GUIDING INFORMAL URBAN GROWTH WITH TRUNK INFRASTRUCTURE

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Summary:
In the developing world the urban poor in their pursuance of livelihoods run the risk to sacrifice the functionality of the city and the economic supply of public utilities, but the statutory system of urban governance is ill equipped to establish a functional accord between land use planning and service provision. In poor countries these two sectors are rarely co-ordinated.

This paper assumes that the reciprocal relations between infrastructure supply and urban growth can be instrumentalised to guide informal urban development in countries with a resource-starved public sector. It is based on ongoing research in Dar es Salaam, Tanzania, which is conducted jointly by the Universität Dortmund, Germany, and UCLAS, Dar es Salaam, and funded under the German programme ‘Sustainable Development of the Megacities of Tomorrow’.

Key Words:
Urban growth, informal settlements, trunk infrastructure, sub-Saharan Africa, Dar es Salaam
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I. INTRODUCTION

In sub-Saharan Africa, urbanisation rates are commonly higher than national economic growth rates. Rapid urban growth has outstripped the capacities of central and local governments to regulate and guide urban land development, to provide urban infrastructure services and to manage the urban environment. Informal rapid urbanisation under poverty poses a major challenge for sustainable development in the region.

Good urban governance strives to merge urban land management with the provision of utilities in order to secure both economies of scale and adequate services for urban residents. In poor countries, this reciprocity is disturbed. With investments in services unable to cope with rapidly increasing needs, informal urban growth will sprawl onto sites which can be served later only at excessive costs. At the same time, informal home builders and enterprises try to take advantage of locations close to utilities even at the expense of otherwise unfavourable or hazardous sites.

While the urban poor in their pursuance of livelihoods run the risk to sacrifice the economics of public utilities and the functionality of the city, the statutory system of urban governance is ill equipped to establish a functional accord between land use planning and service provision. In poor countries these two sectors are rarely co-ordinated.

This paper assumes that the reciprocal relations between infrastructure supply and urban growth can be instrumentalised to guide urban development in countries with a resource-starved public sector. Strategic co-operation between municipal urban land management and utility providers can enable public authorities to direct informal settlers into areas suitable for building and guarantee long-term profitability of infrastructure investments without having to rely on levels of planning and building control which they can hardly deliver.

The strategy of guided planning will require planning authorities and utility providers to jointly designate favourable and restricted areas for settlement expansion and to enforce land reserves necessary for linear infrastructure provision. Detailed urban land management can be left to the settlers whose grass-roots institutions have been proven to be able to regulate urban growth in the early stages of settlement development.

The paper is based on empirical evidence from ongoing research on the concepts and strategies for the provision of trunk infrastructure and the feedbacks between infrastructure and urban growth in the East African city of Dar es Salaam. The research project is conducted jointly by the Faculty of Spatial Planning of the Universität Dortmund, Germany, and the Faculty of Architecture and Planning of the University College of Lands and Architectural Studies in Dar es
II. THE SPATIAL FORM OF INFORMAL URBANISATION

The economic, social and political future of developing countries will to a large degree depend on the functionality of their large cities. Being engines of economic growth, they need to run efficiently, smoothly and reliably. Their power depends not least on the quality of their spatial layout which has a strong influence on the costs of transportation and for the provision of trunk infrastructure like piped water, sewage and drainage. A functional urban layout is also highly supportive for public health and the protection of the natural environment.

Rapid urban growth will not produce functional spatial structures if left to market forces only. State regulation is required to balance individual interests with public welfare. It is the privilege of the state to guarantee property rights, safeguard public goods, and optimise the use of land as a custodian of all citizens.

Modern urban history provides ample evidence for the observation that states seem to be least equipped to fulfil these tasks when the need for urban growth regulation is most pressing during the stage of rapid urban expansion. This discrepancy is especially severe in countries where urbanisation is driven by poverty. There, the public sector is hardly able to guide urban development, to execute land use control, and to provide basic infrastructure services for all.

