

Urban Environmental Challenges in Developing Cities: The Case of Ethiopian Capital Addis Ababa

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Abstract—Addis Ababa is a seat of African Union (AU), United Nations Economic Commission for Africa (UN-ECA) and hundreds of embassies and consular representatives. Addis Ababa is one of the highest capitals in the world with an average 2400 meters above sea level. It is dichotomous city with a blend of modern high-rise and deteriorating slum quarters. Water supply and sanitation, waste management and housing are continuing to be serious problems. Forest wood based domestic energy use as well as uncontrolled emissions from mobile and fixed sources has endangered the state of the urban environment. Analysis based on satellite imagery has revealed the deteriorating urban environment within the last three decades. The recently restructured city administration has brought improvements in the condition of the urban environment. However, the overwhelming size of the challenges faced by the city dwarfed their fairly good results.

Keywords—Addis Ababa, Urban environment, Slum, Housing, Relocation

I. INTRODUCTION

THIS research work examines the urban environmental challenges faced by Addis Ababa. Addis Ababa is an Amharic word which means “new flower” [1]. The total surface area of the city is 54,000 hectares (AACA, 2008) [2]. Addis Ababa is located at 9° 2' N, 38° 42' E (see Fig. 1). The city possesses a mix of highland climate zone. The high elevation moderates temperatures year-round, and the city's position near the equator means that temperatures are very constant from month to month.

Addis Ababa is a fast growing city that is overwhelmed by problems afflicting most cities in the developing world, including extensive urban poverty, joblessness, inadequate housing, severe overcrowding and congestion and underdeveloped infrastructure. Moreover, mounting social ills, such as begging, homelessness and youth delinquency are grim realities of life in the city. The economy cannot create sufficient jobs, so unemployment is a common problem in the society. In 2006, the unemployment rate was 28.6 percent among the population aged 10 years and above (CSA, 2007) [3]. Slum and

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informal settlements brought a great deal of challenge to the city, which is considered to be the core problem that affects the livelihood and the state of the urban environment. The city's march to modernity has suffered a setback due to complications that arose from these slum and informal (squatter and other illegal) settlements.

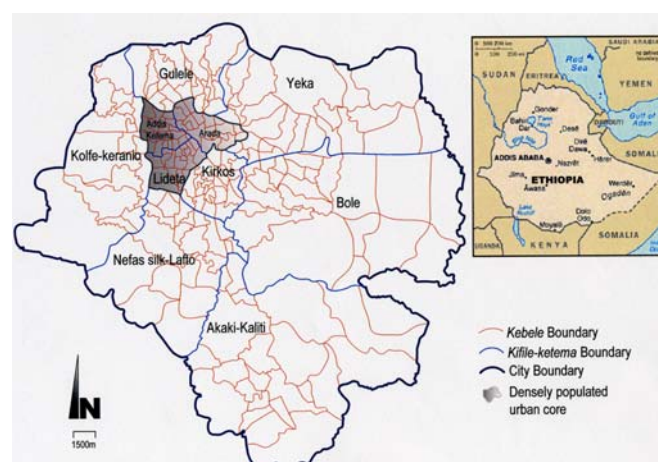


Fig. 1 Map of Addis Ababa city and its regional location. Addis Ababa is organized in to three administration boundaries, which are kebele (the smallest), Kifile-ketema, and City council.

II. ARCHITECTURE AND THE URBAN FORM

Since its foundation, Addis Ababa has seen four major stages in development, each with a unique urban settlement pattern. The first period is the time between the founding of the city to the Italian occupation during WWII. The second period was during the Italian occupation, (1936-1941) when marginal improvements to infrastructure were made with the construction of few modern buildings. The third period followed the liberation and extended in to the 1960s. During this period, Addis Ababa saw significant infrastructure development, including a number of modern buildings. What has been going on recently and what has been changing the city's image appears to be the fourth stage, now known as contemporary architecture [6].

