vision for Greater Khartoum and charts a distinctive path for its future development that aims to maximize its natural assets, to enrich its urban image and to propose measures to safeguard its unique environmental qualities. Such a vision is not a stand-alone exercise, nor developed in a vacuum. Rather, its point of departure is the most recent master plan, KPP5 of 2008, to which the proposed vision relates. The study proposes a vision for what the city is capable of evolving into in the coming decades. It investigates the essential components of urban planning – namely, land use, housing, transportation, infrastructure and social services – all within an enriching environmental framework. The methodology used in this study includes a thorough review of urbanization trends and past urban development plans for Greater Khartoum, review of environmental laws, strategies and acts that impinge upon urban development in Greater Khartoum, and facilitating the formulation of an alternative vision by a sample of young generations and future residents of Greater Khartoum – including high school students, university students, recent graduates from both genders. Such visions, as the study concludes, are different, optimistic and more creative when compared with those espoused by older generations and professionals who developed the previous master plans. Special participatory workshops were organized where young participants were given the chance to express their visions verbally, in writing and through sketches. The principal investigators then compiled the main features and highlight of those budding visions into an alternative vision for Greater Khartoum – one that reconciles its unlimited appetite for urban land with the desires of its future residents for a pleasant city where all essential amenities are engulfed within a cleaner and "greener" environment. This study though not comprehensive enough, identifies trends of how future generations envision Khartoum in 2030. The study concludes by providing some recommendations that pave the way to the realization of that vision as well as to ensure the sustainability of suggested urban changes and transformations.

Kewywords: green city, environmental issue, participatory methodology, Khartoum Masterplan.

1. Gamal M. Hamid, Ibrahim Z. Bahreldin, Department of Planning and Urban Design, Faculty of Architecture, University of Khartoum; email: gmhamid@uofk.edu, ibrahimza@uofk.edu.

Introduction

Since its inception in the early 1830s as the seat of administration for the Ottoman/Turco-Egyptian rule that governed Sudan from 1820 to 1885, Khartoum has been experiencing massive waves of urbanization. It grew from a small village with a few thousand people to a bustling metropolis with about seven million people in 2008 (Fig.1). It has been the capital for the successive governments that ruled Sudan since then. The unique geographical location of Greater Khartoum, at the fringe of the Sahara and at the confluence of the Blue and the White Niles, bestowed upon it a favorable climate, natural flora and fauna that made it a sanctuary for migrating birds and a habitat for a number of wild animals. The massive urbanization that takes place in Greater Khartoum has replaced natural habitats and cultivable lands with built-up settlements. The resultant deforestation has led to a warmer climate in Greater Khartoum that contributes negatively to the infamous global warming.

On the other hand, the massive urbanization in Greater Khartoum, in the absence of efficient municipal services, such as sanitation and solid waste disposal, has led to serious environmental degradation manifested in polluted ground water and concentrations of non-degradable waste in open spaces. If these trends are left unabated, the impacts will definitely be disastrous. The present article[2] reflects on the development of Greater Khartoum over some 180 years and attempts to propose an alternative vision for its future development that takes into account the aspirations of its future residents.

The methodology adopted in this study includes the following: (i) review of past urban development plans for Greater Khartoum; (ii) assessment of environmental laws, strategies and acts that impinge upon urban development in Greater Khartoum; (iii) review of previous studies on urbanization trends in Greater Khartoum; (iv) facilitating the process of formulation of an alternative vision for Khartoum's future by a sample of young people and future residents of Greater Khartoum – including high school students, university students and recent graduates

2. This article is part of a larger study commissioned by the Sudanese Environment Conservation Society under its Eco-neighborhood Project. Its findings were presented to the Khartoum Environmental Forum in March 2013. The Authors are grateful to the Society for its funding and to the Forum's participants for their invaluable comments.

from both genders. Special workshops were organized in which they were given the chance to express their visions verbally, in writing and with sketches. The main features and highlights of those budding visions were then analyzed and processed into an alternative vision for Greater Khartoum – one that reconciles its unlimited appetite for urban land with the desires of its future residents for a pleasant city where all essential amenities are engulfed within a cleaner and greener environment.

Greater Khartoum's Urban Environment

The present environmental condition in Greater Khartoum, which includes the three cities of Omdurman, Khartoum and Khartoum North, rests on at least five pillars: (i) the natural physical environment; (ii) the visions and plans that guide their development; (iii) the actions and interventions carried out by urban dwellers either in compliance with plans, laws and regulations, or informally and in direct opposition to those plans and directives; (iv) the laws and regulations that govern local and metropolitan affairs; and (v) human and financial resources allocated for environmental protection and enhancement. In the following sections, the key factors that impinge upon the development of Greater Khartoum will be investigated in detail to assess their impact on the current environmental conditions in Greater Khartoum.

Greater Khartoum: The Natural Setting

Greater Khartoum is situated at the confluence of the Blue and White Niles in north-east Africa. Its terrain is generally flat with occasional outcrops. The average maximum temperature reaches 42° in May and the minimum temperature reaches 15° in January. The relative humidity during the day reaches as high as 57% in July and August, and as low as 11% in March during the evenings. The average annual precipitation in Khartoum is generally low reaching an average of 119 millimetres, most of which falls between July – September. Nevertheless, Greater Khartoum is vulnerable to flooding of the three rivers that pass through it (the Blue and White Niles, and the Nile River) and to flash floods from the dry streams (*wadis* and *khors*) which carry surplus rainwaters to the Nile during the rainy season. These often cause destruction in the settlements close to them.

