Growth of Urban Agglomeration Nodes in Eastern Africa

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ABSTRACT The future of urbanization points to increasing agglomeration forces through which towns and cities merge into huge continuously built up areas with variations in the diversity of economic activity. This paper reports the results of a study of urban agglomeration trends in Eastern Africa and the implications for urban policy and planning. Based on secondary statistics on urbanization and on the mapping of urban sprawl of the largest cities, recent population size and growth projections are configured to generate areas of potential intense population convergence where these centers will grow and merge into urban agglomerations. The results indicate spatial expansion that eventually will see the merger of smaller towns within a 50± kilometer radius of the city, growth computations predict that huge chunks of territory in the region will still be supporting a large non-urbanized population; doubts as to the soundness of current urban planning approaches which are built on a public administration platform, and that distortions in the rural-urban interface create doubts about long term planning for economic growth. The findings point to the need to review and restructure urban policy and planning.

INTRODUCTION

Eastern Africa is experiencing one of the fastest urban growth rates ever seen in the recent past. This growth, however, appears to be concentrated in traditional primate cities with the rest of smaller towns and secondary centers showing limited structural and functional changes (UNO 2010; Fox 2012). Urban centers dot the African landscape and their growth projections may be understood in the context of location and the ability for generating agglomeration forces (Krugman and Venables 1990; Rosenthal and Strange 2010; Ruhiiga 2011a). Today, there are only five cities with a population of over one million people. With the exception of Djibouti at 87%, the rest show generally low levels of urbanization in the region ranging from 14% in Uganda, 17% in Ethiopia, 10% in Burundi to 22% in Kenya (UNO 2010). While Potts (2012a, 2012b) believes that rapid urbanisation across Africa is a myth, there are indications that towns and cities are expanding at variable rates but simultaneously diversifying the range, content, sophistication of their economic base and the linkages in terms of participation in information flows (Ruhiiga 2002a). There is a tendency for technology, capital, knowledge generation, entrepreneurship and labour to be attracted to particular nodes in space (Florida 2002; Mbeu et al. 2012). The responses of the owners of capital through investment (Wadell 2002; Ruhiiga 2002b) drives the urban economy.

A significant volume of research literature on spatial association (Anselin 1995) agglomeration and dispersion is reported in Krugman (1991a), Venables (1994,1998), Krugman and Venables (1990), Rosenthal and Strange (2010). Agglomeration and dispersion forces are critical in understanding firms, inter-firm relations and location of manufacturing (Ruhiiga 2002a) but also several components of the urbanisation process. But the traditional dominance of location studies and the choices that result in such locations have been centered on understanding industrial activity in the context of transportation costs, labour mobility, changing technology and policy. Limited work has been done in understanding the role of agglomeration and dispersion forces in the growth of cities. With the increasing impact of the information, communications and technology (ICT) revolution (Geenhuizen and Nijkamp 2011), the central role of physical location as a control on agglomeration and dispersion tendencies is questioned. Geographic proximity can be a physical, social and or a time concept. Cities are seen as agglomerations of economic activities based on advantages of proximity. They provide advantages of knowledge spillover effects and workers in the knowledge economy (Acs 2000; Rutherford 2010). The concentration of activities close to each other minimizes cost overheads and eliminates physical distance. Spatial concentration of activities increases the opportunities for in-

teraction and knowledge transfer, and the resulting spillover effects reduce the cost of obtaining and processing information. In addition, workers preferably interact with each other in agglomerated environments to reduce interaction costs, and they are more productive in such environments (Florida 2002). Accordingly, urban areas are the cradle of new and innovative industries (Geenhuizen and Nijkamp 2011).

Research Problem

To date, no research work has been carried out in Eastern Africa on the growth of towns and cities into urban agglomerations and the implications of such growth on urban planning. It is important to test the extent to which the location of towns and cities in Eastern Africa come close to achieving agglomeration clustering because this has immediate policy and planning implication for the future of urbanization. The thrust of the study is justified given that the dominant interest of contemporary literature on Eastern Africa has been a focus on the environmental implication of urbanisation and on the changing socio-economic profile of households. The persistent separation between urban, urban-rural fringe and rural as geographical demarcations with distinct boundaries, needs to be reviewed. The same applies to the dilemma of determining a standard operational conceptualization of the urban context, in terms of population and the dominant methods of production.

