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The urban infrastructure for sustainability: learning from Kigali

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Abstract

Until 2013, when a new master plan for the city was approved, Kigali had very few urban regulations in place. Incremental constructions, usually associated with informal urbanization, were the norm rather than the exception. Most of the city fabric grew organically creating a unique configuration of urban adjacencies, which would be improbable for planners and designers to imagine. This configuration is particular to the geographic, economic and social conditions of the city as incremental urbanization slowly adjusted to the living conditions, through the actions of thousands of city residents over a long period of time. These actions were formed in reaction to people, administrations, businesses, and occupations with an urge to sustain their presence in the city. In short, no document or design initiative can replicate the depth of information that the physical environment of these neighborhoods contains. This paper is a call for designers to mine the complex ways in which neighborhoods are produced in order to inform architectural and urban strategies that can be integrated within the spatial production of the city. In that sense, it is a call to rethink the way we identify and label indigenous organically developed low-income neighborhoods in order to describe them for what they are and not to dismiss them as "slums" waiting to be corrected, erased or healed. These neighborhoods lack adequate infrastructure, harbor unhealthy conditions, but they are also actively participating in the city's spatial production. In fall 2015, I worked with fifteen architecture students to develop interventions in low-income neighborhoods in Kigali by analyzing existing processes of production and implementing a process of change towards more sustainable living conditions. Using these academic experiments, archival research, multiple interviews and fieldwork in Kigali, I want to argue in this paper that sustainability in architectural practice needs to incorporate questions of urban infrastructure within the very specific contexts in which these practices are to be implemented.

THE URBAN INFRASTRUCTURE FOR SUSTAINABILITY:
LEARNING FROM KIGALI

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Nyabisindu neighborhood in Kigali Rwanda. Photo by author.

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1. Introduction

International agencies and governments often use indiscriminately the derogative term "slum" to refer to various informal, organic and indigenous settlements across the world. In spite many policies to prevent it, informal, organic and indigenous settlements have been exponentially growing since the mid twentieth century in many cities in the global South. Accordingly, it is becoming increasing urgent to develop policies that recognize this form of urbanization and acknowledge its spatial characteristics for future design strategies. After all, informal, organic and indigenous urbanization is increasing becoming the dominant form of city fabric in the world.

Reporting on the 2013 UN Habitat conference in Kigali, Peterson Tumwebaze of Kigali's newspaper The New Times wrote: "Lack of political will and poor public policy is the reason why more than a billion people still live in urban slums worldwide …. Dr Aisa Kirabo Kacyira, the deputy executive director of the United Nations Habitat, said that African countries risk creating more slum settlements unless proper governance is enforced."[1] However, Dr

Kacyira, herself, acknowledged in a 2014 UN-Habitat report that these neighborhoods were "formed in response to the unmet housing needs of low-income households."[2] The demand for low-income housing in cities is the result of consistent growth of urban population triggered by the relative concentration of wealth in these cities, which present more demand and opportunity for low-wage workers. In many locations, informal settlements accommodate workers (and activities) that can provide the needed services (or goods) for the city, which in turn does not provide a suitable real estate market to accommodate them. As such, these neighborhoods need to be regarded as part of the solution and not the problem. While informal, organic or indigenous settlements vary from one city/country/continent to another, designating them collectively as "slum" implies problematic conditions that need to be corrected. This enabled the term to become a political tool, which legitimized major interventions in these areas that lead in certain instances to a complete destruction of these neighborhoods. This may sound as an outdated story, but its repercussions are still evident in many cities around the world including Kigali city, Rwanda in which the city has been actively trying to regulate its rapid urbanization process.

