IN TRANSITION TOWARDS A CIRCULAR FUTURE FOR THE NORTH-EAST SECTION OF THE NAIROBI RIVER

- an exploration of potential implementation of circular resource management, by social-ecological spatial and systemic interventions along the Nairobi river, Kenya -



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COLOFON

TITLE

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KEY WORDS

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Planning Complex Cities

Inclusive Cities of the Global South

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ABSTRACT

This graduation project addresses the problem of waste management in Nairobi, Kenya. The current inadequate waste management throughout Nairobi remains a spatial challenge as it contributes to health concerns, threatens local ecologies, and degrades public space. Analyzing waste flows, the social construct and in particular community-based-organizations which are catalyzing local challenges to enhance community participation brings forth a set of solutions.
By combining circular economy principles, the strengths of community-based-organizations and proposing schools as collection point, this study develops a roadmap towards a circular, healthy and green future. By defining a spatial program at the urban river front of the Nairobi River, as well systemic interventions this roadmap has ambition to improve the local environment and give answer to local needs.

"Problems cannot be solved with the same mindset and level of consciousness that created them." - Albert Einstein

PREFACE

Global processes like climate change, rapid urbanization and neo-liberalism in a post-colonial era are challenging many citizens and the cities they live in. These cities are contributing for 70% of the global greenhouse gas emissions (UN-HABITAT, 2011) at the same time expected to host 66% of the world's population by 2050 (United Nations, 2015). Given that, plus the highest pace of urbanization of the global South, tends to challenge urban development in these areas in many ways.
Innovative system-thinking and bottom-up-approaches are trends currently addressed within Urban planning and design in the Western World. Circular Economy is one of the methodic School of Thoughts founded in 2012 by Ellen MacArthur, currently spreading itself in European institutions. Chinese governance has understood the importance of changing towards a 'closed-loop' system and achieved policies and regulations accordingly.

However, I believe the regions of impact are not only China and Europe, but also the developing countries and with a main focus on sub-Saharan Africa. While trying to grasp the New Town movement, exploring its challenges and its opportunities, I believe it has a valuable meaning to explore possibilities for (re) implementation in circular concepts in their urban plans and processes. Being aware of the European background I do this investigation, this is an attempt to learn both ways. By that I mean, learning from the African context, their local knowledge and expertise and at the same time translate Western-based visions into meaningful concepts to enhance local-participation of the waste problem.

ABBREVIATIONS

CBO	Community Based Organisation
CBD	Central Business District
CE	Circular economy
DHC	Dandora HipHop city
LDC	Least Developed Country
MYTO	Mathare Youth Talented Organisation
NCC	Nairobi City Council
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
ROAf	Regional Office for Africa
UN	United Nations
UN-HABITAT	United Nations Center for Human Settlements
SDG	Sustainable Development Goals

Image: Authors' own - February 2019

I.

FOUNDATION

Research motivation

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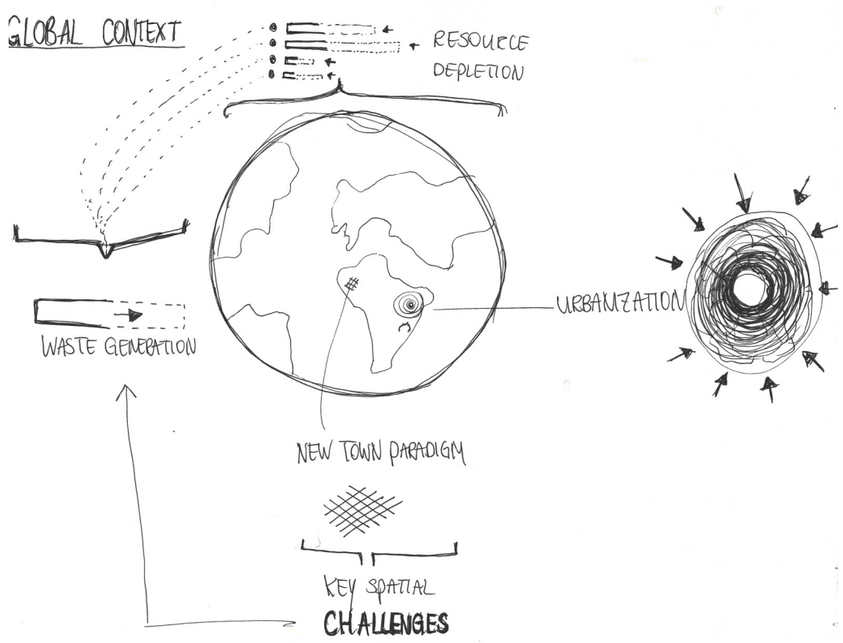


Figure 1: Global context - Authors' drawing

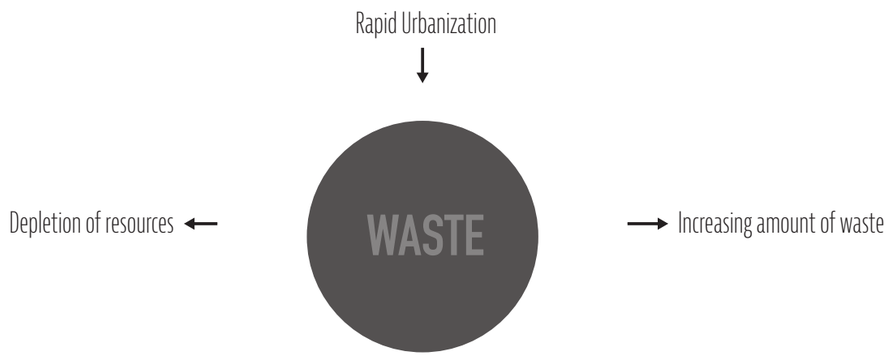


Figure 2: Global trends - Authors' diagram

Future proof?
SDG – concern not going to reach!
#11: sustainable communities –
95% in developing countries
Utopian vision – what works?
New town movement

MOTIVATION

Future proof?
Sustainable transformation
Circular principles
How to make impact?
Plastic waste problem
in Africa

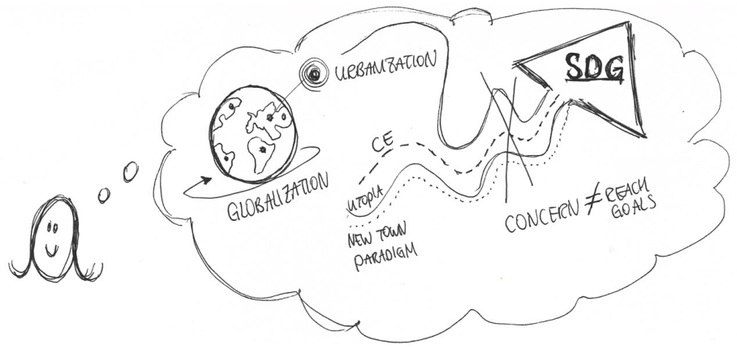


Figure 3: Motivation - Authors' drawing

As researcher, and as a person, I am engaged with the growth and trends worldwide. Recently, what had drawn my attention multiple times is the globalization and urbanization all over of the world and the remarkable note of the United Nations of their concern regarding achieving the Sustainable Development Goals. While living in the Netherlands, I have the luxe to surround myself in an adequate, safe and rich environment. Once more, while traveling to Kazakhstan in the summer of 2018, my concerns around resource depletion has been confirmed. People living in different, poor, environments that have to live with little.

At the same time, as bachelor student and during my master's in Architecture and Urbanism and as employee at The Green Village, I have been in contact with the Circular Economy paradigm. Multiple summer courses, the third quarter of Urbanism track and my study abroad program in Berlin included a similar topic concerning innovative-system-thinking with CE as base. However, realizing that Circular Economy is not thé answer to saving the planet from resource depletion, poverty and inequality I figured myself wondering what to research on. Having the ambition to make impact, and at the same time knowing that the time limit for this research is one year, I saw the possibility to connect to a yet undiscovered concept for me, new town development. Eager to learn new things, affecting historical complex situation with the colonial-era and at the same time discovering sustainable solutions was for me the valuable combination for a graduation topic.

RAPID URBANIZATION

'Africa: fastest growing continent' – UN 2017

Three world-wide trends and their interrelations are key for the start of this research. These trends are undoubtful going to result in challenges concerning the development in the future. The first trend of rapid urbanization, specially rapid urbanization in the Global South, is visible for more than a decade. The United Nations stated in 2007 that the urban population became bigger than the rural population and while still growing it is expected to increase even more towards 2050. The world population is projected to increase by more than one billion people within the next 15 years, reaching 8.5 billion in 2030, to increase further to 9.7 billion in 2050 and 11.2 billion by 2100 (UN 2015).

More than half of global population growth between now and 2050 is expected to occur in Africa, with the highest rate of population growth by 2.55 per cent annually in 2010-2015 (UN 2017). According to the predictions Africa should prepare for a total population increase of about 60 per cent between 2010 and 2050, with the urban population tripling to 1.23 billion during this period.

A more detailed data set in figure 5, shows the continuous growth of the African continent, whereas this will decrease in the region of Asia after 2040. The urban growth has led to a rapid increase in poverty. It is estimated that 46 per cent of the urban population in Kenya live below the poverty line, often in informal settlements which are deemed to be 'illegal' (Ishani & Lamba, 2018). More than half of Nairobi's 3.5 million inhabitants live in slums (Ministry of Environment and Natural Resources, 2016). Hand in hand with this development, cities produce an ever-growing amount of solid waste (Ministry of Environment and Natural Resources, 2016). Lack of formal employment opportunities and the fast-growing informal sector (8.1%), however, offers alternatives in the waste management sector (Ishani & Lamba, 2018).

At the same time, the Sustainable Development Goals (SDG) developed by the UN are showing slow progress and are not on track to reach 2030 targets (UN, June 2018). Regarding the eleventh SDG, The UN states that: rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health (Report of the Secretary-General, 2017). 'Not a single African government can afford to ignore the on-going rapid urban transition.', quote by Regional Office for Africa (ROAf).

***Half of global population growth** between now and 2050 in Africa,*
*Highest rate of population growth by **2.55 per cent** annually in 2010-2015 (UN 2017).*

*Total population increase of about **60 per cent** between 2010 and 2050,*
*Urban population tripling to **1.23 billion** during this period.*

Another significant remark by the United Nations is point 11.6: 'By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.' Which currently in Kenya is a significant issue, it seems set to build on an ever-increasing growth in population.

Kenya's total population between 1969 and 2009 roughly tripled (from 10.9 to 38.6 million), with an urban population as proportion of the total increasing from 8.8% in 1960-70 to 20.9% in 2000–2010 (UNDESA, 2010). The lack of effective answers to this increased demand on urban services has stimulated residents to seek a solution for their housing needs through informal processes (Mitullah, 2003), resulting in the rapid growth of informal settlements in Kenyan cities and towns. Depending on the city, 60-80 percent of Kenya's urban population live in informal settlements, characterized by lack of access to water and sanitation, insecure tenure, lack of adequate housing, poor environmental conditions, and high crime rates (UN HABITAT, 2008).

This is showcased by the capital Nairobi, with an estimated percentage of slum dwellers of 60 percent of the resident population, while slums only occupy 5 percent of the total land area (UN HABITAT, 2008, p.10). This amount of 2 million people, is expected to double within the next 15 years (UN HABITAT 2008). For Nairobi, it is estimated that the city will continue on its upward trajectory in terms of population, reaching 5 million in 2025. Seen in the areal view of 1986, and the expansion within 30 years in figure 9, a significant growth can be noticed.

Elaborating on the Kenyan population forecast, is a not surprising fact the rising percentage of urban population, seen in figure 10. The yearly change however is slowing down from 2.52% in 2020 to expected 1.54% in 2050. However, a remarkable prospect is the higher median age. Currently, the average was around 20 years old, this will become around 27 in 30 years. As conclusion, there will be less babies and the youth of now will consist as a significant part of the population.

As conclusion, the rapid urbanization, especially in the African continent and confirmed by the Kenyan forecasts, could emerge in serious poor circumstances for inhabitants. Potential lies in urban planning to deliver more services for specifically the urban poor. Pointed out by the Kenyan forecast, is the importance of the current youth as they turn out to be a significant of the population for the future.



