

Environmentally - Friendly Development

A proposed strategy for architects and planners in Khartoum Region.

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Abstract :

This paper sets out to study the directions environmental developments in Greater Khartoum are taking. It attempts to assess contemporary architectural and planning practices in the region in terms of natural and economic resource sustainability and area-specific climatic adaptability. A practical strategy is proposed to direct future developments in the area.

1- Introduction :

Urban areas are the most exhaustive with respect to natural resources so this particular urban compartment is studied in relation to other environmental compartments by means of flows of water, energy, food, raw materials and waste. The extent to which developments have been respectful to resources are viewed as well as the extent to which people are being provided with suitable environments that ensure their physical, psychological and social well-being.

Pollution is conceived basically as a by-product of inefficiently organized development. It receives due emphasis in terms of existing potential for waste recycling. Thus, waste will be considered as a possible resource. A practical strategy for those concerned with the environmental situation in Greater Khartoum is organized in these three inter-related issues :

PROBLEM IDENTIFICATION: the situation is comprehensively analysed into problems and sub-problems.

POLICY, PROGRAMME and PROJECT FORMULATION: the translation of environmental priorities into planned intervention in the area.

ORGANISATION of INTERVENTION: the identification of appropriate instruments, types and levels of intervention to implement environmental strategies.

The proposal focuses on economic feasibility and social acceptability.

The methodology adopted in the paper is basically a coverage of some previous studies of the area. To what extent the recommendations of the papers, seminars or workshops have been adopted and implemented will be examined.

The aim of this paper is to discover how Greater Khartoum can be transformed into a sustainable, self-reliant, hygienic, green city.

2- URBANIZATION : a global concern.

World cities are using up the natural resources of the world - many of which are non-renewable. They are also suffering greatly from the problems of over-congestion, and urban sanitation has reached appalling standards. Urban poverty is continually increasing. It rates up to 60% and causes this negative and serious aspect of urbanisation to be one of the major concerns of all those involved in the alleviation of the poor situations urban dwellers are facing: "... their work opportunities are so restricted that they cannot work their way out of misery." (Schumacher, 1973:168)

Schumacher (1973:164) believes that: "... the primary causes of extreme poverty are immaterial, they lie in certain deficiencies in education, organization, and discipline". At the time of writing this Habitat II has been in progress in Istanbul for the last few days under the title city summit, and the themes focus on sustainable urbanization and adequate shelter for all; the issue of `Incorporating Environmental Concerns` contains the following agenda: pollution, inadequate sanitation, water supply and waste management. Habitat II aims to identify the best practices for improving the urban environment and this approach of best practices is adopted in the following paper.

Some urban problems can be remedied but others are a major source of concern since results may permanently damage the natural environment. So before embarking to study 'best practices' in terms of environmental development, it may be of benefit to identify the 'worst practices'.

The irreversible damage we are inflicting on the world's environment was portrayed by Schumacher. He criticizes large enterprises, sophisticated and capital intensive technologies: "In an intermediate technology would be immensely more productive than indigenous technology... but it would be immensely cheaper than the sophisticated, highly capital-intensive technologies of modern industry. At such a level of capitalization, very large numbers of workplaces could be created within a fairly short time; and the creation of such workplaces would be 'within reach' for the more enterprising... not only in financial terms but also in terms of their education, aptitude, organising skill and so forth." (1973:175-176). He continues: "The intermediate technology would also fit much more smoothly into the relatively unsophisticated environment in which it is to be utilized. The equipment would be fairly simple and therefore understandable, suitable for maintenance and repair on the spot."

And most important: "Simple equipment is normally far less dependent on raw materials of great purity or exact specifications, and much more adaptable to market fluctuations... men are more easily trained; supervision, control and organisation are simple; and there is far less vulnerability to unforeseen difficulties."

Thus, intermediate technologies are ultimately less exhaustive of natural resources and well suited to the unstable situations in developing countries.