Until 2013, when a new master plan for the city was approved, Kigali had very few urban regulations in place. Incremental constructions, usually associated with informal urbanization, were the norm rather than the exception. Most of the city fabric grew organically creating a unique configuration of urban adjacencies, which would be improbable for planners and designers to imagine. This configuration is particular to the geographic, economic and social conditions of the city as incremental urbanization slowly adjusted to the living conditions, through the actions of thousands of city residents over a long period of time. These actions were formed in reaction to people, administrations, businesses, and occupations with an urge to sustain their presence in the city.[3] In short, no document or design initiative can replicate the depth of information that the physical environment of these neighborhoods contains. This paper is a call for designers to mine the complex ways in which neighborhoods are produced in order to inform architectural and urban strategies that can be integrated within the spatial production of the city.[4] In that sense, it is a call to rethink the way we identify and label indigenous organically developed low-income neighborhoods in order to describe them for what they are and not to dismiss them as "slums" waiting to be corrected, erased or healed. These neighborhoods lack adequate infrastructure, harbor unhealthy conditions, but they are also actively participating in the city's spatial production. In fall 2015, I worked with fifteen architecture students to develop interventions in low-income neighborhoods in Kigali by analyzing existing processes of production and implementing a process of change towards more sustainable living conditions. Using these academic experiments, archival research, multiple interviews and fieldwork in Kigali, I want to argue in this paper that sustainability in architectural practice needs to incorporate questions of urban infrastructure within the very specific contexts in which these practices are to be implemented. In what follows, I will address the limitation of urban design practice by discussing the challenges that the city of Kigali is currently facing in the implementation of new urban regulations. I will then describe spatial production in Kigali to identify certain characteristics that substantiate sustainable urban living. I will conclude by articulating the possibility of expanding the practice of architectural design to engage urban infrastructure as a way to develop integrated design for sustainability.

2. Urban design practice and the global south

Looking at the master plan rendering of Kiyovu, the central hill of Kigali, it is obvious that the city does not look like itself. The business center is full of new shiny towers, the housing on the slope does not exist anymore and entertainment ponds replace the agricultural fields in the wetlands. As explained to me by city official, the master plan of Kigali includes three major hubs (financial, administrative and knowledge) that occupy three of the hilltops in the city, respectively.[5] Kigali master plan of 2013 won multiple awards, such as American Planning Association Award and UN Habitat Scroll Award.[6] These awards became one of the indicators that the country distinguished itself from the rest of the surrounding countries in East Africa.[7] This is particularly significant as design practice operates globally where ideas

may be tested in one environment and get implemented in another. Within the dynamics of urban design practice, urban regeneration strategies get standardized and globalized; more so when evaluated and awarded by professional and humanitarian agencies. In the process, these agencies are legitimizing their metrics of evaluation, which are hinged in many ways on coded categories: such as eradicating slums (which are very loosely defined), advancing controlled governance based on artificially created landuse boundaries, and identifying major centers for capital projects.[8] Following the master plan, and in an effort to align the city to the landuse boundaries of the plan, expropriation around Kiyuvu and Kimihurura started in 2011 and neighborhoods demolition was on its way in the early 2012.[9]

Even though the urban design strategies of the Kigali master plan are widely adopted in urban design practice, there is no guarantee that such strategies are sustainable within fragile economies. These strategies are expensive because they require new infrastructure and a network of roads, the series of capital projects may require partial or full privatization of development to cover its cost and an additional cost is required for expropriation of existing neighborhoods and the construction of new ones. Indeed, these strategies have been implemented with little success in many cities such as Cairo, Beirut and Lima to name a few. It is evident that these strategies were developed in accordance with strong economies and with a strong system of city governance. Rwanda seem to be doing well with the latter[10] but may face challenges similar to other cities when trying to finance the strategies of the master plan. For example, not being able to fund the construction and upgrading of all the roads needed to serve this new landuse distribution may end up in highly congested traffic throughout the city as people are trying to move from their relocated (far) neighborhoods to the center(s). Privatization of capital projects may result in a large economic gap that may lead to social conflicts. And finally neighborhood relocation and redistribution that replaces current organic distribution may result in the proliferation of uncontrolled informal urbanization as lower income workers try to find affordable living conditions close to their place of work, mainly around the financial, administrative and knowledge hubs.

Such is the contradiction of urban design, which segregates what seem to be interdependent activities in the city. Indeed, the Batsinda affordable housing project was designated as the destination for some of the evacuated neighborhood in the Kiyuvu-Kimihurura area. If the relocated families were employed in the business center in Kiyuvu, they would have been moved from being a walking distance from work (less than one kilometer) to being seven kilometers away, in a city that is mostly served by one lane two-way streets with a limited public transportation system. Based on my two visits to Batsinda low-income housing project, in June and November 2015, it is evident that the neighborhood is gentrifying very quickly as low-income dwellers identified a market for their properties. The owners are selling their newly acquired houses to middle income families who are transforming the highly efficient original building into a fenced-in villa with a garage for their private car. Batsinda housing is fulfilling a need for affordable housing for middle-income families but the original owners are possibly locating informally back closer to the center; their place of employment. If this description is accurate, and given that urban regulations were only approved recently, Kigali would be witnessing informal urbanization for the first time in its history!