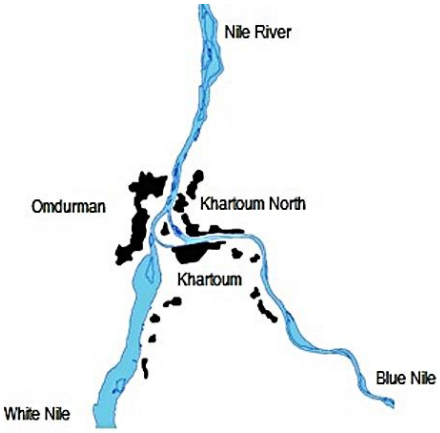
Greater Khartoum: Human Interventions

Administratively, Khartoum State is one of 18 states that comprise Sudan. With a total area of about 21,828 square kilometers, it is still the smallest one in terms of area but the largest in terms of population. According to the 2008 population census, it accommodated about 5.3 million people in 2008, which represented about 16% of Sudan's total population. More realistic estimates, however, put that figure at more than seven million people. By all measures, Khartoum is the most important state politically, economically and socially.

Greater Khartoum, the metropolitan hub of Khartoum State, on the other hand, has an area of about 1,300 square kilometers and accommodates about 5.5 million people. Thus, Greater Khartoum that encompasses only about 6% of Khartoum State area accommodates about 78% of its population – which is by far the highest population density in Sudan. According to official census data, Greater Khartoum grew rapidly from a small urban center with only 245,000 people at the time of Independence in 1956, to about 784,000 people in 1973, to about 1,343,000 people in 1983, to about 2,918,000 in 1993 to about 5.5 million people in 2008 (Fig.2).

This rapid increase in population, also known as hyper-urbanization since the population doubles almost every 20 years and sometimes in 10 years, is fueled by high rates of natural population increase, at an average of 6.4 children per woman, and high rates of rural-to-urban migration. Two types of migration can be identified: voluntary migration undertaken by migrants who come to Greater Khartoum in search of employment opportunities and services; and forced migration caused by insecurity, civil wars, famines and droughts. Massive waves of displaced people seek refuge in Khartoum periodically due to those reasons.[3]

3. Hamid 1996.



Greater Khartoum, circa 1820

Fig.1. Location of Greater Khartoum and its Horizontal Expansion

Greater Khartoum, circa 1988

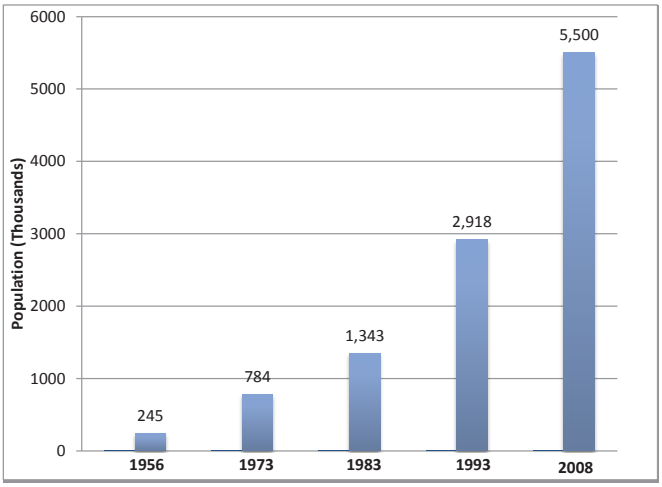


Fig.2. Greater Khartoum's Population Increase, 1956-2008, Source: Hamid, Bahreldin 2013

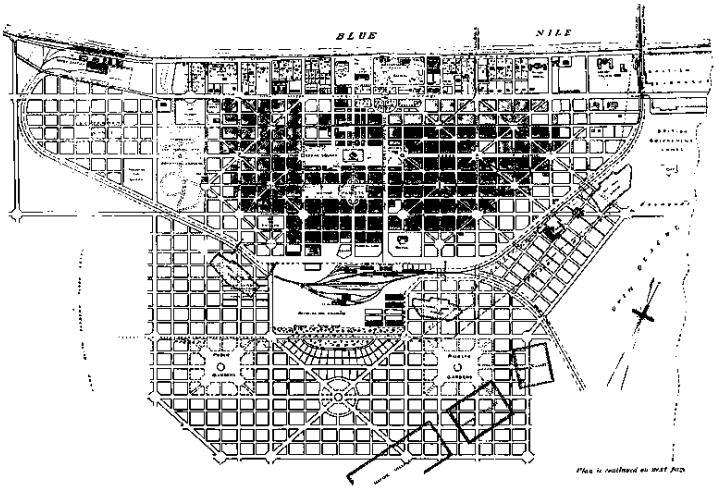


Fig.3. McLean's 1910 Plan of Khartoum (Hatched plots indicate those which had been built on based on the 1898 Kitchener Plan). Source: McLean and Hunt 1911: 282

This massive urbanization creates many environmental problems in Khartoum, key among which are:

i. Encroachment over agricultural lands that surround the city, particularly on its southern and eastern sides. This encroachment reduces the agricultural output and threatens food security in the national capital that has the highest concentration of population in Sudan.

ii. Use of burnt clay bricks as the main building material increases the pressure on agricultural lands and releases harmful gases and odors into the atmosphere.[4]

iii. Concentration of industrial establishments in Khartoum, coupled with ineffective industrial waste management systems, lead to air pollution and harmful industrial waste in solid and liquid forms.

iv. Absence of an effective sewage disposal system leads to open defecation in poor areas that lead to outbreaks of diseases. Use of pit latrines, septic tanks and percolation wells in middle- and upper-class areas, on the other hand, leads to pollution of ground water. Recently, drilling machines are used clandestinely to dig deep wells to dispose off

4. In recent months, Khartoum State authorities banned the manufacturing of baked clay bricks on river banks. Enforcement of this law, however, has been very slow because they are the prime building material in Khartoum to which there is no affordable alternative.

sewage effluent produced by septic tanks. This leads to serious pollution of aquifers and ground water sources.

v. Heavy vehicular traffic leads to street congestion and increases air pollution. Use of slow modes of transportation, such as rickshaws that run on polluting fuels, aggravates this pollution.

