Upgrading Infrastructure in a Historic Town: 
Management of Water Supply Systems 
In Lamu, Kenya

By
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Supervisor: Prof. Dick Urban Vestbro

In the subject of
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Abstract

Lamu presents itself as an island rich in resources of cultural heritage, enjoying a vibrant tourist industry, and ecological diversities (coral reefs, mangrove forests, marine life, water aquifers). It experiences a lot of pressure on the existing infrastructure systems manifested in inefficiency and corruption, in dealing with the growing demand of the population within its limiting constraints of heritage management. There is therefore a need for continuous adaptation of its infrastructure systems such as water supply management that would conform to the spatial structure of the town and incorporate its stakeholders. The study of this possibility is done through historical analysis of past management systems and their relationship to spatial structure, documentation of the current scenario and reflecting with various water supply management theories.

The traditional systems of water management within different clusters of urban plan have shown to be effective in continuously providing for the people’s needs while enhancing effective maintenance. This system was replaced by the conventional piped system when the population outgrew their clusters during the colonial times. This could have been due to the existing cultural diversity of migrants or just for the need to control crucial resources. With the decline in economy and social structure of the town, there has been a shortage of resources, expertise and incentive to maintain and manage the water supply system for the continuing and growing use of the community. The postcolonial era has been depicted by un-maintained water system causing frequent water loss, health risks and damage to historic buildings. It then becomes necessary to revert and compliment the current water system with the traditional forms of administration in a bid to aim at enhancing community participation and consequently efficient management of water supplies. The options analysed towards achieving this are by decentralisation strategies, people empowerment and private sector incorporation as strategies of subsidising and improving the existing administrative system.

Key words: Lamu, Kenya, infrastructure management, water supply, cultural heritage, and popular participation.
Acknowledgements

This work would not have been made possible if it wasn’t for the constant support and encouragement obtained from my parents, family, colleagues and friends.

I am grateful to my supervisors Dick Urban Vestbro of the Royal Institute of Technology and Athman Lali, Senior Curator at Fort Jesus Museum, Mombasa, for putting me back on track whenever I would wander off. Sincere gratitude to the staff of National Museums of Kenya, in Lamu, Mombasa and Nairobi too, without whose assistance this work would have taken longer to reach its current state.

My participation in the Environmental Engineering and Sustainable Infrastructure study Programme was under the sponsorship of SIDA. I extend my gratitude for their generous assistance. I would also like to thank the EESI course co-ordinators Jan Erik Gustafsson, Angela Churie and Christina Ek for facilitating my involvement and my stay in Sweden.

Thank you all
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1. Introduction

1.1 Background

Figure 1: Map of Lamu in Kenya
Source: Siravo & Pulver 1986

Figure 2: Map of Lamu Island
Source: Tourist Brochure

Lamu is an island off the Kenyan coast, a natural harbour enjoying good rainfall, fringed by coral reefs and lined by thick mangrove forests to its north, west and north-east. Towards the south, it has a sandy beach with sand dunes rising to the height of about 20m at the estuary accommodating the Shela village and the island’s water wells (supply for fresh water). It is one of the port towns that came into being in the 12th century, had flourished by around the 15th when the Portuguese arrived bringing about its decline with their destructive looting. It saw though, most of its current construction in the 17 and 18th century under the Oman Sultanate after the overthrow of the Portuguese. The Oman rulers brought along and encouraged intricate architectural decoration evident in Lamu from the doors to the carved plaster works (Siravo & Pulver, 1986).

Plate 1: Carved door
Photo by: Kobayashi, 2000

Plate 2: Wall with niches and plaster decor
Photo by: Kobayashi, 2000
The 19th century colonial period brought about further decline with the effects of trade over the Indian Ocean as Mombasa took preference to it as a more favourable port. This stagnated Lamu’s development, that continued even during the postcolonial era and sparing the disruption of its existing town plan and architecture from fast urban sprawl common to urbanisation. Its narrow pedestrian streets characterise the habited area on the east of the island; with its social life flowing out of the adjoining houses and shops aligning them. It is rich in history, religion and culture and enjoys a vibrant tourism industry.

It is estimated that around 18 000 tourists visit the district annually (Lamu District Development Plan 1996-2001). Tourism is bound to increase once the site has been listed as a World Heritage Site due to increased recognition and publicity. This would bring about more employment opportunities in boat transportation, hotels, historical sites and museums but would also increase pressure on infrastructure systems whereby there are no evident efforts of re-investment of the tourism industry back into the society.

The economy of Lamu is supplemented by other small-scale income generating activities that vary based on land and soil characteristics and rainfall patterns. These include fishing and mangrove harvesting off the island, agricultural activities in the peri-urban areas, harvesting natural forests with hard wood timber for building construction, boat building, furniture and handicrafts, industries like the cotton ginnery and bakeries, and wholesale and retail business. These activities offer a limited employment scope for the educated inhabitants in Lamu forcing them to migrate to other towns like Mombasa and Nairobi for better prospects, thereby diminishing the number of trained professionals.

Lamu currently has a population of approximately 17 000 inhabitants (District Statistics Office), catered for by infrastructure systems installed about 50 years ago during the colonial era.

Sewerage is catered for individually, by using pit latrines in every building dug out during its construction. Most of the inhabitants have shifted towards the use of the water cisterns and water flushing systems making it problematic for the pit to retain the liquid waste within its porous coral walls. This results in seepage of the wastewater into wells or other ground water sources posing serious health hazards to all the users in general.
Garbage is collected regularly by county council employees with their tractor from some strategic spots along the sea front promenade. It is then dumped on reclaimed land on the sea front due to the lack of a garbage disposal area. There is a risk of this garbage being washed into the sea during high tides, polluting the aquatic environment and causing foreseen harm to the marine life within. Efforts are currently being made to acquire a suitable disposal area within the island and construct a conventional landfill.

Plate 5: Garbage Disposal posing risk to aquatic life
Photo by: Fatma Twahir

Electrical power is generated from diesel oil. With the growth of the town’s needs and aging equipment, the power output requirements of the town are difficult to be met due to run down machine and the lack of repair pieces. This leads to power rationing in different sections of the town. There are ongoing discussions though of a new plant to be established on the mainland and have power supply to all other islands on the archipelago. How soon this is to be implemented is unknown. However, new generators have been recently placed at the existing site with a capacity to comfortably cater for Lamu’s current needs.

Water, on the other hand, is supplied from the wells at the Shela sand dunes that act as catchment areas. Until recently when all 30 wells tapping the ground water source were rehabilitated and opened up, there has been an acute shortage of water supply. Wastewater on the other hand, runs along in open drains laid on the street grid that eventually drains its effluent directly into the sea where fishing and swimming takes place. There an obvious health significance of this action whose intensity is yet to be clarified as the marine environment play a wide role, crucial to the ecosystems (wetlands, coral deposits, fish, mangrove etc)

Plate 6: Open drain along street
Photo by : Fatma Twahir,

Plate 7: Grey water drains into the sea
Photo by : Fatma Twahir
Infrastructure deals with all the basic physical and social services provided for the population. This research however, intends to focus on documenting and analysing the change of water supply management strategies in time within changing urban forms and societal compositions of Swahili towns.

1.2 Statement of the Problem

Lamu is a historic town slowly developing, with increasing population, changing urban form and user needs influenced by education and media. Its key role in development is from the tourism industry that offers its attractions from the historic area and sandy beaches. There is pressure on the existing infrastructure systems to deal with the growing demand within its limiting constraints of the conservation plans. There is therefore a need for continuous adaptation of its infrastructure systems such as water supply management that would incorporate the stakeholders. The interests of these actors vary from local and regional to national and global scales in their perspectives of values for these systems to the site. The purpose of this exercise is to study different water supply management strategies and their possibilities for further development to suit Lamu’s constraints as a heritage site.

1.3 Study Objectives

In order to analyse the discussed problem, this thesis focuses on the following objectives:

- To study how urban form might have affected the administration of water provision
- To identify the various stakeholders in the water management systems and assess their role in water supply provision.
- To find out the existence, effects and potential for community participation in providing water and the community’s involvement in decision-making processes.
- To suggest how water supply system management can be arranged to have the least disturbing effect on the continuity of the historic urban form and environment.

These objectives would be achieved by studying the evolution of the physical structure of settlements in Swahili towns and reflect on their management of water supply. A look at the current situation and its problems is then necessary to assess the involvement of stakeholders and the role the community plays in decision-making processes. This will lead towards a discussion on ways and means of an effective participation, public and private, in order to promote an effective water supply system.

Research Questions

In order to make the objectives operational and researchable the following research questions were formulated:

1. Whose responsibility was infrastructure (water supply) management in the pre-colonial Swahili towns?

2. How was the spatial structure of the settlements influenced with the changing administrative systems or vice versa?

3. What is the interest of the stakeholders in water supply and how are they (politicians, county council, tourism industry managers, National Museums of Kenya, town elders, general public) supporting or contradicting each other?
4. What is the role of the public and private sector in providing water within the constraints of cultural heritage?

5. What are the major political or administrative interventions needed to bring about an improvement in the water supply administrative systems?

1.4 Methodology

The following methods have been used to address the above mentioned research questions:

1. Literature review on the history of administration of the coastal towns.

2. Analysis of theoretical literature about the provision of the public good, the role of the private and public sector, strategies of infrastructure management and ways of evaluation of stakeholders involvement.

3. Analyse aerial photos, maps and demographic documentation

4. Direct onsite observations of the efficiency of the water system, the cultural association on the people and the potential of community empowerment.

5. Interviews with key-persons and residents on system administration in the past, the current stakeholders, their targets and their extent of involvement in the overall scenario of service provision.

6. Photographic documentation of water sources and supply systems.

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Table 1: Methodology Selection by themes within the thesis

The different sizes of the stars indicate the relative significance of the different methods in relation to the subjects being studied.
Assumptions and Limitations

The methodology used has been based on certain assumptions and limitations that have been considered in the analysis. These are:

- The main focus of the study is limited mainly to the area regarded as Lamu town on the east of the island where most of the heritage buildings of architectural significance are located. A brief comparative analysis is however undertaken on other systems of water management on the island or on most of the surrounding islands in the archipelago.

- The archaeological data used in the historical study presents layouts of ruined Swahili settlements that have been analysed by different experts with varying conclusions. It is assumed that this data is reliable thus drawing relationships from this information without verification.

- The lack of documented administrative strategies of water systems of the pre-colonial era have led to the reflection on the general administrative strategies of entire settlements. It is assumed that the way the various political interventions administered the town would have been replicated in their water administration.

- The available technical data from prior research is accurate and reliable

- Difficult access to government documents has limited the study not to include an analysis of the central government policies. This would have assisted in assessing the degree of government response to the local situation and the accomplishment of targeted objectives and programmes.

1.5 Concept Discussion

Cultural Heritage and Development

Cultural heritage is the physical representation of contemporary societal needs and administrative systems, from the past through the present and into the future. It may include urban forms of the past that have survived into the contemporary city (Ashworth et al, 2000). These urban forms are valued based on aesthetics, varying styles within artistic periods represented, authenticity with age, increasing rarity value and their association it with a certain period or historic / political personality.

