

Mixed Modernities: towards viable urban environmental infrastructure development in East Africa.¹

Position paper.

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Wageningen, October 2005



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Introduction

The rapidly growing urban centres in Africa are facing major problems in providing clean water, sanitation and solid waste management for the whole population, as also has been acknowledged in developing the Millennium Development Goals. This paper focuses on and contributes to the improvement of sanitation and solid waste management in East Africa (Uganda, Tanzania and Kenya), with an emphasis on the Lake Victoria region. It does so by developing and assessing an integrated approach - labelled the modernized mixtures approach (MM-Approach) - that deviates both from the well-known western large-scale high-technological grid based systems, as well as from the familiar small-scale, low-tech, decentralized technologies that are currently being applied in many African communities. Such an approach integrates the (eco)technological, economic and socio-political dimensions of new environmental infrastructures against the background of specific local contexts.

It is essential to set out an academic research programme, closely linking a wide range of international agencies, national policy-makers, local municipalities, NGOs, CBOs and private enterprises, to develop the knowledge base and the relevant networks for developing and applying such an integrated approach. For developing the knowledge base to sustainable infrastructure development, the data generated with respect to the different dimensions of the MM-approach (economic, technological, socio-political) should be gathered in a systematic way and formatted in such a way that this knowledge can be used in the future by researchers and policy makers facing similar problems in Africa and elsewhere.

Access of the (urban) poor to viable and robust environmental infrastructures for the provision of water, sanitation and waste-services, should be regarded as key-issue for realizing the goal of sustainable development.

Background: towards sustainable waste-water and solid waste infrastructures in Africa.

Africa is experiencing the most rapid rate of urbanisation in the world. A growing number of cities face the challenge to provide their populations with adequate water supply, sanitation and solid waste services. The practice in most towns and cities is one of continuing discharge of increasing volumes of wastewater and waste into freshwater bodies and on dumpsites. These problems of environmental service provision are intimately, although in a complex way, related to poverty in the cities and towns of East Africa. Poor and inadequate water provisioning, failing waste management and incomplete sanitation facilities result in waste materials and excreta ending up in the commons, polluting water, soil, and air. This has relatively larger effects on the poor, since they depend more strongly on the air, water, and land of the commons for drinking and washing water, for planting, grazing, recreation, livelihood and business activities, and for shelter and food storage. Growing parts of the world's population are living with chronic water shortages and this situation is worsening because the water quality has deteriorated as well. Many cities and towns lack even basic pollution control.

Of the approximately 30 million people who live in the Lake Victoria basin, 50% live below the poverty line. Therefore UN-Habitat has identified the Lake Victoria region as a priority area in achieving the Millennium Development Goals of

halving the number of people without access to safe drinking water and sanitation by 2015 and improving the lives of at least 100 million slum dwellers by 2020. There is recently indeed a growing attention from governmental and non-governmental actors, from national and international organizations, to improve the urban environmental infrastructures in Tanzania, Kenya and Uganda, the three main countries in the Lake Victoria basin. The question of how the Millennium Development Goals can be fulfilled now needs to be answered urgently.

The need to revise and adapt the 'Modernisation Paradigm'

In urban settings of developed countries, environmental infrastructures have been successfully developed and modernised in the past mainly through large and centralized technical systems. Most urban centres in OECD countries have a well-developed sewer system, connecting all houses to centralized wastewater treatment plants. Solid waste collection and treatment systems follow a similar logic of centralized organization and treatment. In developing countries modernising urban environmental facilities through the implementation of such large technical systems has, however, so far been less successful and faces a number of pertinent and persistent problems. In many cases the implementation of such systems has only reinforced inequity in the distribution of environmental goods like clean air, soil and water. Furthermore, paying for the investments and operational costs of such large infrastructures bleeds money out of the social system and seems to run counter to local needs or sustainability in the short run. The pressure to introduce (full) cost recovery for waste collection and processing and for managing sanitary infrastructures forces the private sector to seek rents from serving (only) the highest income areas or fully paid services, leaving poor and marginal areas under the responsibility of under-resourced local authorities. In addition, many of the large-scale systems in developing countries proved not to be resistant against the political, economic and social instabilities that many developing countries face, leading to poor environmental performances and breakdown of systems due to lack of maintenance and proper investments.