3. Watersheds of spatial integration

Kigali is at an important junction in its urbanization where new regulations are expected to transform what used to be an organic indigenous process of urbanization to a more regulated process that requires approvals and permits.[11] In developing this process of urban governance, it is important to tap onto the unique presence of organic indigenous neighborhoods of Kigali to learn the way its inhabitants shaped their place in the city and contributed to its process of production. Hence, the space of the city embodies tested urbanization strategies, which can inform the future urban regulations needed to support sustainable living conditions.

Figure 1. Analytical view of the wetlands between Kiyuvu hill to the left and the Kinamba/Kacyiru hill to the right. Photo by author.

Walking along the road that used to border Kimicanga neighborhood, which got demolished in the aftermath of the masterplan, one is exposed to a corridor of wetland that centers the Kiyuvu-Kinamba/Kacyiru watershed. Kiyuvu hilltop is occupied by the financial center of Kigali where most of the bank headquarters are. The administrative center that includes the president's office, the American embassy and the police headquarters occupy the Kinamba/Kacyiru hilltop. In between the hilltops and the wetlands, different neighborhoods are stratified creating a mix of low and middle-income houses where generally the lower income houses are closer to the wetlands.[12] In the wetlands, I see multiple women, with their kids playing in their vicinity, plowing in the fields of corn, taro, cabbage and Cassava. In the distance a young man is passing through the wetlands with his buffalo herd. The wetlands is a busy productive landscape that serpents the multiple hills of the city. The Kiyuvu-Knamba/Kacyiru watershed features a cross-section of Kigali's urban fabric where residents are spatially integrated into the geography of the land [see fig 1]. Unlike what real estate markets stipulate, most of the hills in Kigali city include such diversity of functions and income groups.[13] Given that this fabric grew organically, its current form is a refined iteration of multiple incremental trial-and-error settlements conducted over the last fifty years when Kigali was getting urbanized after Rwanda's independence in 1962; and this urbanization accelerated in the aftermath of the 1994 genocide. This current urban iteration is significant because unlike generalized abstracted conditions of urban design, this fabric is produced by the economic, political, social and geographic dynamics in the city. Kigali presents a unique urban pattern where rural and urban environments, with their respective architectural practices, are interwoven through the network of hills and floodplains. This urban configuration allows for a diversity of jobs to be in close proximity to each other: within less than half an hour, one can literally walk from agricultural fields where indigenous farming is practiced to the business center with office towers, markets and various institutions. This allows for the different income groups and family members with different training and skills to remain productive with minimal commutes from their place of residence to their place of work exerting less pressure on the transportation infrastructure.[14] This spatial-social urban morphology is consistent across the whole city which makes it all the more valuable to study and analyze.

Figure 2. House with biogas system in Nyabisindu to the upper right and cattle farm to the lower left (left frame). Zoom in on house (right frame). Detail of aerial view provided by City of Kigali.

Furthermore, this spatial proximity of different income groups allow for some synergies to emerge. For example, upon inquiring about a nearby cattle farm in the wetland near Nyabisindu, a couple of young farmers started explaining how the dung of the cattle is sold to a house nearby. The farmers lead us to the house in which we witnessed a complete system of waste management and water collection. The owner has installed a biogas systems that relies on the cattle waste, feeds methane gas for cooking which is piped into the kitchen while the digested waste is secreted from the tank to a pit outside the residence fence, which in turn is used by the farmers as fertilizer for the sugar cane field nearby [fig 2]. The house has also installed a water tank that collects water from the roof of the house and provides the house and the biogas tank with the necessary water source. This is an example of a complete sustainable system of living that transforms waste into resource. Such as system is dependent on an urban condition that is specific to Kigali where agricultural fields, urban living and different income groups are present in close proximity to each other and intertwined in a sustainable cycle of interdependence.