Purpose and Objectives

The purpose of this study was to measure the growth of potential agglomeration clusters. Four objectives are advanced to address this purpose: (i) to present location patterns of regional centers as at the end of 2010, (ii) to use existing statistics on urbanization to generate growth trends for the period up to 2030, (iii) to identify and configure potential urban clusters in Eastern Africa based on growth trends and finally, (iv) to comment on the implications for urban policy and planning. In terms of structure, Part 2 covers the methods of investigation. In Sections 3, 4 and 5, results and discussion, conclusion and recommendations follow respectively.
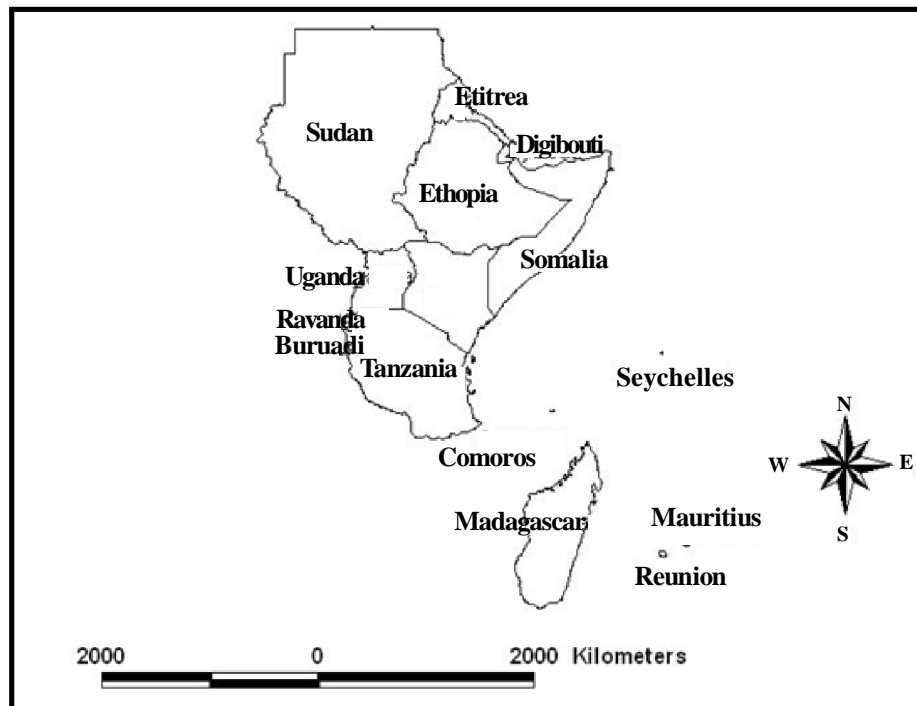
Fig. 1. Eastern Africa
Source: Author

MATERIALS AND METHODS

Eastern Africa as reported here is made up of the following countries: Uganda, Rwanda, Burundi, South Sudan, Eritrea, Ethiopia, Djibouti, Sudan, Somalia, Kenya, Tanzania, Comoros, Mauritius, Madagascar, Mayotte and Seychelles (see Fig. 1). The research design is built around the use of quantitative data sources extracted from official documents- on population, urban growth trends since 1980 and growth projections for the period 2010-2050. Table 1 presents comparative data on urbanization trends in Eastern Africa and in Africa as a whole while Table 2 presents population growth rates. Identification of towns in close proximity to the main city is done using survey maps of urban areas on a scale of 1: 50 000. Population data is analyzed using official growth trends and frequency distributions are computed.

An adjustment factor is inserted into the final population estimate for 2030 assuming that higher rates than official statistics are possible. Five cities and towns falling within a 50 kilometer radii of the main city are included in the final demarcation of agglomeration clusters of the future.

RESULTS AND DISCUSSION

Distribution Patterns

The results are presented in terms of the objectives set in Section 1 of this paper. The first part presents location and growth patterns of cities as at the end of 2010. The small number of cities with a population of over 200 000 people is noted as well as the dominance of the primate city structure. The data for this paper only covers Addis Ababa, Kampala, Nairobi, Dar es Salaam, and Antananarivo (see Fig. 1). Trends for other large urban centres- Khartoum-Omdurman (Sudan), Juba (South Sudan), Mogadishu (Somalia), Kigali (Rwanda) and Bujumbura (Burundi) are not computed but remarks still cover the entire region. It is natural therefore that these are the centers that show evidence of the emergence of agglomeration tendencies in time and space.

Growth Trends -2010-2050

Several drivers are noted for the expansion of these cities. Developments in Nairobi, Addis Ababa, Dar es Salaam and Antananarivo follow the same trend. This is a common feature of urbanisation in many developing countries: the process is driven not by an industrial-agricultural revolution as occurred in the western city, but by the changing structure of the demographic profile (Fox 2012) that fuels massive rural-to-urban migrations without a corresponding expansion in the urban economy's capacity for creating enterprises and employment.