The problems related to environmental infrastructures in developing countries have much to do with the models of modernisation and urban development applied so far. The paradigm of large-scale systems that was designed and put into place in temperate-zone cities in Europe and North America at the end of the 19th century does not readily fit the African context of the 21st century. Such modernization models are mostly conceived as monolithic or one-dimensional: grid-based systems making strong assumptions about homogeneity in housing stock, density, degree of urbanisation, accessibility, related infrastructure (such as street paving and drainage), and the like. The mismatch of these centralised systems with the actual situation in East African cities and neighbourhoods with inadequate sanitation structures can be observed along all relevant dimensions of sustainability: policy and legal systems; socio-cultural factors; organisational and institutional resources; financial and economic circumstances; environmental carrying capacity and impacts; and the purely technical aspects of construction, maintenance and performance (Van de Klundert et al, 2004). Modernisation of urban environmental infrastructures, if it is to succeed in improving daily lives and livelihoods in East Africa, simply has to take a different path, which represent a specific, modified form of modernization. This adapted, specific development path has to be broadly tested and applied not only in rural areas, but also in the context of cities with high densities of poor peoples in combination with absent or fragmented environmental infrastructures.

When looking for key characteristics of a revised and adapted modernization paradigm, the experiences that result from research and pilot experiments with decentralized systems as they have been conducted over the past centuries also in western developed regions can be of great help. These alternative models for environmental infrastructures are referred to under different names, among which the concept of DeSaR: Decentralized Sanitation and Re-use systems. They were developed partly in opposition to centralized systems (Mels et al, 2005) and claim to be more robust and cheaper in comparison to centralized systems and to deal more effectively with environmental challenges like high levels of water consumption and the indiscriminate discharge of potentially valuable substances from wastewater (Lens et al., 2001, Otterpohl et al., 1997; Lens and Lettinga, 2003; Anschutz et al, 2004). Most of these alternative designs have been developed in experimental (new built) areas with a high environmental profile, although some attempts have been made to apply DeSaR technologies in already developed urban areas (Hukka and Katko, 2003; Seppälä, et al., 2004; Van Vliet, 2002; Mistra, 2002). Up till now, none of the DeSaR alternatives has proven capable of providing sustainable solutions at the larger scale in the urban centres of Northern countries. These difficulties are related to the path dependencies and the lock-in effects that come along with the existence of large-scale socio-technical system. Once these systems are in place, they give alternatives outside the dominant paradigm a hard time for successful implementation (Guy and Marvin, 1996; Guy et al., 2001; Geels, 2005). From the research and pilot experiments on DeSaR (infrastructural) systems conducted so far, it can be concluded that these alternative, decentralised systems seem to score positively on a number of dimensions involved in the sustainable provision of water, wastewater and solid waste services, especially in situations where centralized systems are not yet in place and in situations where the end-users of these systems (strive to) function rather independent from higher level institutions and authorities.