An ecological approach to urban development is studied by Sachs (1985): Attempts to use hidden resources of cities, both physical and human, wastes for the production of food, fuel and building materials, resource conservation, self-help housing and social services etc. (BOON 1990:495)

Research on urban development alternatives should focus on the following:

- The urban ecosystem as a source of resources (a production-oriented ecology)
- Low investment urban growth
- Markets, the household economy and the public sector towards an anthropological economics of the city .
- Thinking globally, acting locally, macro-policies and micro-solutions ... (Sachs 1985 in BOON 1990:518-519)

The complexity of the problems of urbanisation are overwhelming. They are: "...inextricably bound up with regional, national and international relationships and social limiting conditions of an economic or cultural nature, for example. The environmental problems are intertwined with problems of poverty and social disruption and manifest themselves in a context of concentration and urban growth, whereby the institutional and administrative possibilities for development have been undeveloped. (Deelstra, Koning, Beekee 1990:15).

To render these problems simple, and thus manageable, solutions should be oriented to the local level, under the umbrella of wider policies and approaches at the city level. Measures should actually be implementable and should promote participation .

The sustainable development of cities should ensure both the continued existence of nature and the health and well-being of people. With the above in perspective, we will tackle the environmental problems of Greater Khartoum .

3- GREATER KHARTOUM: The existing situation.

Sudan's capital, Greater Khartoum, is located in central Sudan at the confluence of the Blue and White Niles (latitude 32° 31' east and 15° 36' north and 380m above sea level). It comprises the three towns of Khartoum , Omdurman and Khartoum North (Bahri). Except for some hilly areas to the west and far east. The land is generally flat with a gradual slope towards the north and towards the Niles." (Agraa , Haywood, Elkheir, Ahmed 1985:86).

The climate is typically tropical with "A fluctuating mean annual rainfall of about 167mm occurring mainly in August and to a lesser extent July and September, and extreme temperatures of 48° C in June and 6° C in December... The unpleasantness of heat during the summer is exacerbated by the occurrence of dust-storms, known locally as haboobs, the minimization of these two main factors of heat and dust constitutes as a major planning and design challenge of the human habitat." (same source above:86).

3.1 Migration Characteristics:

According to Agraa, Ahmed, Haywood and Elkheir (1985), the three towns tend to nearly double their population every ten years. "Greater Khartoum is among the cities of the world which are growing most rapidly: it was six times bigger in 1988 than in 1956. At this rate the population of the city will be more than nine million by 2010." (BOON 1990:96). Population increases are mainly due to migration and to a lesser extent natural causes. Migration is caused by poorly developed rural areas and the on-going war in the south of country.

"The human cost of the war has been substantial, many have starved, and many more have moved to the slums of Khartoum and Omdurman... One estimate suggests that 250,000 have moved north in the past few years..." (Pearce, Barbier, Markandya 1990:119).

Also, if the fact that the most advanced services are existent only in Khartoum, the situation is well justified. "Khartoum contains 70% of the Sudan's industrial establishments and about 60% of it's doctors (Elsammani 1986:34 in Boon 1990). Greater Khartoum contains almost all of Sudan's financial establishments and all its major enterprises and 60% of it's total employment and professional and technical groups and the majority of it's post-secondary educational institutions (Shaddad 1989).

In 1985 the squatter population in Greater Khartoum was estimated as 40%. "They are said to be distributed in over more than 91 locations..." (Agraa, Ahmed, Haywood and Elkheir 1985:111). Considering the worsening political and economic conditions of the country during the last years one can only assume that this appalling situation has been further aggravated.

"Squatters, 4th and 3rd class areas account for about 90% of the population... (same source above:117). Residential areas in Greater Khartoum are officially classified as 1st, 2nd ,3rd or 4th (4th class settlements are considered to be at a temporary stage before upgrading to 3rd class-i.e. squatter settlements). This situation is truly a source of concern if we consider that these are the less advantaged groups: thus a large percentage of urban poverty .

Also complicating the matter further an additional class has emerged (other than the official classes) i.e. ' below 4th class ' and also in the late 70's and early 80's an 'above 1st class` appeared. These disparities are causing even more social and economic problems. The great differences between 1st and 2nd class groups and 3rd and 4th class groups are made evident in many studies in Khartoum (E.g. Agraa, Ahmed, Haywood, Elkheir 97-101).