A second force that persists in all the major cities is the role of the existing road and rail infrastructure linkages. In all cases, rapid growth of built up area conform to a ribbon pattern along

Table 1: Urbanisation Trends in Eastern Africa and Africa

	1980	1990	2000	2007	2010	2020	2030
Total in 000's	114 366	155 635	204 370	257 267	268 050	343 372	432 359
Urban in 000's	15 338	25 159	38 111	52 628	57 343	87 343	131 765
Urban as %	13.4	16.2	18.4	20.5	21.4	25.4	30.5
Africa Urban pop %	27.9	32.0	35.7	3.7	39.9	44.6	50.0

Source: http:books.google.co.za.

Table 2: Population growth rates 1980-2030

| Growth Rates %	1980 1985	1985 1990	1990 1995	1995 2000	2000 2005	2005 2010	2010 2015	2015 2020	2020 2025	2025 2030
Africa	2.89	2.79	2.61	2.45	2.32	2.25	2.15	2.01	1.85	1.71
EA	2.98	3.04	2.57	2.75	2.57	2.54	2.43	2.26	2.06	1.89
Urban Africa	4.3	4.16	3.87	3.52	3.38	3.31	3.23	3.12	3.0	2.87
Urban EA	4.98	4.97	4.23	4.01	3.87	3.92	3.96	3.97	3.91	3.81

Source: UN-HABITAT, 2008; World Urbanisation Prospects, 2007 Revision; Habitat: Nairobi, Kenya

the main highways into the city such that the resulting shapes are already more or less predetermined. In Antananarivo, the spatial expansion is towards the south, south west, north and north east. In Kampala expansion is towards the north, west and east while to the south, the presence of Lake Victoria restricts expansion (Fig. 2). In Addis Ababa the four major highways from the north (Asmara), south east towards Debre Zeit, north- west and west form the fastest growth arteries (Fig. 3). In Dar es Salaam current growth trends show a concentration to the west and to the north (Fig. 4). In Nairobi, the road network that links the city to a series of small towns to the east, north and east has facilitated spatial expansion along these link roads.

A significant volume of research literature dominates discourse on economic growth and urbanization (Waddell 2002; Ruhiiga 2006, 2011b; Witten et al. 2003; Satterthwaite et al. 2002) in developing countries and on Sub-Saharan Africa proper. But consistent in this literature is the dominance of interest on forces of growth, trends in urbanization (Alaci 2010), problems of growth, challenges of rapid urbanization (Olujimi 2009; Parnell and Walawege 2010; Agunbiade et al. 2012), problems of housing the poor (Mafikudze and Hoosen 2009), the impact of the informal

Fig. 2. Kampala, Uganda
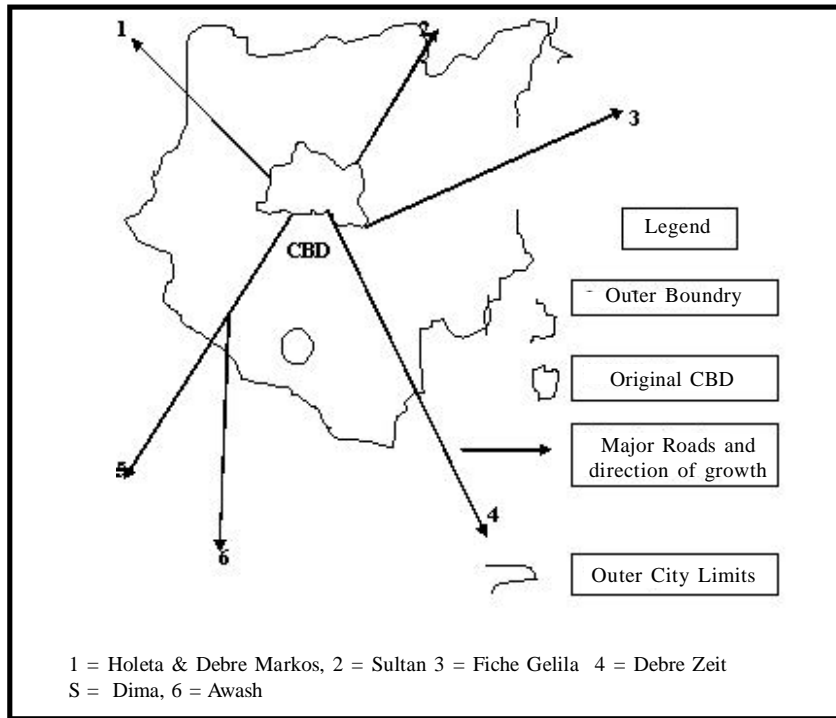*Source:* Author

sector and the informalisation of trade in Sub-Saharan Africa (ADB 2010). Studies of urban location in Eastern Africa and the limitations of such location remain limited. Yet, the fortunes of a central place are linked to the identity of its location. Location then becomes an absolute and relative concept; the former provides precise point location parameters ideal for GPS systems while the latter carries with it connotations of accessibility (Ruhiiga 2000), connectivity, local linkages, resources and attractiveness (Ruhiiga 2011c). It is in the latter medium that location is housed because, here, the possibilities for modeling growth (Ligman-Zielinska et al. 2005) become real.