In the literature on sanitation and solid waste management in developing countries, small scale, flexible, low-technological and decentralized approaches have flourished widely. Improved designs of pit latrines, small-scale household composting and other decentralized systems of re-use of solid waste are widely discussed and described in the literature on appropriate or alternative technologies for developing countries. Starting with David Dicksons' (1974) famous book – and a subsequent journal *Appropriate Technology* - a whole generation of engineers and development experts have been trained in applying this paradigm, inspired by the work from E.F. Schumacher ('small is beautiful'; 1973) amongst others. While this appropriate technology paradigm has certainly booked major results, it remained too much a simple, second best technology paradigm, useful in situations where the finances, technological capabilities and organizational capacities are severely limited. In practice, this first generation decentralised, 'appropriate' technologies was to be replaced however with more advanced systems as soon as the social, economic and technological conditions allowed for it. In developing countries in general, and in East African urban centres in particular, alternative systems for sanitation and solid waste management are not jeopardised by the dominance of already existing, 'conventional' large scale socio-technical systems. This gives alternative, decentralized technologies applied at niche levels a fair chance to develop into a regime for the sustainable (fair and ecologically sound) provision of water and waste(water) services (Kemp et al., 1998; Geels, 2005). To meet the challenges of the present day situation in Africa (high pressure from population growth; higher demands in terms of safety, accessibility and eco-efficiency) the first generation of decentralized systems

(appropriate technologies) has to be replaced by a new generation of decentralized systems (DeSaR). The DeSaR systems as they are developed nowadays differ from the systems developed in the appropriate technology paradigm of the 1970's and 1980's in some crucial respects. In the contemporary approach, the most modern materials, organisational formats, and scientific knowledge are applied to develop environmental infrastructures that are sustainable both from a technical and social point of view. These DeSaR-like systems on the one hand offer an alternative development path to the naïve modernization approach of just copying centralized, large scale infrastructures and on the other hand do away with some of the negative features and images of the old, appropriate technology approach as rooted in the 1970's. We suggest the concept of Modernized Mixtures to refer to the development of also medium and large-scale environmental infrastructural systems which 'build upon' and are constructed from decentralized units of the DeSaR type and which take into account the specific local conditions of developing countries. They are referred to as 'mixtures' because they take the best features out of both (modern) decentralized and centralized systems, and combine features of the central and decentral approaches into new forms which better fit the local situation of African cities.

Theory and practice of 'modernised mixtures'

The Modernised Mixtures Approach: combining the best of two paradigms

One of the keys to sustainable development of urban environmental infrastructure provision in cities and towns in the South in the 21st century, we argue should be connected to the introduction of a mix of scales, strategies, technologies, payment systems and decision-making structures, that better fit the physical and human systems for which they are designed. This type of organized eclecticism, when applied to sustainable urban development, can be called a Modernised Mixtures Approach (MMA) to urban sanitation.