Perhaps the first development in the city was a system of roads that were built in a circular fashion about the city center. This radial network, interconnected by roundabouts and winding pathways, defines the physiognomy of the city. The map presented in Fig. 3 represents the typical urban form and

settlement pattern in Addis Ababa. The urban form is characterized by large blocks and informal street patterns that restrict access in to the settlements. Though a mix of land uses has been the main planning feature, land use incompatibility remains a concern. The map that shows one of the Addis Ababa's important center revealed the extent of slum settlements within the urban core.

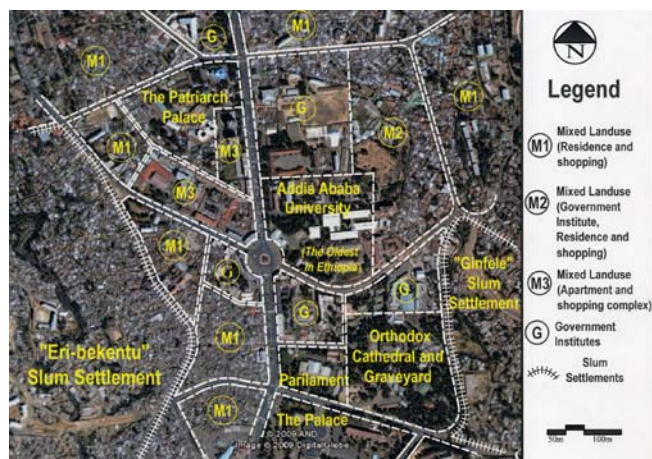


Fig. 2 Typical land use and street network around the capital old center.

III. URBAN ENVIRONMENTAL CHALLENGES

Assessing various conditions of the urban environment can indicate its livability and sustainability. Urban environment can be generally represented by the level of clean water supply and urban sanitation as well as the air, soil and water quality [5]. In addition to this, proper management of the urban ecosystem and efficiency of the urban system such as transport and energy use can be taken as part of the urban environment. The quality of the urban environment is one of the major disparities among cities of developed and developing nations. In most cities of the industrialized countries basic amenities of the urban environment improved satisfactorily. On the contrary, third world cities like Addis Ababa are facing major problems due to deteriorated urban environment. The magnitude and severity of slum and Informal settlements are significant indicators for the troubled urban environment. Living standards in slum areas are far below the acceptable level and the water, soil and air qualities are greatly depreciated. Slums are characterized by a lack of access to improved water supply and sanitation, sufficient living area as well as durability of housing and security of tenure [6].

A. Slum: the Critical Challenge

Slum settlement is the greatest challenge that Addis Ababa has ever encountered. This challenge is considered as the core problem that affects the city's livelihood and quality of the urban environment. Slum settlement, faster urban growth rate and instability within the administration along with its limited technical and financial capacity have kept urban areas from proper management. Slum settlements are mostly seen as the end product of the previous malfunctioned urban

administration and an obstacle to the current effort of bringing prosperity to the city of Addis Ababa.

The mixed residential blocks that began earlier were not altered by the changes that took place in its economic base as the country opened up to Western civilization in the early 20th century and subsequently during the five years of Italian aggression during WWII. These congested and unplanned residential quarters coupled with the lack of basic sanitation and amenities have paved a way for the emergence of slum settlements in Addis Ababa. Today most of these early settlements still exist and constitute most of the dilapidated urban core (see Fig. 4). An estimated 60 percent of the city's core is occupied by deteriorated slums and about a quarter of all housing units have been built without any municipal consent [7].



Fig. 3 various forms of slum settlements in Addis Ababa's core. Fig.3(a) shows extensive slum settlement in Arada sub city whereas Fig. 4(b) shows a slum contained within the city's main center called Piasa. (Photo by Paul Myhill and Aire).

Slum settlements along with planning and management deficiencies severely affect the city's livability and environmental quality. The slum and the related informal settlement problem accumulated overtime and created a daunting task of urban renewal. It made development works next to impossible by posing complex social, economical and spatial challenges. The current environmental quality, especially inside the slum, is degraded as it is difficult even to provide basic water supply and sanitary services.

B. Housing

High rise shopping malls, office blocks and luxurious hotels erected along the main streets of Addis Ababa are giving a rather misleading impression. Together with a mixed and apparently well integrated apartment and residential quarters, these impressive street side buildings often cover the predominantly low standard housing units and residential neighborhoods.