Figure 4a: World map - Authors' diagram

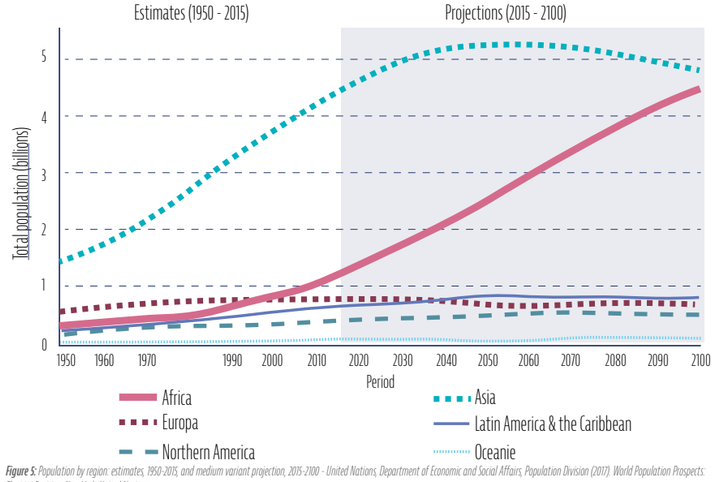


Figure 5: Population by region: estimates, 1950-2015, and medium variant projection, 2015-2100 - United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision. New York: United Nations.

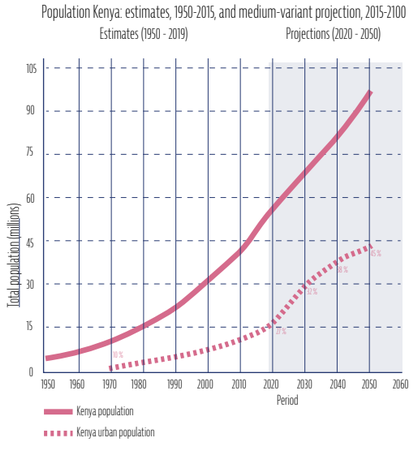


Figure 6: Population by region: estimates, 1950-2015, and medium variant projection, 2015-2100 - United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision. New York: United Nations.



Figure 4b: Africa - Authors' diagram

Figure 4c: Kenya - Authors' diagram

Kenya Population Forecast

Year	Population	Yearly % Change	Yearly Change	Migrants (net)	Median Age	Fertility Rate	Density (P/Km²)	Urban Pop %	Urban Population	Country's Share of World Pop	World Population	Kenya Global Rank
2020	**53,491,697**	2.52 %	1,251,088	-10,000	20.0	3.77	94	27.6 %	14,737,720	0.69 %	7,795,482,309	27
2025	**60,063,158**	2.34 %	1,314,292	-10,000	21.2	3.49	106	29.9 %	17,973,485	0.73 %	8,185,613,757	25
2030	**66,959,993**	2.20 %	1,379,367	-10,000	22.5	3.26	118	32.5 %	21,766,907	0.78 %	8,551,198,644	24
2035	**74,086,106**	2.04 %	1,425,223	-10,000	23.7	3.06	130	35.3 %	26,148,088	0.83 %	8,892,701,940	21
2040	**81,286,865**	1.87 %	1,440,152	-10,000	24.9	2.89	143	38.2 %	31,090,842	0.88 %	9,210,337,004	21
2045	**88,434,154**	1.70 %	1,429,458	-10,000	26.2	2.74	155	41.4 %	36,595,049	0.93 %	9,504,209,572	21
2050	**95,467,137**	1.54 %	1,406,597	-10,000	27.4	2.61	168	44.7 %	42,636,284	0.98 %	9,771,822,753	20

***Figure 10** : Worldometers , Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2017 Revision. (Medium-fertility variant)*



***Figure 8 :** Areal view Nairobi 1986*



***Figure 9** : Areal view Nairobi 2016*

NEW TOWN PARADIGM

As answer to this rapid urbanization, that likely grows unregulated and informal (UN 2014; Pieterse 2015), the planning of New Towns rises. In Africa this growth is characterized in two forms: unregulated and informal communities and the highly-planned execution of New Town or gated community development (Keeton, R. and Nijhuis, S, forthcoming 2019). Both forms of urban growth are unsustainable (Murray, 2017; World bank 2016). The definition of New Towns has been formulated as 'planned urban developments for more than 30,000 residents with mixed programs on greenfield sites, that are developed as a single entity with some degree political autonomy' in the research of Keeton. The majority of these New Towns are suburban enclaves catering to higher income groups (Watson 2014; INTI 2017). Noticeable in this research paper is, that New Towns do not effectively address the compelling social, ecological and financial challenges that characterize many African urban environments. Based on academic literature, internet sources as well empirical evidence, they have defined key spatial challenges that address new insight into potential areas of improvement for urban planning in the African context. These challenges are based on a database of 150 New Towns in Africa planned since 1960. It describes the history of New Town planning and the influence of different European colonies during the colonial period (1884 and 1960). Remarkable is that after the wave of independency, African countries built new capitals and other New Towns based on African socialism ideology. Contemporary New Town planning are underlined by Watson as 'urban fantasies' and as 'instant cities' by Herbert and Murray in 2015. In their paper a key quote of Nunes Silva (2015) has been written down as 'African urban planning will have to address and adapt to the needs of the citizens living in African cities and to be more cautious about imported urban models.' Shown the figure below, is the chronological rises of New Towns on the African continent. In Keetons' extended PhD-research, she formulated guidelines as addition for the Urban Agenda set up by the United Nations in 2017. Summarized in the following list:

1. Planning is an ongoing process, 2. Plan for adaptivity, 3. No New Town is an island, 4. Use no cut-and-paste universal model, 5. Embrace new ideas, 6. Infrastructure and mobility for all, from the start, 7. Use a blue-green infrastructure as the central framework, 8. Incorporate local cultural heritage(s), 9. Combine top-down and bottom-up, 10. New Towns need diversity.

These guidelines are of high importance, since they try to tackle the firstly explored (spatial-social-environmental) challenges. **Among others in enviro-spatial challenges, waste management has been found as key challenge. Stated as conclusion: 'the current New Town planning approach deployed across the continent has failed to effectively address the social, ecological and spatial challenges of individual, contemporary, African urban environments'.**

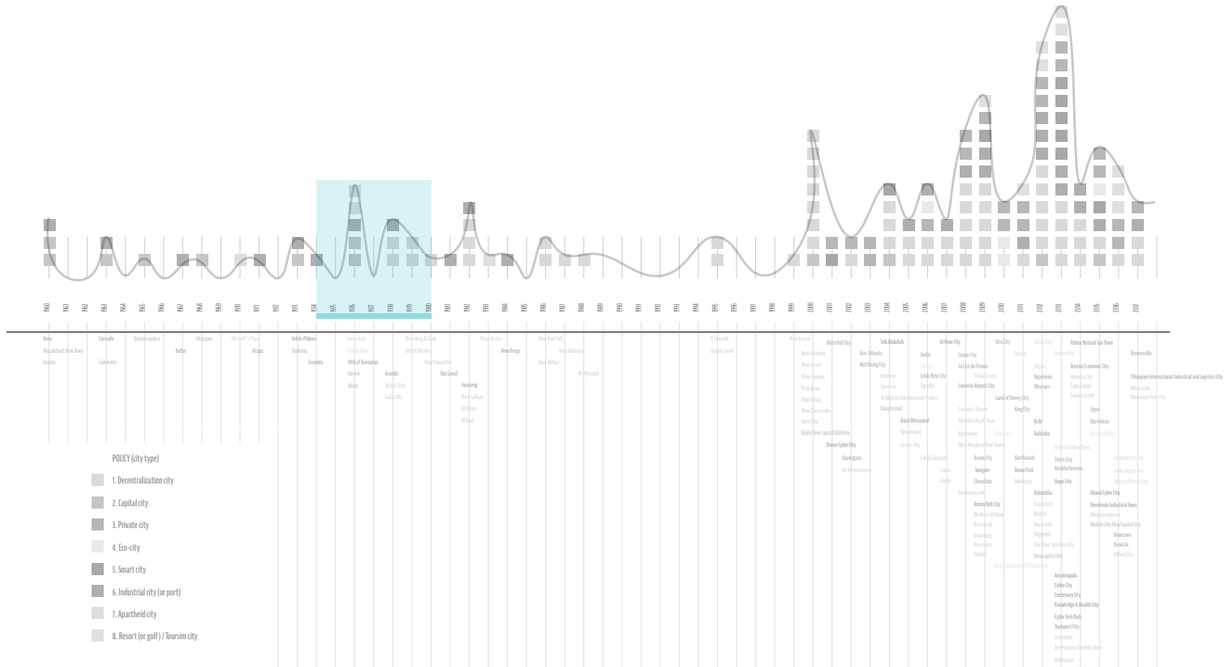


Figure 11: *Timeline based on 150 New Towns with highlight to 1974 till 1980 -* ***Keeton, R., forthcoming 2019***

Moreover, apart from Keeton's outcomes, specially regarding point 9, the importance of a revision of the top-down system regarding achieving an environmental agenda including mainly waste management in Eastern African cities, is also highlighted by the ICLEI report (2014). As requirement to realize this, radical decentralization of powers at local, municipal levels enable community level self-organization of these processes. As it underpins the importance to reconsider how bottom-up systems of governance might be implemented in short terms, it is remarkable the multiple times partnerships with communities and engagement at the city level regarding waste management are recommended. It outlines that linking top-down driven initiatives to bottom-up priorities requires additional concerted attention, so that regional scale interventions link to local initiatives more cohesively. **In a sense, the need for top-down formal institutions that can act intelligently on governance, planning and resource management strategies is obvious** (ICLEI & UCLG Africa, 2014).

As result of rapid urbanization and New Town planning paradigm, the urban development strategy of Site & Services schemes rises. In figure 11, the period between 1974 and 1980 is highligthed, characterizing this period in Nairobi, Kenya.

Nairobi, as capital of a former British colony, illustrates neo-colonial processes. It still shows the same pattern of socio-spatial segregation of development (Mitullah, 2003), that has been the base of the informal urban process of the city throughout history (Anyamba, 2011). The planning framework that is inherited from the colonial regime, which little changed after independence (Anyamba, 2011) (Nulty, 2009), is not able to cope with the described contemporary challenges that the city faces.

However, in 1973 the Nairobi City Council developed multiple plans to experiment with various urban strategies. The site and services scheme is one of them. They are mixed public and private projects, the public sector developing the serviced sites and private individuals erecting the housing units. The sites and services schemes are designed to cater for the low-income population (World Bank, 2013). Figure 12 expresses the different influences factors to site and service schemes.

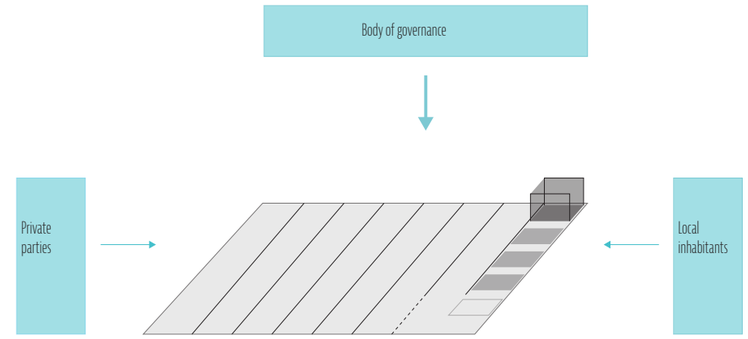


Figure 12: *Influencal factors in Site & services schemes - Authors' diagram 2019*

‘SITE&SERVICES SCHEME’ URBAN PLANNING STRATEGY

In the current research of Simone Rots, she describes sites and services as a way of combining a planned construction of plots and public facilities, such as water, roads, sewage, and electricity and within that framework the construction of houses by self-organization through a ‘progressive development’. The government develops the land with the basic infrastructure and publishes the plots, whereby land is also reserved for public facilities (Rots, forthcoming 2019). Different practices in site & services schemes can be distinguished. Varying from a plot delineated with four pins and basic facilities like access to public waterpoints, latrines and unpaved roads till core house built dwellings by the government with sanitary cell and possibilities to expand. Before Crane introduced the term sites and services, ‘Land-and-utilities’ indicated the same system, as Skinner and Rodell (1983) describe the work of Abrams and Koeningsberger in the period 1955-1963.