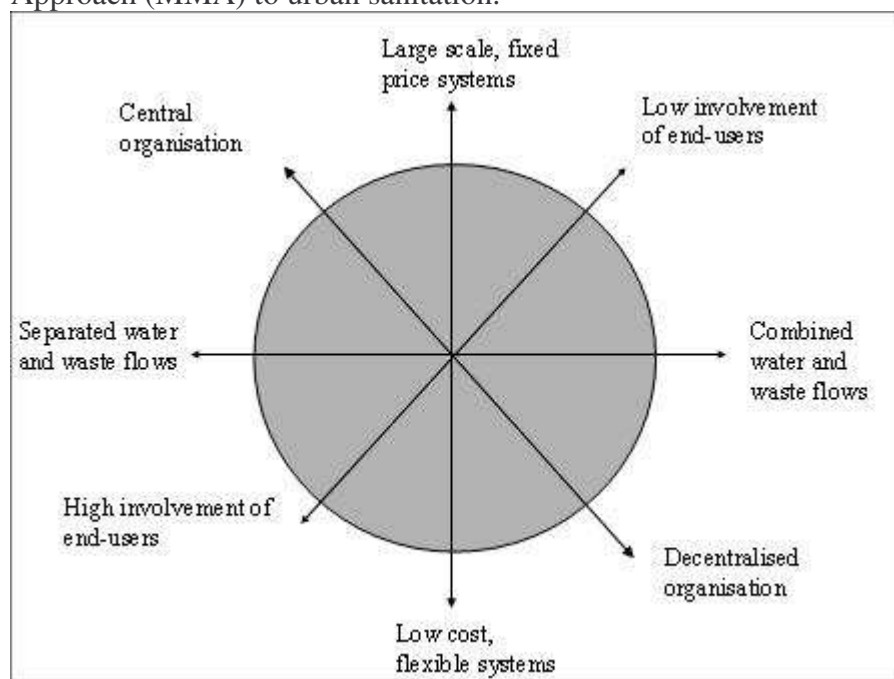


Figure 1a: dimensions of environmental infrastructures

When working with modernised mixtures, one leaves behind the (according to us: false) dichotomy dividing centralised, large-scale, high-tech solutions on the one hand

from the decentralised, appropriate, small scale and low- technology solutions on the other. Instead of opposing centralised and decentralised paradigms, the best of both paradigms have to be combined into new configurations that represent the low cost, accessible and robust performance of decentralised systems with the economies of scales and high urban density/capacity characteristics of centralised systems. Figures 1a and 1b together illustrate the basic notion of the modernised mixtures approach, bringing together elements from both paradigms in a number of options and strategies, adapted to the particular infrastructural, institutional, economic and environmental contexts of – in this project – East Africa. Figure 1a represents the relevant dimensions or variables which have to be taken into account when developing urban environmental infrastructures for water and waste(water) services, while figure 1b illustrates some possible ways in which these dimensions can be combined into specific modernized mixtures.

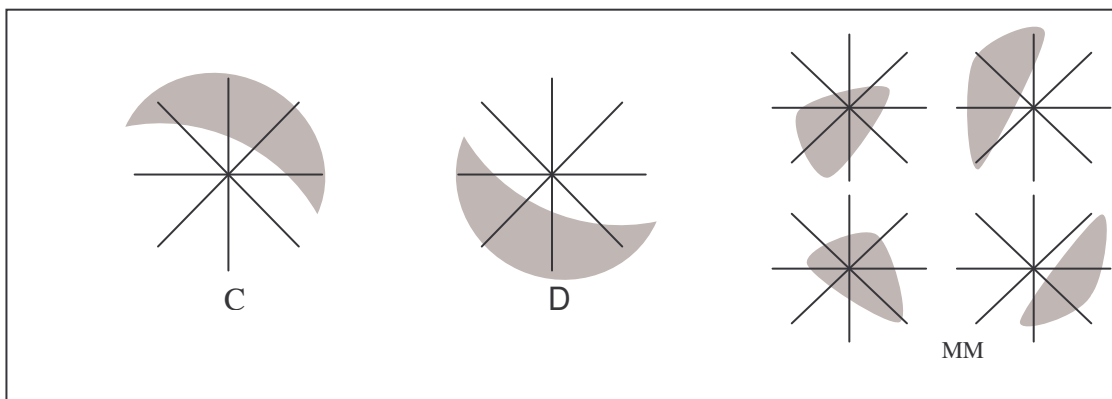


Figure 1b: Modernized Mixtures (MM) as alternative to Central (C) and Decentral (D) systems.

By moving towards the upper-right corner in the model (C), infrastructures tend to resemble the large scale public, central grid-based systems in industrialised, developed countries. Moving to the bottom-left corner in this model (D) visualises the decentralised and small-scale systems developed in the past for developing countries and particular (DeSaR) solutions for industrialised countries. The third example (MM) shows different modernised mixtures, adapted to the specific local context and requirements. Integrating knowledge with respect to all relevant dimensions is needed to optimize the chances for socio-technical systems to fit into the specific local social and technical conditions.

