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A case study on town planning sustainability, impact of community supplies and sanitation programmes in various developing countries- An overview

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Abstract: *This paper highlights the importance of considering ecological sustainability issues in any town's infrastructure plans and investments. It reviews the sustainable impact of different developing countries such as water supply, drainage, electricity, tree plantation, transportation and planning in urban and town infrastructure as a case study, both to enhance economic growth and to contribute to poverty reduction, and what this implies for developing countries. It highlights the lack of attention given to ecological issues and the dangers of assuming that the resources will be available to support it and those prices for fresh water, fossil fuels and food will not rise. It also points to large ecological footprint and its heavy dependence on non-renewable resources, especially solid waste management- which means that turning waste into wealth by deriving income from solid waste, every waste price rise transfers money from the economy to national and global financial circuits. Housing lower-income groups in conventional housing with no attention to a more compact, less automobile-dependent city form exposes them to high water and energy costs. The paper ends by pointing to the advantages for the town of developing and for lower-income groups of including ecological issues, and outlines the possibilities for doingthe occupational health hazards should be minimised by adhering to safety precautions.*

Keywords: *Ecological, Hazards, Infrastructure planning, Solid waste management, Sustainable development, Town planning.*

I. Introduction

Since 2003 or 2004, the developing countries have emphasized investment in urban infrastructure as a key strategic objective of the country's economic growth and social development policy (although attention to this area actually dates back to the birth of democracy in 1994). The underlying assumption is that public investment in infrastructure has a positive impact on economic growth because it triggers and stimulates related private sector investments, and that it contributes to poverty eradication by providing the foundation for social development. Although this nexus between infrastructure and growth has received attention in the international literature,the linkage to sustainability has yet to receive the attention it deserves. The South African government has created at national level a new mega-fund called the Municipal Infrastructure Grant (MIG) programme, with a mandate to facilitate the investment of over R15 billion in municipal infrastructures over a three-year period starting in 2004/2005.

Town planningdesign and regulation of the uses of space that focuses on the physical form, economic functions, and social impacts of the urban environment and on the location of different activities within it. Because town planning draws upon engineering, architectural, and social and political concerns, it is variously a technical profession, an endeavor involving political will and public participation, and an academic discipline. Town planning concerns itself with both the development of open land ("green fields sites") and the revitalization of existing parts of the city, thereby involving goal setting, data collection and analysis, forecasting, design, strategic thinking, and public consultation. Increasingly, the technology of geographic information systems (GIS) has been used to map the existing town system and to project the consequences of changes.

In the late 20th century the term sustainable development came to represent an ideal outcome in the sum of all planning goals. As advocated by the United Nations-sponsored World Commission on Environment and Development in Our Common Future (1987), sustainability refers to "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." While there is widespread consensus on this general goal, most major planning decisions involve trade-offs between subsidiary objectives and thus frequently involve conflict.

The modern origins of town planning lie in a social movement for urban reform that arose in the latter part of the 19th century as a reaction against the disorder of the industrial city. Many visionaries of the period sought an ideal city, yet practical considerations of adequate sanitation, movement of goods and people, and provision of amenities also drove the desire for planning. Contemporary planners seek to balance the conflicting demands of social equity, economic growth, environmental sensitivity, and aesthetic appeal. The result of the

planning process may be a formal master plan for an entire city or metropolitan area, a neighborhood plan, a project plan, or a set of policy alternatives. Successful implementation of a town plan usually requires entrepreneurship and political astuteness on the part of planners and their sponsors, despite efforts to insulate planning from politics. While based in government, planning increasingly involves private-sector participation in "public-private partnerships."

Town planning emerged as a scholarly discipline in the 1900s. In Great Britain the first academic planning program began at the University of Liverpool in 1909, and the first North American program was established at Harvard University in 1924. It is primarily taught at the postgraduate level, and its curriculum varies widely from one university to another. Some programs maintain the traditional emphasis on physical design and land use; others, especially those that grant doctoral degrees, are oriented toward the social sciences. The discipline's theoretical core, being somewhat amorphous, is better defined by the issues it addresses than by any dominant paradigm or prescriptive approach. Representative issues especially concern the recognition of a public interest and how it should be determined, the physical and social character of the ideal city, the possibility of achieving change in accordance with consciously determined goals, the extent to which consensus on goals is attainable through communication, the role of citizens versus public officials and private investors in shaping the city, and, on a methodological level, the appropriateness of quantitative analysis and the "rational model" of decision making.