Greater Khartoum: Visions and Plans

Master and structure plans represent visions and desirable ends that planners and decision makers intend cities to evolve into (Hamid, G.M., & Bahreldin, I. Z. (2013). Master and structure plans also constitute management tools to control and manage the development of urban areas. Ideally, those visions should be reached through consensus and wide consultation with different stakeholders; but in most cities in developing countries – including Greater Khartoum – that is not the case. Only a few professionals and policy makers are involved in the plan making process, leading in most cases to unrealistic plans and unsatisfactory results. Previous attempts to engage Khartoum's citizens and professionals in plan formulation didn't go beyond merely informing them about plan objectives and progress. Five planning efforts have been conducted so far for Greater Khartoum. Each of them had its implications on the urban environment in Greater Khartoum. In the following sections, each of those planning efforts will be discussed.

The McLean Plan of 1910

The first incidence of an orchestrated effort to formulate a plan to guide the re/development of Khartoum was the plan formulated according to the directives of Lord Kitchener who led the British, Egyptian and Ottoman troops when they defeated the Mahadiya forces and re-occupied Sudan in 1898. The ruins of the Turco-Egyptian Khartoum built in 1830, that were destructed by the victorious Mahadist troops in 1885, were scrapped and a new layout was superimposed over it (Fig.3). The 1910 plan was prepared by the municipal engineer W.H. McLean following the same lines of the Kitchener plan of 1898 and was approved by Lord Kitchener himself when he visited Khartoum again in

1910 (McLean and Hunt, 1911). Although the new plan did not include Omdurman and Khartoum North, it was still the first incidence of proper town planning in Sudan. However, the result was a highly polarized town composed of the following: (i) a European-style nucleus formed by wide, tree-lined boulevards, mansions and government quarters; (ii) residential quarters for expatriate merchants and civil servants, (iii) the Arabic market immediately to the south of that nucleus; and (iv) "native villages" located beyond the railway line outside the planned city.

In addition, it included also a botanical garden, several parks and adopted appropriate measures for storm water drainage and sewage disposal. This indicates that the Plan was very conscious of environmental aspects and sought to enrich the urban environment and to devise measures for its protection and enhancement. However, the plan made no reference to Omdurman and Khartoum North, which confirms that the welfare of the "natives" was not a top priority for the British planners and administrators.

According to McLean, «the Sudanese native villages immediately to the south, outside the old fortifications, were built to accommodate the natives who had been living previously amid the ruins of old Khartoum. In this way an attempt was made to segregate the native population, a very desirable arrangement, more specially from a sanitary stand point, as the epidemics to which all tropical cities are liable can be so much more easily dealt with».[5] Consequently, British administrators organized regular inspection tours through "native" areas such as Omdurman and the Alduem in Khartoum, to assess the public health conditions in them and to impose immediate fines and remedial actions to rectify perceived public health threats.

The Doxiadis Associates 1958 Master Plan

Prepared immediately after Independence, this master plan espoused the famous Greek planner Doxiadis's concept of the Dynametropolis with unidirectional growth. Hence the plan advocated the expansion of Khartoum southwards while curbing the growth of Om-

5. McLean 1980, p. 139.

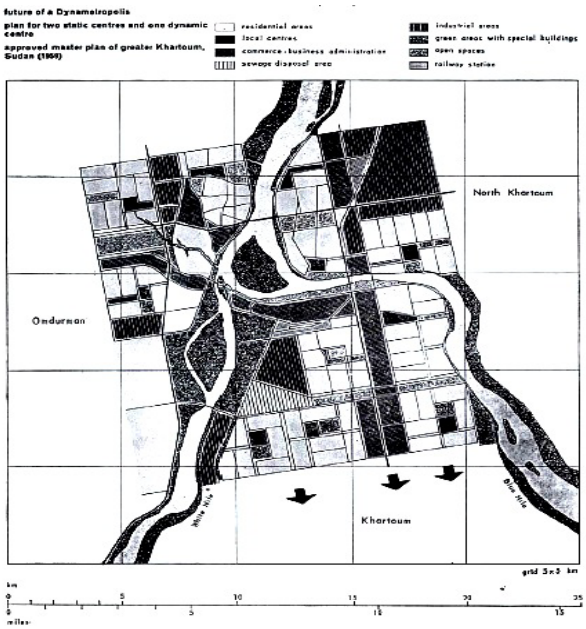


Fig.4. Doxiadis 1958 Master Plan Source: HAFAZALLA 2008: 46

durman and Khartoum North. This meant that Khartoum city was allowed to grow till it collided with agricultural schemes and fertile farmlands that were situated to the south of it. No attempt was made to direct urban growth towards barren lands, e.g. west and north of Omdurman. This trend continues up to now as more and more urban growth takes place over fertile lands leading to food security threats, environmental degradation and desertification.

On the positive side, however; the plan stressed the need to establish a green belt to protect Khartoum city from dust storms that blow from the south. In addition, it was intended to supply the city with wood for buildings, fuel and for some budding timber industries. With a total area of some 3,000 hectares, the green belt was established and was partly irrigated from the effluent discharged from the sewage treatment plant and partly by the Gezira Scheme canals and pump stations on the Blue Nile.[6] Lack of adequate funds and implementation capacity, however, precluded full implementation of the Doxiadis 1958 Plan.