Up till now the debate on the modernised mixtures developed mainly with respect to the highly industrialised parts of the world, where gradually a new, hybrid paradigm evolved, that combines technologies and policies from the dominant (uniform, central grid based) and the alternative (DeSaR-like) paradigms. DeSaR-like systems have challenged the sustainability of conventional systems (Lens et al., 2001; Lettinga, 2004), and turn out to be performing best in close relationship with or even in certain dependency from the (elements of) conventional large scale socio-technical systems. The example of windmills in Germany might serve to illustrate the claim that a breakthrough in the application of more sustainable, decentralised technologies was realised as soon as the ‘stand-alone’ approach was left behind in favour of a modernized mixture approach in which windmills are connected to reorganized

(central) grids for energy provision and managed in shared responsibilities between different stakeholders (utility companies, farmers, local or regional government agencies and groups of end-users). What proved successful for energy provision, distribution and consumption might serve as an inspiring approach for water and waste(water) provision and consumption as well. From the research and pilot studies conducted so far it can be concluded that it is the intelligent and flexible mixture of technologies, institutional lay-outs and management systems from the two paradigms, adapted to the specific local context, that have made innovative sustainable strategies in urban sanitation possible in West-European countries.

The Modernized Mixture Approach applied in the African context.

While the approach as outlined above forms the basis of this research program, the concrete ideas and schemes for socio-technological solutions developed in Western Europe cannot be transferred to East Africa as they are. When investigating the applicability and design of modernised mixtures for utility provisioning in the urban context in East-African countries, we have to bear in mind some of their specific historical and contemporary characteristics in socio-economic, institutional, political as well as technological respects. Some of the most important differences which have to be taken into account when developing the Modernized Mixture Approach in the African context are:

- (waste-)water and solid waste provisioning in Africa has to consider the poor (or to put differently: we need pro-poor modernized mixtures).
- instabilities in African regimes and economies require robust systems, that remain intact under changing socio-political and economic conditions.
- technological capabilities, institutional support and maintenance facilities for urban infrastructures services are different from and at lower levels of development when compared to OECD countries
- the need for an appropriate form of (also CBO- and NGO-) stakeholder involvement to develop pro-poor sustainable socio-technological systems and tools (certainly if they have to fit slum area social conditions).
- the existence of the so-called ‘enforcement gap’, referring to the presence of, sometimes well elaborated, laws and regulations which are not enforced and in many cases not even known among the organizations concerned.
- enforcement-gap problems are directly related to East African specifics in state capacities and state-society relations, requiring ‘good governance’ strategies for sustainable provision.
- the collective and institutionalised memory, information exchange and learning processes about numerous previous initiatives, pilot projects and studies that have been undertaken over the last several decades is generally poor.
- scientific research and development efforts put into (waste)water and sanitation are emerging in the region but not at the required levels

Forms of environmental infrastructures should be designed for waste and (waste)water services which build upon the experiences of DeSaR technologies and incorporate the specific African, local factors and conditions mentioned above.

Methodology

On the basis of this modernized mixtures approach and insights in the East African situation, this project intends to contribute to solving the challenges facing contemporary urban sanitary and solid-waste infrastructures and management in East

Africa. Such an approach aims for optimization via combining decentralized, isolated systems with larger scale, centralized socio-technical systems, depending on the specific situations. Optimization of technologies and technological systems for sanitation and waste can take place along the following dimensions (see figure 2):

- flows, i.e. chains of waste(water) generation, collection, treatment, reuse and disposal, and their interaction with the environment;
- the actors/organization (institutions involved, management requirements, possibilities for participation of citizens, public-private partnerships),
- the technological and socio-economic aspects (costs-structure, ways of financing, etc.)