The third feature is that the presence of small towns within close proximity means that continued growth is seeing these disappear into the equivalent of satellite cities of the main city. But these are different from 'satellite cities' reported in Salim (2012) adjacent to Nairobi (Konza, Tatu) and adjacent to Dar es Salaam (Kalungulu, Kigamboni) which are essentially urban enclaves for the elite. Simultaneously, rural farmland on the urban fringe around the main city and around these smaller towns is gradually being urbanized such that the actual boundaries of the original city become indistinguishable. Nairobi and Kampala show the best example of this development. Fourth, distortions in the urban land market that arise due to conflicting tenure rights mean that a significant percent of the urban middle class and new immigrants to the city cannot afford existing housing stock. The pricing system has taken them out of competition. The fifth concern deals with the attraction to the existing road network into these cities which means that planning, state policy and a rudimentary urban land market are unable to control urban development today. This has led to the growth of unplanned settlements, serious environmental degradation, the disappearance of wetlands- as in Kampala; the encroachment of urban agriculture- as in Nairobi, Addis Ababa, Kampala and Dar es Salaam and, serious backlogs in the provision of basic services as in Addis Ababa and Antananarivo. These conditions raise questions of sustainability of the urban future (Smit and Parnell 2012). But this scenario may hide stark differences in levels of services and infrastructure between different parts of the same city. Across the five cities, the best provided state of services and infrastructure corresponds-
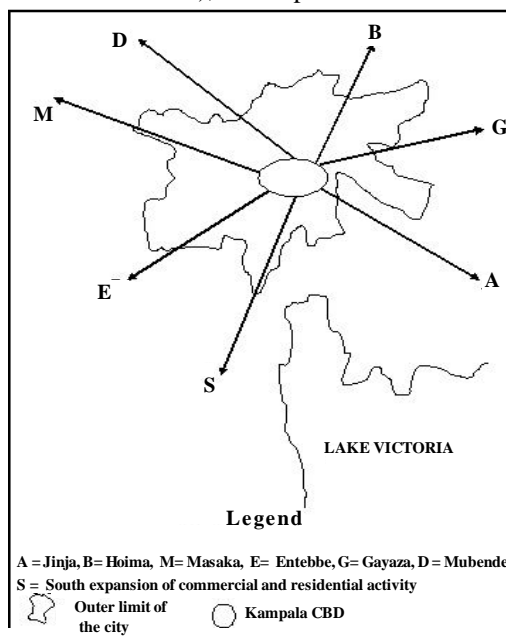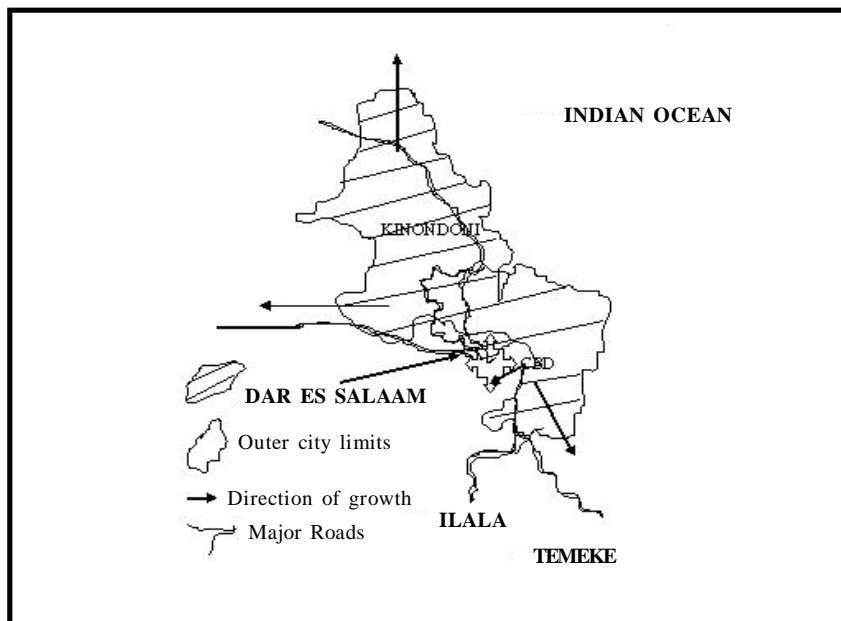
Fig. 3. Addis Ababa, Ethiopia
Source: Author

Fig. 4. Dar es Salaam, Tanzania
Source: Author

without exception- to the older planned parts of the city.