3.2 Planning Policies, Building By-laws and Regulations:

The objectives of building by-laws and regulations have been listed by Hamdi (1972) as follows:

- 1- guidance functions for better use of resources.
- 2- social justice for even distribution.
- 3- planning promotion by control of land use, population density, urban renewal etc.
- 4- control functions by giving administrative authorities the right to check designs, inspect construction etc.

Obviously by-laws and regulations should be positively directing the development of Greater Khartoum as well as maintaining some quality control over the built environment, but the existing laws have proved to be wasteful of expensive urban land and restricting to the development and creation of more interesting and climatically suitable morphological layouts: "Sudanese building regulations, standards and by-laws need to be reformulated. They lead to a wasteful use of space which increases the cost of services and contributes to urban sprawl with all the ensuing transportation problems." (Agra, Ahmed, Haywood, Elkheir 1985:245; the same issue is also discussed by Ahmed 1981:13 in BOON 1990).

AbdAllah and Ahmed in 1972 also emphasized the fact that planning standards should be based on our unique climate, soils, traditions and aspirations. They again reinforce the idea that: "... the factor contributing most to urban sprawl and to consequently to many environmental problems is the size of the house plot: the plot area is not based on any scientific analysis but merely imported from the rural areas of central and northern Sudan. New space standards must be found.

At that time plot areas ranged from 400 - 800 m at present they range 250 - 600m and based on many recent studies plot areas can be reduced even further. It is believed that with ever-changing life styles and user requirements as well as more and more economic pressures space standards should be thoroughly revised. Some of Hamdi's main criticisms of laws and regulations in 1972 were:

- 1- promotion of the class system .
- 2- waste of land.
- 3- the promotion of prejudice against certain building materials.
- 4- no general specifications but fixed regulations.
- 5- isolation of residential buildings from all sides.
- 6- sewage regulations prevent sharing.

It is interesting to note that despite the years that have passed and the fact that building regulations and by-laws have undergone several changes during this time the same weaknesses are still present.

The inherited system of class sub-divisions (that is from colonial eras) is still being practiced. areas for lower classes is quite unrealistic since in this way urban land is distributed in relation to the income of the household irrespective of family size although high income families can expand their houses vertically (Shaddad 1989:69)Waste of land and urban sprawling is still caused by unsuitable standards, prejudice concerning mud buildings has been promoted so much that unless economic abilities are completely limited its use is avoided, some aspects such as minimum window areas or set-backs from site boundaries are fixed regulations that limit flexibility and innovation.

Considering building set-backs, the by-laws state that any residential building is to be separated from its neighbours from all sides (less to the east,west sides and more to the north,south sides. Third class areas are exceptional). Which is completely unsuitable considering our hot, dusty

climate. We find that building regulations tend to treat each individual plot like an isolated island. This is made evident in the fact that sharing of drainage facilities is limited (septic tanks and wells outside the plot boundaries are not permitted).

An alternative shaping of the built environment is proposed to replace the existing morphological character of the region. It is considered that the maximization of shared walls will reduce surfaces directly exposed to the harsh sunrays of our tropical climate as well as providing increased shading. The above has been advocated by Tawkil in 1987 who emphasizes the importance of grouping buildings around inner courtyards isolated from the heat and dust. He also notes that houses should be grouped together with increased densities. Very low densities are also one of the major problems in greater Khartoum. " Low densities due to wide roads, large plot areas and detached single storey type of housing are special handicaps to the provision of essential services (Shaddad 1989:74)

Encouraging shared facilities will enhance community spirit and thus greater initiative and co-operation of small communities to care for their immediate environment.

Obviously Khartoum is growing in a manner that is somehow unsuited to its climatic and social aspects and unsuited to the general well being of the people. Planning standards such as road width (a minimum of 10 meters) further render our harsh landscape harsher. Tawkil (1987) also discusses the importance of grouping buildings around public spaces, walkways and narrow roads in day hot climates. He proposes the use of different building heights, the higher buildings to protect the lower building from sun rays and hot dusty wind.