Important factors influencing the site&services model, are time and planning. The sequence of diagrams reveals an increasing impact of planning. The variations are mainly caused by involvement of the government. **Rots’research points out that the more the government in involved, the less self-organization there will be and the more expensive the dwellings will become.**

In case of Nairobi, the 1970-1974 Development Plan, sites and services schemes were planned to meet 43 per cent of all demand in Nairobi. In the 1974-1978 Plan, this was increased to 56 per cent. In the 1984-1988 Development Plan, sites and services units planned for Nairobi constituted 80 per cent of total planned output. A large proportion of the population cannot afford the cost of a rented room in a sites and services scheme and has no other option than sub-standard accommodation in the informal sector. As important notice, the World bank - who together with the government were the main investors in this project - exluded the lowest 20 per cent on the income-scale from the target group, since it was believed that they were incapable of both constructing the houses and repaying their loans (World Bank, 2013). **In a sense, this resulted in an exclusion of an important part of the initial and potential stakeholders.**

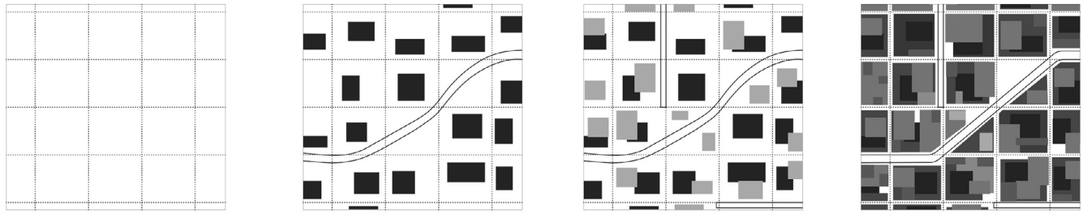


Figure 13: *1. Basic model: Issue land on the basis of planned subdivision and by filling in self-organization. Demarcation of public and private space. Strongly linked to informal urbanization, with the difference that the government makes the land available and divides the lots. (Peattie 1982).*

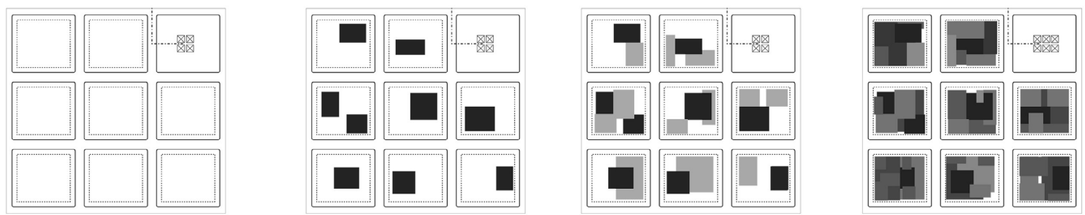


Figure 14: *2. Basic model with centrally located water points: Planned allotment with infrastructure and centrally located service s-points such as water tap places. Lots filled in by self-organization*

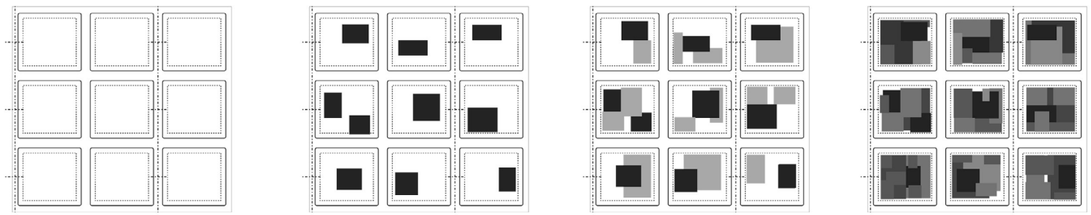


Figure 15: *3. Landscaped (un) paved infrastructure with facilities, with which the plots and the centrally located facilities such as water points and electricity are accessible. The sewer system is also being installed in the infrastructure. The lots are filled in progressively by self-organization.*

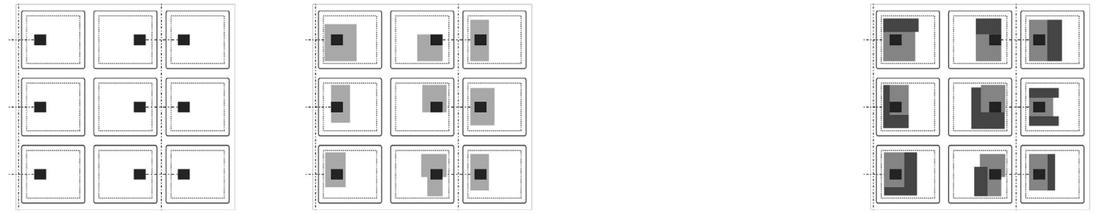


Figure 16: *4. Core houses (Abrams et al.) / Shell houses (Corrada) are designed and built, which guarantees access to the facilities (water, sewerage, electricity) and at the same time provides a space that the residents can supplement and improve at their own discretion. Mass production begins to make its appearance.*

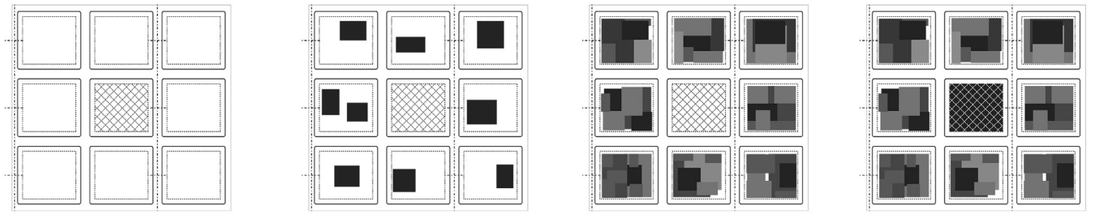


Figure 17: *5. Public space is included in the schedule for filling in public facilities such as schools, community space. These are also built up by self-organization within the community or by the government.*



Figure 18: *6. Completely planned: allotment, infrastructure and public space with prescribed design for the houses, of which sometimes the construction requires some form of self-organization, with as a result a urbanization that has the appearance of a top-down planned and built homogeneous residential area or new town.*

RESOURCE DEPLETION

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Brundtland report, 1987), is one of the most frequently quoted defenitions from *Our Common Future*. Nowadays we are aware of the fact that natural resources we use in our daily lives are not inexhaustible. This concern started in 1972, when awareness was created by the Club of Rome in their report 'limits to growth' (Meadows et al., 1972). This erected alertness on the fact that a lot of natural resources are not renewable and that there are limits to our economic growth because of this. An elaboration on the problems related to this trend and the urgency to make changes are the main driving forces behind this research. This trend of depleting resources is accelerated by the fact that cities are tremendously growing and more resources are consumed.
In 2011, an article in the guardian discussed six natural resources which are drained the most by the world population of already 7-billion people (Ruz, 2011). Camilia Ruz came to the conclusion that most of the important natural resources we use, like oil, natural gas, phosphorus and coal, will deplete within the coming 50 years. Next to that, she illustrates the growing scarcity of water. . The core of the problem is that resources we use in our daily lives, which might feel like common sense, are depleting. With ongoing growing economies, the rate of depletion goes faster, which makes it a problem to face now.
The reasons for this ermerging depletion are those of overpopulation, overconsumption, unnecessary use of resources, deforestation and destruction of ecosystems, technical and industrial development, erosion and pollution (The World Counts, 2018). The BBC made in 2011 an graphic to illustrate the depletion times of different minerals, fossil fuels and ecosystems. **The graph, based on multiple researches concerning natural resources reserves, gives a good overview in what time frame we are facing depletion of crucial resources** (figure 19).

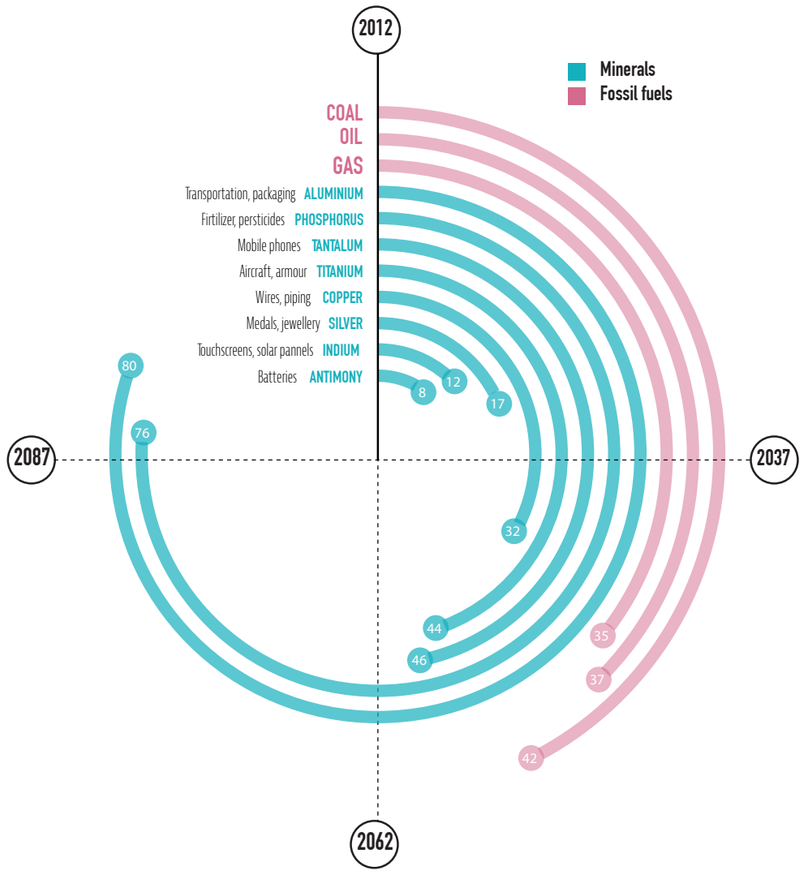


Figure 19: *Estimated depletion time of different minerals and fossil fuels - The numbers at the end of the different loops represent the amount of years it is expected tot take for the natural resources to deplete completely. Especially minerals used in electronic devices are expected to deplete quickly. (Image by Author, based on BBC 2011 and fellow student T. Cortenraede).*

WASTE GENERATION

Above all, the third and most direct global trend is the increasing amount of waste generation. According to Hoornweg et al. (2013) solid waste is particularly an urban phenomenon. In rural areas less waste is being disposed since less people live there, food is less packaged, there is in general less food waste, and less manufacturing and use of other goods. Residents living in urban areas produce twice as much waste compared to a person with the same state of welfare living in rural areas. Visible in figure 20 is that the OECD is accountable for 44% of the total waste generation, whereas the whole African continent responsible is for 5%. In addition, high income countries generate 46% of the total waste generation, opposite to only 6% by low income countries. However, figure 22 shows the remarkable projection of future growth of population and growth of waste generation. **Explicitly low income countries, like Kenya, waste generation will escalate tremendously (184%), whereas high income countries increase their waste generation by 14%.**

Country Classification According to Region - legend:
(AFR) - Africa -
(EAP) - East Asia & Pacific
(ECA) - Eastern & Central Asia
(LAC) - Latin America & the Caribbean
(MENA) - Middle East & North Africa
(OECD) - Organisation for Economic Co-operation and Development
(SAR) - South Asia

Country Classification According to Income
(LI) Lower Income -e.g. Kenya
(HIC) High Income - e.g. The Netherlands

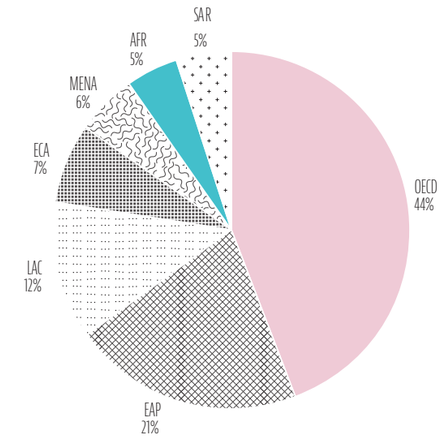


Figure 20 : *Waste generation by region (Authors' diagram, based on Hoornbach et all and fellow student T. Cortenraede).*

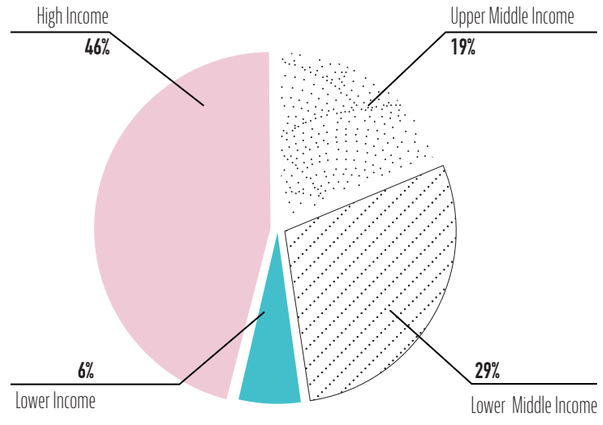


Figure 21: *Generation of waste by income level (Image by Author, based on Hoornbach, 2013).*

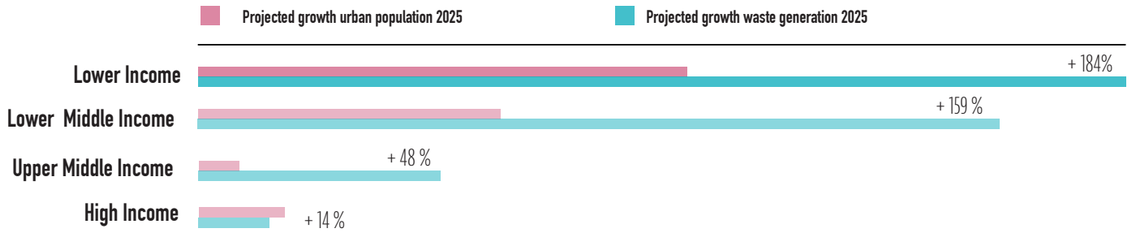


Figure 22: *Urban population growth and projected growth of waste generation 2025 (Image by Author, based on Hoornbach &Bhada-tata, 2012).*

FUTURE PROJECTION OF WASTE GENERATION

Among others Hoornweg (2013) tried to make future projections for the global waste production in the report 'What a Waste, A Global review of Solid Waste Management', commissioned by the World Bank.