The people on the other hand have variable needs based on values influenced by the need to develop and advance ones lifestyle, as seen from the shift of dry pit latrines to water cisterns for sewerage disposal. More diversified development is expected with the boost of tourism once Lamu is included into the World Heritage List as per the convention’s requirements (Annex 1), by the end of this year, 2001. The consequences of increased public awareness, international assistance and recognition will not only boost tourism and development but will increase risks too on the conservation area if not properly managed. These risks of economic related pressure, development projects and unmanaged tourism can be monitored and managed based on the degree of knowledge, recognition and legal protection of Lamu available to its stakeholders.

Types of planning and management

**Preservation** focuses on the intrinsic qualities and sites resulted from the creation of comprehensive and rigorous legal framework enforced by powerful state agencies, like the National Museums of Kenya, with assistance from international agencies. Conflict, though seeking consensus between preservation and development, must analyse trade offs between the past and the future.
**Conservation** may not be as protective to a site with a specific end of state target, but endeavours at continuous process management, maintaining different equilibrium at different times. It then becomes a part of urban management engaged in a continuous monitoring and adjusting of urban change.

**Heritage planning**, therefore, covers anything inherited from the past and destined for the future while focusing on the island as a product with users or consumers with 3 fundamental characteristics:

- It is demand not supply driven- historic city created out of a demand for it.
- The supply of resources becomes an inexhaustible quarry of possibilities
- Selling the interpretation on the monument would vary at different times within the same space.

Users are generally more amenable towards heritage management approaches while resource managers prefer the preservation approach. There’s a need to have less pronounced difference between aims of conservation planning and market oriented heritage planning, not in terms of maximum profits or sales but towards socially progressive ends.

One has to keep in mind that all the anticipated impacts in Lamu in the coming year after its listing, are expected to be basically supported by the underlying infrastructure of the site. Its capacity and ability to adapt to these changing needs has to be assessed critically to ensure its continuing support to the whole process of conservation and heritage planning. This link between culture and infrastructure development presents challenges and opportunities for experts of conservation and of economic and social development to realise their shared objectives towards an effective use of resources.

To conserve heritage through adaptable reuse becomes an ideal solution in trying to satisfy the needs of the contemporary population within old structures without rendering destruction to them or causing them to change drastically leading them to lose their authenticity. It has however, an acknowledged contradiction that needs to be considered within their environmental contexts in order to create an operational partnership to sustain cultural heritage in urban management.

**Management of water supply systems**

Policymaking involves the following actors like policy makers, infrastructure managers who service policy and technology, operational staff for daily provision, and the users. These actors vary from National, regional and local governments to private firms, NGOs and donors. Problems faced by the water supply systems affect economic performance, congestions, environmental degradation and poor health conditions. Hence improvement of efficient maintenance is through:

- Meeting specific user demands
- Maintenance programmes that provide incentives, finance and encourage self-help.
- Devolution of responsibilities to local governments
- Systems maintenance to reduce life cycle costs
- Equity in fee systems having special programmes for those incapable of paying
Demand orientation responds to the consumer services, technology and pricing. There is a need to derive consistency between demands required and provision whereby the issues of priority in question are accessibility, capacity of service, diversity offered, reliable quality, flow time and price (Fox. 1999). There is a need to identify present and future demands in order to Focus on improving systems with greatest shortcomings; financial, management and technical

**Decentralisation and Participation Mechanisms**

Forms of administrative decentralisation that can be implemented, to transfer responsibilities from the central government to the local one and individuals in general, include:

1. **De-concentration**: redistribution of administrative or implementation responsibilities from the central government to offices in regional or departmental agencies including their operational power so as not to be imposing on the local population.

2. **Delegation**: decision-making and management delegated to specific experienced organisations not properly part of the central government. They are expected to perform efficiently because they are independent of inefficient government procedures.

3. **Devolution**: total transfer of specified functions with the central government retaining advisory and supervisory functions. This local autonomy can easily be given or taken away as it rests on firm foundation of local political and social organisation, participation and decision making.

4. **De-bureaucratisation**: transfer of responsibilities directly to voluntary private institutions or groups complementing government agencies. (UNCHS, 1989)

Different forms can be found in combination with others because specific programmes may involve considerable resources and time.
2. The Development of Infrastructure Management

2.1 Transformation of Swahili Towns and Administration of Water Supply

Most of the towns along the East African Coast begun as small villages of fishermen and farmers. They subsequently thrived as trade centres due to their strategic location on the western edge of the Indian Ocean that provided them with access to reliable monsoon winds, potable water and ample vegetation. These towns belonged to the Swahili, an African coastal people, who formed gateway communities serving as middlemen between the African interior and the rest of the Far East. One of these was Lamu with its excellent harbour facilities, adequate fresh water, peripheral agricultural land and fishing grounds, making it favourable for settlement.

Before the formation of the city-states and merchant towns, the Swahili were foragers based on reaping natural resources within their familiar coastal environment. These were places of abundant water and variant food resources. In order to obtain local unavailable resources, they would exchange agricultural goods favoured by the region’s ecology promoting the formation of local trade networks. Valuable interaction spheres were created that facilitated the exchange of ideas and produce (Kusimba, 1999). The Swahili society then, would seem to have been composed of small clusters of people with similar values and beliefs (homogeneous) and interactive with others. Being of a pastoral nature, they might have had no permanent or complex stratified society and settlement pattern. Such small settlements had a parochial relationship where neighbours were close friends or relatives retarding the formation of social clusters. (Allen, 1993) Their settlement was based on clanic patterns though. They may have had a common understanding towards the use and maintenance of a common resource like water that would be beneficial to all. It could have been reinforced by customs or religious faith directing their action from fear of punishment from God for wasting or misuse of water. Hence they may have had no definitive administrative system of their settlement in general and infrastructure, even though it was the key determinant of its location.

With the beginning of iron working, societies became specialised on specific crafts bringing about wealth and the beginning of status based on it. The leadership then, was hierarchical with lineages established by seniority in settlement and socio-economic conditions. In this case leadership and decision-making responsibilities were in the hands of capable and experienced elders. With the introduction of Islam, civic and private affairs were administered through the bonding based on adherence to the religion. It became a unifying factor normally symbolised by a centrally located congregational mosque as seen in Pate (Garlake 1966). It can be noted that the communal congregational mosque was located next to the town well where women fetched water, both services regarded as a communal and social activities.

The period of around 1000-1500 saw the emergence of the Swahili city-states when the villages grew into towns with increased commerce from international trade links (and agriculture). The architecture of this period shifted from being predominantly of mud structures to those of permanent coral stone ones, signifying security and more established political economy. The height of Swahili civilisation was at its ‘golden age’ from the 13th century through the 15th. The water source, a crucial item to the survival of any settlement, became a key-controlling element in the administration of the town, as seen at Shanga.

Shanga was a 13th/14th century Swahili town on the Lamu archipelago. The spatial structure of this town seems to emphasise the importance of the water supply in being determinant for the location of the site. Its earliest fresh water well was in the centre of a natural hollow formed by the surrounding sand dunes. Reconstruction of Shanga suggests that there were formal street patterns at the edge of the settlement with densely packed houses that may have been grouped based on their occupation: agriculturalists, pastoralists, traders and craftsmen.
There was no evidence of street patterning within central enclosure around the well. There was another outer enclosure at the periphery forming a ‘doughnut’ shaped plan. (Horton, 1996)

Figure 3: Reconstruction of Shanga showing 7 clans sharing one well near mosque
Source: Horton, 1996

This suggests a certain degree of town planning under some form of authority that had political control over the water source and the use of public space. The central enclosure may have been dismantled with the construction of the Friday mosque next to the well, allowing easier unrestricted access to it. Exposure to Islam was a secondary development since the water source existed well before the mosque (Horton, 1996) hence did not determine the settlement’s basic form, contrary to popular belief especially in this case, even though it was traced around the vicinity as early as the 9th century. Having one mosque with a well next to it is said to suggest a relatively tight knit society with little social stratification still. (Wilson, 1982) It can be seen from the number of gates the central enclosure had, that there existed seven clans having access to the water source four of which were dominating with access and control of the external gates. Impermanent mud houses were built outside this enclosure with any new clans either ousting the original ones or merging with the internal ones for permanency (Horton, 1996).

As the town grew the central open area was occupied too. The site was later abandoned due to either:

- Diminished water supply production as they relied on the same well until the 14th century when 2 other wells were dug for 2 other mosques on the sand dunes.

- The control of the well may have been lost to other rival settlements.

- Political attack by Pate under the Nabhani Sultans, the waungwana, a social hierarchy, against the ancient social and religious system that existed in Shanga (Horton, 1996).

- Expansion inwards may have deteriorated this water supply by probable contamination.

This case study may demonstrate that people of different clans or economic backgrounds could collaborate to promote trade and exploit new territories by common use of the well, a crucial sustaining resource. The clans were physically represented in the urban layout of the settlement in the form of wards or mitaa forming clusters that comprised of the extended family units with variable sizes and structure. They were still a relatively small settlements as a whole, where monitoring of common users of resources could still be informally managed since they had intimate interaction patterns with little cultural differences existing amongst them. (Fig. 4)
The importance of the water source stands out as a strategic and common pull of unity and the drastic consequences of unmonitored growth on it might have led to the abandonment of the site.

Lamu town might not have been in existence on the present site long before the 14th century but there are a few traces of 12th century settlement that cannot be properly defined. It said to have been composed of 2 inhabited sections or mitaa groupings towards its north and southern periphery of the current settlement referred to as Zena and Su’udi. They were permanently represented on the town’s governing council with the presidential post alternated between them on 5-year terms (Ghaidan, 1975). By the 15th century, Lamu was a thriving city-state exporting ivory, timber and ambergris in exchange for manufactured luxury goods across the Indian Ocean and maintaining their link with the Persian Gulf through trade (Siravo & Pulver, 1986). Increasing prosperity brought about migration into it, intermarriage and merging with the local society while still maintaining cultures derived from their regions of origin. This made the structure of the Swahili society more textured (heterogeneous), a thriving civilisation with economic based social division. They adapted different forms of non-indigenous architectural styles, values and administrative strategies influenced by the settlers. With the spread of Islam, a greater connection was established both locally and internationally from the adherence to the common faith.

During this period, Lamu was under a cadre of leaders, the elite class, who commanded access to important strategic resources through their collection of wealth and power acquired from their association with the Arab traders/rulers. There arose a hierarchical relationship with an institution of guardianship. This monopolised guardianship was limited to monitoring, assessing worthiness of services and supervising the sequence of the use of natural resources (including water supply sources). There is no evidence though, of specified system of rules or laws that could have used for strict guidance. The Portuguese, with superior navigation and arms hence the ability to destroy the towns, later threatened this administration. They arrived along the coast in 1497 and sought control of the trade routes. They exacted tribute from the rich coastal trading towns as they stopped along the ports to re-supply their ships. Any resistance resulted in attacks as seen at various occasions in Mombasa, Kilwa and Lamu. Their system of colonising was by plundering and looting; destroying towns, their trade networks and declining their economy. The Portuguese fleet monopolised shipping and suppressed coastal economy totally (Siravo & Pulver, 1986).

In 1652, the Sultanate of Oman was sought after to aid the Swahili states in throwing out their oppressors. Coastal commerce regained its former momentum, though never again the autonomy of the city-states. It was during this period that Lamu’s inhabitants built most of their traditional stone houses and mosques of coral stone and mangrove timber.
They used slave labour and skilled craftsmen from India (Siravo & Pulver, 1986). Their town structure shifted from the cluster system (as shown in fig. 3) as population grew and neighbouring space was occupied. Growth of the town brought about expansion around its peripheries.