"Experiment in new planning patterns is necessary in our flat and featureless terrain to avoid the monotony of the grid iron pattern which now characterizes our cities." (AbdAllah, Ahmed 1972). It is again noted that some problems concerning Greater Khartoum have been identified continuously in previous studies but never remedied through practical solutions. AbdAllah & Ahmed in 1972 also discussed the possibility of modifying the micro climate of Greater Khartoum by better utilizing the rivers. "Khartoum is in a unique position and water and greenery can be taken to every private home. Canals carrying running water should be dug connecting the White and Blue Niles from east to west and these canals in turn could be linked to others running from north to south. The canals should be wide and deep enough to be used for transportation, recreation and sports. Pumps could be located on the banks to deliver water through pipes and open channels to form artificial lakes to irrigate all parks, squares and open spaces...."

A beautiful conceptualisation that has not been realized. Urban priorities need to be well defined and anticipated actions need to be realistic considering available resources but basically great improvements on micro climate can be achieved through better planning and building practices.

Authorities who formulate policies need to take into account global approaches to development, as well as area-specific climatic and geographic requirements in addition to the many researches that have been carried out in the fields of infra-structure provision & improvements to local building materials (which are quite substantial but rarely implemented at a large scale... although some isolated projects have been initiated).

And of course, to ensure that such steps are taken, overall government policies need to be reformulated: "Government policy itself is frequently a major factor in reducing the stock and quality of natural capital. Five policy areas, in particular, are relevant to Sudan: land tenure & resource right; agricultural policy and prices; energy policy relating to charcoal; credit; and institutional problems." (Pearce, Babier, Markandya 1990:140)

Institutional strengthening "... involves more than supplying more equipment, better building and more manpower. It also involves a reconsideration of the inactive structure for this vital, longer-term work within the government." The issue of landuses will be discussed further.

3.3 Landuses:

The wise distribution of landuses within a city has a direct effect on the environmental-sustainability of the city. Some aspects of landuse distribution in Khartoum clarify this:

- 1- Grouping of industrial areas in the 3 towns means a concentration of industrial waste, thus a concentration of pollution.
- 2- Urban land is expensive: the present structure does not indicate the most economic use of land. Some landuses are dislocated within the structure (E.g. the airport is centrally located, which, of course, also leads questions of noise pollution).
- 3- "Although the three towns form an economic and social entity, there is no evidence to indicate a positive relationship between these functional areas... homogeneous landuses do not show any sign of cohesion. (Bushra 1972).
- 4- Concentration of tourist areas, as well as other functions, along the Nile banks, particularly along the Blue Nile in Khartoum town, contributes to serious pollution in the area.
- 5- The location of Khartoum North industrial area in the north renders it in the path of prevailing winds and there are no buffer zones,(Bushra 1976:29 in Boon 1990 :568).
- 6- Horizontal expansion of the three towns is proving disastrous: people are forced to live further and further away from the central business areas in these towns and hence, for many, further and further away from their work places and all the important services. The green belt in the south of Khartoum has gradually been taken over by expanding residential areas.
- 7- Concentration of business and commercial areas also causes traffic bottle necks at rush hours and congestion is a major problem.

In the points above we can again see how planning ordinances can have direct impacts on the health and well-being of people as well as the maintaining of environmentally-friendly development practices.

3.4 Building Materials :

In 1973 65% of houses in Greater Khartoum were built in mud. This is an indication of the high proportion of 3rd & 4th class areas since the use of mud is restricted, by regulations, to these areas." Brick is dominant in the higher classes." (Agraa, Ahmed, Haywood, Elkheir 1985:106)

The cost of building materials has sky-rocketed in the last years. If in 1985 the approximate number of annual incomes required to build durable houses for different sectors of the society ranged from 300-15 years (same source above:203), the situation is only worsening due to seemingly uncontrollable inflation. Disparities in the economic status of the people in Greater Khartoum are made more clear when we find a flourishing, sophisticated building industry existing side by side with very simple and poor quality buildings.