6. Musa 1977.

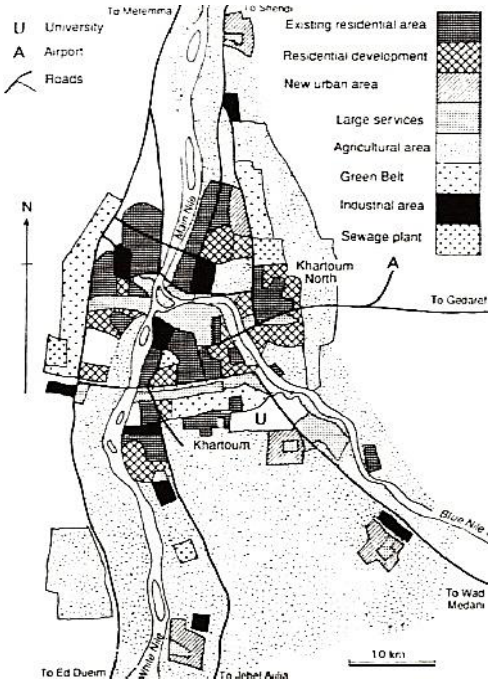


Fig.5. MEFIT 1974-77 Regional and Master Plan, Source: Hafazalla 2008, p. 47

MEFIT 1974 Regional Plan for Khartoum and Master Plan for the Three Towns

The third plan prepared for Khartoum (Fig.5) was wider in scope an ambition. Its regional focus allowed it to take into account the juxtaposition of agricultural and urban functions. Notably, the plan proposed establishing two new green belts – a northwesterly one at the outskirts of Omdurman, and an easterly one at the fringe of Khartoum North. Those belts were to be irrigated by effluent water discharged by two proposed sewage treatment plants. The plan also included a "beautification" component that sought to introduce high-rise, well-landscaped housing and urban design schemes to enrich the drab and sprawling urban environment that characterized Greater Khartoum at that time.

Unfortunately, those worthwhile and environmentally enriching schemes never materialized due to lack of political will, administrative capacity and financial resources.

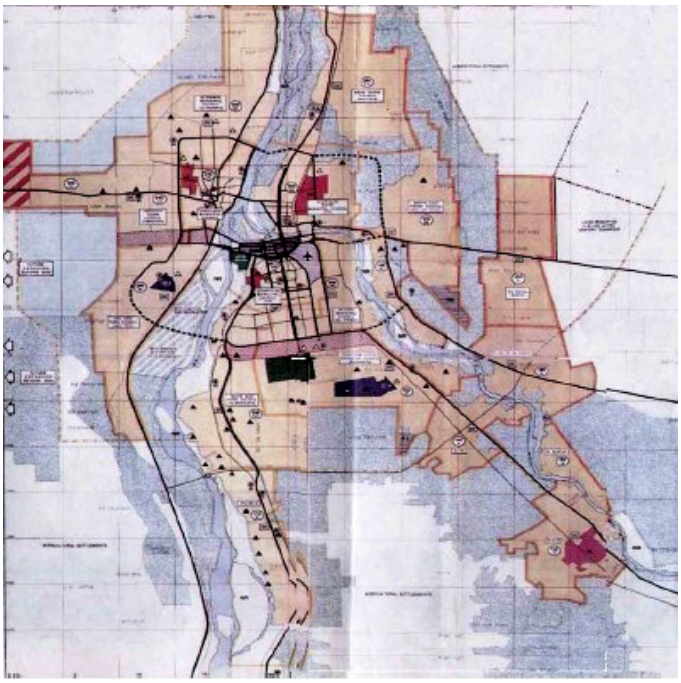


Fig. 6. Doxiadis and Abdelmoneim Mustafa 1991 Structure Plan Source: Hafazalla 2008: 48

Doxiadis and Abdelmoneim Mustafa 1991 Structure Plan

The 1980s in Sudan were punctuated by several natural and man-made disasters that affected negatively Greater Khartoum. The 1983-84 severe droughts and famines in eastern and western Sudan, and escalation of civil wars in southern Sudan after 1983, forced thousands of internally displaced persons (IDPs) to seek refuge in the capital city; thus increasing its population from about 1.8 million to about 3.2 million in 1990. Heavy floods in 1988 ravaged vast areas of Greater Khartoum – including many IDP camps and squatter settlements. Beyond the immediate relief efforts, the national government, aided by international donors, sought to rehabilitate and restructure the city.

Hence, Doxiadis and Abdelmoneim Mustafa Associates were commissioned to prepare a ten-year structure plan that would orchestrate its future development focusing primarily on 'structural' elements such as transportation routes, bridges, ring roads, in addition to revitalization of the CBD and some action projects and priority areas.

The 1991 Structure Plan (Figure 6) also proposed concrete measure to enhance Greater Khartoum's urban environment. In particular, it proposed the following: (i) implementation of the green belts west of Omdurman and east of Khartoum North that were proposed in the 1977 MEFIT plan; (ii) revitalization of the existing green belt which had been almost eradicated by IDPs and other squatters who utilized its wood to construct their shelters and to feed their fires. These destructive actions were not stopped by the authorities such that by the late 1980s the green belt was lost and vast squatter areas had mushroomed in its place; (iii) creation of a proper and effective refuse collection and disposal system that included creation of three landfills at the outskirts of each of the three towns. The cost of the system was estimated then at $36 for the ten years duration of the plan (1991-2001).