4. Architecture as infrastructure

Most of Kigali does not have municipal sewage and storm water system. Building owners need to take care of their waste on site and periodically use trucked services. This poses a problem in low-income neighborhoods where residents cannot afford such services. The grey water and storm water of these low-income neighborhoods flow in open channels into the wetlands mixing dirty water with the clear water streams in the fields. Toilets in these neighborhoods are usually constructed as pit latrines shared by two to four families. Pit latrines are usually not emptied but once full, they are sealed with dirt and replaced by another pit latrine nearby. As these neighborhoods get denser, these practices may contaminate underground water, which can eventually end up in the potable water extracted from springs in the wetland. These conditions cause significant environmental and health problems that need to be addressed. The city has been gradually upgrading the infrastructure in multiple neighborhoods, mainly in Gitega and more recently in Biryogo.[15] These conditions may also be opportunities for designers to develop new architectural alternatives that integrates urban infrastructure with private construction practices. Such integrated architectural design intervention would not only resolve existing environmental problems but may have long term impact on raising the environmental awareness of city residents; similar to the awareness I witnessed with the farmers in Nyabisindu mentioned above. Within this context, I developed an architectural design studio to experiment with possible neighborhood interventions in Kigali that could learn from the particular spatial conditions of the city and address some of its problems.[16] In this studio, we focused on two watersheds, the first was the Biryogo-Gikondo watershed which is to the south of the city center and is adjacent to one of the oldest neighborhood in the city, Nyamirambo. The second watershed is the one north

of Nyabisindu, which is around seven kilometers east of the city center. Nyabinsidu is a relatively new low-income neighborhood that emerged with the settlement of construction workers employed in building the luxury neighborhood across the wetlands.[17] While these two watersheds show different urban characteristics, both are consistent in the integration of different income groups and occupations as well as their disposition between the hilltops and the wetlands.

Based on the current spatial production in Kigali, all the projects developed by the students addressed the way architectural design can integrate urban infrastructure in order to reinforce the presence of these neighborhoods in the city and develop sustainable practices that minimize the demand for a costly centralized infrastructure. I will conclude this paper by briefly describing three themes that emerged from the studio as illustrated by three student projects. The first theme emphasized the need to protect the environment of the wetlands and the activities it supports by reshaping the spatial transition of the fields with the neighborhood on the slope. Kendra Koch proposed a community center at the foot of the Biryogo hill, which included a training center that supports farming in the wetlands [fig 3]. By channeling the grey water produced by the neighborhood to the building complex, Koch designed a series of multiple vegetated beds that filter the water before it flows out into the existing streams in the wetlands. The project used native plants, locally produced material and methods of construction to produce a new typology of buildings that borders the edges of the wetlands and can create productive synergies between dense urbanization and the agricultural fields.

The second theme highlighted the significance of infrastructural spaces in creating communal interactions. By identifying the existing housing clusters, MJ Johnson redesigned the ad-hoc channels of grey water that flow down the hill in Nyabisindu into a network of activities that can be shared by these clusters [fig 4]. The redesigned infrastructural corridor included shared compost toilets, gardens for subsistence farming and small communal centers. This "greenway" corridor also collects grey water and liquid waste from these houses to be filtered by layers of ground gravel, sand and vegetation. Filtered water and solid waste compost would be utilized in the subsistence gardens and the excess filtered water is channeled underground into the wetlands.

The third theme tackles the rapid densification of low-income neighborhood due to the growth of Kigali's population. A number of existing houses are building rooms for rent that are shrinking the space for courtyards and private subsistence gardens in Nyabisindu. Wenqian Wen project develops a new residential typology that includes one owner family house with additional units for one or more renting families as well as street front shops [fig 5]. The building includes a central court that creates layers of privacy for the multiple inhabitants and provides natural ventilation and daylight for all the units. Making use of the topography of Nyabisindu, the design integrates a system of rainwater collection and conservation and a biogas tank for waste management. The project interrogated possibilities of densification that provide affordable housing for city newcomers as well as additional income for existing population with a reduction of demand on water supply and significant reduction in waste.