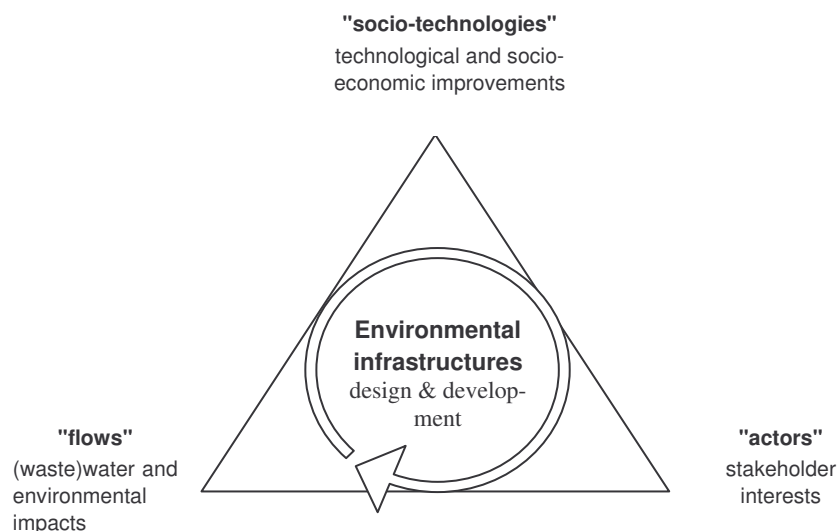


Figure 2: Design of waste and wastewater infrastructures (based on Van Koppen, 2004).

In the end the different designs, optimized along lines of flows, institutions and economics, have to be judged against three sets of criteria:

- ecological sustainability of the infrastructures and practices involved: to what extent do the new systems or the new technological options that become part of existing systems, improve the environmental performance of the urban infrastructure?
- accessibility (particularly of the poor to avoid exclusion of particular groups): to what extent are specific groups included and excluded from environmental infrastructure due to financial, physical or cultural reasons?
- flexibility and resilience (in both technological and institutional respect): how does the system or unit fit into more embracing future systems and how does it behave in times of instability in various dimensions (climate, political, economic, institutional)?

Developing a shared, integrated knowledge and data-base

The scientific basis for developing sustainable, accessible and flexible environmental infrastructures will be improved by developing an integrated data-base containing information on the three sets of key criteria:

1. criteria measuring the ecological sustainability of the infrastructure: to what extent do the new systems or the units which are developed as part of emerging (central) systems, improve the environmental performance of the urban infrastructure; these criteria refer to the substance flows and technological characteristics of the systems.
2. criteria measuring the accessibility of the systems in particular for the poor. What is the risk of specific groups becoming excluded from the use of the system due to financial, physical or cultural reasons? In some situations, specific low-cost systems have to be developed which are both technologically and socially adapted to slum-conditions; forms of privatization and/or Public Private Partnerships (PPP's) have to be assessed with respect to the socio-distributional consequences of the measures taken.
3. criteria measuring the flexibility, resilience and robustness of the systems in both technological and institutional/socio-political respects; which features make the components or sub-units suitable for functioning in different socio-technical environments; how does the system and system components behave in time of instability in its various dimensions (climate, political, economic, institutional).

From the criteria as distinguished above it becomes clear that the design and development of modernized mixtures for sustainable, pro-poor environmental infrastructures, necessarily has to be a combined effort of specialists from different disciplines, including technological, environmental and social sciences.

Strategic linkages between academic research projects and so called practitioners activities and projects are of essential importance for realizing the central objectives of the Mixed-Modernities Approach. To achieve the objectives of this project – developing socio-technical infrastructures which are sustainable both in environmental and social respects - an interdisciplinary approach is required. Environmental policy experts dealing with issues of management, (local) governance and accessibility to the urban poor will have to collaborate with environmental technology experts dealing with sustainability in terms of environmental performance and with development economists dealing with accessibility in terms of prices, with economic dimensions of privatization, with issues of sunk-costs for large technical systems and urban infrastructures and with the economic consequences of internalizing external costs for reasons of sustainability.

Realising the research objectives necessitates close collaboration between these different disciplines, which goes beyond simple co-ordination and exchange of results. The concept of modernised mixtures provides a framework for bringing the contributions from different disciplines together in a much more productive manner.