Agglomeration Nodes

The third objective centes on the use of existing statistics on urbanization to generate growth trends for the period up to 2050. Separate statistics are not yet available for South Sudan, which became a separate state in July 2011 but already, Juba has registered explosive growth rate only comparable to Kigali in the last five years. Population growth rates for Eastern Africa, according to Table 3, are consistently higher than for Africa as a whole but aggregation of individual data sets tends to mask individual variations between countries within the region. Falk (2012) reports that of the projected top 20 fastest growing cities in the world in the period 2010-2025, five of them are located in East Africa. These are Kampala (Uganda) at 99.5%, Dar es Salaam (Tanzania) at 85.2%, Kigali (Rwanda) at 79.9%, Mombasa at 79% and Nairobi 77.3% both in Kenya. Such a booming population in Eastern Africa would appear to indicate a lower stage of the region in terms of the demographic transition model and the fact that urbanization has been at a slower rate than in the rest of the continent. See for example Table 2, where even by 2030, only 30.5% of the population will be urbanized compared to 50% for the continent. In Table 4, the population size as of mid year 2011 is computed and growth trends compared to generalized data for the region in Tables 2 and 3. The deviation between the individual growth rate of the city in each of the five countries is computed by comparing with the mean for the whole region as of the period 2010-2015 at 3.96%.

Table 3: Eastern Africa: Current urban population estimates as of mid 2011

City	Country	Population 2011	Growth rate 2010-2015	Deviation 2011
Addis Ababa	Ethiopia	2 979 100	2.92	-1.04
Kampala	Uganda	1 659 600	4.2	+0.24
Nairobi	Kenya	3 303 132	3.5	-0.46
Antananarivo	Madagascar	2 159 897	1.96	-2.0
Da es Salaam	Tanzania	3 131700	4.39	+0.43
			3.38	

Source: source data from http://www. internet world stats.com/africa.htm.

A closer scrutiny of the statistics and the computations generated in Table 4 indicates the variation in growth rates for individual cities for the period 2010-2015.

The mean score of 3.38% is lower than the overall score of 3.96 % in Table 3 showing that regional and secondary towns are growing often at higher rates than the largest cities. In the last column of Table 4, only Kampala and Dar es Salaam register growth rates higher than the mean for the region as a whole. This shows that growth trends for Antananarivo, Nairobi and Addis Ababa indicate stabilization. A finding that concurs with Potts (2012a) who reports similar trends in parts of sub-Saharan Africa. For each of the five cities, a set of towns within close proximity is identified that will eventually constitute an agglomeration node around the original city. These appear in Table 4, Column 3. Thereafter, for each of these towns, statistics on population size available from secondary sources is used to sum their population which in turn is subjected to a growth projection in line with information in Table 3. The resulting individual sums are added to the population projection of the main city to generate consolidated values for 2015, 2020, 2025 and 2030. In Table 3, mean growth figures for urban Eastern Africa are used instead of individual rates in column 4 of Table 4. The final population in 2030 is a projection based on these generalized growth rates.

It is noted that using these conservative estimates, Nairobi will be the largest agglomeration in 2030. But other estimates indicate that Dar es Salaam which is growing at a higher rate of 4.39%, (see Table 4), will have overtaken Nairobi. Note that computations of growth are based on established rates in Table 3. The values for 2030 appearing in brackets indicate the use of a variable adjustment factor that takes into account the possibility that smaller towns merging with the main city may be growing at higher rates.

Bosker et al. (2007) reports that the seminal paper by Krugman (1991) gave rise to what became known as the new economic geography literature, where the 'new' refers to the fact that the spatial distribution of population, production and consumption emerges endogenously from full general equilibrium models (Fujita et al. 1999a; Helpman 1998; Krugman and Venables 1995). Any particular spatial distribution of economic agents goes along with spreading and

Table 4: Potential Urban Growth Clusters (UGC) within a 50 km radius of the largest city