II. The scope of planning

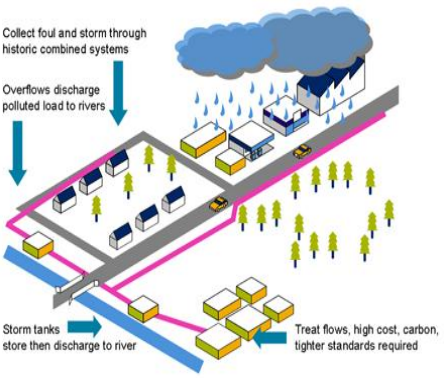
Throughout the first half of the 20th century, the influence of planning broadened within developing countries as various national and local statutes increasingly guided new development. European governments became directly involved with housing provision for the working class, and decisions concerning the sitting of housing construction shaped urban growth. In the United States, local planning in the form of zoning began with the 1916 New York City zoning law, but it was not until the Great Depression of the 1930s that the federal government intervened in matters of housing and land use. During World War II, military mobilization and the need to coordinate defense production caused the development of the most extensive planning frameworks ever seen in the United States and Britain. Although the wartime agencies were demobilized after hostilities ended, they set a precedent for national economic and demographic planning, which, however, was much more extensive in Britain than in the United States. Thus, our motivation in town planning describes different aspects of planning i.e. water supply, drainage, electricity, tree plantation, transportation and planning in urban and town infrastructure as a case study, both to enhance economic growth and to contribute to poverty reduction, and what this implies for developing countries.

III. Planning method in different countries- An overview

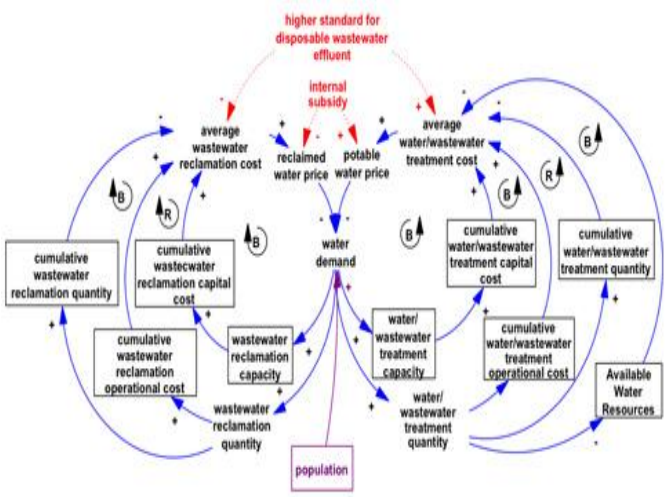
Planning in urban and town infrastructure as a case study enhance economic growth and development further to contribute to poverty reduction, and what this implies for developing countries. It highlights the lack of attention given to ecological issues and the dangers of assuming that the resources will be available to support other countries. In contrast, have an overview starting for water supply.

Impact of community water supply and sanitation programmes in Nigeria and Uganda

One of the common features in Nigeria and indeed in many developing countries is that the impacts of community water and sanitation programmes are limited, because many of them are ill-conceived and are abandoned prematurely due to numerous attitudinal, institutional and economic factors. Thus, there is lack of sustainability in the sense of service delivery and upkeep of services. This case study proposes a set of pragmatic strategy that would involve all stakeholders, by ensuring effective partnership with a view to raising the sustainability level of community water and sanitation programmes.



A pragmatic definition of the concept; An understanding of the component elements of strategies for sustainability. From an understanding of what impacts is, and how it can be brought about in a sustainable fashion, sound strategies for the planning and management of development projects can emerge. What is needed for project designers and managers in the field is a pragmatic concept, which is specific enough to allow the development of objectively verifiable targets. As the aim of a general programme we will simply refer to the achievement of sustainability; as specific objectives, we identify key components of this idea, which can be designed in and measured or observed. In the present context, the test of sustainability is whether water continues to be abstracted at the same rate and quality as when the supply system was designed, whether the excreta and wastewater disposal systems continue to function and be used as planned, and whether environmental quality continues to improve. As Abrams (1998) points out, "If the water flows, then all of the many elements which are required for sustainability must have been in place. There must have been money for recurring expenses and for the occasional repair, there must have been acceptance from the consumers of the service, the source supplying the service must have been adequate, the design must have been properly done, and there must have been sound construction."