An important methodological issue in this research programme is the way in which 'local' and 'regional' knowledge obtained in three East African countries can or cannot be generalized into similar social and geographical situations and cases. In order to achieve this aim, we will develop a knowledge and data-base which can be

used by different actors to further develop and apply in practice the modernized mixtures approach, both in Africa and elsewhere. With the development of this integrated data and knowledge base for the modernized mixtures approach, the scientific methods as applied within the different research-projects will be discussed with respect to their similarities and differences: how does one measure the relative impact of technical versus economical versus socio-political impacts? How does one translate an emphasis on accessibility of environmental infrastructures for the poor into manageable data and criteria?

For this project to succeed, it is necessary to have good, well structured relationships between

- academics and practitioners
- academics from technical/natural science background and those from social sciences background
- academics in Europe and East Africa, with special emphasis on social science inputs from the African context

Relevance of the approach for international development issues/international discourse

Developing environmental infrastructure in East Africa is particularly relevant within the framework of the Millennium Development Goals (MDGs). These MDGs were formulated in 2000 by the international community with the intention to halve global poverty by the year 2015. Although the central objective within international development co-operation remains 'sustainable poverty alleviation', these MDGs are providing clear guidance in defining concrete and achievable targets. Developing countries should identify specific poverty reduction strategies based on these MDGs, and thereby provide a framework for resource mobilisation and international co-operation. Developed countries are asked to support these MDGs and the Netherlands government is for example giving priority to MDG 7.

This seventh of the eight Millennium Development Goals intends to 'ensure environmental sustainability' and two of its targets are particularly relevant for the PROVIDE project:

Target 10: halve by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation,

Target 11: have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers.

Key requirements to address the MDGs in general are: improved governance, technological innovation and diffusion, and enhanced financing mechanisms. Achieving targets 10 and 11, therefore also needs an integrated approach and to include contributions from policy and social sciences, technology and economics.

People without access to decent water and sanitation facilities, living in slums, (or informal settlements), form a growing challenge. The fastest growth is expected in Sub-Saharan Africa where the slum population is expected to grow from 101 million in 1990 to 313 million in 2015 (UNDP, 2005), and where already an estimated 72 per cent of the urban population lives in slums (DFID, 2004). Most slums and informal settlements are deemed illegal and therefore interventions by public authorities to regularise or upgrade these settlements are politically sensitive as they could be interpreted as de facto recognition of the legal status of slums. Slums are often seen as temporary, when in fact they have become a permanent form of settlement. Breaking from this vicious circle requires a move towards more integrated policies aimed at

promoting socially inclusive development and concrete actions seeking to reduce existing inequities in access to services (Tibaijuka, 2005). In many such places, conditions are so poor that infant and child mortality rates are ten to twenty times higher than in places with little poverty. Poor families often have to turn to private service provision, which is why households in informal settlements typically need high cash incomes to avoid poverty. Proximity, clearly, does not imply access. A well-managed system for piped water, sanitation, drainage, and garbage removal can greatly reduce the poverty city residents, even without increasing their income (Satterthwaite, 2004).

The contribution from scientific research to international development co-operation remains controversial, as some suggest that the problem of development is not a lack of knowledge but a lack of political will and of concrete action. Others nevertheless claim that knowledge, linking scientific research with policy-practices and capacity building is essential. Scientific research can result in technological innovations, spread of information, and increase in knowledge about societal dynamics. To achieve its potential effective research should be demand driven, embedded in policy and practice and interaction between different social actors, practice-oriented and have additional value in comparison with other forms of knowledge production.

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¹ This discussion paper is the result of different projects and research activities among which the Afrin-net project (2004-2005). This project involved staff members from WUR and from WASTE, Advisers on Urban Environment and Development (Arnold van de Klundert and Anne Scheinberg) bringing in practical experience in East Africa. Materials and texts from the Afri-net project are used in this paper, but the text in this paper is under the full responsibility of the authors mentioned and the WASTE staff members were not involved and are not necessarily in agreement with all of the points.