The upper diagram of figure 23 shows the three possible scenario's by the 'What a Waste' report. They made three projections, consisting of different trends and global circumstances. In the first scenario, 90% of the world population (7-billion) will live in urban areas by the year 2100. Within this scenario, cities are developed in a more sustainable way, the consumption of fossil fuels has been reduced and the residents are more aware of negative environmental effects. The second scenario represents the 'business-as-usual' prognosis, where 80% of a global population of 9.5-billion lives in cities. The last scenario describes a world population of 13.5-billion and an urbanization rate of 70%. This scenario is characterized by a lot of countries with rapid population growth and areas with poverty and limited wealth. All three scenarios describe totally different future forecasts and it can be argued how accurate these scenarios are. **However, all the scenarios describe a doubling of the global waste generation till 2050. The more developed and high income countries, as described before, have the biggest share in this waste generation. In the coming future, these countries need the focus on waste reduction or a change in waste treatment. However, in the far future, other regions in the world (lower income countries) are becoming a bigger problem.**

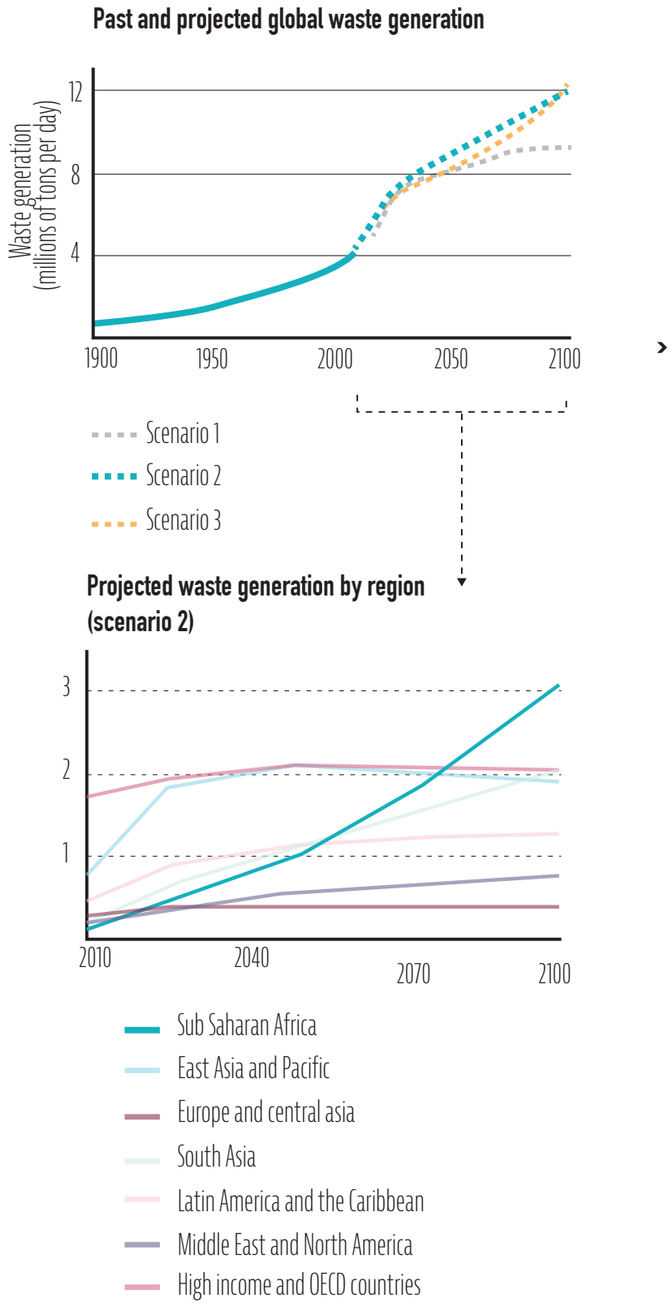


Figure 23: *Projected growth of waste generation according to different scenarios (Image by Author, based on Hoornbach et al., 2013).*

WASTE GENERATION

Waste management is an essential and urgent problem, in the words of Director of the World Bank: "*Solid waste management is everyone's business. Ensuring effective and proper solid waste management is critical to the achievement of the Sustainable Development Goals.*" (Ijjasz-Vasquez - Senior Director World Bank) (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018).

Sub-Saharan Africa, identified as least developed country (LDC), has a low waste collection rate and due to irregular or no waste collection (Bundhoo, 2018). Currently, 69 percent of waste in the Sub-Saharan Africa region is openly dumped, and often burned (figure 24). Around 24 percent of waste is disposed in some form of a landfill and about 7 percent of waste is recycled or recovered. Identified as increasing problem is that many people in LDCs are resorted to illegal practices such as illegal dumping or open burning of wastes. Burning releases toxic gases which may have irreversible health effects (Bundhoo, 2018).
Nairobi produces around 2,400 tons of waste per day. While 93 per cent of Nairobi's waste is potentially reusable, only 5 per cent is recycled and composted. Moreover, only 33 per cent of waste produced is collected for disposal at Nairobi's single official dumpsite, Dandora (JICA, 2010). This dumpsite, of 43 hectares, contaminates the groundwater which results in poisoned blood levels in half of the 328 children being examined by UNEP in 2007 (Ministry of Environment and Natural Resources, 2016).
Taking a closer look into the Low income countries - Kenya is part of these - a current state and the growth till 2025 has been calculated. Figure 25 shows the waste composition for Low Income regions will grow from 75 MT to 201 MT. **However, zooming in on the continent of Africa, Figure 26, is revieling a remarkable fact. The composition of waste in Africa is significantly containing a higher amount of plastic waste.**

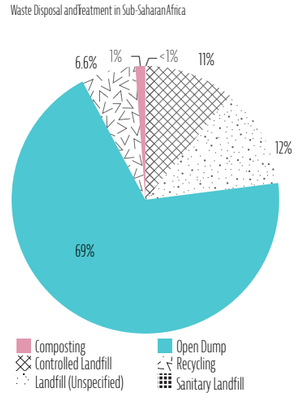


Figure 24: *Generation of waste by income level (Image by Author, based on Hoornbach, 2013).*

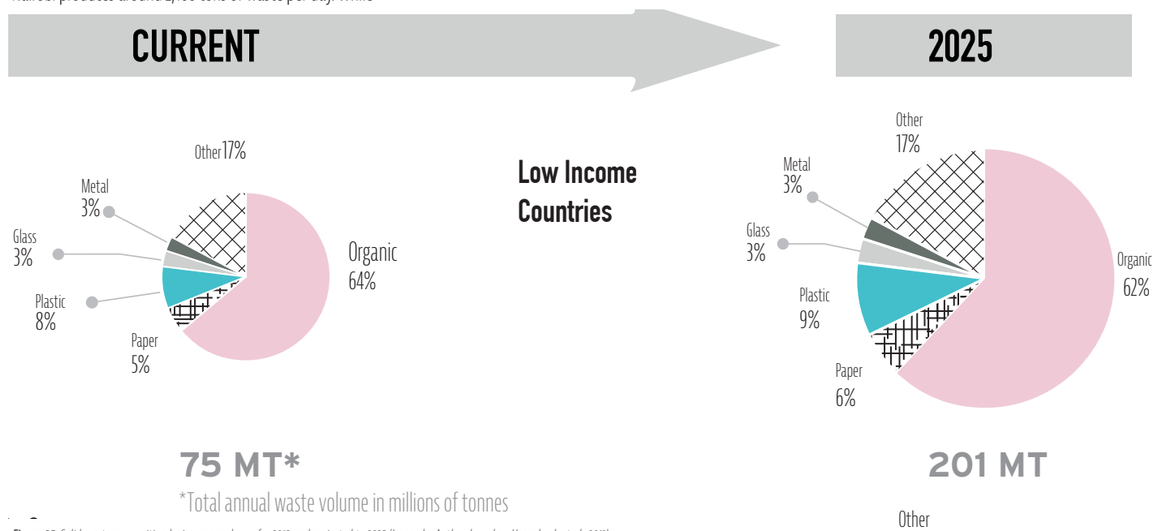


Figure 25: *Solid waste composition by income and year for 2012 and projected to 2025 (Image by Author, based on Hoornbach et al., 2013). Source: current data vary by country *Total annual waste volume in millions of tonnes*

Figure 26: *Solid waste composition for AFR (Image by Author, based on Hoornbach et al., 2013)*

III. PROBLEM STATEMENT

The world population is projected to increase by more than one billion people within the next 15 years, reaching 8.5 billion in 2030, to increase further to 9.7 billion in 2050 and 11.2 billion by 2100. (UN 2015)

More than half of global population growth between now and 2050 is expected to occur in Africa, with the highest rate of population growth by 2.55 per cent annually in 2010-2015 (UN 2017). According to the predictions Africa should prepare for a total population increase of about 60 per cent between 2010 and 2050, with the urban population tripling to 1.23 billion during this period.

As research shows, projected is the continuous growth of the African continent, whereas this will decrease in the region of Asia after 2040. The urban growth has led to a rapid increase in poverty. It is estimated that 46 per cent of the urban population in Kenya live below the poverty line, often in informal settlements which are deemed to be 'illegal' (Ishani & Lamba, 2018). More than half of Nairobi's 3.5 million inhabitants live in slums. (Ministry of Environment and Natural Resources, 2016).

Hand in hand with this development, cities produce an ever-growing amount of solid waste (Ministry of Environment and Natural Resources, 2016). Lack of formal employment opportunities and the fast-growing informal sector (8.1%), however, offers alternatives in the waste management sector (Ishani & Lamba, 2018). Sub-Saharan Africa, identified as least developed country (LDC), has a low waste collection rate and due to irregular or no waste collection (Bundhoo, 2018). Currently, 69 percent of waste in the Sub-Saharan Africa region is openly dumped, and often burned. Around 24 percent of waste is disposed in some form of a landfill and about 7 percent of waste is recycled or recovered. Identified as increasing problem is that many people in LDCs are resorted to illegal practices such as illegal dumping or open burning of wastes. Burning releases toxic gases which may have irreversible health effects (Bundhoo, 2018).

In this research is put an eventual focus on Kenya and its capital Nairobi. Nairobi produces around 2,400 tons of waste per day. While 93 per cent of Nairobi's waste is potentially reusable, only 5 per cent is recycled and composted. Moreover, only 33 per cent of waste produced is collected for disposal at Nairobi's single official dumpsite, Dandora (JICA, 2010). This dumpsite, of 43 hectares, contaminates the groundwater which results in poisoned blood levels in half of the 328 children being examined by UNEP in 2007 (Ministry of Environment and Natural Resources, 2016). The Kenyan government tried institutional changes, for instance a plastic bag ban, but their strategy did not have significant effects yet. Moreover plastic bags are only 1% of the total amount of generated waste (Paffenholz, 2019). The strategy-policies, like Vision for Kenya 2030, formulated by the government are not based on the local context or an extensive research regarding implications of adequate waste management strategies. In many parts of Nairobi, inadequate waste management remains a spatial challenge that contributes to health concerns, threatens local ecologies, and degrades public space.

Moreover, in Dandora, Kenya, we see exceptional local initiatives to provide waste management for community members (i.e. Taka Bank, Dandora Transformation League, etc.). However, current waste management practices throughout Nairobi and specially in the planned town of Dandora, are unable to sufficiently address the problem on social, economic and spatial level.