Many building materials are imported: "...local cement production cannot cover demand and steel and timber are imported with great difficulty due to hard currency problems." (Shaddad 1989:72). Abdallah & Ahmed (1972) suggest: "Building material industries should be planned in conjunction

with the requirements of the national development plan with the aim of producing sufficient quantities and thus reducing price."

Local alternatives are a must. Although much research has been carried out on improvement of local materials and construction techniques applications have been limited. Attempts should be made to build public trust in unfamiliar technologies. Some projects have been over-ambitious and their failure has only increased bias against local solutions. Successful projects have not received enough attention from authorities.

Mud has many advantages over other building materials being used in Sudan: it is abundant at low cost, little energy is needed to work it, it is cool, easy to construct and maintain.

The fact that it has a shorter life span than other materials has been remedied through the use of additives and different techniques. Some were quite successful while others proved a failure, but comprehensive follow-up of performance has not been carried out nor documented. Many studies have not seen the light in actual projects. It is evident that social acceptance is crucial and professionals and authorities should work together in eliminating taboos towards simple affordable technologies.

3.5 Quality of Habitat : Urban Sanitation in Greater Khartoum

As mentioned, there are extreme differences in socio-economic status, quality of building materials, level of servicing etc., in Greater Khartoum. But the over all problems are similar, though not identical, in 1st class or 3rd class areas. A malaria epidemic that hit the capital in 1994 did not differentiate much between these areas! "...diseases related to hygiene and sanitation are a significant problem in the three towns." Hawksky 1981:B7).

The level of sanitation available in the city not only threatens public health but also damages the sensitive ecology of the area.

To ensure comprehensive coverage the issues will be tackled separately:

1) WATER SUPPLY: "At the present time only half of the residents of the capital have domestic piped water supply. The remainder have to rely on communal stand pipes, wells and river for their daily supply of water." (Shaddad 1989 : 81)
This is a serious threat to the health of many people in the capital: "Use of inadequate quantities of water for personal washing and for the washing of eating utensils and clothes will... lead to high incidence of disease." (Hawksky 1981 : B7).

Areas connected to public water pipes use it wastefully and there are great losses of clean water (E.g. for watering gardens). Bad social habits need to be remedied since they also cause water contamination. But even clean water is threatened in various ways: "...Sewage can be sucked into water pipes when water pressure falls (which is frequent); boreholes are at risk from contamination by septic tanks and pit latrines; sewage can be taken up by the waterworks." (Elhassan 1983).

The latter point is explained by Ahmed (1983): Overloads on the municipal sewage system may reach the inlet of the Khartoum municipal drinking water treatment plant when the Blue Nile is low since the overflow is pulled by gravity to the White Nile.

Almost all water delivered to and consumed by households will reemerge as sullage or sewage: "Thus any level of water supply to dwellings must be matched by appropriate facilities for water removal." (Kirke 1984 : 15).

2) SULLAGE & SEWAGE DISPOSAL :There are several systems of human waste disposal in Khartoum ...pit latrines are the most widespread. Conventional water borne sewerage, aqua privies and septic tanks are the others. Although pit latrines are suitable and inexpensive for low income communities (Shaddad 103), modifications need to be incorporated in order to improve on this simple technology. Other inexpensive techniques have been studied but applications are limited.

The capital has two sewerage treatment systems that serve 15% of Khartoum population & 5% of Khartoum North (Shaddad 1989: 93-98).

In Khartoum, the plant is overloaded and excessive waste is directed to the Nile without treatment and in Khartoum North the plant is serving a much lesser area due to the problems of maintenance. Due to its broken down condition, waste from industrial areas accumulates close to residential areas. These plants both need expansion and maintenance. Ensuing waste can be treated and used for irrigation, sludge can be used for fertilizers. Boon (1990) suggests that the private sector be involved in such enterprises.

There is a common practice of sullage disposal by spreading it inside and outside compounds and this "...can have varying risks associated with it." (Hawksley 1981: B10). Again we find that education of communities can reduce negative practice and improve sanitary awareness. But generally Sudan's hot/dry climate is a blessing in terms of hygiene.