Like its predecessor plans, the 1991 plan was implemented only partially and on a piece-meal fashion. Lack of funds necessitated focusing on a few infrastructural projects at the expense of projects that would have enhanced the urban environment. It also continued the pattern of horizontal sprawl of the three towns onto surrounding agricultural lands and pockets of farmlands (e.g. Al-Manshiya, Kafuri, etc.) located within the urban boundaries of Greater Khartoum. The plan also perpetuated the pattern of monotonous grid-iron neighborhoods in which no attention was paid to parks and green areas, which were relegated to lower priorities when compared with basic infrastructure projects such as water supply, electricity and storm water drainage networks.

MEFIT and CENTECS Khartoum Regional Development Plan (*KPP5*)

KPP5 (i.e. Khartoum's fifth physical plan) is the last plan that seeks to guide the urban development of Khartoum State for a span of 25 years (2008 – 2033). In this article, however, we focus only on the metropolitan area of Greater Khartoum. It is fair to say that KPP5 dealt with the urban environment comprehensively and devised an implementation plan divided into five phases, spanning five years each, at a total cost of about nine billion U.S. dollars.[7] Regarding the urban en-

7. Mefit and Centecs 2009-2, p. 112.

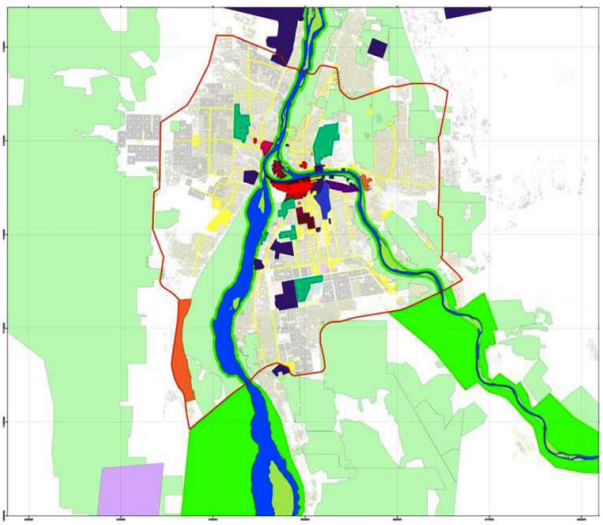


Fig.7. MEFIT and CENTECS 2008 Structure Plan. Source: Mefit and Centecs 2009-1:86

vironment, KPP5 dealt with the following issues: (i) preservation of forests and the natural plant cover; (ii) preservation of agricultural lands which represent about 50% of the area occupied by residential land uses; (iii) preservation of rural settlements, water points and natural water courses; (iv) creation of urban parks in areas currently occupied by other functions, such as the Khartoum railway yard and parts of Khartoum International Airport and industrial areas; (v) expanding recreational and green areas on river fronts and Tuti Island. In terms of projects, KPP5 identified dozens of projects directly related to sanitation, drainage and environment to be implemented during the plan period at a total cost of two billion U.S. dollars, which represented about 22% of all planned investments. The total cost of projects planned to be completed during the first phase of the plan (2008-2013) amounted to U.S. $ 630,000,000, which represented about 25% of the total cost of the planned investments during this phase.

Implementation of KPP5 is proceeding very slowly owing to severe budgetary constraints. With the first phase of the plan approaching its end, only few projects have been implemented. It is unfortunate that the efforts exerted in plan preparation will not bear fruits as expected. In conclusion, the previous review of the five master and structure planning efforts that have been performed at the urban, regional and state levels in Khartoum shown in Table 2 illustrates that ideas have not been

in short supply. Most of those plans – notably the last three ones – have paid attention to the urban environment in Greater Khartoum and included recommendations and projects to protect and enhance it. However, implementation has not been in a par with the planning and programming mainly due to lack of political will and, consequently, meager budgetary allocations for this vital sector. It is hoped that this trend will be reversed soon and implementation of the planned interventions related to the urban environment receive the support and commitment they deserve. It is also noticeable from Table 2 that public participation in plan formulation and review has been very limited. This, we believe, results from a lack of appreciation of the potency of public participation and its ability to nurture a sense of ownership of master plans among citizens, thus increasing the chances of success in plan implementation. In the following sections, we will present an alternative approach to plan making based on involving one of the key segments of society – viz. its youth – in developing the key visions and agreeing on priorities.

	McLean	**Doxiadis 1**	**MEFIT**	**Doxiadis & AM Mustafa**	**KPP5**
Duration	1910 - ?	1960 - 80	1975 – 1990	1990 – 2000	2008 – 2033
Scale	Urban; Khartoum only	Urban	Regional + Urban	Urban	Regional + Urban
Main positive Features	- Well- designed European city - Green boulevards. - Parks	- Green belt - Uni-directional expansion	- 2 new green belts + beautification schemes - Vertical expansion - Satellite towns - Relocation of airport + U of K	- Focus on structural elements - Advocated green belts - Solid waste management.	- Comprehensive - Preserves agri. land - More parks - Preserves natural assets
Main Negative Features	- Polarized development.	- Sprawl - Loss of agri. land	- Loss of agri. land	- Sprawl - Loss of agri. land	- Unrealistic targets - Uncertainties
Implementation	- Within Khartoum only	- Limited	- None (Plan not formally approved)	- Limited	- Few projects - Other conflicting plans/projects
Public Participation	- None - Elitist	- None - Elitist	- None - Elitist	- Limited - Elitist	- Limited (information-giving) - Elitist

Table 2: Comparisons between Khartoum's different master and structure plans

Khartoum 2030: an Environmentally-Sensitive Vision

In this part, an environmentally sensitive vision of Khartoum's future has been mapped and drawn by its future inhabitants. As explained earlier, the vision-mapping process was achieved by a series of participatory workshops through which a consensus was made among workshop participants.
Workshop procedures and outcomes are thus discussed henceforth.