The Sultans encouraged settlement of Indian merchants to help finance commerce into the interior. Their presence led to the construction of the bazaar street at the Lamu sea front. In 1744 an Oman family, the Mazrui, was sent to the coast to assist in the ruling. They later broke away from their Oman link and became autonomous rulers. They formed an alliance with Pate, the then powerful state that dominated Lamu. Lamu however sought further help from Oman and defeated the allied forces in battle. Lamu came under the established rule of a liwali, the sultan’s representative until later colonisation of the British whose initial interests were economical and propagation of anti-slavery (Siravo & Pulver, 1986). These anti-slavery moves reduced the availability of labour that was required to carry water from wells to residences. This was then done on wage basis making it an expensive venture.

The British formed an alliance with the Oman leaving them the coastal strip while they penetrated the vast interior. It was in 1890 that the coastal strip came under the British Company’s protectorate that handed it over to the rulers of the hinterland for a joint administrative system. In 1898, the East African protectorate organised the region into provinces and districts making Lamu town the headquarters for Lamu district, administered under collaboration of a British District Commissioner and a Muslim local liwali (Middleton, 1992). This constant change in administrators encouraged the infiltration of external influences affecting the uses of water such as the installation of the water cistern flush system in comparison to the dry pit disposal used earlier on. There’s a noted increase in the way and amount of water used, brought about not only by increased population but by changing user values and administrative patterns of water too.

Originally, the mitaa systems were visualised as a small-scale regional structure with voluntary coming together of diverse groups to form area-based development strategies. The areas’ (clusters) administration allowed each community member to have some sort of participation in the affairs of the settlement as a whole while permitting limited internal autonomy. Each mitaa had a leader, a representative on the council that administered the settlement’s affairs (Allen, 1993). This mitaa system mitigated tensions, which might have arisen with different cultural and economic backgrounds co-existing within the same settlement. Up to the 19th century, mitaa boundaries ceased to reflect socio-political reality. Affairs were gradually passed from the hands of the locals to those of the Sultan, colonial and post-colonial authorities.
Generally, the mitaa’s modes of operation were based on:

1. **Corporation**: where franchised headmen were stewards, who managed the flow of trade, allocated corporate land, oversaw strategic reserves such as water sources, and were responsible for diplomatic relations with strangers. Corporate strategies in water management involve community integration, masking of class and other differences through rituals and other public benefaction. Each member invests in their kin’s success, as it would gain them back ample return as a community. This ensured economic well-being of their associates while enhancing their own authority (equity). It was necessary though to establish regional connections when corporate strategies were insufficient from resource scarcity.

2. **Networking**: The expanding need for surpluses in corporate ventures made it necessary to network other resources of different mitaa and towns as a whole. Water has been seen to be transported from Lamu island to the neighbouring Manda and Faza islands to substitute their lack of it due to saline wells. These close ties were forged by common cultural background of the coastal people, Islam as a unifying factor, a mark of group identity, and the realisation of water being an important marketable commodity. (Willis, 1993)
These modes could be combined and alternated in significance through time (fig. 7). Different mitaa could have sourced its water independently while assisting those that had none, whenever necessary. The degree of community participation seems to have been dependant on the size of the settlement. There was a need to have the cluster system for efficient representation in bigger settlements. With the upcoming of the Europeans, there was an imposition of monopolistic centralised administration system, leading to the decline and an end to prosperity of the Swahili towns and their representative systems.

The importance of mitaa diminished, except for directional and location purposes, when they lacked fixed composition and boundary definition. They originally reflected the ethnic and kin affinities of the inhabitants that later became obscure with intermarriages and increased immigration. In most cases each mtaa cluster had its own well, administered through neighbourhood responsibility. The clanic or area based political authority most probably later brought contradiction and conflict with immigration of new comers during the town’s flourishing era. The formation and composition of urban social clusters within the society affected the case of communal use of water to neighbourhood that later came down to individual use since the element of familiarity and common understanding had diminished. This is evident from the vast increase in wells within individual residences.

2.2 Decline

The general decline of Swahili states was started from environmental deterioration (drought, salination of wells or crop failure), ethnic conflicts (competing for scarce resources), and Portuguese bombardment. The Swahili then lost their social, economic and political power to Arab and then British colonialists. 1500-1950 colonial periods brought about further decline and abandonment of some Swahili settlements while others diminished in status.

The 1920s saw a full-scale depression in Lamu with neither trade nor agricultural support to the economy. People migrated, population fell and Lamu drifted to dormancy; a small remote island sustained by traditional maritime industry which ironically saved it from the evolution of modernisation. The British authorities sought to re-shape urban physical space in order to change the social relationships, nationalism, since urban plan affected society and vice-versa. They did this through formal grid like street planning, standardised building codes and water supply requirements enforced by law. They focused their concern on commercial areas though, areas whose investment would have had an economic gain to them. They extended further inland reducing trade resources for the continuous maintenance of the island. This was when they realised that Mombasa would serve better as a harbour. Hence they shifted their interests from Lamu totally. As Ghaidan (1975) indicates, Lamu stands at present as testament of 200 years of architecture and town planning whose prolonged foreign intervention arrested its development into a fully-fledged merchant town.

In 1956 the British colonialists realised Lamu’s potential ground water resource based on research undertaken, and tapped it through the construction of 19 wells along the Shela sand dunes. The water was led it to a sump tank for treatment before it was pumped to the highest spot on the island, for gravitational distribution to the rest of the town (JICA, 2000). The town that had earlier depended on private, neighbourhood and communal wells for their water supply switched to a central system that was supposed to be safer and more convenient. This could have been due to the existing haphazard cultural diversity of migrants or just for the need to control crucial resources. With the decline in economy and social structure of the town, there was a lack of resources, expertise and incentive to maintain and manage the water supply system for the continuing and growing use of the community. The dormancy of the island has resulted in the limitation of administrative initiatives towards developing advancements in water supply system.
2.3 Conclusion

Settlements were built near sustaining resources - fertile soils, water and trade links. When the rich coastal strip prospered economically and became an immense attraction to migrants, it became densely populated bringing about social transformation and with it city patterns and management strategies. It seems possible to draw on five administrative systems that reflect the link between the transformations of urban society to the spatial structure discussed above:

1. The informally or non-administered communal resource when society and urban plan was one homogenous unit

2. Religion linked administration acknowledged by the attachment of a well to the mosque acting as cores around which the population grew. The node here could either have been the mosque or the water source. Society had then acquired religion as a common value respected by all as the element of authority. Hence the increase in the number of mosques and water source point could have been indicative of the initial beginnings of social, economic and political subdivision in society.

3. Cluster headmen in charge of their mitaa affairs who had to represent the people at the council of elders. These leaders were identified in their relevance and control based on their status but later on their wealth. The unequal distribution of wealth though, led to social and political tension. Each mtaa therefore had its own well and mosque.

4. Centrally controlled networked supply over-ruling any subdivisions to ensure equal distribution of water for all serviced areas within the town. The emergence of civic practices replaced strictly private or familial observances into public and government controlled ventures.

5. Individual efforts of having water sources in the form of wells and boreholes within their own residences having full autonomy over its management. This was influenced by disintegration of the sense of community towards individualism promoted by decline in efficiency of the central supply, individual economic affordability and the lack of social cohesiveness. Networks established were on a more impersonal nature based on trade purposes rather than common advancement of all.

Towns are and have always been centres for communal, ritual and political activities whose pattern and management are inter-dependant on their social and spatial structure. The change in systems and increase of the distribution of wells could be termed as indicative of social, economic and ethnic subdivisions in society, which turned a communal activity to a private, individualised one. Decisions were based on some form of ‘common ground’ attained, initially through area based and later on function-based strategies.

The contemporary principle of egalitarian (among the locals), integrated and central control of services initiated by the colonial government, encouraged the set up of a networked pipeline system. The scale of the area under this central authority had changed with the growth of town structure and nationalism. Could this egalitarian and centrally controlled approach still be feasible especially with the recurring problem of insufficient resources and maintenance problems in almost all developing countries and particularly in this economically dormant island? The current management system of water supply needs to assess the effectivity of the centralised system and the possibility of reflecting the above identified systems to improve or compliment it.
3. The Current Scenario

3.1 Town Layout

Lamu town has been developing linearly with a north-south orientation influenced and determined by its social (religious preference) and environmental conditions (wind patterns).

Figure 8: Plan of historic Lamu showing linear orientation
Source: Siravo & Pulver, 1986

Lamu has two main streets, at the sea front, (Usita Pwani) and the bazaar street (Usita Mui) parallel the sea front, which acts as the main thoroughfare and communication spine. These two streets run parallel to the sea wall on the eastern end and are mainly used for commercial activities.

Plate 8: Busy Bazaar Street
Source: Ghaidan, 1976

To the west of the street is an outlay of the residential area served by secondary lanes, which become smaller and less ordered as they reach deeper into the residential quarters. This maze of streets is lined with hard, richly textured windowless facades providing densities of shadows brought about by bridged rooms and stone benches, barazaas, at house entrance porches (Ghaidan 1976). The streets terminate into house entrances or onto the outer extreme of the unauthorised development.

This informal townscape has narrow and strictly pedestrian streets that enhance intimacy through increased face-to-face interaction with the users, encouraging a high involvement. They therefore act as social spaces as some element of privacy is maintained within them and amidst small pockets of open neighbourhood spaces. It is in these spaces that wells with public taps are located and in most cases near a mosque.
Lamu is divided, though not physically, into 3 main parts; the old stone town (Mkomani) in the north, the new town (Langoni) in the south and the mud and thatch section that is a part of Gardeni along the western periphery. Gardeni officially represents all the new extension areas such as Kashmiri and Bombay. Centrally placed is the market area next to the old fort that has been converted into a marine environment museum. The museum opens out onto a communal gathering place commonly known as Mkunguni. This central place has established itself as the main communal meeting place of the inhabitants of the town. Mkunguni extends outwards towards the seafront to one of the jetties via government administrative buildings.

The town area (Mkomani and Langoni), has a current population of approximately 14,000 inhabitants (table 2) of which 50% reside in the new expansion areas out of the original stone town. The average density is of the town is around 350 people per hectare and rising up to 600/ha at denser areas of Langoni (JICA, 2000). A lack of developable land has driven the population to settle on marginalised lands that lack clear planning concepts, in infrastructure or otherwise, prior to their occupation since as they are privately owned. The distinct subdivision of stone and mud shelters based on lineage and permanency is not as evident as earlier mention by Ghaidan (1975) due to the unhindered settlement of the migrants that were earlier encumbered by political or social reasons.
Table 2: Provisional Results of Population Census of Lamu Island
Source: District Statistics Office, Lamu

<table>
<thead>
<tr>
<th>Sub-location</th>
<th>No. of Households</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langoni</td>
<td>1614</td>
<td>7226</td>
</tr>
<tr>
<td>Mkomani</td>
<td>1370</td>
<td>5718</td>
</tr>
<tr>
<td>Shella</td>
<td>312</td>
<td>1364</td>
</tr>
<tr>
<td>Manda</td>
<td>203</td>
<td>649</td>
</tr>
<tr>
<td>Matondoni</td>
<td>330</td>
<td>2038</td>
</tr>
<tr>
<td>Kipungani</td>
<td>64</td>
<td>311</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3893</strong></td>
<td><strong>17306</strong></td>
</tr>
</tbody>
</table>

Lamu is still divided into *mitaa* but they are not easily identifiable by definite urban edges except for those recognisable by the inhabitants. The *mitaa* have lost any element of political authority except to describe the location of an area. Hence public representation is through elected councillors to the Local Authority based on the three formal sub-divisions. Most *mitaa* have their own mosques and wells whose maintenance responsibility is jointly shared by people around. The patterning of space is culturally determined as earlier argued. This culture, based on the ways of life of the people, is clear in the shift of the administrative systems of water. The British however adapted their own systems of water administration without due consideration of the existing and functioning system.