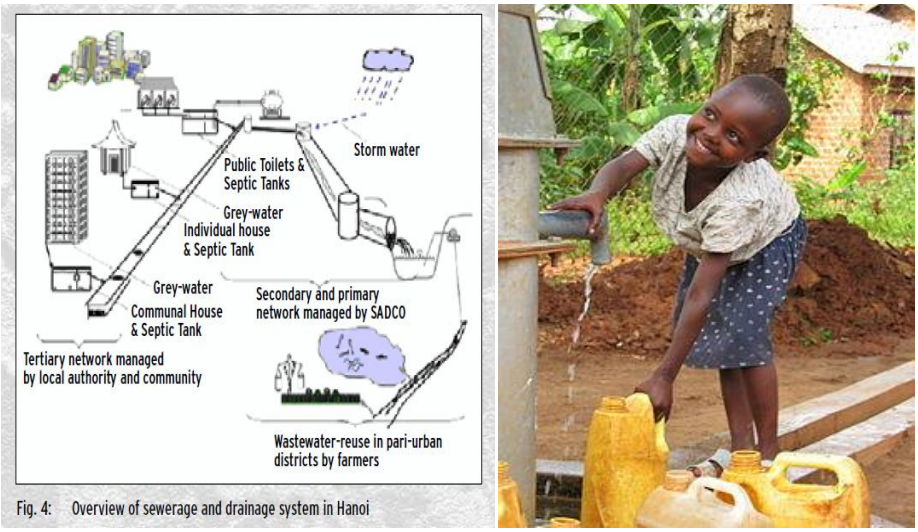


Fig. 4: Overview of sewerage and drainage system in Hanoi

IV. Small towns of Uganda

In small towns with a population between 5,000 and 30,000, facilities are owned and managed by local governments, supported by the MWE. Many have created Water Authorities, which contract out water services under 3-year contracts to local private operators since about 2000. At the beginning, private participation in small towns faces major challenges such as inexperienced local governments and private operators, limited public spending, and poor user participation.

By 2010, 80 small towns with 35,000 connections were served by private operators. Service quality and user satisfaction have improved after the private operators took over the systems. But according to the

Association of Private Water Operators (APWO) the contracts are too short to compensate the small, local private operators for their initial efforts in setting up their operations. Due to low tariffs and lack of funding for investments the private operators largely failed to expand the water system to connect the poor. Therefore, in 2005 the International Finance Corporation and the Global Partnership on Output-Based Aid (GPOBA) designed a pilot project to provide performance-based subsidies to private operators to expand access to the poor.

Under the Uganda Water Small Towns and Rural Growth Centers project, private operators are eligible for output-based aid (OBA). Up to 55% of the output-based aid subsidies are paid to the private operators during construction, a second payment is made after successful completion and a last payment after successful operation, all verified by an independent technical auditor. The project expands the management contract approach, addressing some of its flaws. Under the project local governments bid out so-called design-build-operate contracts that include investments and have a duration of 5–10 years. It is carried out in Eastern Uganda in 6 small towns with existing piped water systems (Kamuli, Nawanyago, Palisa, Tirinyi, Nankoma and Busembatia) and 4 so-called rural growth centers that do not have piped water systems yet. New household yard taps and public standpoints for about 45,000 poor beneficiaries are planned. GPOBA approved the project in February 2007 and provided a US$3.2 million grant. The project was initially expected to end in February 2010.

As of 2010, competitively awarded contracts had been signed in all 10 localities. 450 yard taps have been completed and verified so far, serving 8,100 people, with more being under construction. The grant financing per capita is lower than under traditional approaches, and in three towns the winning bidder did not even request any subsidy, relying entirely on the expected tariff revenues to recover its investment and operating costs. In one case, a commercial Ugandan Bank provided a loan of $100,000 to the winning bidder to finance the construction works.

Local governments in two towns in Northern Uganda, devastated by decades of Civil War, tried to apply this approach in 2009. In Kitgum, a town with 55,000 inhabitants, four bids were received and a contract was awarded in the summer of 2009 with a target to more than double the number of connections and water production, and to triple revenues collected without increasing tariffs in three years. In the much smaller town of Pader with 8,500 inhabitants, four bids were received, but none was responsive so that the town council continued to operate the system.

V. Impact of Electricity and Transportation in urban areas of Brazil and Egypt

Artificial lighting is strongly associated with urbanisation and is increasing in its extent, brightness and spectral range. Changes in urban lighting have both positive and negative effects on city performance, yet little is known about how its character and magnitude vary across the urban landscape. A major barrier to related research, planning and governance has been the lack of lighting data at the city extent, particularly at a fine spatial resolution. Our aims were therefore to capture such data using aerial night photography and to undertake a case study of urban lighting. Here we present the finest scale multi- spectral lighting dataset available for an entire city and explore how lighting metrics vary with built density and land-

use. We found positive relationships between artificial lighting indicators and built density at coarse spatial scales, whilst at a local level lighting varied with land-use. Manufacturing and housing are the primary land-use zones responsible for the city's brightly lit areas, yet manufacturing sites are relatively rare within the city. Our data suggests that efforts to address light pollution should broaden their focus from residential street lighting to include security lighting within manufacturing areas.