Objectives of the Workshops

The purpose of the three workshops was to develop ideas and visions of Khartoum in 2030. Thus, the nature of these three workshops remains exploratory rather than analytical.
The workshops' objectives are:
- To identify major environmental challenges facing the capital region as seen by its future inhabitants.
- To prioritize the above environmental challenges according to their importance and effect on urban development.
- To map an environmentally-sensitive vision for Khartoum 2030 as seen by its future inhabitants.
- To define and identify strategies and tools leading to the realization of the visions drawn in the previous stage.

Sample Identification and Selection

To understand the major environmental challenges faced by Khartoum, and how its future inhabitants envision it in 2030, it was necessary initiate a dialogue with the city future inhabitants.
Thus we opted to limit the workshop participants to two main categories that partially represent Khartoum's future generations identified as:
- University-level, fresh graduates and final year (5th year) students of architecture, planning and environmental studies. Six public universities were chosen to participate in this workshop from which twenty-seven participants were selected.
- High school students of both gender who live in Khartoum. Six schools were selected by the State Ministry of Education from the list of Model High Schools.
Two schools from each of the capital region's seven localities were se-

lected to participate. Special focus was given to schools located at the urban fringes of Khartoum City.[8]

The Workshop Process

The three workshops were conducted in five stages as follows:

- An orientation Stage through which an introduction to this research, the workshop objectives, process and expected outcomes are explained and discussed with participants.
- An ice-breaking and brain-storming stage through which workshop participants introduce themselves and get to know each other. By the end of this stage participant were divided into working groups of 5-7 participants each.
- An investigation stage in which workshop participants worked together to identify the major environmental challenges facing Khartoum.
- A vision development stage in which a vision of Khartoum in 2030 is drawn.
- The Learning stage (groups presentation) through which each group presented its findings to the other groups. This stage also includes a thorough discussion of groups' outcomes and findings.

Workshop Outcomes

A major interesting finding observed throughout the three workshops is the high level of understanding of the terms "environment" and "environmentally-sensitive city". Participants have proved a high level of understanding of the natural, social, economic and political environment of urban Khartoum, not to mention their high capacity for identifying city challenges and opportunities. The workshop outcomes are organized as follows;

Recent and Urgent Environmental Challenges Facing Khartoum

Environmental challenges that compromise Khartoum's development efforts as seen by the workshop participants vary from those

8. In this category, two workshops were conducted of which one targeted male student while the other targeted female students.

associated with natural disasters, (e.g., droughts and floods) through to unsustainable land-use practices. The latter has contributed to the process of desertification, deforestation, soil erosion, rural poverty and population growth that does not match available, yet insufficient resources. Some groups (especially high school students) pointed out the problem of pollution with special emphasis on air quality and drinking water. Pressure on land aggravated by the high population growth and internally displaces people (IDPs) was also among the challenges pointed out by the participants. The latter is believed to have contributed to: a) The substandard and deterioration of infrastructure and social amenities and; b) Unplanned urbanization.

Workshop participants identified about eleven major environmental challenges facing Khartoum today. These challenges, which are shown in Figure 8, range from pollution which stands out as a major threat and challenge, to poor planning qualities that doesn't respond to rapidly urbanizing Khartoum. These environmental challenges helped to a varying degree to envision Khartoum 2030.

An Environmentally-Sensitive Vision of Khartoum in 2030

A vision is an intended future in which ones' expectations, dreams and wishes can be arranged to reach that target, and it thus represents an "idealized" view of the future. Having said so, workshop participants have drawn several visions of Khartoum 2030. The most significant visions among them are the ones that imagine Khartoum as;

1. A green city.
2. A city with sustainable public transportation.
3. A walk-able city.
4. A city of green neighborhoods
5. A city of smart buildings and tourist activities
6. A city that reflects its identity.
7. The complete list of visions drawn by workshop participants are ordered in Figure 9.

Photo 1: High school students during the workshop session

Photo 2: University graduates and final year architecture students during the workshop