“The Swahili town is a delicate and sensitive expression of social organisation. With its functional structure and limited vocabulary of form, it has created an environment for the growth of an evolved culture and a reasonably high level of artistic attainment. Within this environment the inhabitants live in ecological balance with each other and with the surrounding world. It is in its degree, a sophisticated environment with a potential breadth of applicability that transcends national boundaries.” (Ghaidan, 1975 p.85)

This idealised situation seems to have disappeared with the uncontrolled growth in Lamu where planning, harvesting and disposal of water has not been considered nor realised as a threat to the earlier attained ecological balance.
3.2 The Water Supply System

Water was drawn mainly from public to private wells scattered around the town, and supplemented by rainwater. In a survey conducted in 1930s there were 30 private wells, 31 attached to mosques and 30 on the streets. Water transporters were a common sight that has currently shifted to Shela, Gardeni and Langoni areas since the introduction of piped water (Siravo & Pulver, 1986). They are still evident within the old section of Mkomani whenever there’s a shortage of piped water even.

Piped water was installed in Lamu in 1955. Its water supply comes from the Shela sand dunes about 8km south of Lamu town. This dune belt lies 10km long extending the whole length of Lamu bay. These deposits have the highest aquifers due to their high permeability hence acting as good water catchment areas. Rainwater infiltrate was therefore pumped out using submersible electrical centrifugal pumps, from 19 medium deep wells with a diameter of 3m and ranging from 15-25m in depth that discharged the water into a 50m³ sump tank at the main pumping station (JICA, 2000).

It is chlorinated using sodium hypochlorite dispensed through gravity dozers into the tanks and then pumped to a 450m³ reservoir at the highest point in town, at the District Water Office, for gravitational flow to the rest of the town (JICA, 2000). The distribution from here is through pipes that run underground or in grey (bath/storm) water drains and come up to be connected to the buildings. This network posing great risks in contamination from broken pipes that lead to outbreaks of all sorts of water borne diseases.

Incidence of Water borne diseases in 1998

<table>
<thead>
<tr>
<th>Type</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>49,235</td>
<td>43.3</td>
</tr>
<tr>
<td>URT</td>
<td>26,685</td>
<td>23.1</td>
</tr>
<tr>
<td>Diarrheal diseases</td>
<td>10,010</td>
<td>8.8</td>
</tr>
<tr>
<td>Intestinal worms</td>
<td>7,516</td>
<td>6.6</td>
</tr>
<tr>
<td>Total out of 113,625 hospital cases</td>
<td>93,446</td>
<td>81.8</td>
</tr>
</tbody>
</table>

Table 3: Incidence of water borne diseases
Source: Public Health Office

The water is mainly used for household and commercial (hotels, offices etc) consumption within the town area while most farms are irrigated using privately dug wells within them. Since the population of Lamu is comprised mainly of Muslims, water consumption is high from the religious requirements of ablution, toilet use and frequent bathing. Individual requirements are therefore not just for drinking, cooking and washing but for spiritual purposes too.
Increased shortages brought about by unmanaged increased demands led the inhabitants towards individual and collective neighbourhood efforts to supplement this centralised piped supply with well water. These wells were mainly located in residences, adjacent to mosques and at open neighbourhood areas.

The household usage of water has traditionally been free for all as it was regarded as a natural resource essential for everyone’s sustenance. The Islamic religious background has further emphasised on assisting in providing and sharing this resource, as form of worshiping.

Cooperation is however necessary in contributing for the maintenance where required, like for the electricity bill if an electric pump was installed. Basic cleaning activities are automatically self-assigned to all the responsible users within the prescribed area or might have been under the jurisdiction of the mosque maintenance authority if they initiated the well.

From an interview with the conservation officer, it was established that, in 1986 a Lamu Water Supply Augmentation Project was undertaken, where 10 more wells were dug while rehabilitating existing supply and distribution network. The project was halted though in 1990 when only 70% of the work was completed due to misappropriation of funds. Included in this project was construction of storage tanks within the town area that was never accomplished. It seems that the donor, the Norwegian Government wanted to have the Local Authority participate only as recipients of the service and not to handle the financial aspects of it, due to corruption. This brought about a disagreement leading to its abandonment.

A recent El-Nino Emergency Project was undertaken (1999-2000) to upgrade the water supply system or repair any damage that might have been brought about by the extensive El-Nino rains. This led to the rehabilitation of the 20 existing wells and the construction of another one. Each well was equipped with a pump rated 60m³/hr against a head of 25m (JICA, 2000). Not all of the documented work was completed because tender was issued to a contractor with the lowest quotation, a price incapable of meeting all the costs to be incurred.

The pump control is mounted adjacent to the well and has an automatic low level cut-out switch that breaks the circuit at a specified water level, to prevent over pumping of the well that would result in their salination. An extra 50m³ sump tank was put up and new booster pumps installed (plate 17).

Plate 16: Neighbourhood well with taps accessible to all
Photo by: Fatma Twahir

Plate 17: New booster pumps
Photo by: Fatma Twahir
Most of the distribution pipes that were laid in 1956 are of galvanised mild steel resulting in their frequent breakage. Additions have been made when some 5000m of PVC pipes were laid. The reticulation network is now undersized in that there are some areas that have not been serviced yet and the situation will worsen with increasing expansion of settlement and consequent demand for water. It must be noted at this point that there is no record of the existing layout making any improvement efforts difficult. Siravo and Pulver in their 1986 study recommended the necessity of such layout data but it seems to have fallen on deaf ears.

The present day and projected demand calculated from an all-in per capita consumption of 100l/day would be 1730m$^3$/day in 1999 and 2390m$^3$/day in 2010. The current source capacity ranges from 2000-3400m$^3$ depending on the number of pumps functioning (JICA, 2000). The current supply is 1400 / 1500 m$^3$ and can go up to 2000m$^3$ if all wells are operational. From a prior ground water survey done by CowiConsult in the 1980s, the aquifer is said to have a capacity of 3400m$^3$ of water. This provides room for accommodating around 23 more wells for the growing population. The recharge regime still needs to be clarified further so that maximum allowable annual abstraction can be established. Studies have been undertaken on the possibilities for complimenting aquifer abstraction at Makafuni, 2km west of the town (KamalKhan, 1992). Such efforts are useful resources for future management planning of the water supply system.

The improvement programmes earlier mentioned, have both been under minimal consultation with the existing water management authority. The immense improvement in the water supply has shifted development priorities towards other issues like the upgrading of the drainage system and garbage disposal. Most of the relevant authority is therefore relaxed in coming up with new ideas even when majority of the houses still have a rationed supply. It becomes absolutely necessary to have small storage tanks for domestic use where water can be stored for continuous daily use whenever it is rationed.
The main problems faced by the central water supply system, as discussed with the operations manager, are:

- Leakage of about 60-85% (Kamal Khan, 1992) from worn out distribution pipes leading to wastage of such a valuable resource, risks of contamination and destruction of heritage buildings.
- Limited supply, 9 well not being harvested
- Non-existent water supply in the expansion areas
- Insufficient water pressure
- Expensive power supply as it is distributed commercially by the generating company.
- Faulty or non-existent water meters of up to 50% of the installed networks

The continuing need to ration water, when there is adequate supply in many parts of the town, could be due to un-maintained wells that require constant repair, existence of a higher demand than the projected 100l/day or the extremely high leakage rates leading to a lot of water loss within the network. This central system that might have been initiated with the hope of conveniently providing reliable and safe water still has problems hindering its efficiency of service production. It is currently supplemented by various individual and communal efforts to operate wells within Lamu town.
At other smaller settlements on the island, like Matondoni and Kipungani, people are served by individual and communal wells. Shela on the other hand, is served by individual wells where affordable, community based network run by the local mosque under a small fee and a privatised network owned by a football club investing in the most important and available resource in their regional environment, water. Both network systems charge on flat rate basis of general consumption activity of household depending on the standard function of the structure, commercial, residential and others.

In conclusion, there are four main water supply systems identified on Lamu Island:

1. The private well within houses or hotels
2. The piped system of networked distribution
3. The communal wells
4. Private investors like in Shela

These systems have been analysed by many scholars, Ghaidan, Siravo and KamalKhan, just to mention a few. Their efforts do not seem to be considered or implemented within their full capacity of potential data that could assist in resolving most of the existing problems faced. Who are in charge or in anyway involved in administering or catering for the water needs of the people and how do they function? It is through understanding the objectives and targets of the role players in water supply administration that one can understand the means and process towards implementation of any water development programs.

3.3 The Stakeholders

The stakeholders considered here are all the people or organisations directly or indirectly involved with the planning, management, supply and usage of water. These include government authorities, Non-governmental Organisations, communities and individuals.

A. Government authorities

1. Department of Water

The department of Water is under the Central Government’s Ministry of Water, Natural Resources and Environment whose head office is in Nairobi. It is headed by the District Water Officer, a hydrologist and assisted by an electrician, geologist, surveyor, water inspectors and subsidiary staff. Its management is subdivided into the operation and maintenance department, electrical department, mechanical and the administrative sector. The operations and maintenance department has another branch at Mokowe mainland where another source of water is being harvested. This branch was initiated by the armed forces that have a Navy base nearby.

Some subsidiary organisations are:

**Water Apportionment Board**
The board represents the Minster in authorising, supervising and controlling use of water throughout the country. Their function is discharged through the catchment boards.

**District Water Boards**
The district water board is a subcommittee of the District Development Committee that assists in planning and coordination of water related activities. Their mandate includes:
- Protection, conservation and preservation of all catchment areas
- Partitioning, allocations and authorisation of all water bodies
- Management and control of water use
- Overseeing and coordination all water related activities in the district
- Assisting in the enforcement of the Water Act.

**Water operations at District level**

Its management is vested on the district water engineer with the following structure of authority:

```
Minister for water development
   ↓
Permanent secretary
   ↓
Director of water development
   ↓
Provincial water engineer
   ↓
District water engineer
   ↓

Support agencies: Water Apportionment Board, District Water Board
```

*Figure 10: Hierarchy of authority*

**The functions of the Department of Water:**

This department manages ground and surface water resources by hydrological observation, assessing water resources, controlling water quality and pollution control, planning water projects, and assessing environmental and other impacts of water resource management practices. It also controls the water catchments by managing division of water rights and assessment of issues, cancellations and registers of water permits and maintains the national water database. (JICA, 2000). Its functions basically include the development of the water supply distribution, which ideally includes activities like replacement of old, and broken pipes, metering and billing within the jurisdiction to include drainage charges. The revenue is then sent to the central authority in Nairobi where they analyse the department’s needs and set an annual budget for them, allocated back to the district as running costs.