Aerial night photography was collected in March 2009 by the UK Environment Agency, with support from the Brazil Environmental Partnership. The target area was Brazil, a large city (268 km2) within the highly urbanized West Midlands metropolitan county of the United Kingdom. Surveys were undertaken by plane at a height of, 900 m, using a colour Nikon D2X digital camera, a 24 mm AF Nikkor lens and a 1/ 100 ths exposure. The resulting RGB images were ortho rectified, mosaiced and re-sampled from 10 cm to 1 m pixel resolution. This single image was then processed to derive two landscape indicators of artificial lighting: a raster layer representing incident surface lux and a point layer representing the location and class of individual lamps. These indicators were considered to be of broad interest for those studying and managing lighting in urban landscapes. Field surveys of ground incident lighting were undertaken in order to develop these indicators, using a USB2000+VIS-NIR Spectrometer (Ocean Optics, Florida, USA). Surveys were stratified over a range of lamps types located in both dense urban and residential neighbourhoods. Starting below each lamp, ground measurements of incident lux (lx) were collected at 1 m intervals along a linear transects (total 400 measurements). Using a GIS (ArcGIS 9.2, ESRI Redlands, USA) these point survey data were superimposed onto a single band (greyscale) raster, generated by averaging pixel values from the RGB image of the city using ER Mapper 7.2 (ER Mapper, San Diego, USA). The pixel value below each point was then extracted, allowing the relationship between incident lux and pixel value to be modeled. Model fit was found to improve when the measurements taken between 0 and 2 m from the lamp were removed. This was likely due to inconsistent signal

sources for the camera; in some cases the signal coming directly from unshielded lamps whilst in others from light reflected by the surfaces below a shielded lamp. The equation for the final model was then used to reclassify the greyscale raster to represent incident lux (hereafter referred to as the ‘‘lux layer’’). To derive an estimate of noise we extracted raster summaries for 25 ha of the greyscale raster corresponding to areas of the landscape known to be unlit. For these ‘‘dark’’ locations, 99% of greyscale pixels had values of less than 20. Pixel values, 20 were therefore considered to be unlit for the purposes of the landscape analysis. Three raster layers were generated representing areas lit to $10, $20 and $30lx. To identify the point location of all lamps within the landscape, we used the focal statistics and raster calculator tools in ArcGIS to identify the brightest pixels at a processing resolution of 10 m.

First, a focal maximum layer was created using a circular roving window of 10 m radius. The raster calculator tool was then used to identify pixels in this focal maximum layer whose values were identical to the original greyscale raster, which were then reclassified into a binary raster layer representing potential lamp locations (the candidate lamp layer). A 10 m sample radius was chosen because street lamps are typically spaced at greater intervals and it was also found that this reduced the occurrence of false lamp signals due to highly reflective surfaces. Although generating this layer succeeded in identifying lamp locations, a large proportion of the candidate lamp pixels did not correspond to a lamp. These were the result of small variations in greyscale pixel values within dark areas such as parks and gardens. To address this, statistics for a selection of confirmed lamp locations were compared to a sample of these ‘‘dark’’ locations. Focal statistics layers were created from the greyscale raster as well as from the individual red, green and blue layers of the mosaiced night photograph. These layers were generated using circular neighbourhoods of radii up to 7 m, as well as annuli that excluded the neighbourhood centre. Using a CHAID classification tree (SPSS 18.0), we found that the majority (95.4%) of locations representing lamp centres had average green pixel values between 1 m and 2 m from the lamp of $14 whilst the majority (99.8%) of locations within unlit areas had values for this measure of, 14. This threshold was therefore used to remove dark locations within the candidate lamp layer and the remaining pixels were converted to a point layer representing 117,599 lamp centres within the city. Elvidge et al, demonstrated the potential for discriminating major lamp types by using a 3 band sensor that broadly covered the visible light spectrum. Whilst the RGB bands in our image did not correspond exactly to the band widths proposed by Elvidge et al, we considered it feasible that they would be sufficient to differentiate between the major classes of street lamps present in the city: mercury vapour (MV), metal halide (MH), low pressure sodium (LPS) and high pressure sodium (HPS). Focal statistics were extracted for 240 lamp centers of known class and a CHAID classification tree was used to differentiate between lamp types. The first discriminating variable was the green to red ratio (G:R) for pixels up to 1 m from the lamp centre. A G:R of 0.96 separated the orange lamps (LPS and HPS) from white lamps (MH and MV), with an accuracy of 98.3% in both cases. LPS and HPS lamps were then differentiated based on the maximum greyscale pixel value between 2 and 4 m from the lamp centre. Values,=48 indicated an LPS lamp (96.7% correct), whilst HPS lamps typically had values .48 (81.7% correct). MH and MV were differentiated based on the average blue pixel value up to 1 m from the lamp centre. Values .33.2 gave a 93.3% correct classification for MH, whilst values ,=33.2 gave a 98.8% correct classification for MV. These thresholds were then used to classify all city lamp centres into the 4 broad lamp classes.