Photo 3: High school students during one of the workshop sessions

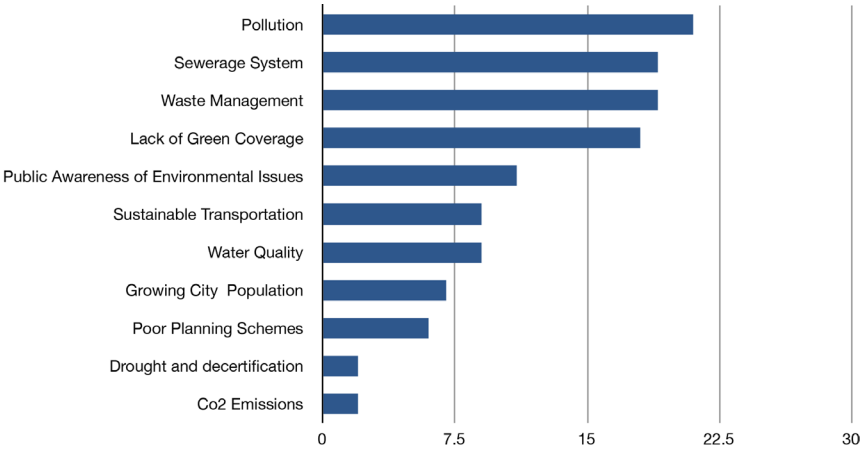


Fig.8. Major Environmental Challenges as seen by Workshop Participants

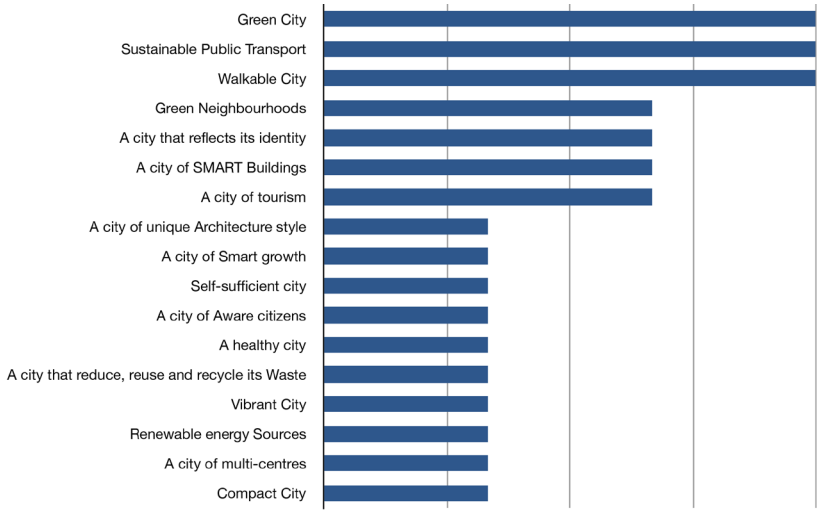


Fig.9. Summary of Visions Generated by Workshop Participants

Summary and Synthesis of the Visions Formulated in the Workshops

The visions drawn by Khartoum's future inhabitants outlined their expectations of Khartoum 2030. For the purpose of this study, the visions generated, as seen in Figure 9, are arranged into five major themes as follows;

1. Visions related to urban form and transportation. This includes the following:
   Sustainable public transports;
   A walk-able city;
   A city of multi-centers;
   A compact city;
   A city of smart growth.

2. Visions related to natural environment, this includes:
   A green city;
   Green neighborhoods;
   A city that reuses, reduces and recycles its waste;
   A city of tourism.

3. Visions related to building construction and architectural style; this includes:
   A city that reflects its identity;
   A vibrant city;
   A city of unique architectural style;
   A city of smart buildings;
   A city of tourism.

3. Visions related to community health and well-being; such as:
   A healthy city;
   A city that reuses, reduces and recycles its waste;
   A self-sufficient city;
   A vibrant city;
   A city of conscious citizens.

4. Visions related to resource conservation. This includes:
   a. A city that reuses, reduces and recycles its waste;
   b. A city of renewable energy sources;
   c. A compact city;
   d. A city of smart buildings.

The above five themes are explained further as follows:

Visions Related to Urban Form and Transportation

Without doubt, urban configuration and transportation are among the major factors that affect sustainable urban development. Under this category, two major issues were brought to the surface: a) the land development issue; and 2) sustainable transportation. Under the former goal (land development) participants' visions were set to stress the importance of creating an urban development that fosters a compact, yet, connected urban components that are walk-able and accessible by different modes of transportation. Participants also called for green neighborhoods and building types that support more energy-efficient forms of transportation e.g. trains, bicycles, trams, etc. In terms of land uses, though participants recognized the importance of high residential-densities that support mixed-use development, regulating land use through which conflicting uses are avoided was clearly observed in participants' discussions as well as the images drawn by them. The second factor (sustainable transportation) envisions a citywide access to walk-able and pedestrian spaces. Participants also emphasized on a transportation system that allows for an efficient and attractive transit system (walking, bicycles, buses, water ways, etc.).

Visions Related to the Natural Environment

Khartoum is a city that lives with water. It is also a city that has one of the prestigious natural forests, Alsunut, that extends more than two square kilometers in the urban area. Considering this, workshop participants' stressed that land use and urban development in Khartoum should safeguard the existing natural ecosystem as well as resources. Land development is also expected to respect and promote urban landscape at the neighborhood level. Urban agriculture and edible landscapes were two of the strong themes envisioned by the participants. The goals identified in this category also include water preservation and recycling. Water safety and security were also tagged as important goals to be reached in Khartoum 2030. Last not least, pollution reduction and management were also considered as two of the major goals through which air, water, soil and city image were expected to improve.

Visions Related to Building Construction and Architectural Style

Several goals were identified in this category; namely, the design of new buildings that will result in a sustainable urban fabric in which building materials, water and energy are efficiently used. This goal also calls for creating an architectural identity and an image to the capital region that would maximize the functional, economic and cultural value of existing buildings. The architectural style is also expected to reflect the Sudanese identity and culture. A universal design approach was also recommended to allow various age groups and people with disabilities to equally enjoy the city.

Visions Related to Community Health and Well-Being

A vibrant and attractive Khartoum, characterized by different cultural and physical activities, is thought of as one of the goals towards Khartoum 2030. Equally, a healthy Khartoum in which its' residents have the necessary means and infrastructure that supports residence well-being in terms of social, mental, physical and spiritual health is also advocated. Participants also imagined a city that becomes a true home for its residents in which opportunities to work, play and live are guaranteed. Khartoum 2030 is also recognized as a safe and secure city in which a room for different Sudanese cultures and people is guaranteed. High level of citizens' awareness is seen necessary to attain some of the previous goals.

Visions Related to Resource Conservation

In this theme, encouraging the use of renewable sources of energy coupled with water use conservation are among the major goals. Khartoum 2030 is also envisioned as a city that reduces, reuses and recycles its waste and city output, thus improving market opportunities by creating new business attraction. Reducing CO2 emissions was also one of the goals envisioned by workshop participants.