Integrating these three thematic proposals can produce a comprehensive approach to largely resolve the existing environmental and social problems in these neighborhoods. These neighborhoods continue to be under threat of evacuation as local and international organizations continue to identify them as "slums" or "informal" at best. These neighborhoods however, provide affordable living conditions for a large percentage of the city population.[18] These living conditions are based in sustainable construction methods, subsistence farming, diversity of jobs and gas-free transportation to work. In addition to providing social equity for city residents, these neighborhoods should be considered as significant thick archive of spatial production in Kigali that is yet to be fully uncovered.
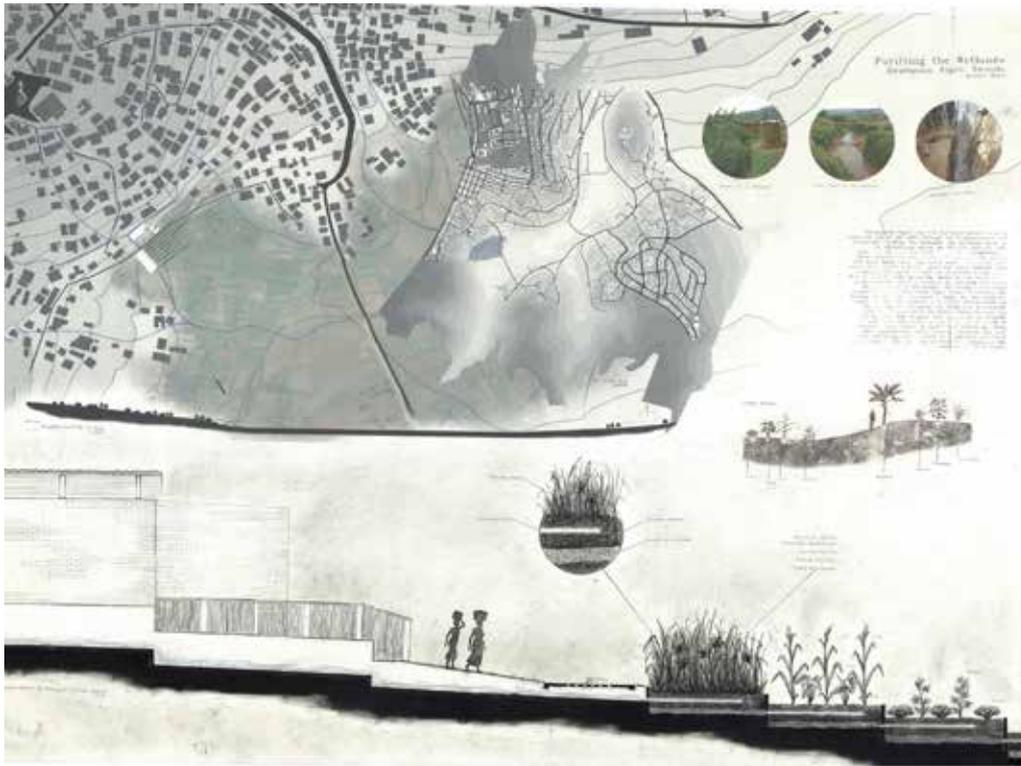
Figure 3. Purifying the Wetlands: project by Kendra Koch; Arch 401-RW, Iowa State University.
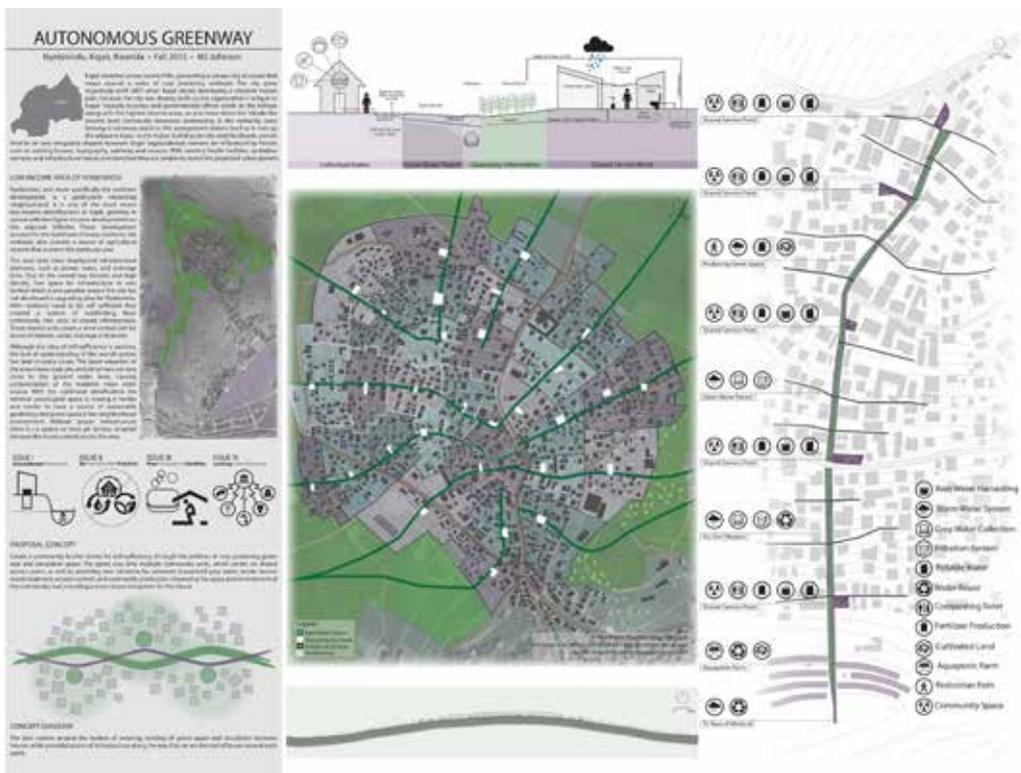