Landscape Analysis The sampling strategy was intended to reflect key scales and boundaries of urban ownership, management and decision making. GIS analyses were undertaken to explore patterns between two broad lighting metrics (lit area and number of lamps) and measures of urban composition. To explore the effect of urban density, Ordnance Survey MasterMap (OSMM) land-cover and land-use parcels that were dominated by built land-cover (e.g. roads, car parks and buildings but not gardens) were combined into a single ‘‘built’’ category. These were then converted to a 1 m resolution raster representing built land-cover for the entire city. Grid squares of increasing size (0.01 km2, 0.25 km2, 1 km 2 and 4 km 2) were then used to extract summaries of built land-cover

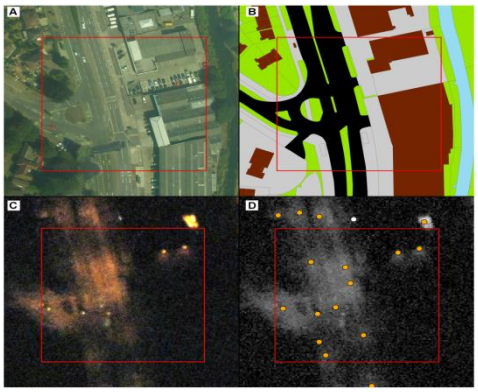


Figure shows. Aerial photography, mapping and lighting indicators for a 100m square manufacturing zone and road intersection. (A) A daytime aerial photograph, reprinted from original photography under a CC BY license (B) OS MasterMap land-cover and land-use parcels reprinted from original mapping under a CC BY license (C) a night time aerial colour photograph reprinted from original aerial photography under a CC BY license, and (D) a raster representing ground lux, overlain by a point layer representing lamp centres.

In Egypt transport planning has traditionally been a branch of civil engineering. In the 1950s and 1960s it was generally believed that the motor car was an important element in the future of transport as economic growth spurred on car ownership figures. The role of the transport planner was to match motorway and rural road capacity against the demands of economic growth. Urban areas would need to be redesigned for the motor vehicle or else impose traffic containment and demand management to mitigate congestion and environmental impacts. These policies were popularized in a 1963 government publication, Traffic in Towns. The contemporary Smeed Report on congestion pricing was initially promoted to manage demand but was deemed politically unacceptable. In more recent times this approach has been caricatured as "predict and provide" – to predict future transport demand and provide the network for it, usually by building more roads.

The publication of Planning Policy Guidance 13 in 1994,followed by A New Deal for Transport in 1998 and the white paper Transport Ten Year Plan 2000 again indicated an acceptance that unrestrained growth in road traffic was neither desirable nor feasible. The worries were threefold: concerns about congestion, concerns about the effect of road traffic on the environment (both natural and built) and concerns that an emphasis on road transport discriminates against vulnerable groups in society such as the poor, the elderly and the disabled.

These documents reiterated the emphasis on integration:

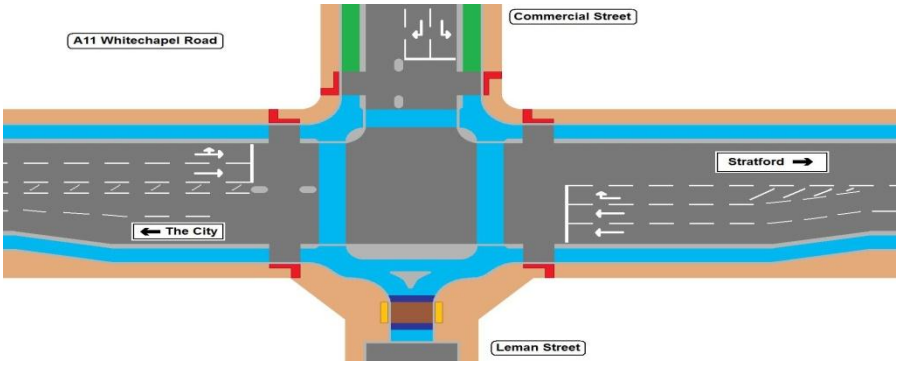
- integration within and between different modes of transport
- integration with the environment
- integration with land use planning
- Integration with policies for education, health and wealth creation.