In the highly industrialised countries rapid urban growth during the period of early industrialisation was driven by economic development. After a difficult initial phase, when adequate concepts and instruments were still to be developed, municipalities were soon charged with the task and endowed with the necessary resources to check rapid urban expansion. Although the budgets required to establish effective planning authorities were supported by a growing tax base and a revived recognition of the principles of subsidiarity and decentralisation, the early urban design and land use regulations were simple and straightforward but powerful enough to improve public health, support fire protection, facilitate vehicular circulation, and direct urban growth into favourable areas.

In sub-Saharan Africa, urbanisation in poverty is progressing at a rate unprecedented in human history. In most countries, the ailing state is not in a position to deploy a responsive legal framework and to mobilise adequate human and material resources to guide urban growth in accordance with principles inherited from colonial governments and spelled out in constitutions. Consequently, spatial frictions in the rapidly expanding urban agglomerations are increasingly becoming an additional burden to the struggling economies.

In the large cities, new settlements are mushrooming at the urban periphery and the urban centre is densifying following the rules of liberal property markets largely without land use guidance and control. In cities like Dar es Salaam, Tanzania, where two out of three dwellings have been built without a permit on land which has not been zoned for residential use, informality is no longer a residual category but the mainstream of shelter and housing delivery (Fig. 1). Its

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1 The working group at the two universities consists of Timo Basteck, Alexandra Hill, Tanja Hühner, Wilbard J. Kombe, Volker Kreibich, Christian Lindner, John Lupala, Wolfgang Scholz and Hans-Peter Tietz (director).
dominance questions the appropriateness of the housing policies, urban development priorities and land use regulations in place (Kreibich, 2000).

**Figure 1: Land use in Dar es Salaam (2002)**

Source: Kombe and Kreibich, 2007

1 **Limits and potentials of the ‘social regulation’ of urban growth**

Any search for improved urban growth governance has to start with a recognition of the institutions and processes which keep the large cities moving and working despite the obvious odds caused by the weakness of statutory urban planning. Under certain conditions new settlers are able to obtain property rights and tenure security, to arbitrate land disputes and neighbourhood conflicts, to assure plot accessibility, and to provide basic services without the statutory regulatory framework which the ailing state is unable to enforce (Kombe and Kreibich, 2000). Their neighbourhood institutions operating at the grassroots provide the necessary investment security under informal arrangements which can been termed ‘social regulation’ of urban growth (Kombe and Kreibich, 2007).
The functionality of social urban growth regulation depends on a number of critical prerequisites: Affordable housing land should be available for both rural migrants and second generation urban settlers in the urban periphery on markets which are not overly distorted by unequal power relations between sellers and buyers. This condition can still be assumed to prevail in the urban agglomerations of a number of sub-Saharan countries (e.g. Tanzania, Uganda, Zambia, Ghana, Mozambique, and Angola) as well as in parts of SE-Asia. Ethnic and social homogeneity in the settlements is another prerequisite for the successful social regulation of challenges and conflicts associated with rapid urban growth. It can be observed in many settlements in urban peripheries where the migrant settlers tend to originate from the same sector in the rural hinterland or even belong to the same tribe.

In the initial or infancy stage of settlement growth social regulation is most effective. Later, with rising land values and increasing social heterogeneity during settlement consolidation and saturation, conflicts over land ownership and land use become more and more intense with the consequence that the arbitrating power of informal institutions is set to wither. It is in this mature phase of settlement growth (Fig. 2) when roads and public spaces are under high pressure of encroachment and public interests can no longer be safeguarded, that statutory interventions would be essential (Kreibich and Kombe, 2000). A critical analysis of urban policy priorities under the dictate of highly restrained public resources reveals, however, that many urban planning authorities waste their limited resources on drawing detailed lay-out plans for newly built neighbourhoods without being able to enforce them on the ground, while excessive densification proceeds unabated.

Figure 2: Urban lay-out of the informal settlement of Daraja Mbili in Arusha, Tanzania

Source: Kombe and Kreibich, 2007

The ‘shelter first’ strategy which poor migrant settlers are forced to apply does not leave any room for prospective investments into a functional structure of the evolving settlement. Coming from villages with rural land use patterns, they can hardly envisage the requirements for a
functional urban lay-out which will arise from land use differentiation and the subsequently growing demand for trunk infrastructure, especially motorable roads, piped water, drainage and sewage. An irregular, rural lay-out of their neighbourhoods will, however, render any later retrofitting with line-based amenities extremely costly.