In cities of developing nations, the problem of inadequate housing is closely linked to urbanization process and demographic growth. The situation in Addis Ababa is no exception. Since 1970's the city witnessed acute shortage of residential housing which has resulted in severe congestion and overcrowding. The housing deficit grows as the urban population increases. Housing construction is possible for the high-income group, where as the middle-and low-income groups of society cannot afford to construct their own dwellings. Construction of public housing has shown a promising start after the restructuring of the city administration but the accumulated deficiency has made success far out of

sight. In 1994 the number of housing units was 374,742, which is 9.5% less than the total number of households. After 10 years the difference increased to 24.8%, though the total housing stock rose to 471,429 [8].

The structural features of the bulk of the housing stock in Addis Ababa similarly suggest that the housing problem is much worse than estimates of the housing deficit indicate. The structural condition of most of the existing units is so poor that any long-term use is difficult to imagine. The walls of some 75 percent of housing units are made of mud and wood known as "chika" houses. With poor building standards and lack of proper foundations, most "chika" units age quite rapidly. As a result, substantial proportions are always in need of major repairs while a sizable number are so old and in such poor shape that they are only fit for demolition. Out of the total housing stock 97 percent are single-story and nearly 60 percent are attached row houses. Roofs are almost invariably made of corrugated iron sheets that make a vast and unpleasant rusty blanket in the central and older parts of the city. A further apt indicator of poor quality is that 50 percent of all the units have mud or earthen floors. Data also show that a similar proportion have no ceiling whatsoever, and close to 25 percent have no toilets. Only about 38 percent of all housing units have private kitchens, and 27 percent have none at all [9].

C. Water supply and sanitation

Since water is the basic necessity, the sufficiency and quality of its supply directly affects the well being of the society living in that particular city. Safe collection and treatment of waste water is almost equally important as the supply part, since inappropriate handling of waste water and sewerage create disease prone living environment.

Unfortunately, most third world cities are not too much concerned about the environmental impacts related to water supply and sanitation as they are struggling to provide a stable supply of clean water. Addis Ababa would be the best example to demonstrate this situation. Sixty percent of the city's water demand is supplied. An estimated 30-40 percent of the potential water supply does not reach to the consumer and is wasted due to leaking pipes and aging distribution infrastructure. Few parts of the central city are served by the 110 km sewer network, which constitutes the only 4 percent of the total network needed by the city. The city administration is always under pressure to allocate its scarce resource to meet the growing demand and less priority is given to the expansion of underground sewerage networks. Most of the residents who don't have access to sewer are using other methods of sewage disposal, i.e. septic tanks, which may be considered "improved sanitation" but are less effective for dense populations [10].

D. Waste management and the environment

Today waste management gives a meaning more than collecting trashes for incineration. Cities in the third world have a significant gap even in collecting wastes. The daily waste generation in Addis Ababa is estimated 0.252kg/capita/day. The current daily waste generation of the city is 2,297m³. Of municipal waste per day, 65 percent (1,482m³) is collected (Tadesse, 2004) [14]. The remaining 35 per cent of waste is disposed off through informal means, except smaller percentage going to incineration and dumped on open sites, drainage channels, rivers and valleys. The rivers are widely used as disposal sites, as can be seen by the simple observation of the river banks. Although the hygiene and environmental sanitation regulation issued by the Addis Ababa city administration (Pro. No.1, 1994) prohibits people from disposing waste along roads, avenues, rivers, ponds, and other sites, the regulation is continuously violated by the people due to lack of alternative means for disposal. Sizable amounts of waste end up in open spaces or drainage system, threatening surface and ground water quality as well as the entire urban space. The conventional open air burning of waste, spontaneous combustion in landfills, and incineration plants that lack effective treatment for gas emissions are causing air pollution. The situation is exacerbated in slums where households cannot access garbage collection containers. Lack of the most basic sanitation and solid waste services in crowded, low-income neighborhoods is a major contributor to the low life expectancy among the urban poor. For the coming years, the daily waste production is expected to increase along with the increase in the city's population. Thus, taking appropriate measures is a matter of some urgency.