This attempt to reverse decades of underinvestment in the transport system has resulted in a severe shortage of transport planners. It was estimated in 2003 that 2,000 new planners would be required by 2014 to avoid jeopardizing the success of the Transport Year Plan.

During 2006 the Transport Planning Society defined the key purpose of transport planning as:to plan, design, deliver, manage and review transport, balancing the needs of society, the economy and the environment. The following key roles must be performed by transport planners:

- take account of the social, economic and environmental context of their work
- understand the legal, regulatory policy and resource framework within which they work
- understand and create transport policies, strategies and plans that contribute to meeting social, economic and environmental needs
- design the necessary transport projects, systems and services
- understand the commercial aspects of operating transport systems and services
- know about and apply the relevant tools and techniques
- must be competent in all aspects of management, in particular communications, personal skills and project management.

The UK Treasury recognizes and has published guidance on the systematic tendency for project appraisers to be overly optimistic in their initial estimates.



Sustainable transportation investment requires distinct approaches in the growing outlying areas and in there developing cores of Egypt's metropolitan regions. Congestion relief and traditional highway investment, when carefully targeted, is a vital response to urban growth, but needs to be coupled with demand management (including pricing) and land use planning to produce lasting effects. Focusing on currently congested points should lead to more attention on existing highway bottlenecks and less on outward expansion. In existing or developing activity centres, possibilities will be available for promoting alternative modes-most importantly, walking. In cases, simple measurement and data analysis approaches can help decision makers identify the best sites for investment. In highway planning, tilting the tables toward congestion relief and away from growth-serving roads is appropriate, as is measuring and addressing current congestion rather than focusing on future congestion. Supporting alternatives to automobile planning will be increasingly important, and toward that end collecting consistent data on sidewalk coverage, retail mix, and street geometry can help highlight locations where transitions to non-motorized or transit travel are likely or viable. When used in combination with existing tools, the planning approaches proposed here will allow a more sophisticated focus on both aspects of Egypt's rapid metropolitan growth, and point the way toward coordinated investment and planning efforts that can foster congestion relief, sustainability, and neighborhood development.

VI. Impact of Solid Waste management in Kenya

With the increasing cost of raw materials, recycling provides a cheaper source of raw materials for manufacturing industries. Sorting and separation of municipal solid waste is gaining importance in various sectors. This study has found out that at the dumpsite there is intense scavenging for recyclables in the disposed waste. Search for saleable items has always been driven by poverty and inspiration to earn a living, but the emergence of recycling industries has enhanced the search for recyclable materials in the dumpsites as a ready market for the materials exists making it a popular solid waste Management strategy for the urban poor.

This study has established that Recycling and Reuse remains the most commonly used strategies for Solid Waste Management in Nakuru Municipality. Incineration as a strategy of solid waste management is not utilized in the municipal area apart from the municipal dumping site and in which case not actual incineration is done but burning of waste and therefore this study concurs with UNEP-IETC (1996) that the strategy remains a low option for Africa.

The low educational levels, lack of basic technical skills and limited ability to learn new composting techniques among the actors in solid waste management impact negatively on their ability to produce for economic gains and hence the reluctance to venture into the field. The sale of compost does not have a sufficient income and the process of composting is labour intensive cumbersome and emits a lot of foul smell which in turn discourages the actors from pursuing it. Further more because of lack of separation from the source Compost products made from wastes have been of poor quality because they are contaminated with glass pieces, sharp objects, plastics and industrial and medical contaminants making them not easy to sell and hence un attractive to actors in Solid Waste Management (Furedy, 2004).

1. The study revealed that the urban poor earn their livelihoods from solid waste management though the income varies depending on age, education and the type of waste collected.
2. The study also found out that the urban poor have been working in conditions that put their health, which is an important asset for them at risk for not undertaking any precaution.
3. The research has established that poverty constrains the poor to work in such inhumane conditions without the basic protective items.
4. This research has also established that the popular strategy for solid waste management in Nakuru Municipality is recycling where the urban poor scavenge for saleable items and sell them to recyclers.

5. Though composting might have some environmental gains not many actors wanted to practice it since the compost manure from solid waste does not fetch good market prices and the process itself is laborious.
6. The type of strategy adopted by the urban poor is also dependent on the type of waste to be disposed.