It could be shown that the ‘urban planning competence’ of poor settler communities can be enhanced when natural structures (e.g. the road network of former plantations) can be followed, community members are able to deploy surveying qualifications (e.g. from their military service), middlemen subdivide regular plots, or the lay-outs of planned urban settlements in the vicinity can be copied (Kombe and Kreibich, 2002; Scholz, 2007).

Considering the grave resource deficits of public planning agencies in developing countries, it would be unrealistic to expect comprehensive ex ante planning guidance and subsequent implementation control in the mushrooming informal settlements in the urban peripheries. It would rather seem imperative to make use of the potentials for social regulation of informal urban growth and to identify instrumental entry points which can help to establish and safeguard rudimentary settlement structures like main roads and public open spaces which will later support the economic provision of technical infrastructure as well as vehicular circulation.

Informal housing land markets for the poor tend to direct urban development onto marginal sites which are exposed to hazards (e.g. flood plains or steep slopes) or can be serviced only at excessive costs. Again, it cannot be expected that under the regime of urbanisation in poverty urban land use planning relying only on master plans would be able to direct poor land seekers into favourable locations. For the research which is reported in this paper it was instead assumed that the provision of trunk infrastructure, foremost roads and piped water, has the potential to guide informal urban growth.

**Figure 3: Encroachments upon major road in an informal settlement in Arusha, Tanzania**

**Figure 4: Blocked access to a graveyard demolished by the municipality after requests from local Road Committee in an informal settlement in Iringa, Tanzania**
2 Costs of dysfunctional settlements

The poor pay more for having to live in dysfunctional settlements. On hazardous sites they are exposed to flooding or land slides, at peripheral locations to excessive costs for water, energy and transportation. Following the ‘shelter first’ strategy, poor migrant settlers will trade these disadvantages for the option of ‘belonging to the city’ which provides them access to the desired ‘greener pastures’. The new urbanites hope to be later able to pay for amenities, and they know that the city will approach them sooner or later making infrastructure services more affordable.

The adverse effects of excessive densification of informal settlements on their path towards saturation are more difficult to cope with. Paradoxically, they often constitute external costs of improved livelihoods (Sheuya, 2004). House owners construct additional rooms or workshops for rental, intruding into adjacent roads after their plot is fully built up (Fig. 3); they might even convert toilets or transfer them into public space in order to obtain additional rooms. With increasing density, public health hazards through indoor and outdoor air pollution and discharge of solid waste and waste water grow. Mixed land use creates job opportunities within settlements, but it can also cause excessive noise and toxic fumes which molest adjacent residential areas.

Figure 5: Encroached and blocked road in an informal settlement in Iringa, Tanzania

Source: Kombe and Kreibich, 2007
With increasing density and poor planning surveillance and control there is a strong tendency to encroach upon roads and public open spaces (Fig. 4). In informal settlements these have normally not been designed for vehicular traffic, rather developed out of former footpaths and unoccupied or disputed plots. Without being legally defined in a planning document, public roads and open spaces can be defended only through interventions by concerned citizens (Fig. 5) (Kombe and Kreibich, 2007).

The blockage of access to assets of urban livelihoods like shops, enterprises, markets or public services as a consequence of assets improvement through house extensions at other locations ‘down the road’ can be a tragic feedback loop on the growth path of unplanned settlements towards saturation (Sheuya, 2004). The decision of a single plot owner to improve his business can cut off other enterprises and hundreds of households from delivery services, customer access, ambulances, pit latrine emptying, fire engines, and police patrols. Once access has been blocked at one location, other house owners are more than willing to follow suite and incorporate adjacent ‘unused’ land into their plot (Fig. 4). The devastating consequences of reduced access are a major concern for residents in rapidly densifying informal settlements, and often the reason for the formation of civil society institutions like road committees (Kombe and Kreibich, 2007).