The urban environmental damage due to degraded slum and informal settlements as well as basic services inadequacy is hard to imagine. Some sample data sets assessed the conditions of the urban environment by juxtaposing with the standards. Table 1 shows that pollution of streams in Addis Ababa today is at alarming levels at industrial and non-industrial point sources. The industrial point source Bio-Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) of the city's streams stand at 4,475 and 14,702 mg/liter respectively, while acceptable levels are 80 mg/liter for BOD and 250 mg/liter for COD. The Suspended solids in the city's streams, at 1563mg/liter, is also higher than the acceptable level of about 100mg/liter. Non-point source water BOD and COD in Addis Ababa stream water are found to be too high. The level of contamination by germs such as E. coli is in the range of 30-100,000,000 mpn² (mpn: most probable number) /100ml, but the acceptable margin for the clean water is 1 to 2 mpn /ml.

TABLE I
 INDICATORS OF ENVIRONMENTAL POLLUTION

Classification	Pollution Indicators	Unit	Comparison	
			Standard	Addis Ababa
Industrial Source	Bio-oxygen Demand (BOD)	mg/lt	80	4,475
	Chemical Oxygen Demand (COD)	mg/lt	250	14,702
	Suspended Solid (SS)	mg/lt	100	1,563
	Treatment Plant (PB)	mg/lt	0.5	4
Non Industrial Source (Non-point source)	Capital Chromium (Cr)	mg/lt	2	6
	Bio-oxygen Demand (BOD)	mg/lt	<10 (Clean water)	400
	Chemical Oxygen Demand (COD)	mg/lt	<10 (Clean water)	630
	Suspended Solid (SS)	mg/lt	na	575
	E.Coli	Mpn/100ml	1-2 (Clean water)	30 to 100 000 000

Source: Habitat-Cities without slum: sub regional program, Situation analysis of informal settlements in Addis Ababa, 2007

E. Urban forest and energy use

After the early settlement in Addis Ababa, the increased demand for fire wood and construction has aggravated deforestation. The natural eco-system as well as the air, water and soil quality in the vicinity of the capital has been degraded ever since. At the end of 19th century the eucalyptus tree was introduced .it is an exotic tree that overwhelmed native trees with its fast growth and abundant yield of timber and fire wood. From that time onwards eucalyptus tree was instrumental in the housing construction and domestic fuel consumption. The city became highly dependent on forest resources. As the population grows in the capital, the demand exceeded the replacing rate and aggravated deforestation. The green cover starts depleting and consequently the city suffered from soil erosion, environmental degradation and micro-climate imbalances. Today the vegetation coverage of Addis Ababa including individual trees in private yards is estimated at 7,900 ha by the Urban Agricultural Office (UAO), covering 14.6% of the total area. About 98% are plantation forests mainly consisting of Eucalyptus. Indigenous forests remain only in small pockets, especially around churches and secured compounds, covering an estimated area of about 250 hectares only [12]. The deforestation of watersheds has resulted in loss of genetic resources, severe soil erosion, flooding of the city, damages to houses and infrastructures, wood scarcity, and deterioration of living conditions. The satellite imagery presented in fig. 5 clearly shows the damage on the environment within thirty years of time. The imagery exhibits the radical change in land use and the loss of green coverage which is aggravated by rapid urban growth within a short period of time.

African nations use the least amount of energy per capita than any others in the world. But the type of energy source used by the nations has intensified the damage on the natural ecosystem. As the urbanization rate increases, the demand for energy puts cities under constant pressure. Fire wood and charcoal is an important source of domestic fuel in urban

Africa. Addis Ababa uses a considerable amount of wood fuel for domestic purposes.