Under the directory of the ministry, a water bailiff is appointed in charge of registering and monitoring private or communal wells within the island. Out of approximately 300 wells existent and still in use, only 10 have been registered. This requires a high registration fee (10,600 ksh) nation-wide for both old and new wells, creating a low incentive for the owners of the old ones hence a low success. There’s no strict regulation on the new individual wells prior to digging, due to the lengthy process incurred in the registration process. Emphasis is said to be on mechanised wells (estimated at 100) rather than the manually operated ones. It becomes difficult to monitor the degree of water harvesting and depletion of aquifer, said to be leading to salinity. It seems though that individual pumps too, are placed at a certain water recharge level ensuring capability of harvesting only if the level has been attained.
Cases of salinity have been experienced where the owners have dug deeper in order to reach this level faster, thereby reaching the salt water table underneath.

It can then be noted from interviews with the district operations manager and the departmental head that the department has various problems such as:

- Understaffed department with the earlier retrenchment programme undertaken to increase pay hence incentive for the workforce efficiency. This pay rise has not been implemented yet
- Low staff morale and incentive to perform due to low pay and insecurity of retrenchment procedures leading to the lack of dedication and corruption of the officers
- Lack of transparency and departmental monitoring mechanisms
- The operation and maintenance department integrates not only the source, treatment and distribution aspects of the water system but also for billing and revenue collection. Technical staff moved into the billing department without training for the commercial aspect reflects on the system efficiency. The billing and collection efficiency is questionable with minimum charged consumers at 78.14% (JICA, 2000)
- No organised schedules have been done for responsibilities yet
- The manager responsible for the system is a hydrologist with no managerial background or training offered with commencement of responsibilities/assignment
- The department lacks resources like proper archival documentation, reliable transport facilities (their current vehicle has mechanical problems) and office equipment
- Faulty or missing meters resulting in unaccounted water consumption based on differences obtained from unreliable consumption and production details
- There are no clear guidelines about new connections, disconnections or re-connections with consumer records not easily available or updated

The problems faced by the billing and revenue collection include manual abstraction of information monthly, making it cumbersome and time consuming; hence estimation similar to the flat rate is used on the un-metered supplies. Consequently, the reconciliation at the end of the financial year would be missing and the annual details for the headquarters would go wrong. The revenue earned does not reflect the services provided by the organisation hence have to be subsidised by the government.

2. Lamu County Council

This is the Local Authority, which is sub-divided into a political and administrative section. The political section is headed by a chairman and comprised of councillors elected by the inhabitants to represent them in political decisions and guidelines. The administrative section, headed by the town clerk, is normally complimented by a treasurer, works and health department to ensure the implementation of decisions taken. The Local authority has a shortage of resources, to process development applications hence work in collaboration with the National Museums of Kenya and other departments within the central government. Their roles and responsibilities are hence not properly defined leading to inefficiency and ineffective management. It is obligated by CAP II 42/65 to form byelaws sensitive to the local condition and mandated to regulate physical development. Instead it uses adapted ones formulated in 1968 to provide building codes and development plans that are too stringent and not sensitive to the cultural heritage.
This is either from the lack of commitment, corruption or lack of awareness that most of its leaders have brought this powerful authority to be looked down on by the other governmental ministries.

This authority is not involved with the water supply system in Lamu but plays a role in constructing and providing for maintenance of water catchment schemes, *madjabia*, in the neighbouring islands. They construct the tanks; let them collect water during rainy periods and auction off the water to individual residents who would then slowly sell it to the inhabitants. The money obtained from this sale is re-used annually in the maintenances of the *madjabia* prior to the rainy seasons. It can be noted here that selling of water, a scarce resource, is a profitable commercial venture for the inhabitants allowing them to gain a water source and an economic means too.

In 1996, a new act gave the County council authority to be made aware comprehensively of any government development programmes. Ideally the local authority must address all development applications after circulating them to all relevant authorities, departments with a stake in the built environment. If a certain development is said to have an injurious impact then it must be advertised to seek support or objection from the general public. It is generally though, not concerned with water issues except when the fitting of new pipes involves the destruction of roads without due repair. The Department of Water has managed to muscle it out of any of their decision-making processes except for its remittance of drainage fee included in the water bill.

The current trend of decentralisation brings about talk of having the administration of the current water supply system transferred to the local authority. The authority is reluctant to take over the responsibility due to its inexperience and financial constraints unless the water supply system can establish itself as self-sustaining from their feasibility studies.

3. **Department of Physical Planning**

It is under the Ministry of Lands and Settlements and headed by a physical planning officer, supported by draughtsmen and subsidiary staff. Though constrained by finance, resources and political authority, its responsibilities are:

- In charge of the use government land
- Acts as advisor to the District Commissioner on issues concerning government land and its uses.

Its mission is to ‘ensure human settlements are well planned by providing appropriate framework within which environmental and socio-economic development activities can take place. Its core function is to prepare long term and short-term physical development plans’.

(Chart at the department offices, Lamu)

This department plays a crucial role in protecting the main source of water at the catchments area, the sand dunes by undertaking deliberate efforts to protect it from encroachment/grabbing by gazetting as a water conservation area. This was done in 1986, without proper boundary definition though, hence ambiguity of extents (interview with head planner). Any development on this crucial surface area thus would have affected the underground water resources with risk of contamination or consequential depletion with the damage of dune vegetation.
In reaction to attempts to have portions of the sand dunes allocated to private developers, its protection was considered necessary. In 2000, plans were prepared in consultation with the Department of Water to identify their area of interest i.e. 1km from both ends of the periphery of the located 30 wells. The plan was then circulated to the relevant departments and stakeholders for comments, political or administrative. It was forwarded to the Minister of Lands and Settlements, and the Ministry of Environment and Natural Resources.

An area of approximately 7km along the sea shore running 1km inland was placed under the jurisdiction of the Ministry of Environment and Natural Resources; Department of Water; in conjunction with the Local Authority. The National Museum of Kenya, the custodians of national heritage have a particular interest in the area, both as a source of water and as a unique and scenic physical feature, the sand dunes. The sand dunes also protect the island from wave action of abrasion hence the need for their conservation. What is left from the procedure is to make necessary surveyed plans, putting beacons and fence.

This department prepares plans ranging from 5 to 25 years periods, submitted to the ministry for approval after circulating at the local level and advertise at the national level. The community needs are represented through putting notices of intention to the local authority and all government departments, and by organising a series of seminars and workshops. They also seek to protect other catchment areas within the district. Their interests boil down to development control where by any development should not interfere with the water reticulation system or the drainage systems. The Water Department provides information upon request towards convenient areas to promote development since it will affect the management of the water supply system.

Research was earlier conducted by Ghaidan in 1975 predicted the increase in demand to develop along the beach area. He then came up with a proposed land use plan that should have been used as a guideline in development. If this would have been done and planned for as early as suggested, these development problems along the sand dunes would not have taken place.
Problems:
The department faces problems that include:

- People lack appreciation/perception of the role of the planning department as long-term planners and allocates land for different uses without conflict
- Internal constraints in terms of personnel and resources
- Local authority not appreciating their role as development controllers, affects the efforts of the planners shifting the blame of uncontrolled development to the Planning department.

These problems inhibit the physical planner to fulfil his duties adequately.

4. The Public Health Department.

This department is headed by a public health officer and supported by health inspectors under the Ministry of Health and Social Sciences. Their responsibilities include ensuring general health of the public, approving of building plans for new development (ventilation and sewerage) and controlling epidemics outbreaks. Its current objective is to increase accessibility to safe water through promotion of low cost harvesting and storage, rehabilitating existing water storage units and establishing a water safety-monitoring unit. It plays an advisory and regulatory role in monitoring the quality of water accessible to the public. This is done through:

- Taking up samples at pre-determined sites, periodically depending on the availability of resources. Their particular area of concentration is on public supply systems in order to try and advise on rectification of the undertaker.
- Public sensitisation through educating *barazaas* and advise on ideal location and care of public wells to avoid any risk of contamination. They would then undertake measures of chlorination efforts and where inadequate ask the public to boil before usage. Free chlorination acts as an incentive to ensure that the beneficiaries of the wells keep it clean.

Public address meetings, which normally have a low turn out, are usually incorporated with other issues, health or otherwise being addressed. Their current efforts are geared towards identifying organised groups of village committees to be trained by the community health workers in order to enable them to deal with their neighbourhood issues. These efforts were seen necessary with an increase in water borne diseases brought about by the floods with the El-Nino rains. The diseases in question are contamination related ones like diarrhoeal diseases and intestinal worms. From their statistical data obtained from the Public Health Office, 1997 experienced 13.9% of diseases reported at the local hospital being water borne, 15.4% in 1998 and a drop to 10.9% in 1999 when the chlorination efforts had been initiated.

**Problems:**
The main problems faced by this department are:

- Identifying responsible stakeholders of communal wells
- Lack of water analysis facility locally forcing them to take it to Mombasa.
- Resource limitation to reach all wells, hence prioritise to those of low-income users at Gardeni.
- Hindrance of the conservation area in laying possibilities of laying out new and modern infrastructure.

Minimal integrated efforts can be seen with the water authority except through the District Water Board of which they are members and discuss water issues. These issues are discussed collectively to ensure that efforts are not being replicated. Otherwise individual attention is paid on the matters arisen at the end of the day.

5. **Lamu Town Planning and Conservation Office**

This is a department within the National Museum of Kenya headed by an experienced draughtsman. It is currently under-staffed but efficient with committed staff and a wide range of equipment made available through international assistance. Its jurisdiction is limited to the conservation area that is worked on based on Local Authority byelaws. It earlier suffered opposition from the public, until conservation efforts for the public good were recognised, in relation to conservation of resources, heritage and financial assistance in building repair. This involved efforts of participatory planning that involved welfare groups, council of elders and individuals in general. This needs to be further enhanced to mobilise resources more now that the site is about to be listed as a World Heritage.

The responsibilities of this office include:

- Guide development towards conformity to historicity while catering for the social values of the people
- Initiate upgrading proposal like the re-landscaping and rehabilitation of buildings and spaces. Successful pilot projects have been undertaken to show how layout of water pipes can be separated from the drains to reduce risk of contamination from broken or leaking pipes.
The Lamu Town Planning and Conservation Office is particularly concerned with household water harvesting and storage within the built environment not just in its possible damage to the structure with leakage but also to ensure the continuing existence of the site within its natural surroundings. With full confidence of the unlimited capacity of the ground water table, care should be taken though in its harvesting. There are higher risk of contamination with increasing unregulated population and a drop in the water table could lead digging deeper wells that normally leads to the sea (salt) water table hence its salination.

B. Non-Governmental Organisations

The impact of NGOs in the provision of water supplies appears to be considerable in many parts of the archipelago over many years but not within Lamu Island. NGOs concentrate on working in areas with few government initiatives to provide for their water needs. They normally employ Ministry of Environment and Natural Resources staff as technical advisers during development after which they are handed over to the community with ongoing help from the Ministry. The construction of rainwater catchment tanks, madjabia is seen only on the other islands which have no potential of ground water harvesting. They can therefore be considered as community initiatives, with the formation of registered organisations with set legislation and funded by donors like the World Bank through the Community Trust Development Fund.

Plate 23: Small rain water catchment tank (djabia) at Manda

Photo by: Fatma Twahir

C. Communities

Where resources are limited, it becomes necessary to encourage people’s ability to devise ways to deal with their constraints. The residents are the main beneficiaries to the water system as users and stand to lose directly from its inadequacies. Hence they would be in a better position to understand and handle their own problems. This is mainly seen in the rainwater catchment schemes where the community is encouraged to form associations, learn system management, imparted technical and management skills to ensure continuity of projects. On Lamu Island, the Central government is withdrawing from the management of water resources in order to hand it over to the local authority. These are representatives of the community and present an option of privatisation with facilitated guidance and technical back up from the Department of water. Other municipalities have come up with water supply management bodies like the Water Conservation and Pipeline Authority in Mombasa, to manage different aspects of water supply system efficiently. These decentralisation moves have been in existent in other parts of the country since 1992.