The provision of trunk infrastructure which requires linear open spaces like roads, piped water, sewage and drainage is made more difficult and expensive in settlements with a rural, irregular lay-out, in informal settlements with interrupted roads, and in planned neighbourhoods where the road reserves have been built upon. The reallocation of plots is difficult to achieve with the restricted planning resources available. Successful retrofitting of technical infrastructure is, therefore, limited to projects supported by international development aid. A better solution could be developed with the help of urban planning concepts and intervention mechanisms which provide for basic linear structures right at the infancy stage of settlement development and safeguard their observance during further growth by involving local civil society institutions. This proposition has informed the research which will be reported in the subsequent chapter.

III. INFRASTRUCTURE PROVISION AND INFORMAL URBAN GROWTH – THE CASE OF DAR ES SALAAM, TANZANIA

The city of Dar es Salaam in Tanzania is a paradigmatic case of rapid urban growth under poverty and representative for many urban agglomerations in sub-Saharan Africa. Growing by about 100,000 new inhabitants per year in the last decade, its population has now exceeded 2.5 million. About two thirds of the inhabitants of this emerging megacity live in informal settlements in houses constructed without a building permit on land which has not been assigned for residential use.

For these reasons, Dar es Salaam was selected for a research project investigating the mutual links between trunk infrastructure supply and informal urban development with the intention to identify access points for strategic interventions into rapid urban growth under poverty following the concept of guided planning by incentives and in co-operation with civil society groups. The project is funded by the German government as part of the programme ‘Sustainable Development of the Megacities of Tomorrow’ (www.emerging-megacities.org) which provides for a pilot phase of two years and a subsequent implementation phase. The pilot phase commenced in the year 2005.
Research for the project ‘Trunk Infrastructure and Urban Growth – Managing Rapid Urbanisation in Poverty in Dar es Salaam, Tanzania’ is based on the following assumptions:

- In the absence of effective mechanisms to implement urban development plans, informal settlements are the main vehicles of urban growth. Their location is partly determined by the availability of trunk infrastructure in combination with land market mechanisms.

- The utility agencies providing trunk infrastructure (roads, piped water, sewage, drainage and electric power) are not co-ordinating their activities with each other and with the urban planning authorities. The potential to guide informal urban growth with infrastructure provision is, therefore, not utilised.

- The disjointed planning and provision of trunk infrastructure prevents economies of scale and increases the unit costs of utility supply.

- The lack of co-ordination between infrastructure provision and urban growth forces informal settlers to access utilities at extra costs often illegally and in an unhealthy and unsafe manner.

- Informal settlements can deploy capacities for social regulation which can sustain the development of their neighbourhoods until the consolidation phase without public authority interventions. The informal civil society institutions find it, however, difficult to foresee the future demands for infrastructure supply and for a corresponding urban lay-out.

- The co-ordinated provision of trunk infrastructure can direct informal urban growth into suitable locations and at favourable unit costs.

Based on these assumptions, some of which have already been corroborated in former research (Kombe and Kreibich, 2000, 2007; Scholz, 2007), the project is striving to develop concepts, strategies and instruments to support sustainable urban growth in an environment of widespread poverty and scarce public resources.

1 Determinants of the spatial fabric of urban growth

The quest for more efficient infrastructure supply and sustainable land use patterns in the rapidly growing urban periphery has to be supported by a thorough understanding of the forces which drive land use change. With the help of a computer-based model the interplay between major determinants is being analysed in order to establish a knowledge platform for strategic investigations and forecasts of rapid urban growth in the periphery of Dar es Salaam. The findings will support decision makers, especially utility providers, in their attempts to co-ordinate the provision of trunk infrastructure and to guide future urban growth. Using the technique of cellular automata (CA), the model has already proven to be capable to simulate land-use development considering main land-use types, i.e. planned residential, informal settlements, other urban and vacant/agriculture, producing quite plausible patterns.

The bulk of the database had to be extracted from aerial photographs or field studies provided by ITC, Enschede. It was extended and updated in co-operation with UCLAS, Dar es Salaam. The spatial patterns emerging from the GIS-based analyses confirm that urban growth in the last decades has almost completely taken place in informal settlements emerging alongside the main roads and particularly at the city’s outer fringe (Fig. 6). Unsurprisingly, informal settlements are characterised by significantly higher population densities compared to planned residential areas within the same radial distance to the city’s central business district. They also exhibit a distance
decay effect in population density towards the urban fringe areas where a stable and low population density could be identified.