To conclude this summary, the five themes discussed above encompass futures generations' vision of an environmentally sensitive Khartoum. Three major action-oriented environmental goals can be drawn out of those visions. The three goals, which are shown in Figure 13, are;

1. To change the city urban structure into an environmentally-friendly one;
2. To create an environmentally-friendly lifestyle;
3. To transform the city into a greener community and economy.

The vision goals and components shown in Figure 13 are general to allow for a flexible, yet, sophisticated understanding of Khartoum in 2030.

Fig.10. A vision for sustainable transportation networks and multi-centred city development

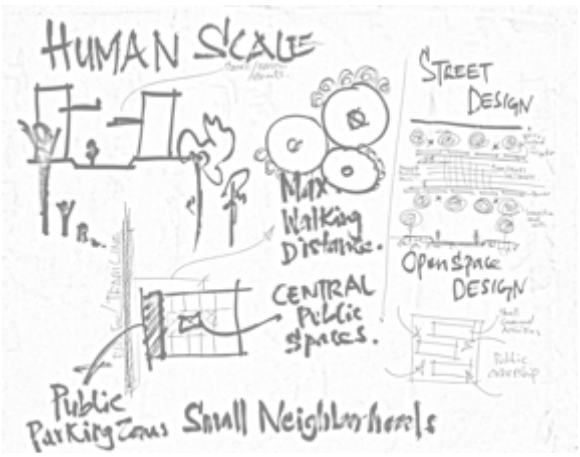


Fig.11. A vision for a walk-able city and multi-centred city development

Figure 12. Walk-able city and ediable landscapes Khartoum Vision

Fig.13. Khartoum my home; a vision that imagine a vibrant welcoming Khartoum

Fig.14. A vision of sustainable Khartoum that reduces, reuses and recycles its waste

Tools for Achieving Khartoum's 2030 Vision

The path to realizing Khartoum's 2030 vision and goals is not laid-back. Several policy and attitude changes are needed to help translating those goals into actions. Nonetheless, workshop participants identified three key tools that will help in realizing the goals set by Khartoum 2030 vision, these tools are:

1. Public participation and involvement through which Khartoum's community is genuinely engaged in most of the vision formulation activities. This tool also allows for community understanding and mutual learning.
2. Public Awareness through continuous training, education and involvement. This tool is believed to work very well if combined with public participation. The awareness raising should target not only general citizens but also decision-makers and officials.
3. Increasing the city's green coverage through urban agriculture, green belts and use of edible landscaping elements such as fruit trees (e.g. mangoes, dates, etc.).

Although we believe that the above tools are value laden, they should be considered as representative rather than comprehensive. Therefore, they show general trends leading to the realization of the vision and its goals drawn in Figure 15.

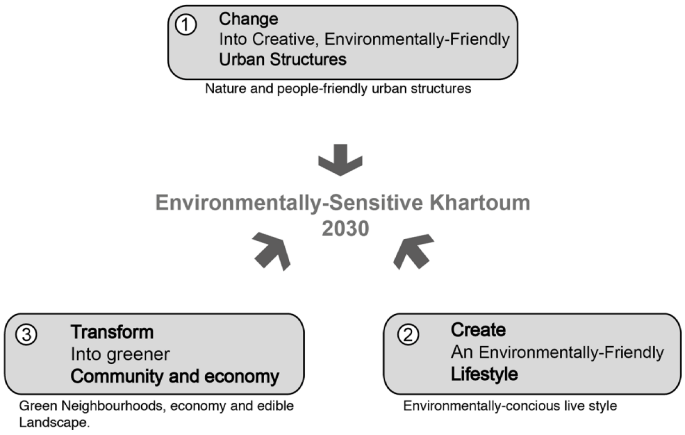


Fig.15. An alternative, environmentally-sensitive Vision of Khartoum 2030

Conclusions and Recommendations

The apparent consensus among workshop participants on the urgent need to promote the environmentally-sensitive vision for Khartoum by 2030 has been underlined by significant differences with regards to the questions of what an environmentally-sensitive Khartoum is, why and how to promote it. Ultimately, the vision and goals developed by the future residents of Khartoum (Fig.15) encompasses all the five dimensions of urban sustainability set by Allen (2002). Not to mention their compliance with Section Seven of the Millennium Development Goals (MDGs).

The dream of creating an environmentally-sensitive Khartoum as drawn by its future active inhabitants does not seem too difficult to achieve. Yet, it requires a comprehensive understanding of the challenges faced by the city. A major conclusion drawn by the workshop participants stresses the need for active public participation and public awareness on environmental issues. In addition, a strong political will would safeguard and ensure the smooth implementation of the vision drawn by this study. At this point, an amendment to planning mandates seems necessary to set-up clear environmental goals and targets.

Finally, the sphere of assessment and investigation conducted during the three workshops was adequate to address and imagine but not to quantify Khartoum in 2030. Equally, the challenges and visions pre-

sented here should be treated with caution. We consider them indicative of trends and/or alternative visions but not sufficient to form a basis for detailed planning.

A study such as this one raises more questions and concerns than it answers, and it is anticipated that the findings and visions drawn by the workshop participants will lead to a greater understanding of the key issues facing Khartoum's urban environment and its environmental future in 2030. Finally, this study has tried to draw a general vision of Khartoum 2030 in the optimum way; it is not as comprehensive as would have been possible with a bigger, multi-disciplinary team working for a much longer time and endowed with more resources. Yet, it provides a clear vision of a sample of Khartoum's future residents on how they envision the city in 2030.

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