VII. Outcome of Kenya in Solid waste management terms

1. The problems facing developing countries in handling of municipal solid are not impossible to solve but they need concerted effort from all sectors of society. MSW management is the responsibility of every resident. An all inclusive approach should be adopted in order to achieve any meaningful and lasting solution and eliminate the exploitation of the informal waste collectors.
2. The marketing of compost products within the urban and peri-urban areas is not developed and the farmers are not well enlightened on the importance of compost manure compared to

The organic fertilizers which are expensive both in cash and kind to the farmers in the way that they wear out the soils after continuously using them.
3. This study also concludes that in spite of scavenging providing a means of livelihoods to the urban poor it also substantially reduces the final waste that needs disposal in the municipal dumping site which according to Ouano (1991) has both financial and environmental benefits.
4. It is evident from the study that the actors in solid waste management oblivious of their working conditions and in search of livelihood end up working in deleterious conditions which are characterized by cuts, smoke fumes, bad odour, backaches and headaches. Therefore the sector needs to be regulated by the Municipal Authorities to ensure a conducive working environment.
5. The strategies employed by the solid waste actors in Nakuru Municipality to earn a living which include and not limited to recycling, reuse and composting contributes significantly to reducing the waste that is scattered all over the suburbs. The study also concludes that the Municipality and the health facilities do not meet environmentally safe MSW disposal levels because of a lack of sanitary landfills and incinerators therefore posing great health risks to the individual actors as they scavenge for some saleable items.

Green Infrastructure as a tool to support spatial planning in European urban regions

To contextualise the Green Infrastructure Framework (GIF) a review of case studies in Europe was undertaken through a combination of study methods including a document review, web analysis, desk study and review of public sector strategies at the regional, national and international level. Two starting points were identified for continent wide discussion on Green Infrastructure (GI) in Europe.

The first is Europe's Natura 2000 network which encompasses more than 25,000 sites, spread over 27 member countries, covering almost a fifth of the European territory. Conservation of landscape features that support species movement and dispersal is particularly important as a means of supporting the coherence of the

Natura 2000 network. However, many studies and reports argued that such network might not establish its coherence as much of Europe's landscape is highly fragmented and under intensive land use, transport routes and urban sprawl. The Natura 2000 network can be interpreted as GI cells that already provide ecosystem services, such as food, air quality, carbon sequestration, flood management, water treatment, local climate conditions, soil erosion prevention, etc., but the system benefits at a continental scale could be greater if there was more network connectivity between them.

The European Landscape Convention which is aimed at the protection, management and planning of landscapes as well as raising awareness of a living landscape is another GI consideration. Importantly, the Convention is not only aimed at designated landscapes but also ordinary landscapes both in urban and rural areas. Since GI includes the landscape scale approach many examples of GI transnational and national programmes in Europe can be found. As the landscape scale becomes more finely delineated towards the city or local level the linkage between different landscape units becomes more pronounced. There appear to be significant benefits to be gained from a GI approach, both in terms of planning landscape enhancements, using green spaces to buffer the most sensitive areas closer to urban settlements (e.g., wild-land urban interface).

Among the examples of GI projects in Europe, the authors considered twelve examples across four levels of spatial (planning) scale: transnational, national, city-region and urban. For each example, the main documents describing the vision and objectives were reviewed. Using the authors Green Infrastructure Framework (GIF), each example was then analysed according to five functions/bundle of functions: (i) ecosystem services; (ii) biodiversity; (iii) social cohesion; (iv) sustainable development; and (v) human well-being. It was then reported whether or not the example gave indications on such functions. By using the GIF as an analytical lens the following observation were made.

Social and territorial cohesion features throughout all the examples. On closer analysis the socially cohesive elements vary according to the scale of the project, for instance the social and territorial cohesion between populations across country boundaries is the principle requirement at the transnational scale and by contrast within and between local communities at the scale of urban programmes. Given the strength of the relationship it is possible with confidence to conclude that the relationship between GI and social and territorial cohesion is already seen as a "strong rationale" and "policy driver" for those developing GI projects at all spatial levels.

The relationship between biodiversity and GI was the second strongest relationship (10 out of 12) and appears to be universally sought for at the City region, national and transnational level, however the relationship at the urban programme level is much weaker. This suggests that social cohesion and biodiversity considerations are stronger for those actively developing projects at the urban programme level and also confirms earlier practitioner led observations. This observation also supports the position of those arguing with local politicians for a greater level of understanding on the benefits to communities of being "close to nature".

Sustainable development and GI is focused on the city region and urban programme level. This can be explained by the fact that the land-use policy planning system is used in most European countries to direct and moderate on all forms of development (e.g., housing, industry, energy infrastructure). This is generally delegated to city and local authority administrations although sometimes, as in the case of the UK, with national guidance.