Currently, community participation in Lamu can only be seen from footing of initial costs of pipe placement and meter buying when the water authority is left with just the water connection to do. This has proved to be quicker in implementation and less costly for the user. There is still a potential of waste reduction in consumption and leakage reduction with individual efforts in maintenance, demand management.
There is a noted awakening of the population in knowing their rights and making demands or taking up responsibility of any development, as they are key stakeholders that stand to benefit or lose directly from any efforts. People have lost confidence in the government and have stopped relying solely on it to fulfil their basic needs, hence the increasing formations of Community Based Organisations. These organisations have been formed to deal with welfare aspects on the island. Some of these are do with poverty alleviation with education campaigns and short loan programmes, the Baraza la wazee - forum of elders has been re-established to voice out any grievances and Tawasal Foundation keen on public education on civic awareness. Women too have interests in income generation, water outsourcing and monitoring, as they are more involved in its domestic usage and are concerned about its efficient production. Women are noticeably playing a major role in functioning of the development projects and represent their capacity to manage as commonly seen in their leadership of many of the community-based organisations formed.

The role of women in these organisations is seen as crucial in understanding and managing issues that have a direct impact on their household activities. Such organisations, normally led by women, have proven to be more sensitive to development issues and have potential in playing a greater role in urban water management systems. This conforms to the Habitat II gender policy aimed at promoting women’s equal rights and empowerment, supporting governments, NGOs and other partners in capacity building and development in order to mainstream gender equality in human settlements development and at mainstreaming a gender perspective throughout the centre’s activities. (Gender Policy, UNCHS, 1996). This can be done through capacity building of grass root women worldwide to strengthen and create sustainable communities. The concerns of grass root women should therefore be incorporated in public decision-making and policy at a variety of levels by activating their participation in local authority decision-making. Even in Lamu, women have proved to be “...the most important resources for development in this world” as said by the Norwegian Deputy Minister of Foreign Affairs, Mr. Asbjoern Mathieson, at the Habitat II conference in Istanbul (Habitat Press Release, 1996). It is therefore necessary to have gender sensitive planning and consultation that involves both women and men as elements for a more effective and equitable participatory development of water management.

D. Individuals

There are approximately 300 wells in individual homes obtained from an undocumented study undertaken in 1992 by the Department of Water. These wells could be drawn manually or with electric pumps. There are instances of more that one pump in wells owned by different users indicating cooperating efforts of neighbours. With the current risk of contamination most of the well water is used for domestic cleaning activities and drinking water is supplied from neighbours with tapped water, upon request. Since quite a number of households are billed on flat rate basis its cost recovery efficiency is further jeopardised.

There are a lot of neighbourhood wells managed informally by those around. They take initiatives to clean and maintain them not only for personal gain but also for all in general. This may also include contributions for the electricity bill in case of mechanised pumping. The mosques are manly located in pockets of neighbourhood spaces where public taps are put up and in most case near a mosque. Mosque committees and people in general regard the digging of wells for the general good of the public, an act of good will, acts of good faith and religious worship.
3.4 Cooperation Efforts

The main cooperation and integration effort existing on the island is from the formation of teams comprised of delegated ministerial representatives whereby they have the capacity to take up the responsibilities of the government ministries locally and independently. They have formed committees that decide on development issues like the District Executive Committee, District Development Committee (DDC) and Liaison committee. The Liaison committee includes elected leaders where deliberations made by the committee acts as part and parcel of the public. DDC meetings are supposed to be held on a monthly basis but do not always take place due to the availability of all stakeholders at the required time.

The Physical Planning Officer is the secretary of such meetings that prepares their agendas after consultation with other involved parties and then circulated to them prior to the meeting. There exists the possibility of co-opting. This is when a person or group of people with a particular interest of issues at hand e.g. NMK, are invited to such meetings. People can come forward to show their interest and request for an invitation to present their views. Normally, they try to ensure that departmental heads are invited, since they can address issues responsively as decision makers and as people with different skills and know-how. Apart from such forums where different departments present their current activities and objectives to avoid conflicts, there’s no direct integration with any other service-providing organisation, in terms of sharing of resources (technical, managerial and financial).

When crucial issues come up, like epidemics, smaller sub-committees are formed to look into them and report back to the main committee, locally. Such committees have full authority and any objections against then have to be petitioned to the central government based in Nairobi. This central overall authority only intervenes if requested to do so by these committees as consultants. Therefore decisions made here are final because the representatives have delegated authority from the central government and include representatives of the general public too. Policies are set by the ministry and passed down to the department where they are operationalised into 5-year development plan. These development plans are an integrated compilation of each ministry’s objectives. The national policies are therefore implemented as programmes and projects at the district level. The policies are made from what is reported back to them making it a 2-way process. This seems like an interactive effort which discusses all issues in general and suffer the risk of losing focus and the target of the crucial ones.

At the ground level, the people make efforts to compliments each other. The society, though diversified, has only four main ethnic groups (the Wa-Amu, Wa-Gunya, Kikuyu agriculturists and Indian merchants). They have not reached the typical social fragmentation common to most urban areas. There’s still an element of neighbourliness existing within the residents of the island.
This could be because they are concentrated in a small-scaled developed area, reducing their spatial scale of communication and enhancing concern. This is a key point towards basing the community efforts in clusters and directing them towards some developmental benefit. It is necessary to nurture this aspect by capacity building (technical and management) and organising for cooperative or integrated moves that were existent in the pre-colonial era and have potential of being re-generated.

3.5 Conclusion
Based on the discussion of the role of the stakeholders in relation to the town layout described earlier, the following comparison can be made to derive the conclusion.

A BRIEF COMPARATIVE REPRESENTATION OF COMPONENTS

<table>
<thead>
<tr>
<th>Aspects</th>
<th>18th century Lamu</th>
<th>Lamu Today</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Built Environment</strong></td>
<td>Based on centuries old traditions on enclosure and definition of space determined by water location</td>
<td>Spatial definitions has spilled beyond traditional confines into a wider regional and global arena</td>
</tr>
<tr>
<td><strong>Behavioural Environment</strong></td>
<td>East African coastal maritime trade centre with typical Swahili and Islamic culture and social groups defined by religion and ethnic origins. The people are with roles determined by cultural roles and expectations.</td>
<td>Urban administrative headquarters with multi-cultural set-up defined by religion, secular education, income levels and age. The people are limited extroverts and elitist whose Individual roles responds to culture as well as contemporary economic and social demands.</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td>Governed by cultural norms and values based on traditional tools and elements. Their water system was originally small scale state defined that later became cluster defined with co-operation and networking</td>
<td>New institutions and systems influence new patterns and modes of spatial behaviour with functional and contemporary concepts and design. The water supply is administered by the central government complimented by individual and communal efforts, with limited co-operation.</td>
</tr>
</tbody>
</table>

Table 4: Comparative representation of components of 18th Century and present day Lamu

As soon as growth spilled out beyond the cluster formation with migration and expansion, it became difficult to retain the cluster based administrative system. This might have been the reason for the British to opt for centralising the control of water, a crucial resource for the sustenance of any settlement. The current population of Lamu is comprised of diverse ethnic origins making the formation of cooperative networks a little retrained. However, it seems that efforts are being made at different levels to cater for the water needs as shown in figure 11. Each individual or organisation involved has inhibiting problems towards their maximisation of potentials. They all have their own targets and value system towards their productivity. These targets may not necessarily be contradicting each other but nor do they compliment each other to overcome their weaknesses and those of Lamu, constrained resources.
Any forms of networking are operating randomly on the basis of individual interests that could be ethnic based or area based bringing about collective dissatisfaction from the beneficiaries. Their interaction is fragmented and lacks a ‘common ground’, a function based node and focus of operation (fig.12), like the wells in pre-colonial Swahili towns, targeting all users strategically.

The failure to incorporate traditional methods of corporation and networking within democratic local governments may be accountable for the urban management problems of inefficiency of service provision in such areas where resource are limited. Efforts have to be integrated for efficiency and affectivity. The social cohesion is used to an advantage but may frustrate the rational definition of individual responsibilities of water consumption since sharing of water use is a common occurrence. There is a need then for a redefinition of roles and responsibilities to enhance transparency of the interactions and enhance public awareness on what to expect and consequently what to demand for, from their local leaders. It may be necessary to consider options that accommodate group liability and recognisable by law.

A historic city is shaped by a series of interventions and decisions. Its existence comes as a result of planning and its maintenance dependant on management. There is bound to be conflict with development and a wide range of motivation towards its maintenance. The variety of goals and objectives brings about a diversity of functions, multiplicity of organisations with interest and responsibility for it. There’s therefore a need to synthesise between functions and objectives and coordinate between different levels of hierarchies of spatial scales. (Ashworth, 2000)

The pre-colonial system of water management of Lamu involved a cluster-based administration that was informal yet focussed and targeted at ensuring sufficient provision of water for all. This was based on the cooperation and networking of Swahili settlements under common cultural backgrounds having the same goal - sourcing water for their continuing existence. The urban forms of these settlements reflected their ways of common administration of water resources. Then came the various political interventions, as discussed earlier, that influenced the urban form and the administration of water sources. The colonial centralised system imposed on the Swahili settlements has been characterised as ineffective in dealing with the water needs of the people. This has lead to a disintegrated system of water provision where people with their own efforts and limited capacities as groups or individuals have tried to overcome water shortages.

These existing efforts work independently limiting the achievement of their optimal potential of efficiency. Working on a common forum and base of action that is targeted mainly and only toward the provision of water, can improve on and compliment these individual efforts. It would require reform of the water provision sector.

4.1 Concerns with the Current Institutional Framework

With reference to the data available from the JICA survey in 2000 and other sources of evidence discussed earlier, the water delivery system has been ineffective and inefficient because of:

1. Water politics: In Lamu, water was regarded as a social good, obligating the state as part of the political culture, to provide for it and assure its disposal. Water utilities are therefore significant employers and instruments of political and communal patronage.

2. Social politics: water is regarded as a common good necessary for the survival of all. The religious and cultural background of the people of Lamu encourages the sharing of this crucial resource as a means of worship and good neighbourliness.

3. The role of private capital, management and pricing of services have not been clarified. This lack of detailed information as a business potential is a major reason why entrepreneurial resources have yet to be mobilised on a scale consistent with the potential of the sector.

4. The centrally managed public enterprise and government department provides water services. Those charged with this responsibility have not been given the managerial and financial autonomy needed to do the job.

5. Water resource management responsibilities are often fragmented among sector agencies becoming a major impediment to integrated resource management.

Keeping these main issues in mind, it becomes necessary to assess partnership options that would assure the availability of resources, financial and managerial, that would lead towards effective water provision with enhanced public involvement.
4.2 Partnership Options.

Partnerships have been formed in Swahili towns and are still formed in Lamu, to strengthen urban management by harnessing the skills and networks of regional experts, communities and organisations in the public and private sector.

The issues and options in consideration are:

- Expand services while meeting users demands through demand orientation. This would need to identify the demand and assess the users ability to pay for them.