Waste management regulated by top-down-systems in sub-Saharan African urban areas are insufficient. Nairobi exemplifies the problems of a dysfunctional waste management system, as in contributes to polluted air, water and soil causing health concerns, threatens local ecology and illegal landfills, eventually resulting in degraded public space (Ministry of Environment and Natural Resources, 2016)**. Since this emerging waste generation effects on social- economic- and spatial level, an alternative strategy is necessary.**

"Solid waste management is everyone's business. Ensuring effective and proper solid waste management is critical to the achievement of the Sustainable Development Goals."
- Ede Ijjasz-Vasquez - Senior Director of the Social, Urban, Rural and Resilience Global Practice of the World Bank

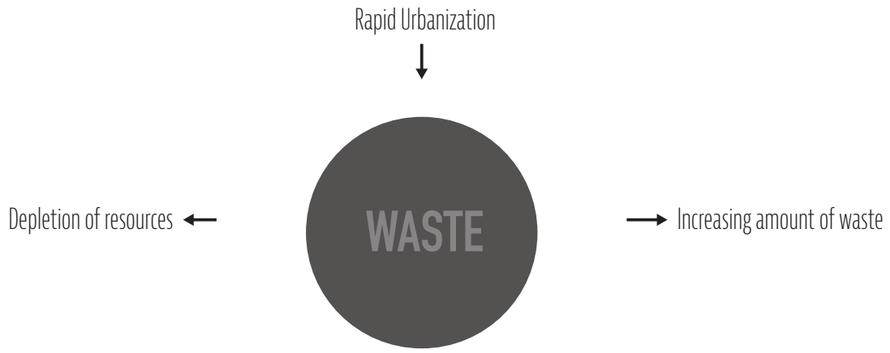


Figure26: *Global trends resulting in problem field - Authors' diagram*

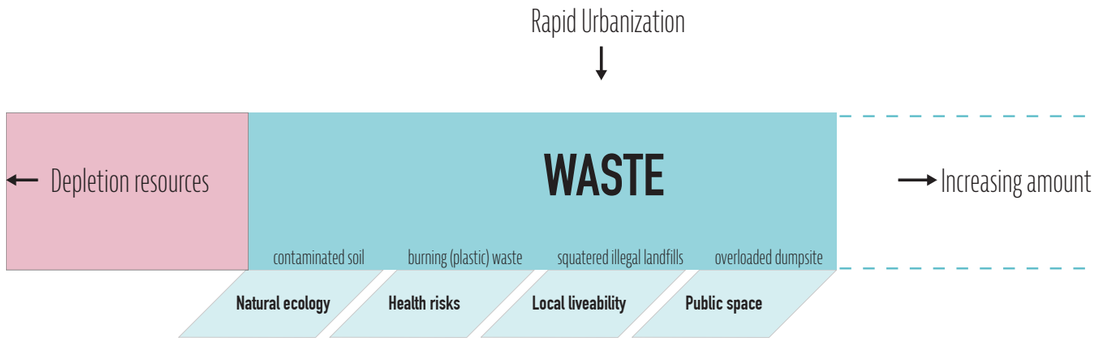


Figure 27: *Global trends resulting in problems (Image by Author)*

III. PROBLEM STATEMENT

Currently, existing private sector companies in Nairobi collect waste only in middle to higher income areas, while not engaging in activities in relation to recycling of organic waste. This leaves two thirds of residents without any proper waste management services (Ministry of Environment and Natural Resources, 2016). Since Kenya envisage the 'polluter pay principle', where every polluter must meet the cost of disposing the waste in question, this is not possible for the low-income inhabitants in Nairobi, which is more than 50%. (Wangatia, 2013)

However, research has proven that the majority of the population participating in SWM practices, were motivated by the income generated from this practice. This could be seen as opportunity to invest in for long-term and sustainable investments (Wangatia, 2013).

Identified by local authorities are the challenges for LDC regarding waste management, highlighting mainly scarcity of funding and lack of legislation. Shortcoming of funding also means that municipal councils do not have enough workforce or equipment to properly manage the increasing amount of waste. Besides, the lack of legislations means that segregation practices cannot be enforced at source while absence of charges or taxes also implies that a considerable source of revenue is not collected (ICLEI & UCLG Africa, 2014).

Kenyan authorities published a SWM strategy in 2014 in response to citizen complaints of poor waste management (National Environment Management Authority, Kenya (NEMA), 2014). However, this kind of top-down visions are lacking results on local scale, confirmed by local urban planner at Placemakers and working for UN-Habitat Nairobi Mark Ojal.

In addition, in the What the Waste 2.0 report is formulated as main reason for Sub-Saharan Africa waste problem that the governments are facing difficulties in coordination services and investment at the intermunicipal level. However, they state that capital financing alone is not the only sufficient solution for Sub-Saharan Africa's solid waste sector. Remarkable is the conclusion on challenging partnerships with the private sector. They state that although international companies are interested in larger public-private partnership opportunities, there only have been few successes. Financial, institutional, and political complications can make it difficult to attract international companies for waste activities. Municipalities are looking for ways to expand local capacity (Kaza et al., 2018).

As Elinor Ostrom (1998) points out, "national governments are too small to govern the global commons and too big to handle smaller scale problems". Government officials, isolated from the problem they aim to solve, have little ability to adapt their policies to specific local context (Tehlova, 2017).

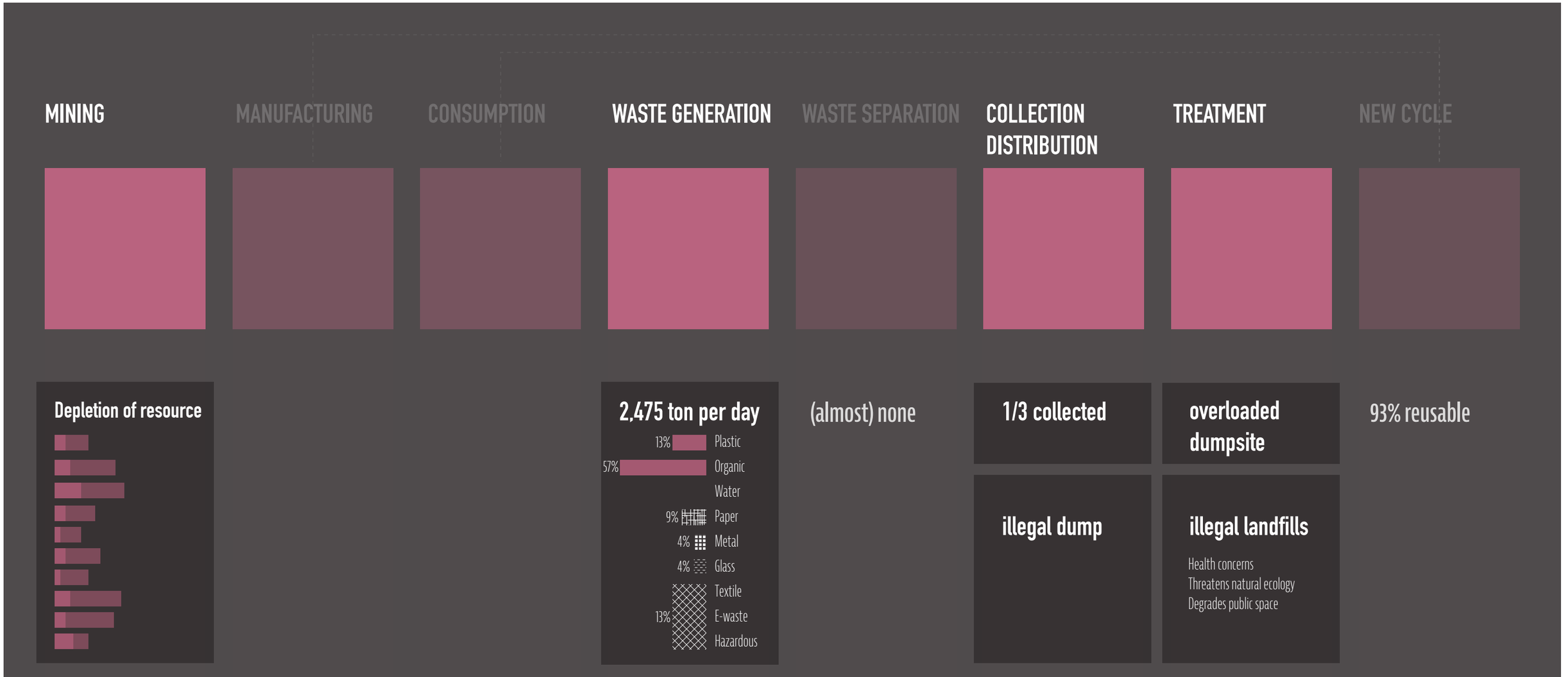


Figure 28: Overview of problems in waste management phases - Authors' diagram 2019

IV. CASE STUDY: DANDORA

As main method this research will conduct a case-study. To choose a suitable location for this case-study a few criteria apply. First of all the area should be exposed by rapid urbanization causing upcoming 'New Town' planning strategies. Recent research has proven potential of the **'site and service'** schemes rising around 1970 (Rots, forthcoming). Secondly, the existing new planned area should have a clear **waste management nuisance** to its' inhabitants. Thirdly an important criteria is the present **existing community-based** or self-organized initiatives to build on to. In Dandora, this criteria is met by the exceptional local initiatives organised by community members for community members (i.e. Mustard Seeds, Dandora Transformation League). Initially the place of Dandora was chosen for its remarkable and overloaded **dump-site** which is causing inconvenience, health risks and air pollution. The existence of the 30 acres big Dandora dump-site enables the researcher to understand the complexity of current waste management processes within a finite site. The site of Dandora is therefore chosen because it offers a unique combination of local commitment to bottom-up strategies, strong existing initiatives and a clear waste management challenge. Dandora has a population of 142,046 residents occupying an area of 3.9Km2 thus a population density of 36,253.8/ Km2 (World Bank, 2013).

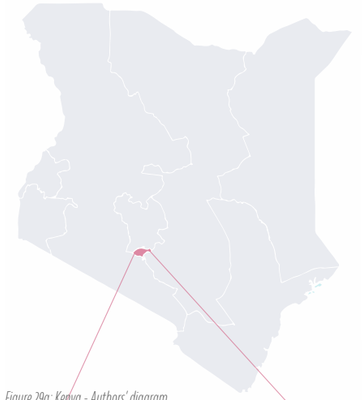


Figure 29a: Kenya - Authors' diagram



Figure 29b: Nairobi - Authors' diagram

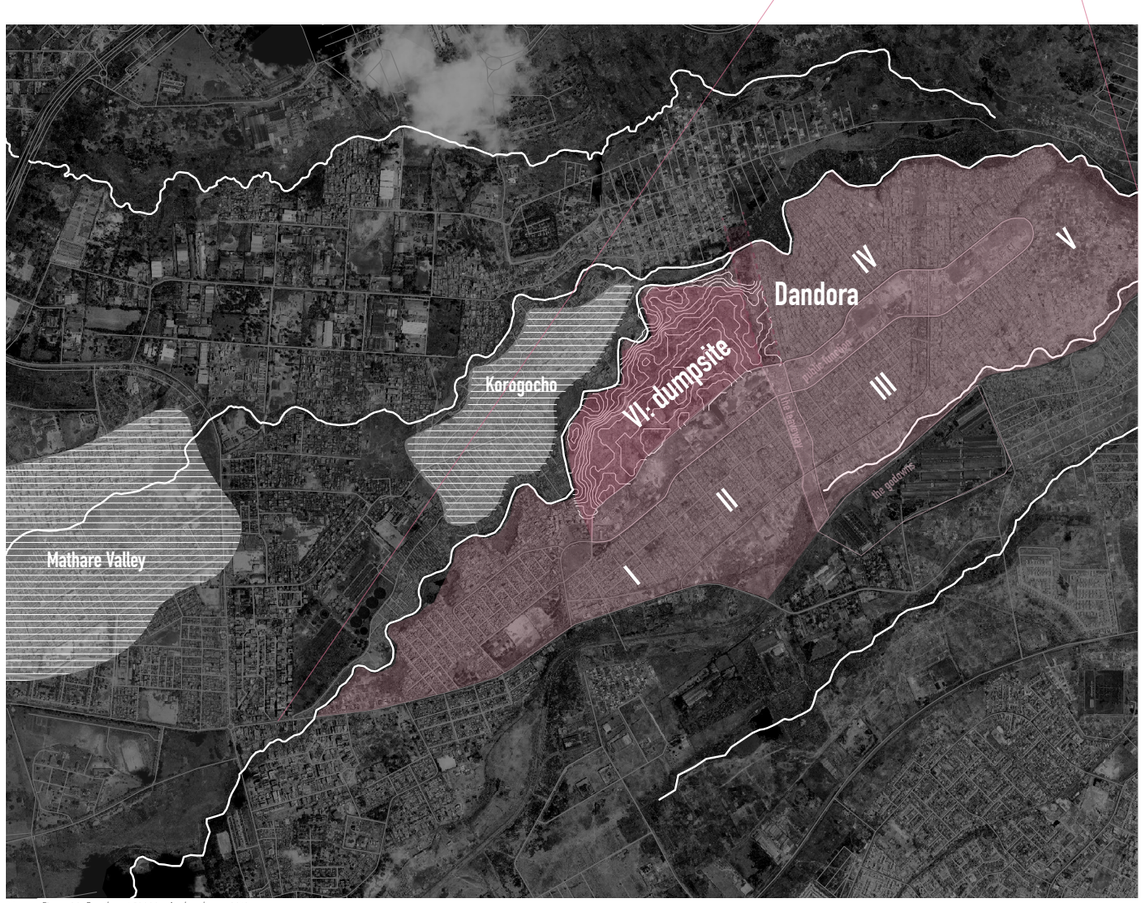


Figure 30: Dandora 1:50000 - Authors' map 2019

The dumpsite: Dandora's dumpsite is different from any other dumpsite in ***scope*** (more than 1 million people live in and around the site), ***history*** (created in the mid 1970s it was declared full more than a decade ago, though dumping continues at a rate of 2,000 tons of waste per day), ***scale*** (it covers 30 acres of land), and ***impact*** (a 2007 UN Environmental Program study found that 154 of 328 tested children suffered from respiratory problems directly attributed to the site) *(Dandora: Conflicting Views and Multiple Struggles, 2017)*. The relation between the community and the dumpsite is interesting because of the different scales they are interacting with.