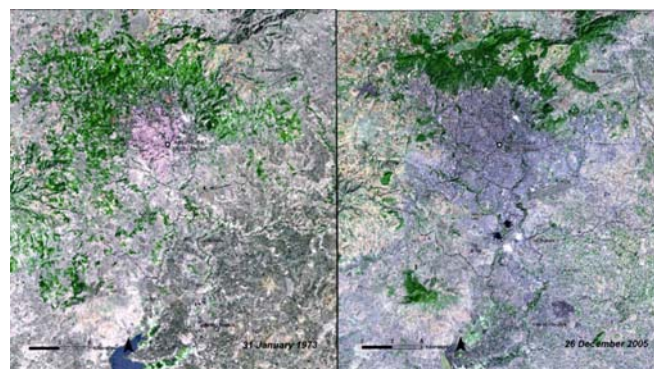


Fig. 4 Satellite imagery of Addis Ababa city and its surrounding in 1973 and 2005. Considerable size of green cover has vanished since 1973. The 2005 imagery also shows a drying polluted lake along the southern periphery. Source: United Nations Environment Program (UNEP)

The percentage share of households which are mainly use wood fuel (as a form of fire wood and charcoal) constitutes around 22 percent which is higher even for a developing city. Currently, Kerosene is used dominantly for domestic cooking purposes and has a total share of 69 percent [13]. Kerosene's availability and affordable price has made it a popular cooking fuel among the large segment of the urban poor. Contrary to its benefits, kerosene continues to be a serious health threat by releasing impurities during combustion and hence downgrading indoor air quality [14].

Rapid urbanization means increased motorization and economic activity, which leads to increased air pollution. Emissions from mobile sources are said to be the principal contributors to urban air pollution and it is becoming a serious health and environmental threat. In developing cities like Addis Ababa, air pollutants are released by rapidly expanding vehicle fleets and poorly maintained old vehicles. Lack of cleaner fuels

and poor regulatory framework specific to vehicular emissions can also be taken as another set of contributing factor. Giving all the consequences of urban air pollution, different stakeholders (governmental and non-governmental organizations) are sensitized and striving to minimize the load on the urban air. Efforts are being made towards lowering sulfur levels in fuels and adopting cleaner vehicle technology [15].

IV. PUBLIC TRANSPORT AND THE ROAD NETWORK

Condition of public transport and infrastructure in Addis Ababa city is regarded as one of the poorest in the world. There is no rail way transit service in the capital and thus public transport in Addis Ababa only refers to bus and taxi services. Car ownership among residents is very low, unlike other cities in the country; bicycle use is insignificant due to the hilly terrain. Public transport in Addis Ababa is carried by a mixture of ownership structures, of which public and private operators are predominantly contenders for business. The modes of transport include public bus; minibus; taxis and the non-motorized transport such as walking and animal transport in the periphery. Currently, taxis, city buses and private cars altogether account 30 percent of the modal share of which is 26 percent bus, 70 percent taxis and 4 percent private cars. Seventy percent of the urban travel made on foot [16].

Traffic congestion and hazardous driving conditions on the account of the extremely poor condition of roads make driving in Addis a difficult task. Large segments of the city area have evolved without basic urban planning. Streets are narrow, winding and lack basic drainage structure and pedestrian ways. Slum and informal residential areas have only arbitrary alleys which make them out of vehicular access. Due to lack of regular maintenance, most asphalted roads quickly develop many pot holes. There is no sufficient parking space and drivers park their cars on sidewalks causing terrible traffic chaos and repeated accidents. The relative rise in automobile ownership together with the poor condition of the roads and the poorly functioning traffic system have resulted in high level of congestion particularly at peak hours. Even though the city administration issued road and traffic safety regulation, the practicality of those management tools is virtually non-existence.

Today, the total length of standard 7 meter width asphalt and gravel road in the city is 2443 kms, out of which 40.5 percent or 990 km is asphalt road, the remaining 59.5 percent or 1453 km is non-asphalt. Road density measured by the ratio of total road to the total city area is 8.5 percent. It is planned to raise the city's road density to 15 percent in year 2010. To aid the fulfillment of this goal, the city administration has undertaken 13 major road rehabilitation and construction projects in Addis Ababa [17].