- Assistance sought from the private sector, Non Governmental Organisations and Community-Based Organisations in partnership with the government (Gidman et al, 1995)

Lamu water supply system has financing problems brought about by low expenditure charge that is not covered by user charges due to system wastage, inept billing, politics and low Willingness To Pay from economic constraints. For financial upgrading, the partnerships to be established here have to include all the relevant stakeholders. These stakeholders are representative of the requirements of all the people of Lamu. Their modes of inclusion vary in different places but the most suitable partnership arrangements and options (Gidman et al, 1995) relevant to the Lamu situation are:

1. Cooperatives
2. Joint ventures especially if investment is required for new or renewed water supply system.
3. Franchising where active companies operate and maintain facility and staff. A percentage of the revenue collected is then return to the public authority. Sanctions are set to monitor adequate maintenance
4. Contracting out by exposing sub-sections of activities for competitive operations and tendering.
5. Privatisation where assets are sold to the public through share capital and regulated strongly

The involvement of the private sector in the provision of urban infrastructure long used though does not guarantee to solve problems of inefficient administration or insufficient resources. This can be facilitated by:

- Administrators with the capacity, motivation and commitment to manage the process.
- The ability to specify service, assess and calculate costs
- Legal sector permitting decision making by private partner.
- Capability of private sector’s interests and skills
- Recognise the need to have flexible approach in monitoring the private partner in enforcing events (Gidman et al, 1995)

There is therefore a need to create an awareness of service standards to be achieved and their costs involved to prepare the public sector for possible change and reforms in Lamu
4.3 Proposals for Reform of the Water Sector

The need to reform the water supply system is now apparent and urgent. The technical and operational; commercial and financial; human and institutional, and environmental problems have to be addressed. This can be done through various ways of decentralisation and service improvement techniques pointed out by Schubler (1996) but three major delivery arrangements applicable in Lamu are:

A. Strengthening the current water management arrangements

Some of the appropriate reform programmes include:

- Strengthening the institutional mechanisms of the Ministry of Water, Natural Resources and Environment, and the Local Authorities.
- Developing contract plans and performance evaluation systems to hold managers of water systems accountable for their results.
- Recruiting skilled manpower with market based compensation systems.
- Increasing autonomy of free water utility managers from government interference in day-to-day operational decision making and from non-commercial goals.
- Allowing gradual move to cost recovery tariffs.
- Increasing community involvement contributing towards the management and operation and increasing the handling capacity of the Water Department.

This would require a lot of in-house cleaning and re-structuring, which is unlikely to happen since all departmental authorities are awaiting the implementation of the decentralisation mechanisms of the service.

B. Forming co-operatives

Cooperatives formed would be autonomous public utilities, to take charge of the water supply system, and focused on explicit performance objectives, well-defined budgets based on revenues of users, and managerial and financial autonomy. The managers can be held accountable for their performance hence having the advantage of rapid improvement in performance. This can be done through:

- Transferring assets owned by water utility to public trust company owned directly by the govt or indirectly through the Local Authority. The company will be managed under an independent Board of Trustees having the capacity to source multilateral funds for development purposes.
- Forming an autonomous operating entity that will be granted some rights to manage the utility on full commercial principles. This establishes independence from the local authority and government making it more focussed on its goals. It would include the role of the main stakeholders in the commercialisation process and the internal arrangements required to create autonomous water departments that will include human resource and financial issues.

Both options involve increased participation with independent means of outsourcing finances, targets crucial to the development of the water supply system in Lamu.
C. Private sector participation

This is based on separation of ownership of assets to those of managing them. It involves changing the managerial characteristics by making a complex set of choices about all factors influencing its performance and creating conditions to yield the desired performance improvements. This has normally helped to:

- Improve the quality and availability of services
- Expand service coverage
- Mobilise capital from both public and private sources for urgently needed investments
- Introduce new cost effective technologies, superior management and more effective labour use.
- Reduce operating subsidies and transform them into positive returns on investments.
- Reduce political interference in the operations.

This might be more effective commercially but require target monitoring to ensure equitable distribution of water (public utility) to all without considering the buying capacity of the marginalised groups.

Considering the current enforcement capacity of Lamu it might be advisable to form cooperatives instead. These cooperatives can be operational with simultaneous reform from policy making and administrative forums within the government.

4.4 Government Authorities

The Central Government: The reasons for low economic development in Lamu comes from reduced allocation of finances from the central government, unattractive for professionals hence understaffed, lack of incentives for industrial relocation and uncoordinated sectored functions. As seen by UNCHS in 1991, one of the reasons for poor management in small, marginalised towns like Lamu is the failure to incorporate indigenous patterns of management. The Swahili societies have been having co-operative networks within their spatial and administrative clusters, in entire settlements and the peripheral settlements too, supplementing each other’s constraints. As a move to incorporate indigenous patterns of management in the water supply systems of Lamu, it would be necessary for the central government to:

- Coordinate effectively with informal efforts for complementarities and coordination.
- Deepen its degree of public responsiveness and participation to ensure empowerment
- Broaden their range of actors while analysing the impacts of having frequent transfers of government officials (UNCHS, 1991)

The central government needs to strengthen both bottom up and top down approaches in planning and management. This requires time, resources, organisational procedures and skills whose effects would trickle down to the local authority.

The Local Authority: The Lamu Local authorities are ill equipped and not prepared to take up water development programme formulations due to the shortage of resources (technical, financial and personnel.), corruption, lack of dedication and proper exposure.
It is necessary to build capacity of the leaders so that they can assume more responsibility and have confidence to delegate duties objectively without social constraints.

The County Council needs to prepare regional development plans to address local needs, that are sensitive to the local situation, in consultation with the conservation experts (National Museums of Kenya), development planners and the general public administration. They need to formulate legislative cover of water supply issues sensitive to heritage areas. This would include gazetting the entire island under a special programme that will enhance a participatory approach in those areas that lack services and prevent further risk of private development hazardous to the balance of the ecosystem. It is particularly necessary at present after the World Heritage Listing whereby more exposure, more visitor pressure and on the other hand more assistance (financial, technical and institutional) from the international community is expected.

People in charge have to be well-trained and ambitious to deal with the coming future challenges and functions that would be delegated to the neighbourhood level for effective participation, mobilisation and coordination of grass root resources.

### 4.5 Community Participation

Participation is where by the consumers and producers are in a position to influence the flow and quality of water supply services. They could build upon existing informal processes and community based infrastructure development. Informal solutions are normally more successful as they adapt supply to prevailing demand, flexibly and boost ownership of facilities contributing to efficient service provision and demand management. (Schubler, 1996). The benefits of participation include cost reduction, resource mobilisation and effective targeting of people’s needs by harnessing the skills and strategies of regional networks of experts and communities within the public and private sector in Lamu.

The society of Lamu, though heterogeneous still has some form of common understanding presenting an existing base of action. From the residential survey undertaken, these users have claimed willingness to contribute financially during implementation or in assisting and supervising in operation and maintenance. Such efforts can be promoted through participation in target oriented programming, planning, public information or assisting in choice of technology.

Several process-oriented approaches giving the user greater roles in expanded decision-making (Schubler 1996) leading to public empowerment can be reflection to Lamu as:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>INVOLVEMENT</th>
<th>REQUIREMENTS</th>
<th>DRAWBACKS</th>
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<tbody>
<tr>
<td>Community based</td>
<td>Social or community groups that support local infrastructure services, manage service development and provide an enabling process that derives strength from learning and the community’s potential for self-organisation.</td>
<td>Existing organisations are the centre of the strategy as they signify community initiatives</td>
<td>They may not be representative or function oriented</td>
</tr>
<tr>
<td>Area based strategies</td>
<td>Channelling larger volumes of resources within an area to ensure efficiency and cost-effectiveness.</td>
<td>Need for new organisations which depend on intended tasks and capacity of existing organisation</td>
<td></td>
</tr>
</tbody>
</table>

45
Function based strategies
Designates responsibilities of stakeholders while establishing effective collaboration towards a specific and common target.

Forum for correspondence
This can be done by devolving decision making and operational processes or privatising for institutional development

Decentralisation strategies
Entire process of infrastructure management as a frame of reference to improve efficiency, demand responsiveness and accountability of services

Require having necessary technical support and awareness building that can be made possible after the listing as World Heritage Site

| Table 5: Approaches towards community empowerment in Lamu |

These approaches may lead to others alternatively or be more effective if employed simultaneously based on different models of action in planning a project. One such model involving different levels of participation at different stages of project management is being used as a key to effective community action planning whereby each stage involves the community and the town in a relationship, which serves their mutual best (Hamdi & Goethert, 1997).

Framework for Participation and Stages of Projects

<table>
<thead>
<tr>
<th>Levels of participation</th>
<th>Stages of Projects and Programs</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Initiate</td>
</tr>
<tr>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Indirect</td>
<td></td>
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<tr>
<td>Consultative</td>
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<tr>
<td>Shared Control</td>
<td></td>
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<tr>
<td>Full Control</td>
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</table>

Table 6: Model of Participation
Source: Hamdi & Goethert, 1997

This model represents projects initiated at all levels by municipalities or as a result of community pressure whose role is in determining demand trends. The shared decisions during the planning stage are the most critical in effective participatory programmes. During implementation and maintenance, the municipalities continue to handle maintenance based on large-scale services and infrastructure whereby the involvement of the community offers an opportunity innovation income generation and training. The communities then become formally involved in maintenance assuming recognised responsibilities either together with municipalities or on their own (Hamdi & Goethert, 1997).

Such models can be used as a process-design tool to design and identify ways of organising projects in Lamu that promote goals like speed, expanded networking, people awareness or others. Using this tool, a similar project proposal can be initiated in water management (Annex 2) whose goal is to incorporate traditional systems while enhancing community participation.
4.6 Conclusion.

Community awareness programmes are the key to community empowerment in order to remind the people of the need for a clean environment and sustainable source of clean water. They can consequently act as monitoring tools, as they already have neighbourhood cooperation efforts that need to be recognised. This can be enhanced through public education efforts on hygiene and proper well maintenance at existing and recognised forums of authority like schools, mosques and churches. Being an Islamic majority, mosques in Lamu, have been identified and recognised as a resource for channelling reliable information, even if they have lost their administrative functions. Further formation of area health committees would then assist in project implementation and provide a link between the community and the service providing agencies. Potential for such organisation schemes has been seen from the existing efforts in dealing with other issues in a similar way, a base that needs nurturing. There’s a realised need to revert back to mitaa based community schemes or a little larger scope of area based monitoring, targeting needs and management.

Consequently an effort could then be made towards demand management rather than the traditional constrained supply management. This can be achieved by establishing a value-for-money culture for efficient and effective productivity that meet the set objectives at minimum costs possible. It can be targeted from initial investment to operational management by:

- Identifying effective demand
- Clearly defining service and quality
- Adopting means of measuring performance
- Identifying costs in comparison to public service

Since such responsibilities have been spread thinly among different organisations, there’s a key requirement for function based integration strategies that would particularly deal with specified water issues sensitive to the island’s conditions. This should be aimed at complimenting one another’s efforts and providing an easily accessible database to reduce duplication of efforts and enhance transparency. This renders itself replicable to other crucial issues of the island.