A most serious situation caused by inadequate waste disposal systems is evident along the Blue Nile in Khartoum where permits are being issued (most contracts are short-term, 2 years) for the erection of tourist facilities. The effect of these on the environment of the area was studied by a team of researchers in 1995 (Ali & MSc students). The results were appalling. Facilities with large-term contracts had introduced some sanitation facilities (although they were closer to the Nile than the required 20m distance) but others found it unprofitable to invest in such facilities.

Sullage and solid waste is disposed of directly in the Nile, although a piped sewage system is close by. Human waste from tourist boats also goes directly into the Nile. The authorities' roles were unclear: those responsible for sanitation were not the same bodies that issued the permits.

Here we find a situation where development and economic policies are causing serious damage to the existing ecology of the area.

3) SOLID WASTE DISPOSAL : Urban solid waste classifications include household waste (the bulk, 75%), commercial refuse, street sweepings, construction debris and industrial waste. Each of these requires different handling, collection and disposal systems.

Garbage collection is one of the acute problems of the capital: "It is calculated that 2,300 tons of solid waste are generated daily in the capital and only 980 tons are collected and disposed of properly by the city council" (Shaddad 1989: 108).

"Unremoved refuse.....has been linked to 22 human diseases." (Boon 1990: 503). Uncollected rubbish blocks rain water drains. Refuse collection equipment has a short life. Locally designed equipment has been experimented with but not used at a large scale.

Collected refuse is brought to low lying areas where it is burnt. The sites can be filled in later used for agriculture. Ahmed (1983 in Boon 1990: 547) causes one to speculate on the extent of

organizational disintegration: "Once upon a time there was a paper factory in Khartoum North which re-manufactured waste paper to produce cartons, but mismanagement and lack of spare parts for its machinery led to its closure".

Municipal solid waste contains biomass which can be recycled to produce gas and enriched fertilizer.... but till now biogas use is limited to a few institutions. Residuals like broken glass can be supplied back to factories or used for other purposes. "Recycling can turn refuse into a resource, can save energy, water and foreign exchange and can provide jobs for the urban poor. Organic matter can be fed to animals and/or composted". Garbage can be taken care of by the informal sector with support from the authorities. (Boon 1990: 504).

4) INDUSTRIAL WASTE : This is an aspect that requires more attention. Although the total number of industries may be relatively low, their concentration is causing high levels of pollution. Some industries have been closed down in developed countries due to the pressures from environmental groups but they are still existent in Sudan: "In a number of countries.... blue asbestos has been banned, but it is used in a Khartoum factory". (Boulis 1980: in Boon 1990: 570). Boon explains that even traditional industries such as cotton and tannery industries produce dangerous wastes.

A substantial number of factories dispose of untreated wastes in the Nile. Burri electricity plant disposes of untreated waste oil and water directly into the Blue Nile and this has had serious effects on fish life in the area (Ali 1995).

5) RAIN WATER DRAINAGE : Stagnant water has serious effects on public health since it becomes a breeding ground for mosquitoes. Insufficient rain water drains are not only causes of disease but they ultimately lead to the breakdown of the cities roads. "Storm-water drainage provision standards, together with the resultant maintenance and cleaning operations impact directly on both the capital and recurrent costs of access and circulation. The provision of an efficient network of earth ditches adjoining the main access and circulation routes may be justified simply by the resultant reductions in initial construction costs and lower annual maintenance cost of the roads and footways" (Kirk 1984: 14). Interconnection of all aspects of environmental considerations is again made evident.