Country	Region	Urban Centres	Population Projections[1]				
			2011	*2015*	*2020*	*2025*	*2030*
Ethiopia	Addis Ababa Axis (AAA)	Addis Ababa,	2979 100	3450 989	4 136 010	4 944 600	5 886 546 (5933520)
Kenya	Kenya central cluster (KCC)	Nairobi, Thika, Limuru,	3303 132	3826 348	4 585 878	5 482 417	6 526 817 (6578900)
Uganda	Uganda central corridor (UCC)	Entebbe, Kampala, Mukono, Nansana	1879 700	2177 444	2 609 666	3 119 856	3 714 189 (4531653)
Tanzania	Dar es Salaam corridor (DSC)	Dar es Salaam, Temeke, Kinondoni	131 700	3627 761	4 347 872	5 197 880	6 188 0763 (7747440)
Madagascar	Antananarivo	Antana-narivo cluster (ATC) and all towns] within the Antana-narivo province	2159 897	2502 024	2 991 170	3 575 944	4 257 161 (4972350)

Source: Author

agglomeration forces and their interplay determines whether or not agents move to another region. These theoretical models are able to give predictions about the effect of a change in these spreading or agglomeration forces (Fujita and Thisse 2002). These predictions are, however, typically based on models that treat geography in a very simple way. Attention is largely confined to simple 2-region models or multi-region models exhibiting a uni-dimensional spatial structure (Fujita et al. 1999; Tabuchi et al. 2005). The agglomeration forces arise from pecuniary externalities due to a combination of love of variety preferences, increasing returns to scale and transport costs. The dispersion forces arise from product market competition and geographically immobile factors of production. The relative strength of these two sets of forces depends on transportation costs, so that changes in transportation costs result in endogenous changes in the distribution of economic activity across space (Redding 2009). Note that some of the findings reported here depart from this theoretical base because understanding the growth of urban agglomeration nodes in Eastern Africa

requires inputs that go beyond simple transportation costs. This is especially so given that urbanisation is a global historical process (Fox 2012).

The modeling of agglomeration behaviuor (Krugell and Rankin 2012; Doroshi and Thurlow 2012) has in the past seen the use of discrete choice -especially logit models- to allocate households and firms across space. These models assume that households and firms derive some utility from locational and non-locational attributes characterizing the grids. The model allocates land uses so as to maximize utility, subject to capacity constraints.This means that proportionality constants are derived that are interpreted in terms of a bidding process. Examples of such models are reported in Waddell (2002) and Bretagnolle et al. (2003). The second approach centers on cellular automata which has been developed for modeling a wide range of spatial dynamics and urban growth. These models are grid-based and simulate land use dynamics by applying a set of rules that regulate changes (White and Engelen 1993). The underlying

assumption is that change in land use in any particular cell is a function of land-use specific distance decay functions. Agglomeration patterns are the results of the land allocation simulation, not one of the forces that drive the allocation. At best, agglomeration forces are taken into account by including the proximity of other activities in utility functions of location alternatives (Waddell 2002). Cellular automata models do incorporate the links between land uses but are weak because they simulate the relationship between cells/land use, not the locational decision making of firms and households and their interaction (Arentze and Timmermans 2002). Bura et al. (1996) used a multi-agent approach to model the evolution of a settlement system over a period of 2000 years. Ligtenberg et al. (2004) proposed a model of land-use change combining a multi-agent system and cellular-automata type of model. Given that this paper deals with agglomeration nodes in the context of urbanisation as a population change process, it is necessary to appreciate why modeling efforts often fall short of expectations. The bulk of such models focus on the dynamics of economic activity in space driven by decisions by households and firms.

Urban Policy and Planning

The last objective is to comment briefly on the impact of these generated growth scenarios for both urban planning and management. In light of the growth projections made in this paper, it is appropriate to relate urban policy to these projections in order to critique the mismatch that is apparent. Underlying this approach is the view that given these projections, it may not be sound planning and policy to persist in traditional city planning, inherited from the colonial past- a position that agrees with Ruhiiga (2011b). Dar es Salaam, for example is now an administrative region, similar to other provinces in the country. The same is true for Addis Ababa, Nairobi, and Antananarivo. Kampala, on the other hand is a district with special city status; but this classification into administrative units has not necessarily spread into the management of cities in Eastern Africa as such and they are run on the same old-style administrative paradigm. This creates bottlenecks in the ability to manage rapid change. If urban areas show evidence of converging into agglomeration nodes, a process the state may be powerless to stop, redirect or control, then policy and planning should use urban clusters as a starting point if such interventions are to remain relevant today and in the future. Such an approach calls for a reconfiguration of boundaries to include all those towns likely to be merged into the existing city so that planning becomes targeted. At a second level, adherence to a long term urban plan makes it possible to envisage the allocation of financial resources in meeting the demands of services and infrastructure for a growing population. Today, these cities are growing beyond the planning capacity of local city councils which appear incapable of imposing that order that arise only when institutions in place have the support of the necessary political will (UN-Habitat 2010) to enforce adherence; a finding comparable to Salim (2012). It makes sense therefore for the demarcation of the potential urban clusters on the ground and a radical paradigm shift in the scale of planning so that there is a move away from single city planning to planning for urbanized spaces of the future. Only through such a shift will it be possible to achieve a more rational allocation of resources necessary to upgrade services, infrastructure and address simultaneously backlogs that have accumulated over decades of under-funding of urban development in general.