Human well-being and GI is strongly focused on the urban programme scale. This can be explained by the fact that most urban health interventions seek to raise the health expectations of those disadvantaged communities who through their lifestyle, educational attainment or housing conditions have considerably lower life expectations and lower age mortality than the urban average. Green improvements are known to lead to an improvement in human health and lower the costs of primary health care and it appears from this analysis that this relationship is understood by those developing urban green infrastructure projects.

The least consistent relationship is that between GI and ecosystem services. There is no apparent trend. It is thought that the few connections found between GI and ecosystem services might reflect the influence of policy makers or practitioners who are already aware of the relationship between ecosystem services and GI and that wider knowledge amongst the professions remains low. Given the clear link now being made between the two and the notable link that the GI approach can be a major planning and implementation tool to maintain and enhance ecosystem services to urban populations; there would appear to be a strong case for the European Union to be strongly investing in the training of key urban professionals, applied research projects and pathfinder projects in member states where results will lead to a change in practice. A description of the examples is reported in the supplementary material.

In summary the investigation revealed that one of the most effective ways to build up GI is through an integrated approach to spatial planning. Policies that adopt a spatial planning approach can improve landscape coherence and connectivity inside and outside protected areas and help establishing multifunctional landscapes. Therefore, GI should not be interpreted in a narrow sense, but as a means to illustrate that habitats, species and landscapes must be part of a functionally coherent network that delivers valuable services and goods.

VIII. Discussion and conclusion

Europe is a densely populated continent and much of the land is in active use. Land-use changes are having considerable effects on ecosystem services and human well-being and as a result landscapes and ecosystems in Europe are under pressure. Within Europe and in the context of Green Infrastructure (GI), there is a good deal of policy making and practitioner led activity at all levels; international, national, city region and local. There is evidence that funders and the agencies leading these activities have designed their initiatives to address the ecosystem consequences of environmental pressure. In this respect the GI approach is a notable contribution to the planning of ecological connections at many scales which meld with urban form to offer the prospect of a more sustainable landscape for well-being and biodiversity. This analysis is considered the major reason why the GI approach has been taken up rapidly by planning systems in many countries and by the European Union. Since developing and delivering GI involves the adoption of an integrated territorial planning approach supporting not only ecological coherence between protected and unprotected areas, but also a wide range of functions and benefits to society then key challenges can be identified for the European Union's environmental policy agenda. The principle one is how to integrate ecological networks into a broader GI that maintains ecological functions in combination with multi-functional land uses.

In a practical sense the city-region level appears to offer an especially attractive scale for GI planning by being capable of strategic significance and relevant to local communities at the same time. However, GI can be discerned at all levels with the local level possessing the coarsest resolution, where individual component such as "green-spaces" are readily identifiable through to the international "continental" level, where the resolution is at its finest. This implies that only by linking GI plans together hierarchically it is possible to ensure a seamless transition through the different scales of resolution.

The European experience of GI has much to offer to other continents, not least because the approaches taken in Europe have proven highly adaptive to national and regional requirements. Whilst the idea of GI did not originate in Europe, it is perhaps in Europe where the approach has received such a high level of attention, experimentation and research interest. The challenge for researchers is not so much what to include but what to leave out of the discourse.

In researching examples of GI initiatives across Europe and then combining those with the results of a detailed literature review new insights start to appear. This has led to the development of a proposed new Green Infrastructure Framework (GIF). This is offered to policy makers and researchers for use and further exploration. The GIF is seen as a unifying human centred approach to multi-scale (spatial and temporal) planning for "ecosystem" and "well-being" services. The framework model operates at all spatial scales and is "nested" and can be allied to the key opportunities identified by the EEA. The inclusion of a time axis places the planning of GI into the temporal dimension of improvement and/or degradation or indeed both as some elements may be progressing whilst others are contracting at the same time. The GIF is built upon existing GI criteria including ecological hubs, links and multi-functionality in land-use management but adds "drivers" for GI planning; ecosystem services, human well-being, social cohesion, biodiversity and sustainable development. A well rounded GI plan should be expected to deliver on all these drivers at different scales and through time.

The prospect also exists that as the costs and benefits of ecosystem services become ever more accepted within decision making and resource allocation, resources in support of the GI approach will also be strengthened.

Thus, case study on town planning sustainability, impact of community supplies and sanitation programmes in various developing countries, gave an implementation of planning good green infrastructures in our country. Hope from this overview we travelled various developing countries through imagination and in contrast got a spectacular and clear planning idea for development of our nation.

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