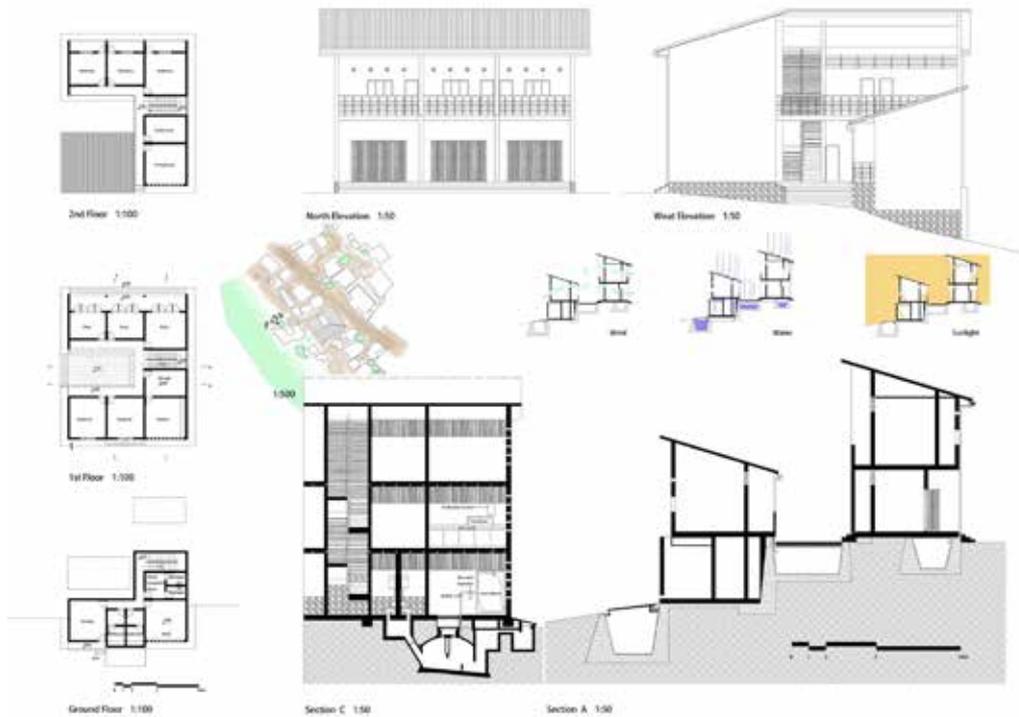Figure 4. Autonomous Greenway: project by MJ Johnson; Arch 401-RW, Iowa State University.

Figure 5. Residential Typology: project by Wenqian Wen; Arch 401-RW, Iowa State University.

5. Acknowledgements

6. References

[1]   Tumwebaze, Peterson, "Experts Raise the Red Flag on Slum Dwelling," *The New Times*, September 4, 2013.

[2]   UN-HABITAT, *Report of the second international tripartite conference: on sustainable urbanisation for urban poverty eradication* (Nairobi: UN-Habitat, 2014). Page 12.