CONCLUSION

The future of urbanization in Eastern Africa points to increasing agglomeration forces through which towns and cities merge into huge continuously built up areas with variations in levels and diversity of growth. The findings of this study indicate that the five largest primate cities will retain their position in the urban hierarchy of individual countries but continued spatial expansion will witness the merger with surrounding smaller towns along existing road networks. These developments have direct implications for both urban policy and planning which today appear hopelessly mismatched with growth trends and increasing demand on the provision of infrastructure and services.

RECOMMENDATIONS

It is recommended that there should be a shift in urban policy so that planning targets the re-

configuration of urban regions (agglomerations) rather than single cities. This may offer a more flexible and interactive intervention in attempts at imposing control over the development of urban areas. The second recommendation is that the separation of rural, rural-urban-fringe and rural proper in regional planning should be re-visited given that the critical criterion for such separation remains dubious and debatable. Thirdly, long term urban planning should be informed by a reliable database of population statistics; without which, the urbanisation process will continue generating developments completely outside the scope of current planning.

REFERENCES

Acs 2000. *Regional Innovation, Knowledge and Global Change*. London: Pinter Publishers.

ADB 2010. Infrastructure Deficit and Opportunities in Africa. *Economic Brief,* Volume1, Issue September, 2010.

Agunbiade ME, Rajabifard A, Benett R 2012. The dynamics of city growth and the impact on urban land policies in developing countries. *International Journal of Sustainable Development*, 4(2): 146-165.

Alaci DSA 2010. Regulating urbanisation in Sub-Sahara Africa through luster settlements: Lessons for urban managers in Ethiopia. *Theoretical and Empirical Researches in Urban Management,* 5(14): 20-34.

Anselin L 1995. Local Indicators of Spatial Association – LISA. *Geographical Analysis*, 27(2): 93 - 115.

Arentze T, Timmermans H 2002. Modeling the formation of activity agendas using reactive agents. *Environment and Planning B: Planning and Design*, 29(5): 719 – 728.

Bosker M, Brakman S, Garretsen H, Schramm M 2007. Looking for multiple equilibria when geography matters: German city growth and the WWII shock. *Journal of Urban Economics,* 61(1): 152-169.

Bretagnolle Anne , Pumain D, Daudé et Denise E 2003. From Theory to Modelling: Urban Systems as Complex Systems. *Paper presented at the 13th European Colloquium on Theoretical and Quantitative Geography,* Lucca (Italy), 5-9 September 2003.

Bura S F, Gurin-Pace, Pumain D, Sanders L 1996. Multi-agents systems and the dynamics of a settlement system. *Geographcal Analysis*, 28(2): 161-172.

Dorosh P, Thurlow J 2012. Agglomerations, growth and regional equity : Analysis of agriculture-versus urban-led development in Uganda. *Journal of African Economies*, 21(1): 94-123.

Falk T 2012. How Satellite Cities are Reshaping East Africa. From <http://www.theatlanticcities.com/neighborhoods> (Retrieved January 21, 2013).

Fischer DT, Church R 2003. Clustering and compactness in Reserve site selection: An extension of the biodiversity management area selection model. *Forest Science*, 49(4):1-11.

Fox D 2012. Urbanisation as a global historical process: Theory and evidence from Sub-Saharan Africa. *Population and Development Review*, 38(2): 285-310.

Fujita M, Krugman P, Venables AJ 1999. *The Spatial Economy*. Cambridge, MA: MIT Press.

Fujita M, Thisse J 2002. *Economics of Agglomeration: Cities, Industrial Location and Regional Growth*. Cambridge: Cambridge University Press.

Krugell W, Rankin N 2012. Agglomeration and firm-level efficiency in South Africa. *Urban Forum*, 23(3):299-318.

Krugman P 1991. Increasing returns and economic geography. *Journal of Political Economy,* 99(31): 483–499.

Krugman P, Venables A 1990. Integration and the competitiveness of the peripheral industry. In: C Bliss, J Braga de Macedo (Eds.): *Unity and Diversity in the European Economy: The Community's Southern Frontier.* Cambridge, Cambridge University Press, pp. 56 – 77.

Ligman-Zielinska A, Church R, Jankowski P 2005. Sustainable Urban Land Use Allocation with Spatial Optimization. *8th ICA Workshop on Generalisation and Multiple Representation,* A Coruna, July 7-8th, 2005

Ligtenberg A, Wachowicz M, Bregt AK, Beulens A, Kettenis DL 2004. A design and application of a multi-agent system for simulation of multi-actor spatial planning. *Journal of Environmental Management,* 72(1-2): 43-55.