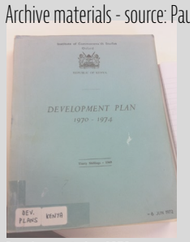
Dandora Estate has been planned in 1970s, after the independency of Kenya (1963), as a site and service scheme with the objective to provide legal titles to property ownership for low-income people to address the housing shortage for the urban poor that has become a serious problem in Nairobi after the independence. After independency privatizing of housing market but also of other systems; waste, electricity and water systems are all run by private parties.

The project was initiated in 1974 and the construction of housing units started in 1977. Dandora was designed in five phases; however, some argue that there was supposed to be a sixth phase, which was not built and was completely covered by the Dandora dumpsite: Austin, a resident of Dandora, says: "dumpsite is one entire phase on its own". (Tehlova, 2017).

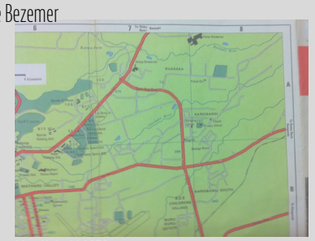
Moreover, Dandora has a bad reputation according to the newspapers. In 'The Nairobian', 2 april 2015, is highlighted the *murderous cartel* that is holding forte in Dandora. In april 2017, in the documentary of the Dutch public broadcaster BNN - *'Trippers op reis'* - the dangerous circumstances of this dumpsite became clear.

Despite these facts and the bad reputation of Dandora, a community-based-organisation called Dandora Transformation League achieved to reach the newspapers in a postive way.

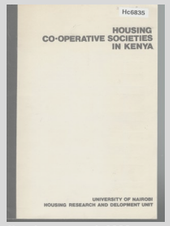
Archive materials - source: Pauline Bezemer



Development plan 1972



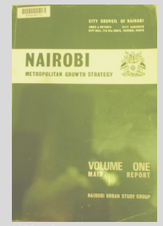
Map Nairobi 1973



Housing research 1983



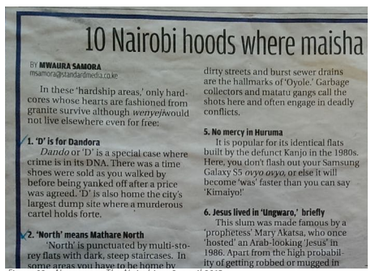
City council survey



MGS volume one



Figure 31 - Maraboestoks at Dandora Dumpsite - Authors' image 2019



10 Nairobi hoods where maisha

BY MWAURA SAMORA
msamora@standardmedia.co.ke

In these 'hardship areas,' only hard-cores whose hearts are fashioned from granite survive although *wenyewo*would not live elsewhere even for free.

1. 'D' is for Dandora

Dando or 'D' is a special case where crime is in its DNA. There was a time shoes were sold as you walked by before being yanked off after a price was agreed. 'D' is also home the city's largest dump site where a murderous cartel holds forte.

2. 'North' means Mathare North

'North' is punctuated by multi-storey flats with dark, steep staircases. In some areas you have to be home by

dirty streets and burst sewer drains are the hallmarks of 'Oyole.' Garbage collectors and matatu gangs call the shots here and often engage in deadly conflicts.

5. No mercy in Huruma

It is popular for its identical flats built by the defunct Kanjo in the 1980s. Here, you don't flash out your Samsung Galaxy S5 *oyo oyo*, or else it will become 'was' faster than you can say 'Kimaiyo!'.

6. Jesus lived in 'Ungwaro,' briefly

This slum was made famous by a 'prophetess' Mary Akatsa, who once 'hosted' an Arab-looking Jesus' in 1986. Apart from the high probability of getting robbed or mugged in

Figure 32 - Newspaper The Nairobian, 2 april 2015.



Figure 33 -BNN Vara - Trippers op reis 24 april 2017



Figure 34 - Dandora Dumpsite - Authors' image 2019

IV. CASE STUDY: HISTORICAL FOUNDATION NAIROBI

Understanding the history of Nairobi by the urban planning strategies and maps, gives perspective in the rise of the site and service scheme of Dandora. The history of Nairobi starts with the establishment of the railway in 1899. The Uganda railway was built by the British Colonial Administration, to link Mombasa on the Indian Ocean coast with Lake Victoria in the interior of East Africa, in order to extract natural resources (Labrujere, 2018).

The first European settlers established a separate development strategy as policy for urban expansion. These were the beginnings of social, economic and spatial exclusions. As a result indigenous people were undesired. At the end of the consolidation period in 1926, Europeans owned plots totaling 2,700 acres while Indians had only 300 acres for their residential purposes.

The 1927 plan for a settler capital, continued the exclusionary practices of the previous years, using the racial simplification of a "class system" through a zoning policy that ensured a pattern of segregation and social stratification (Hirst, T. and Lamba, D. 1994:86). The urban development strategies were meant to control settlements rather than managing the growth, which was leading to a mismatch of supply and demand (Anyamba, T, 2011).

After the war, there was a change in government policy towards housing for Africans in the city and in the 1948 Master Plan, 'official housing zones' were created east as a 'natural extension of the existing official housing areas' to accommodate housing schemes built by the municipality, government or Railway Company for their workers: Africans (Githua, 2016).

In 1945-1953 more than 12.000 subsidized housing units were built in 'Eastlands'.

Figure 9, reveals the city boundary in 1962, and in figure 10 becomes clear what the development of the Eastlands was around 1966. This original map of the city centre was compiled and drawn by the Survey of Kenya and informs us about land use before Dandora was planned, which was not a particular function at that moment (Githua, 2016).

In 1973 – after 25 years of masterplan (1948) the city development published Metropolitan Growth Strategy – did not succeed in overruling the east-west-dichotomy. **North and West were the consumptive, market driven, private sector. While East was mainly subsidized and large scale government financed projects.** Figure 11 shows the first MGS of the Nairobian City Council (Githua, 2016).

In this time, 1970-1986, the site and service paradigm took place, led by World Bank lending program. In this paradigm Dandora was established as new planned development in 1978.

In the period of 1970-1974 the estimated need for urban housing was more than 10,000 units in Kenya, of which Nairobi needed 5,880 in the plan period. In the second plan (from '74 -'78) the need had increased to more than 68,000 in total and 35,000 units in Nairobi. Thirdly, the 1979-1983 plan estimated the need at approximately 75,000 units in total and more than 40,000 units in Nairobi. Current formal housing production only caters for some 20 per cent of new households.

Prior to the initiation of the Dandora scheme, the Nairobi Urban Study Group estimated, that in 1971 there were approximately 75,000 housing units in the old city area. Of these, 53,000 were approved and 22,000 unapproved. In general, the unapproved units were inadequately serviced and lacked proper roads, sanitation, lighting and water supply. Nairobi's annual population increase at that time was estimated to be 7.4 per cent p.a. while the stock of approved housing only increased by 1.5 percent annually from 1962 to 1971 and most of the increase was in high and middle-income housing. **In consequence, informal, unauthorized developments mushroomed in Mathare Valley, Kibera and Korogocho.**

As described before, site and service schemes are an attempt to co-opt the urban poor as co-builders of the ideal rationalist modern city. The key projects in Nairobi East are Kariobangi, Dandora and Kayole. These developments have largely been overrun by speculative market driven developments (Loeckx and Githua). The specific and detailed development of Dandora is shaped by multiple Metropolitan Growth Strategies by the NCC, see appendix for elaborate explanation.

Analyzing more recent history, remarkable is the excessively increased waste generation in Nairobi**. Figure 36 shows the generated amount per day in Nairobi, which increased by 6 times over a period of 42 years.**

Year	Amount Generated/Day
1973	452.66[1]
1975	501.92[1]
1985	850.86[1]
1998	1,426.00[2]
2002	1,530.00[3]
2004	2,347.00[4]
2015	2,679.89[5]

Figure 36: Trends in wastes generation in the City of Nairobi, data from Afdb (2002)

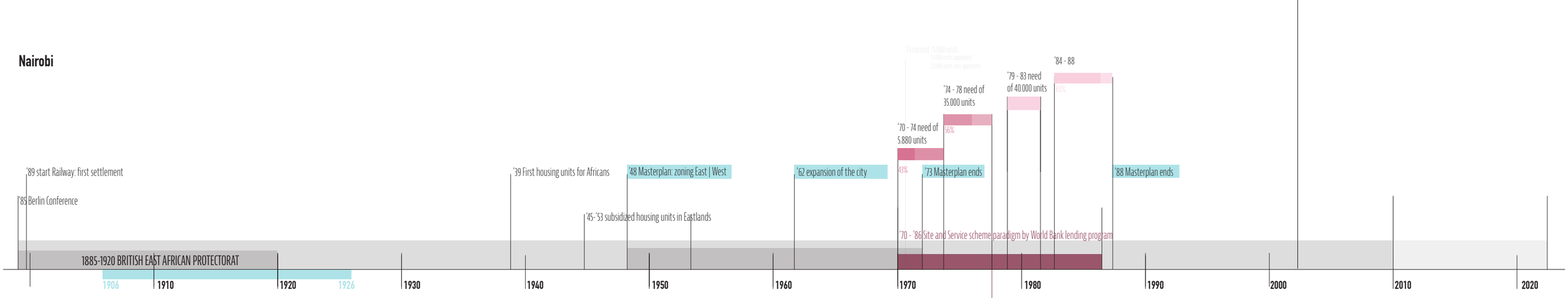


Figure 35: Nairobi Timeline - Authors'diagram

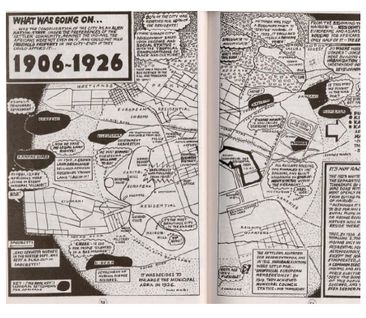


Figure 37: Nairobi's Spatial Configuration c 1906-1926 - Anyamba, T, Nairobi's informal Modernism, Oslo School of Architecture and Design, Maridalsveien, Oslo



Figure 38: 1948: Masterplan for Nairobi, White et al. 1948 - *Githua,B., Urban Exclusion and City Making: Nairobi Eastern Extension 1962–1988, Katholieke Universiteit Leuven, Belgium*



Figure 39: Nairobi's 1962's Boundary , Survey of Kenya - *Githua,B., Urban Exclusion and City Making: Nairobi Eastern Extension 1962–1988, Katholieke Universiteit Leuven, Belgium*



Figure 40: Map 'City of Nairobi' by Survey of Kenya 1966, original map photograph, retrieved from Pauline Bezemer.

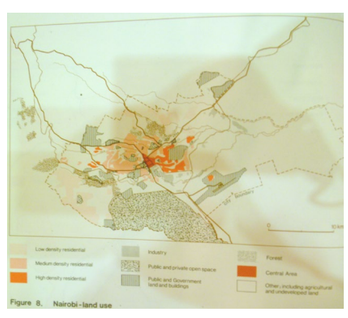


Figure 41: Masterplan of 1973, edition one of Nairobi Metropolitan Growth Strategy (MGS) by the Nairobi Urban Study Group, original map photograph, retrieved from Pauline Bezemer.