When a historic city has managed to involve the people in the management of its infrastructure, it sails on the privilege of using the vast population and their variable abilities to channel their potentials constructively. This not only enhances the forethought advancement of water supply systems but also gives the people and sense of pride and value in the area whose heritage is being managed.
5. References


Areskough, A. & Persson, H. *In the Heart of Bagamoyo*. Lund University, Department of Architecture and Development. 1999  [http://www.ark3.lth.se](http://www.ark3.lth.se)

Ashworth, G. J. and Turnbridge, J. E. *The Tourist-Historic City: Retrospect And Prospect Of Managing The Heritage City*, Pergamon 2000 UK

Ashworth, G. J. *Creating Heritage; Attracting Tourists*. [An analysis between three distinct phenomena; culture (heritage products), tourism and local development; an overlapping triangular relationship.]


Districts Statistics Office, Lamu.

Fox, W. F. *Strategic Options for Urban Infrastructure Management*. Published for the Urban Management Programme by The World Bank, 1995, USA


Hekim, S. *Arab- Islamic cities, Building and Planning Principles*. 1986


Olsson, K. Planning for the Preservation of the Cultural and Built Heritage. Royal Institute of Technology, Department of Regional Planning. 2000.

Public Health Office, Lamu District, Ministry of Health. visited 2001


Snickars. F. How to Assess and Assert the Value of Cultural Heritage in Planning Negotiations. Royal Institute of Technology, Department of Regional Planning.


Internet sites:

Andrea’s Weblog, 1995
http://andrea.editthispage.com/kenya/25

http://www.international.icomos.org/e_archae.htm

http://www.unesco.org/whc/toc/mainf15.htm

Cultural Heritage and Development Network - World Bank, January 1998
http://www.icom.org/bank.html

http://www.international.icomos.org/risk/trends_eng.htm


http://www.unesco.org/whc/opgulist.htm


Habitat Press Release: Habitat Commits Itself to Promoting Gender Issues Post- Istanbul, 1996
6. Annex

6.1 Requirements of the UNESCO Convention for Site Listing.

The UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage thereby defines cultural heritage as monuments, groups of buildings and sites with outstanding universal value from the point of view of history, art or science; sites that would include also archaeological sites of value from the, aesthetic, ethnological or anthropological point of view too. Such cultural heritage constitutes a world heritage, once they have been listed, for whose protection is the international community to co-operate while fully respecting the sovereignty of the states in which these sites are situated.

The convention has therefore appointed a committee to assess its authenticity based on the following criteria (UNESCO, 2001). The site should:

- Represent a masterpiece of human creativity
- Exhibit an important interchange of human values over a span of time or within a cultural area.
- Bear testimony to a cultural tradition or civilization
- Be an outstanding example of structures that illustrate significant stages of human history
- Be an outstanding example of traditional human settlements and land use representative of a specific culture
- Be directly or tangibly associated with events or living traditions, with ideas or beliefs or with artistic and literary works of outstanding universal value.

Above all though, listed sites should meet the test of authenticity (design, material, workmanship, setting distinctive character and components) and have legal or recognised protection and managements mechanisms to ensure the conservation of the nominated cultural properties (UNESCO, 2001)
6.2 Preliminary Project Proposal for the Management of Water System

Lamu island is one of the natural harbours off the Kenyan coast enjoying good rainfall, fringed by coral reefs and lined by thick mangrove forests. It has a sandy beach with sand dunes rising to the height of about 20m at an estuary acting as the island’s water catchment area and accommodating wells that supply fresh water to the town. The town area lies on the east of the island and is characterised by its narrow pedestrian streets with its social life flowing out of the adjoining houses and shops aligning the main streets. It has been spared the disruption of its town plan and architecture from fast urban sprawl common to urbanisation hence presenting itself as key heritage for conservation and management not only for the local community, a population of 17,306, but also the international one at large, with its listing as a World Heritage Site.

PROBLEM IDENTIFICATION

The replacement of the traditional clusters system of water management by the conventional piped central system has been characterised by constant water shortages, inefficient and ineffective water management strategies. The postcolonial era has been depicted by un-maintained water system causing frequent water loss, health risks and damage to historic buildings caused by the uncoordinated structure of the administration of water supply.

PROJECT GOALS

From a series of discussions with the personnel of the department of water, other subsidising agencies, the local authority and the public in general, an initial preliminary analysis of Lamu Island has been undertaken. It has identified the need to revert and compliment the current water system or the future formation of cooperatives with the traditional forms of administration involving enhanced community participation and consequently efficient management of water supplies.

OBJECTIVES

- Outline and publicise clear responsibilities of all involved departments to encourage transparency and community awareness
- Create a forum of common strategy for the improvement and continuous maintenance and management of water resources
- Incorporate community awareness through educative workshops or in schools, churches and mosques
- Encourage active participation of the local inhabitants in water management issues have been left for the government to deal with
- Encourage the formation of cluster based administrative setup for monitoring specified area needs and supply trends
- Develop strategies for conservation of water use
- Gain technical expertise to assess the present day ground water potential and prospects of further harvesting at other sites

ASSUMPTIONS

- Decentralisation or privatisation mechanisms to be implemented by mid next year and accommodating participation schemes.
- The availability of finance for a re-structuring programme
- Willingness of the employees to change their attitudes and take their responsibilities effectively
- Available ability to out-source for technical issues with regards to expertise and finances
- Formation of a common forum of water management does not contradict with political ideologies

**RESOURCE IDENTIFICATION.**

This involves determining what resources are available, both human and material to perform the project activities. It is necessary to examine Lamu’s administrative potential by analysing its strengths, weaknesses, opportunities and threats, a powerful tool to reveal the current situation and future possibilities, favourable or not.

**Strengths**
- Well-known attraction from its beaches, historic buildings, ecological diversity and marine environment.
- Socio-cultural set-up not too diverse as in urban set-ups with cohesive clusters facilitating continuous interaction, self assigned responsibilities and easing monitoring efforts
- Common background and language with common problems affecting all individuals
- Small population and area of coverage
- Unified on the basis of common faith, majority Muslim.
- Efforts already initiated for self-help strategies and co-operation actions on other issues
- Potential for project funding if well administered with no loopholes for corruption
- World Heritage site listing will open it up to the international market and provide worldwide assistance.

**Weaknesses**
- Poor pipe structure
- Prior improvement programmes undertaken without consultation of the local water authority.
- Low economic development hence low pull for trained personnel
- Long term (2-3 years) flat rate payment renders the revenue insufficient for maintenance of service.
- Short term development period and terms of office within government departments
- Haphazard management layout
- Inadequate resources: financial technical, personnel
- Lack of motivation and incentives
- Social set-up encouraging free distribution of water
- Religious influence towards the use of vast amounts of water increasing risks of infection with contamination
- Unmonitored digging of individual wells, difficult to assume aquifer capacity
- Corrupt administrative officials
- Unplanned built up areas that would require installation and rehabilitation

**Opportunities**
- Enhance public image, respect and consequential marketability by improving its strategic approach towards supply management and environmental considerations.
- Create an aware of service standards to be achieved and the cost involved by preparing the public for change
- Potential increase in visitor arrival with international recognition hence economic opportunities
Ecological approach towards sustainable development. The responsibility for the environment and the future brings about confidence and respect to the island authority.

Further their service diversity and flexibility for customer convenience and future spread to more peripheral settlements like Shela.

Benefits from cooperation with other authorities and organisations providing operational and technical guidance

Training the local unemployed inhabitants on issues of importance to their area to provide a viable market locally

Establish a well-defined IT infrastructure enhancing easier communication with customers and providing an information database and probabilities of future marketing tool for the entire island.

Public support from regular communication through publications

Enforce corporate social responsibilities from economic investors of the island to invest back into the society

Appropriate study of per capita consumption of water per day and the current need and location for pipes replacement

Establish allowable abstraction of water by studying the re-charge regime

Assess earlier development proposals that have been shelved for un-known reasons.

Create forum where research can be presented and assess means of utilising it to its maximum potential

**Threats**

- Down sizing operations that will have a large impact economically on the surrounding region and community at large
- External and internal administrative delays from legislative procedures
- Corruption within established co-operative movement
- Land grabbing of communal areas risking ecological balance unmonitored development
- Not reaching targeted market
- Low implementation leading to increased use and unmonitored consumption lowering water table and increasing risk of salt water intrusion
- Unpredictable changes in climate or water levels with global warming
- Running losses from improper pricing, low willingness to pay and low profit from the traditional understanding of water available free for all
- Inability to compete in quality and reliability of individually maintained wells.
- Immigration of trained experts to other locations with lucrative economic opportunities

**APPROACH STRATEGY**

1. **Planning:**
   1.1 Select location of pilot project for initiation
   1.2 Define the scope and activities break down structure from the stated objectives
   1.3 Activity sequencing using the Programme Evaluation & Review Technique
   1.4 Schedule within time limitations, establishing Critical Path
   1.5 Assign resources defined
   1.6 Cost estimating and budgeting
   1.7 Plan expansion of development programme in collaboration with involved parties.

2. **Execution**

   2.1 Distribution of information to all defined stakeholders and establish a communication network
      2.1.1 Organise regular meetings
2.1.2 Monthly Publishing of discussions for further reference continuously from initiation to completion

2.2 Conduct an extensive Environmental Impact Assessment
   2.2.1 Employ specialist
   2.2.2 Conduct study with reference to other specialists
   2.2.3 Return feedback to management group

2.3 Market research for market trends consumer requirements, stakeholder analysis and selection of suitable decentralisation mechanisms and Partnership Company.

2.4 Find location for Forum of new integrated activities within Island
   2.4.1 Establish feasibility of using existing District Development Committee Layout
   2.4.2 Check efficiency of existing participants
   2.4.3 Send out invitations for participation to all inhabitants, administrative and general public
   2.4.4 Attach contractor who will design, procure, engineer and commission the refurbishing of a building structure as per organisation’s requirement
   2.4.5 Constrain contractor in agreement to adopt strategies of heritage conservation, minimal energy consumption in selection of materials, energy solutions and waste management

2.5 Assemble a Water Supply Management Programme
   2.5.1 Select organisation, management and review team
   2.5.2 Structure and agenda of programme
   2.5.3 Staff training
   2.5.4 Evaluate and report effects of project activities.
   2.5.5 Seek registration and certification

2.6 Install appropriate technology systems for logistics, networks and communications
   2.6.1 Employ system analyst
   2.6.2 Design appropriate system for facility that would network the entire port
   2.6.3 Implement communication network on entire port

2.6 Select team for solicitation, quality assurance and political alliance with legislative requirements or amendments during implementation

2.7 Establish and Environmental Management System
   2.7.1 Select team
   2.7.2 Train for basic and specialised tasks management.
   2.7.3 Conduct life cycle analysis from construction and operation to servicing and maintenance

2.9 Present project for assessment by legislative body for approval

3 Control and Monitoring

3.1 Management team coordinate changes across project
3.2 Monitor quality of results to determine compliance with legislative standards by regular checkups
3.3 Collecting and distributing information through status reports, progress measurements and forecasting
3.4 Assess risk management of significant environmental aspects within different phases of project development and implementation
3.5 Review and evaluate results from grass-root administrative team by management team in order to establish strategies of improvement mechanisms

4 Closing

4.1 Compile project performance
4.2 Disseminate information to the stakeholders
4.3 Handover the partial administration of project from the selected private company or local authority framework.
4.4 Maintain management team throughout operation of the project for continuous analysis and performance auditing

Critical Success Factor Or Key Performance Indicators.

- Smooth transfer of water resource management, supplying and maintenance.
- Creation of synergies from the new service within one year
- Effective management of the water.
- Future expansion of water supply services to other areas within the island for common management.