V. THE CITY ADMINISTRATION AND RECENT DEVELOPMENTS

Addis Ababa city administration has long been criticized for being corrupt, slow, inefficient and non-responsive to the needs of the residents. Provision of municipal services are hampered, demand for basic necessities are continually increasing along with the increasing rate of urbanization. The management was

not ready even to acknowledge the prevailing urban problems. Since 2003, the Addis Ababa city administration has restructured itself and brought a significant governance change in the history of the city. The heavily top-down administration strategy has been changed to decentralized system in which local governments get more execution and decision making power. Though it is criticized for being politically biased, the newly restructured city administration has been praised for its accomplishments. The mayor who led the reform process has been awarded the respected "African Mayor of Year 2005" award for his exemplary effort to bring fundamental change to the city [18].

The newly formed city administration is addressing persistent urban problems with little financial resources and implementation capacity. Among a handful of serious problems, priority was given to housing and infrastructure development. The public and private sector is the main actor in the housing development. The housing agency, a newly created public organ has launched extensive housing construction known as the "condominium housing project" for the lower- and middle-income residents. The private sector that targeted the higher income class are building residential complexes, apartment and shopping malls. The Housing agency has planned to build a total of 200,000 housing units by 2010. By year 2005 the agency finalized the construction of 31,399 units [19]. Besides easing the housing deficit through "the condominium housing project", the administration has undertaken the study of local development plan to upgrade the dilapidated urban core. The study of 40 Local Development Plans (LDP) has been completed and three of them are already entered to the implementation stage [2]. The administration has set ambitious goals to undertake inner city renovation and upgrading projects.

A. Challenges and critics

The city administration has carried out a significant amount of work to improve conditions of the urban environment and the general livelihood of the city. However, the overwhelming size of the challenges faced by the administration dwarfs their fairly impressive results. Back-logs are extensive and put additional pressure on the already depleted administration's capacity. In some cases, the basic property registration and tariff assignments are not exhaustively done for considerably large portions of the city. The city administration has not completely possessed records of inner city lands and properties. There is considerable number of landowners who don't possess title deeds for their land since 50 years ago [20]. Policy gaps and institutional weaknesses are said to be the other main obstacles which hindered achieving the best of its goals. In addition to these, the lost coordination among the main public agencies and utility providers has delayed the expected project outcomes.

The city is transforming, as large scale housing and infrastructure projects come underway. Public and private sectors as well as Non-Governmental Organizations (NGOs) are participating in the process. There is wide support among authorities and the public regarding the current development activities. What remains unnoticed, however, is the consequent displacement of predominantly low-income households from

the inner city and farmers residing in the outskirts. Due to inner city developments people are relocating to new settlement sites in the outskirts. The process of relocation has disrupted the relocatees' business ties with customers, breaks their informal networks of survival, causes loss of location advantage and job and incurs high transportation costs [21].

VI. CONCLUSION

Addis Ababa is far better than it was a decade ago. But the new construction projects and the glare of shiny high-rise buildings should not hide the urban poor who live in deteriorated slum settlements. Many are still living in harsh conditions. Moreover the urban poor are directly threatened by the expansion of construction activities. Low-income households mainly living in slums bear the pains of displacement and livelihood disruptions. Relocations are mostly done to the outskirts of the city where there is limited or no access to services and infrastructure. According to the ambitious vision set by the administration, by 2010 Addis Ababa was meant to become a safe and livable city for a healthy and productive society with improved access to the social services and infrastructure. But it seems this vision will have to serve again for the coming decade.

The city administration did a lot towards governance, provision of services and encouraging private sector in the development process. Though these efforts have shown a sign of improvements to the overall condition of the city, there are still daunting tasks to be done in order to ease complicated inner city problems. Several issues have considerably constrained the success of slum and urban environment improvement programs in Addis Ababa in general; they have to do with gaps in policy development, with institutional or organizational weaknesses that lead to serious managerial, programming and operational shortcomings, and with problems in project design, implementation and supervision.

Finally, this research work has examined the state of various aspects of urban environment in the city of Addis Ababa. Architectural and urban planning, slum settlements, housing, water supply and sanitation, waste management, urban forest and energy use as well as urban transportation are all examined for their crucial impact on the overall condition of the urban environment. The result from this research work provides information regarding the urban environment in developing cities by illustrating the city of Addis Ababa. This assessment will basically contribute to the process of policy formulation and planning works.

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