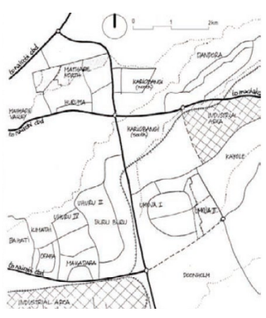


Figure 42: *MGS 1973 - Githua,B., Urban Exclusion and City Making: Nairobi Eastern Extension 1962–1988, Katholieke Universiteit Leuven, Belgium*

IV. CASE STUDY: HISTORICAL FOUNDATION DTL AND PSN

„[Dandora] used to be very dirty. People did not care. They used to dump everything outside. Women serviettes, pampers, condoms,... And later in the day, children came and started to play with all this kind of things. I could not see this anymore. So with two friends we decided to change it." - Charles Gachanga, CEO of DTL

History

In beginnings of his fight for change, he had to struggle with the unconcern of most of Dandora residents; ....

Mustard Seeds Community Based Organization (MSO) was created in July 2013. In May 2014, Changing Faces Competition, which mobilized teams from the entire Dandora to compete who brings the biggest transformation to their courtyard, was launched for the first time. In September 2014, Dandora Transformation League (DTL) was launched as an umbrella organization gathering youth groups from Dandora, each taking care of their immediate environment – space referred to as a courtyard. DTL was officially registered a year later as a community-based organization (CBO). In 2016, the third season of the Changing Faces competition was organized. Throughout three years, Mustard Seeds and later-on Dandora Transformation League managed to mobilize over 120 youth groups comprised of over 3000 youth from Dandora. (Tehlova, 2017)

In 2015, Mustard Seeds' project became winner of Making Cities Together LAB, the international knowledge exchange platform promoting participatory design and program strategies of placemaking to improve public spaces and communities. MSO was competing with 16 other placemaking initiatives in Nairobi that were left behind. Making Cities Together Lab allowed Mustard Seeds and subsequently DTL to reach out and build relationships with urban experts such as the Dutch organization Placemakers, KUWA, Cave architects and more importantly, UN-Habitat which decided to fund DTL's model street project. **Due to expertise and funding, partnerships with such stakeholders have enabled DTL to expand its initiative across Dandora and to become the project of reference in regards to community-driven placemaking initiatives in Nairobi.** (Tehlova, 2017)

As main focus on their website, part of their vision stated: *DTL is not just transforming spaces, it is also transforming minds. We are working to empower the youth and invest in their personal and economic development with the transformation of their immediate surroundings as an entry point.*

Scale up

Within one year, it has grown from 5 courts participating in 2014 to 124 participating in 2015. Annually, hundreds of Dandora youths compete to achieve the biggest transformation within their immediate environment. The overall winner receives a cash prize, which is a great incentive for many unemployed youths to mobilize.

To keep youth groups active throughout the year and ensure the sustainability of the management of open spaces, DTL has just launched the concept of a regular quarterly grading of courtyards. (Tehlova, 2017).

During her stay in Nairobi, Anna Tehlova did some interviews, with among others Cecilia Andersson working at UN-Habitat. *Ideally, a network of specialized courtyards that complete each other should emerge: if one court provides one type of service, which is not present in another one, and another court offers a different activity that is absent in the first court, the flow of people during day time within the neighbourhood would persist and intensify despite the potential exclusionary dimension of gates* (Andersson, interview, 2017).

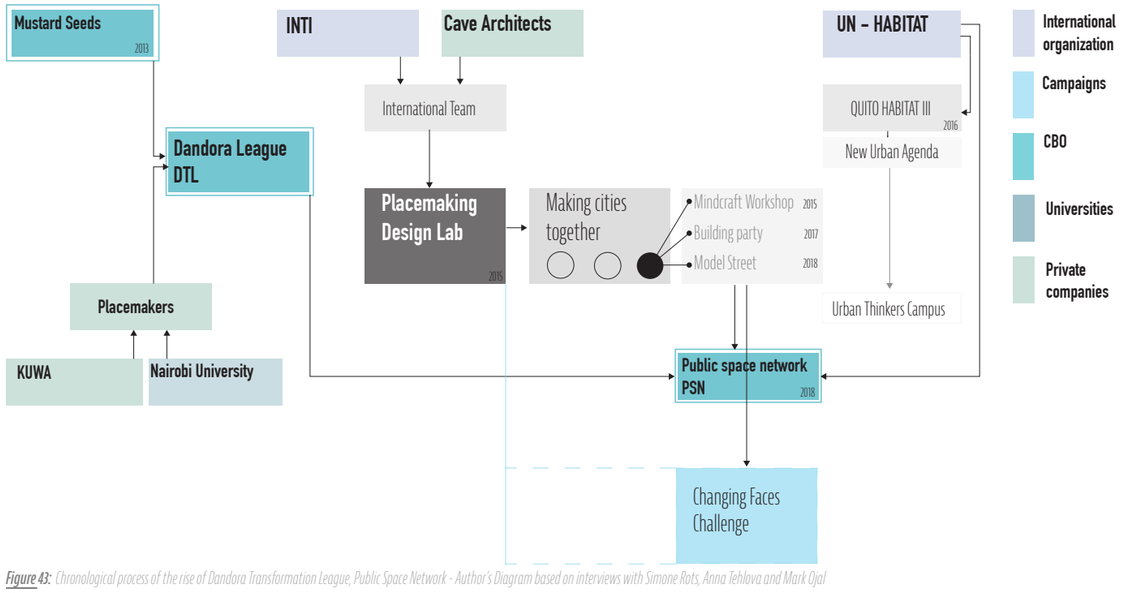


Figure 43: Chronological process of the rise of Dandora Transformation League, Public Space Network - Author's Diagram based on interviews with Simone Rots, Anna Tehlova and Mark Ojal



Figure 44: Number of households in Dandora - Based on professional dissertation Anna Tehlova, 2017

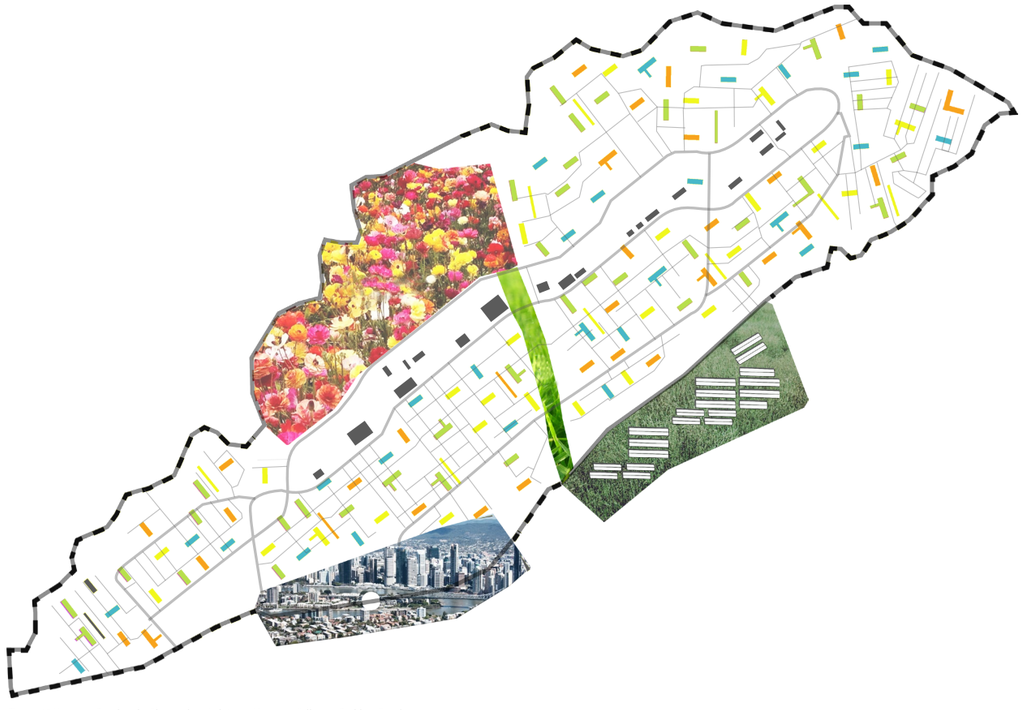


Figure 45: Vision on Dandora by Placemaking Lab 2015 - Vision on Collective Building Dandora



Picture : Authors' own image - 2019

II.

METHODOLOGICAL.FOUNDATION

i. Research framework

ii. Hypothesis: *combining opportunities from CE and CBO*

iii. Research aim: *alternative constellation by a roadmap*

iv. Conceptual framework: *CBO, Circular Resource management and governance constellation*

v. Analytical framework: *Research Questions and Methods*

vi. Timeline and planning

vii. Field research

I. RESEARCH FRAMEWORK

This research addresses the urgent problem of inadequate waste management in Nairobi. Taking into account the current trends of rapid urbanization in the Sub-Saharan African countries, the depletion of natural resources and the unhealthy effects these issues are resulting in. The hypothesis deriving from academic and practical knowledge, results in a future aim, structured by a few research questions.

To underpin the hypothesis and the desired outcome, the vision of the National Environment Management Authority (NEMA) aims to systematically improve waste management outlining collective action mechanisms. However, their research claims that it is lacking in local results. Potentially enhancing CBOs towards a new governmental constellation could result in a decentralized local oriented system.

The research question addresses a combination of two main concepts (CBO and CE), resulting in the conceptual framework. The theoretical framework deriving from these concepts, provides an academic understanding of both concepts. Subsequently, the analytical framework presents the systematic way and methods to answer the research question. Based on the layer approach (Depuy 2009) and a combination of qualitative, explorative and inductive research the analytical framework develops a methodical manner to conclude in the expected outcome of a roadmap. By an iterative process, this roadmap based on scientific expertise and local practices, aims to continuously improve and verify the outcome. Field research contributes to the local verification of the roadmap as aiming to develop this together with the local community of Dandora. Ending with the reflection, to scale up and spread out lessons learned from this specific case study towards the entire town. This as contribution to the PhD of Rachel Keeton regarding the manual for new planned new towns.

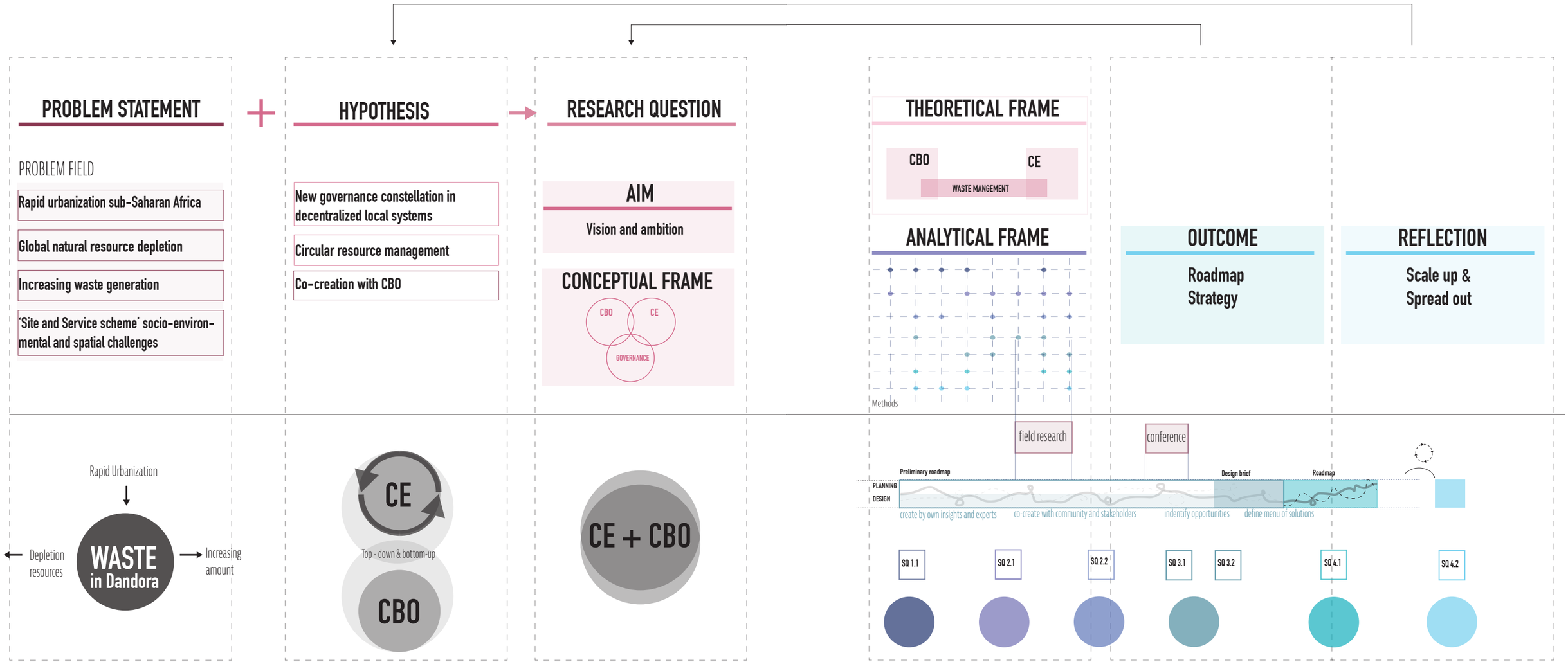


Figure 46: Research framework - Authors' diagram 2019

II. HYPOTHESIS

'Everyone wants to be a winner!' - Mark Ojal Placemakers, Nairobi - 2018

The hypothesis is based on two main themes. First, the circular economy paradigm which is aiming at using waste streams as a resource of secondary resources and to recover waste for reuse and recycling. This approach is expected to achieve efficient economic growth while minimizing environmental impacts (Kaza et al., 2018). CE is currently gaining momentum both in academic world as in business. It includes concepts of solution, as it is a regenerative system in which resource input and waste, emission and energy leakage are minimized by slowing, closing and narrowing energy and material loops (Kirchherr, Reike, & Hekkert, 2017). This can achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, recycling, and upcycling (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). This is in contrast to a linear economy which is a 'take, make, dispose' model of production (Ellen Macarthur Foundation, 2013).