*Figure 6: Land use development in Dar es Salaam 1982-2002*

These development patterns have to be taken up by the model. The following variables, which represent driving factors for land use change in relation with trunk infrastructure provision and which can be supplemented with spatial data, will constitute the model input:

- natural conditions (e.g. slope, terrain roughness, proximity to river, land cover);
- accessibility (e.g. potential accessibility to population, walking distance to next public transport stop, distance to CBD, distance to next (tarmac) road);
- access to water supply (distance to water main, kiosk, next well);
- cell neighbourhood (land-uses in cell neighbourhood);
A special feature of CA type models is the consideration of so-called neighbourhood effects. This enables the simulation of spatial diffusion processes which can be observed in many growing urban environments. It also supplements for some part of knowledge gap associated with the micro motives of urban settlers concerning certain agglomeration advantages they are seeking i.e. people settling close to others particularly due to social and family relations (which is also underpinned by the outcomes of the surveys carried out).

Once all input variables for the model have been made operational, emphasis will shift towards model calibration. This step will constitute the base for the subsequent testing of planning and policy scenarios with the purpose to identify options for a policy of co-ordinated utility supply and land-use planning and for the identification of likely economic trade-offs. It is expected that the rational and the structure of the model can also be applied in other rapidly growing agglomerations in sub-Saharan Africa.

2 The role of infrastructure supply in the allocation decisions of informal settlers

The guiding proposition that the allocation of informal settlements is influenced by the supply of trunk infrastructure had to be corroborated by an analysis of the perceptions and allocation preferences of the settlers themselves. Detailed field surveys were, therefore, conducted in three settlements in the periphery of Dar es Salaam which exhibit inherent potentials for rapid urban growth.

The main objectives of the survey were to

- analyse the decision making processes during settlement development regarding especially the role of infrastructure supply;
- understand why households acquired land in a particular settlement;
- investigate how the availability of services influenced allocation decisions;
- explore the interlinkages between infrastructure supply and settlement development.

The survey applied household questionnaires and focus group discussions with plot owners, water committees, youth groups, elderly people and settlement leaders. Preliminary findings indicate that during the initial phase of settlement development the availability of technical infrastructure does play an important role. For one out of three settlers this was a critical criterion (Fig. 7). Among the various utilities, water supply and access to roads and transport as well as affordable land prices are of outstanding importance (Fig. 8). Later on in the consolidation phase a clean environment and the availability of social infrastructure evolve as the lead determinants of settlement development.

The informal settlers in the urban periphery are also willing to contribute to missing services, not only in labour and cash, but also in land (Table 1). This finding supports the proposition that a potential for self-help and social regulation can be tapped in order to fill the gap which the resource starved public authorities leave open.
Figure 7: Importance of infrastructure supply for the allocation decision of informal settlers

“Did the availability of services influence your decision to live here?”

Figure 8: Importance of utilities for the decision to buy a plot

“Which services would you consider to be important if you bought a plot?”

(settlement of Stakishari)

Source: Basteck, 2007

Table 1: Willingness to contribute to missing services (settlement of Stakishari)

<table>
<thead>
<tr>
<th>Service</th>
<th>Young settlers</th>
<th>Elders</th>
<th>Landowners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>labour and cash</td>
<td>labour and cash</td>
<td>land</td>
</tr>
<tr>
<td>Electricity</td>
<td>labour and cash</td>
<td>land and material</td>
<td>land</td>
</tr>
<tr>
<td>Road</td>
<td>labour</td>
<td>land and labour</td>
<td>land and cash</td>
</tr>
<tr>
<td>Drainage</td>
<td>labour</td>
<td>land and labour</td>
<td>none, task of govt.</td>
</tr>
<tr>
<td>Sanitation</td>
<td>labour</td>
<td>labour</td>
<td>n.a.</td>
</tr>
<tr>
<td>Solid waste man.</td>
<td>labour</td>
<td>labour</td>
<td>n.a.</td>
</tr>
<tr>
<td>Health services</td>
<td>labour and cash</td>
<td>n.a.</td>
<td>labour and cash</td>
</tr>
</tbody>
</table>

Source: Basteck, 2007

3 Disjointed provision of utilities

The general observation that there is little co-ordination between utility providers and with urban planning authorities could be tested with experts with representatives of the central and local government and with utility providers.