6) ENERGY SOURCES : High demands on energy sources are characteristic of all urban areas. The impacts are not only locally or nationally but also internationally. The world is using up its stock of non-renewable fossil fuels. The need to generate more electricity may require new dams to be built which will render natural ecosystems to be disrupted. The production of charcoal needed by cities has serious impacts on rural areas which may in turn trigger increased migration to urban areas thus starting a vicious circle. (Boon 1990)

Study of alternative, renewable sources of energy is important (Solar, Biomass, Wind) and they should be used to supplement energy supply in Greater Khartoum, thus reducing consumption of scarce conventional fuels. A combination of technologies is possible, e.g.:- solid fuel pellets from urban solid waste, waste treatment and energy recovery through decompositing for example, harnessing solar energy, etc. Solar energy, in particular, has proved to be extremely efficient in some cases. In the Bara rural development project solar panels were installed as part of a solar pump set by the Swedish Sudanese Association (six in number). According to an architect involved in the project they have been used efficiently for irrigation for about ten years. Biogas plants have generally proved to be more problematic in terms of installation, possible leakages and social acceptance.

Wider application of isolated experimental projects is crucial if any kind of ecological balance is to be maintained, and this concern moves beyond the capital city. E.g.:- those concerned with the problems of resource degradation in Western Sudan, (Pearce, Barbier, Markandya (1990) explain that a solution to these problems "...involves not just action to raise ecological productivity in those areas, but also measures to constrain the demand for charcoal in urban areas and especially Khartoum". (145)

3.6 CONCLUDING COMMENTS: PROBLEM IDENTIFICATION

Again and again, when covering the existing situation in Sudan's capital, we come face to face with the fact that government policies are complicating problems further.

- Planning and building ordinances need to be reformulated... they are a major cause of disruption of ecological systems.
- The roles of different authorities need to be well defined and collaboration between them well organized.
- Partial, short-term remedies should be avoided, any solution should be directed to the achievement of long-term objectives.

3.7 APPROACHES & POLICIES: PROGRAM & PROJECT FORMULATION

Before it becomes possible to define the operational role of local authorities in managing urban environmental problems, strategic decisions concerning three critical policy areas must be reformulated: Urban hygiene (environmental health), urban land management policies and regional/national resource management policies (Bartone 1989: 82).

Least-cost approaches are crucial if any success is to be expected in any of these aspects.

Natural resource management may seem an irrelevance considering the problems Sudan is facing: "It is certainly true that a lengthy period of political stability is the Sudan's greatest need if any semblance of sustainable development is to be achieved." (Pearce, Barbier & Markandya 1990: 120).

But some aspects of environmental damage are not reversible and remedies should not be delayed. This will entitle that environmental issues always be given the priority in government policies. Development programs should be monitored and its by-products should not exceed the assimilative capacity of the ecological resources of Great Khartoum.

Environmental solutions should always be directed at grassroots organizations at local levels... broader applications are risky and liable to failure within the present organisational disintegration and economic problems.

Existing projects and techniques need to be continuously appraised and the lessons learnt should benefit in the implementation of new projects. The degree of peoples' participation and social acceptance will determine the success or failure of any project... A lot of effort needs to be directed to communities to enable them to take control over their environments.

The private sector should be encouraged to participate more in urban waste management, alternative energy sources, etc. The informal sector also needs to be revitalized and improved.

3.8 ORGANISATION & INTERVENTION

Although the present classification of greater Khartoum as the three towns of Khartoum, Omdurman and Khartoum North (Bahri) is geographically true... for the efficient organisation of

intervention a new approach to subdivision should be adopted based on physical/cultural and social regions (a similar idea is expressed by Mazari in 1972). It will be more comprehensive than the official class subdivisions and will allow those involved to tackle problems at a local level with all the unique characteristics of a specific area in full perspective (e.g. the older areas of Khartoum and Omdurman need special consideration in terms of the retainment of their historical heritage).

The classifications of Greater Khartoum's urban environment can be based on :

1. Geographical: natural resources-degree of use or abuse, landuses, road networks, morphology-physical character in terms of shapes, forms materials.
2. Social: economic analysis of the population.
3. Cultural: different cultural groups within the region, origins, ethnic background-prevailing cultural character.

These three aspects enable the subdivision into smaller localities each with its different needs and approaches and thus interventions will be rendered more area-specific, thus more effective.

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causes one to speculate on the extent of organizational disintegration: "Once upon a time there was a paper factory in Khartoum North which re-manufactured waste paper to produce cartons, but mismanagement and lack of spare parts