Mafikudze JK, Hoosen F 2009. Housing shortages in South Africa: A discussion of the after-effects of community participation in housing provision in Diepkloof**.** *Urban Forum*, 20(4): 379-396.

Mbeu BU, Eze H, Chepngeno-Langat G, Kiman J, Oti S, Beguy D 2012. Family ties and urban-rural linkages among older migrants in Nairobi informal settlements. *Population, Space and Place,* DOI:10.1002/psp.1711.

Nhlapo MS, Kasumba H, Ruhiiga TM 2011. Challenges in the growth of homeland towns in post-apartheid South Africa. *Journal of Social Sciences*, 29(1): 47-56.

Olujimi J 2009. Evolving a planning strategy for managing urban sprawl in Nigeria. *Journal of Human Ecology,* 25(3): 201-208.

Parnell S, Walawege R 2011. Sub-Saharan African urbanisation and global environmental change. *Global Environmental Change*, 21(SI): 12-20.

Potts D 2012a. Viewpoint: What do we know about urbanisation in sub-Saharan Africa and does it matter? *International Development Planning Review*, 34(1) DOI:10.3828/idpr.

Potts D 2012b. Challenging the myth of urban urban dynamics in Sub-Saharan Africa: The evidence from Nigeria. *World Development*, 40(7): 1382-1393.

Redding SJ 2009. Economic Geography: A Review of the Theoretical and Empirical Literature. *CEP Discussion Paper No 7126,* January 2009. London: Centre for Economic Policy Research.

Rosenthal SS, Strange WC 2001. The determinants of agglomeration. *Journal of Urban Economics,* 50**:** 191-229.

Ruhiiga TM 2000. Rural settlement and retail trade business in the Eastern Cape. *Development Southern Africa,* 17(2): 189-200.

Ruhiiga TM 2002. Modeling accelerated business growth. *Southern Africa Business Review,* 6(1): 31-37

Ruhiiga TM 2006. Strategies for Managing Obstacles to Entrepreneurship Growth in Africa. *11ᵗʰ Annual International Management Conference, Theme: The New Economy and Poverty Alleviation-Challenges for Africa's Economic Growth and Development*, Imperial Beach Hotel, Entebbe, Uganda, March 28ᵗʰ-31ˢᵗ, 2006.

Ruhiiga TM 2011a. Settlement and energy access in rural Sub-Saharan Africa. *Journal of Life Science,* 8(S1): 46-53.

Ruhiiga TM 2011b. Settlement, location and rural production: A configuration for growth in Sub-Saharan Africa. *Journal of Life Science*, 8(S1): 140-146.

Ruhiiga TM 2011c. Land reform and rural poverty in South Africa. *Journal of Social Science*, 29(1): 29-38.

Salim A 2012. *Satellite Cities: Is this the Future of East Africa's Urbanisation?* Nairobi: Society for International Development (SID).

Satterthwaite D, McGranaham G, Tacoli C 2010. Urbanisation and its implication for food and farming. *Philosophical Transactions of the Royal Society,* B. 365(1554): 2809-2820.

Smit W, Parnell S 2012. Urban sustainability and human health: An African perspective. *Current Opinion in Environmental Sustainability*, 4(4): 443-450.

Tabuchi T 1998. Urban agglomeration and dispersion: A synthesis of Alonso and Krugman. *Journal of Urban Economics*, 44: 333-351.

UN-Habitat 2007. *Global Report on Human Settlement: Enhancing Urban Security and Safety.* London: Earthscan.

UN-Habitat 2011. *The State of Africa's Cities: Governance, Inequality and Urban Land Markets.* Nairobi: UN-HABITAT.

UNO 2010. *World Population Prospects the 2010 Revision.* New York: UNO.

Venables A 1994. Economic integration and industrial agglomeration. *The Economic and Social Review,* 26(1): 1 – 17.

Venables A 1998. The International Division of Industries: Clustering and Comparative Advantage in a Multi-Industry Model. *CEPR Discussion Paper No. 1961*, August

Waddell P 2002. UrbanSim: Modeling urban development for land use, transportation and environmental planning. *Journal of the American Planning Association*, 68(3): 297-314.

White R, Engelen G 1993. Cellular automata and fractal urban form: A cellular modelling approach to the evolution of urban land-use patterns. *Environment and Planning*, 25(80): 1175-1199.

Witten K, Exeter D, Field A 2003. The quality of urban environments: Mapping variation in access to community resources. *Urban Studies*, 40(1): 161-177.