The interviews revealed weak interagency linkages and the ensuing negative impacts on urban development in Dar es Salaam. Among the different actors involved in the urban development process, only loose mechanisms for mutual information are in place. It was observed that each
agency is following its own agenda without considering benefits accruing from intersectoral co-operation. The City Council has not yet managed to implement a strategic planning approach coordinating utility provision and urban growth regulation. Furthermore, it was emphasised that utility agencies provide their services responding to demand, while the availability of services is ranking very high in the allocation decision of settlers. Water and energy services are only supplied in a certain area after a sufficient threshold of residents have already settled in order to ensure adequate returns. The informal settlers, on the other hand, wait for the suppliers before acquiring a plot. Together with the prevailing weak urban development control, this urban management deficit causes uncoordinated and uneven service provision and high unit costs for utilities. Urban development does not go in hand with infrastructure extension.

Some statements underline the grave co-ordination deficit:

“Normally we give plans for new developments in planning areas to the utilities. But we have the problem that services are outsourced, so they want to maximise their profits. They need an immediate profit. So they follow the demand that they can get their profit. There, automatically people will demand for the services and will be taken.” (a municipal planner)

“We can not sit down and plan together with other utility agencies. Each agency looks how to make their own profits and do not care about joint planning. They have different priorities and instruments to absorb their interests.” (a utility manager)

“We never meet with town planners, engineers, land surveyors, land officers to plan for the development of an area. Each individual does his or her assigned tasks… The utility agencies go with the demand of the people. That means people must go to an area, then services like electricity, water and telephone will follow. That is the current situation.” (a municipal engineer)

“Urban development is not controlled by any organisation. People develop in any part of the city according to their will and needs. As a result, development does not go in hand with infrastructure extension. This is due to a lack of strong co-ordination between infrastructure stakeholders. Each stakeholder has its own plans and tries to make profit. So it happens that DAWASA is doing projects in the north, while energy supply is extended to the south. Furthermore, stakeholders follow the demand. They do not go to areas where people are not yet living; they just go to areas where they can make money.” (a utility manager)

Potable water is an amenity which clearly demonstrates the problems ensuing from disjoint utility provision and land use planning. While a reliable water supply top in the informal settlers’ set of priorities, piped water cannot be provided to the many new settlements because of a syndrome of reasons which can be related to management deficits of the utility provider and the municipal planning authorities: the supply generated from the water plants is insufficient, but one third is already lost within the system. Affluent consumers tap the water mains illegally causing additional losses (Fig. 9), while less affluent households (and small scale enterprises) have to buy water at excessive prices from street vendors - the poor pay more. New settlers very often do not know if their site will ever be serviced because there are no plans. The utility provider, on the other hand, cannot make use of economies of scale in extending the network because the direction of future urban growth is not reliably fixed.
IV. THE WAY FORWARD

Problem pressure is high enough to support activities towards improved co-ordination between utility providers and with urban planning authorities. The research group has become a catalyst facilitating round tables for stakeholders. In several meetings and workshops the clarification of interests and positions and the exchange of experience created a common platform which is already being used to negotiate common policies.

The multitude of activities and projects which have been and are being conducted in infrastructure provision, urban land management and housing has surprised many participants, but even more so the low level of mutual exchange and information. The high reliance on external funding is often presented as one explanation, but the need for improved co-operation has become a common issue.

One important outcome of the joint discussion process is an improved understanding of the informal housing sector and a growing awareness of the potentials of social regulation in informal settlements. It goes along with new ideas about a more productive division of labour between the public, the private and the civil society sectors in urban development and servicing.

The way forward will see intensive discussions about the likely effect of improved services on land values which could drive poor land seekers further out into the urban periphery where the provision of utilities would be prohibitive. Will it be possible to strike a functional balance between the demand for cheap building land and the need to provide the option for later servicing? The concept of incremental development is not easily accepted by urban engineers and utility managers. The core group of stakeholders which is pushing the discussion process...
has, however, already agreed to support a pilot study for the guided development of a newly emerging informal settlement in the urban periphery of Dar es Salaam.

V. BIBLIOGRAPHY