[3] In "People as Infrastructure," AbdouMaliq Simone writes: "African cities survive largely through the conjunction of heterogeneous activities brought to bear on and elaborated through flexibly configured landscapes." Simone later describes the highly organized informal economies at the transport depot in Abidjian: "The specific operations and scopes of these conjunctions are constantly negotiated and depend on the particular histories, understandings, networks, styles, and inclinations of the actors involved." In AbdouMaliq Simone, "People as Infrastructure: Intersecting Fragments in Johannesburg", *Public Culture*. Volume 16, number3, fall 2004. Pages 407-429. See also Samuel Shearer description of Nyabugogo market in Kigali in Samuel Shearer, "Producing Sustainable futures in post-genocide Kigali, Rwanda;" in Cindy Isenhour, Gary McDonogh and Melissa Checker, eds. *Sustainability in the global city: myth and practice* (New York: Cambridge University Press, 2015).

[4] My understanding of spatial production is based on Henri Lefebvre's theory in which space is produced through the dialectic relationship of the perceived (physical), conceived (mental) and lived (social). See Henri Lefebvre, *The Production of Space* (Cambridge, MA: Blackwell, 1991).

[5] As explained to me by a city official, City of Kigali, June 2015.

[6] See list of awards for Kigali masterplan in Dona D Rubinoff, "Rwanda leading the way to sustainable urbanism," *The New Times*. March 18, 2014. Also, Busco R Asiimwe, "UN-Habitat pledges more support," *The New Times*. January 17, 2012. Both downloaded from www.Newtimes.co.rw on February 16, 2016.

[7] Tom Goodfellow, "Planning and development regulation amid rapid growth: Explaining divergent trajectories in Africa;" *Geoforum* 48. 2013. Pages 83-93.

[8] For discussion of institutional coding that reduces complex social relations, see AbdouMaliq Simone, "People as infrastructure…"

[9] See Bosco R Asiimwe, "Kimicanga expropriation kicks off," in The New Times, December 29, 2011. See also Grace Mugoya, "Kimicanga landlords get two weeks demolition notice," in The New Times, February 28, 2012. Both downloaded from www. Newtimes.co.rw on February 18, 2016.

[10] Tom Longfellow, "Planning and development …"

[11] See Samuel Shearer, "Producing Sustainable futures…" Also see Tom Longfellow, "Planning and development regulation…"

[12] This form of urbanization seem to have historical roots. Toma Berlanda writes: "The keyword in understanding this [urban configuration] is UMUSOZI or hill. This does not refer to the hill as mere topographic unit, but denotes it as primary economic and social unity fo the entire territory. …Traditionally, the hilltop was reserved for the dwelling of the head of the clan, which allocated to the members of its group the cultivated plots along its slopes called ISAMBU, which means both field and property." See Toma Berlanda, "Umujyi: Cities and Human Settlement in Rwanda," *Sustainable Futures Conference 2012*, http://www.sfc2012.org/papers.html

[13] Josephine Malonza writes about a symmetry in urbanization where "Until 2008, between the downtown Kigali main roundabout, also seen as the gateway into Kigali's CBD and the Sopetrad junction, on opposite sides of the avenue, existed two neighbourhoods, Upper Kiyovu (ikiyovu c'yabakire) and Lower Kiyovu (Ikiyovu c'yabacene); A bizzare symmetry between the rich and the poor." See Josephine Malonza, "The Post-Kiyovu symmetry: a critical analysis," *The New Times*, October 20, 2015. Downloaded from www. Newtimes.co.rw on February 16, 2016.

[14] Toma Berlanda expresses concerns about the redistribution of population in accordance with the new masterplan that may foster an "…increase in social disparities and segregation. Kigali used to be a mixed city for income and type of work." See Toma Berlanda, "Umujyi: Cities..."

[15] Thanks to Jacques Murama for guiding me through the different neighborhoods in Kigali on June 2015.

[16] This course was offered in fall 2015 at the Department of Architecture at Iowa State University as Arch 401-RW. The course title was "The technology and morphology of in-place architecture: neighborhood intervention in Kigali Rwanda" and included 15 senior undergraduate students.

[17] This is based on a conversation with a local potter who is one of the early settlers in the neighborhood. Thanks to Jacques Murama for facilitating the conversation in Kinyarwanda.

[18] A city official informed me that 67% of Kigali's population may be considered as living in informal settlements. The city is already looking for alternative methods to enhance the quality of life in these settlements rather than relocating them.