Apart from the multiple notions that reduce and reuse is preferred to recycling waste, various researchers moreover express the required radical alternative solutions needed in order to achieve a complete system innovation towards the CE (Ness & Xing, 2017). Recognizing the complexity and interconnections of the system, numerous research ply for the combined top-down and bottom up approach (Pomponi & Moncaster, 2017).

Secondly, the strong feeling of community in low income areas, which enables locally grown community-based-organizations. My educated guess as urban researcher is that community-based-organizations (CBO) could help solving the waste management problem with their locally imbedded implementation.

As an example of a CBO, the Dandora Transformation League in Nairobi is a locally initiated organization, leading different workshops and campaigns to improve public space with the help of the local residents. By competition between courts, their strategy is to continue these improvements and to aim for more. ("Dandora Transformation, History, Mission Vision," n.d.)

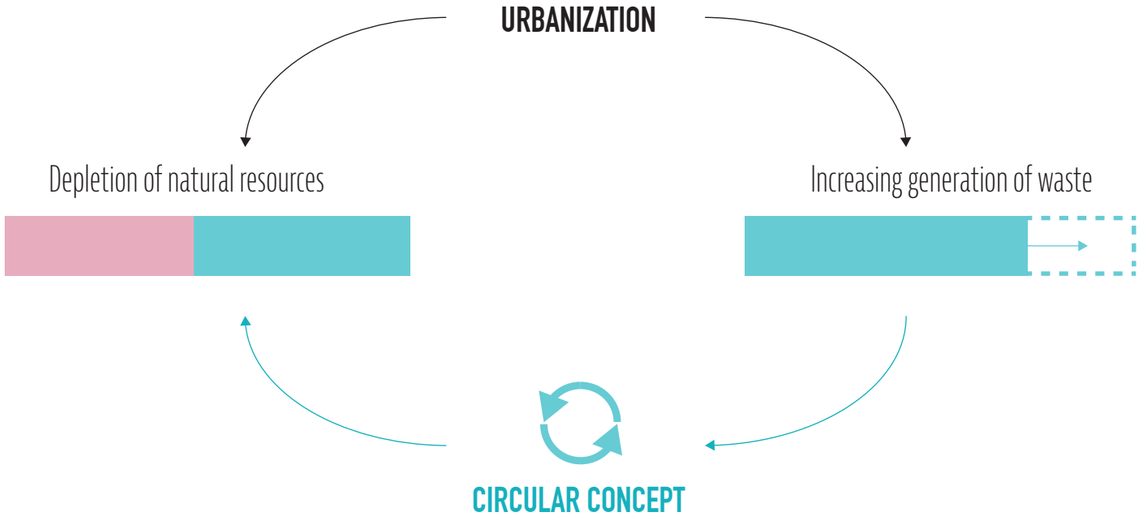


Figure 47: Circular concept as solution to waste generation and recourse depletion (Image by Author, based on Hoornbach et al., 2013)

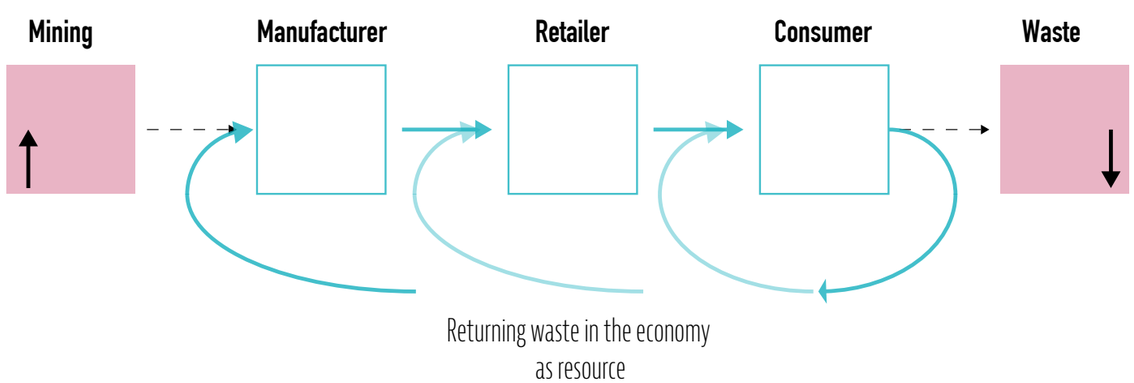


Figure 48: Reducing the use of natural resources and the avoiding the end-of life-stage of waste ((Image by author, based on T. Cortenraede and Murray et al., 2017)

To underpin this hypothesis, the argument that participation of communities in their own development choices is increasingly attractive option for those seeking to bring about more active political constituencies in urban Africa (("Waste is wealth," 2018). Moreover, as stated in the 'State of African cities 2014', all too often, however, participation is weakly employed as a coercive mechanism to consolidate political power. Politicians make promises they fail to keep, thereby risking urban political disengagement and potentially inviting community power exercised in alternative ways, including public disobedience, social unrest or violent conflict (ICLEI & UCLG Africa, 2014).

To conclude, by enhancing the existing and rising community-based-organization, and by observing local systems, understand their qualities and seek opportunities to adapt circular processes in the urban system, one can create a local decentralized network structure to provide sufficient circular waste management. As hypothesis this thesis addresses the strenghts of CBOs combined with the opportunities of local implementation of circular concepts as solution for the increasing waste management problem in Nairobi.

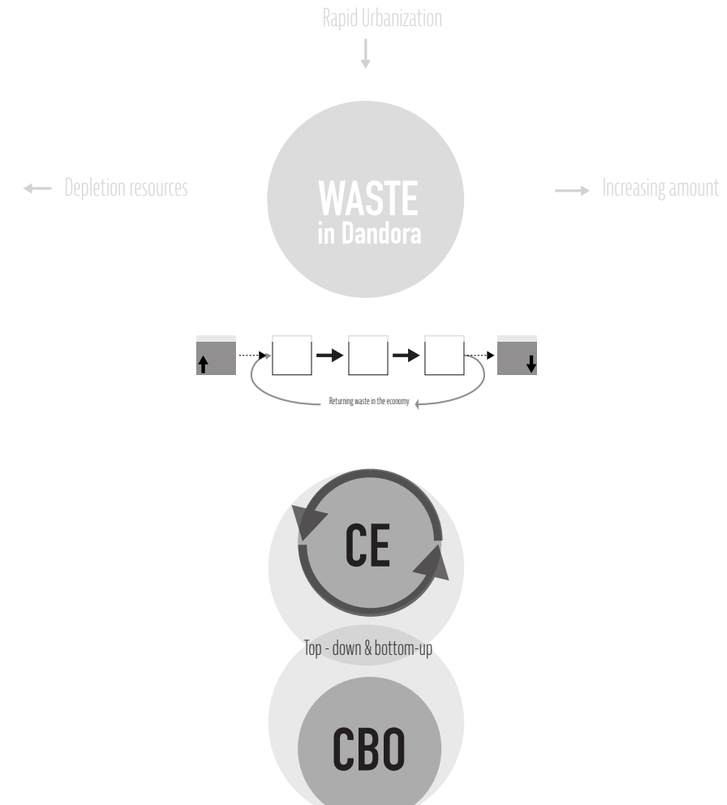


Figure 49: Hypothesis - Authors' diagram

II. HYPOTHESIS IN URBAN METABOLISM CONTEXT

In order to understand circular processes and principles in cities, it is of value to firstly understand the metabolism of a city as a concept. Various definition for this theory has been explored, in this thesis the following will be used: *'Urban metabolism can be understood as the "collection of complex sociotechnical and socio-ecological processes by which flows of materials, energy, people, and information shape the city, service the needs of its populace, and impact the surrounding hinterland."* (Urban metabolism for resource efficient cities, UNEP, 2017).

More extensively, urban metabolism studies show an overlap in the interests of scholars across different disciplines: urban ecology, industrial ecology, political ecology, political geography and ecological economics. A common concern across these studies and disciplines is the relationship between social and natural systems, cities and their hinterlands, sustainability of resource consumption and social justice in densely populated urban areas (Newman, 1999, Kennedy et al., 2010).

Shown in the left diagram, is the linear metabolism of a city and on the right one, the potential of a circular metabolism. As the circular metabolism explicitly announces ecosystem perspectives, this relates to the realm of system thinking and the potential application in urban systems. **An ecosystem metaphor of cities represents resource efficiency and closed loops in which all outputs are potential inputs**. (Urban metabolism for resource efficient cities, UNEP, 2017).

linear metabolism city unsustainable, inefficient, organism perspective

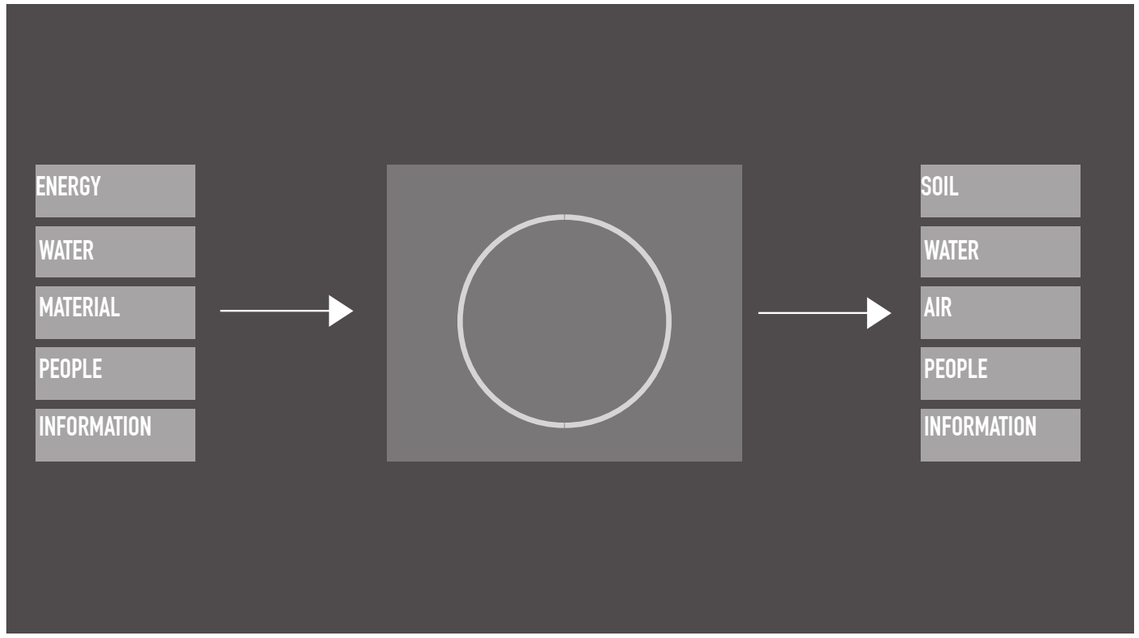


Figure 50: Linear Urban Metabolism based on source: based on Urban Metabolism For Resource-efficient Cities: From Theory To Implementation, UNEP and sustainability institute 2017, figure 3, p. 7 - Authors' diagram

circular metabolism city sustainable, efficient, ecosystem perspective

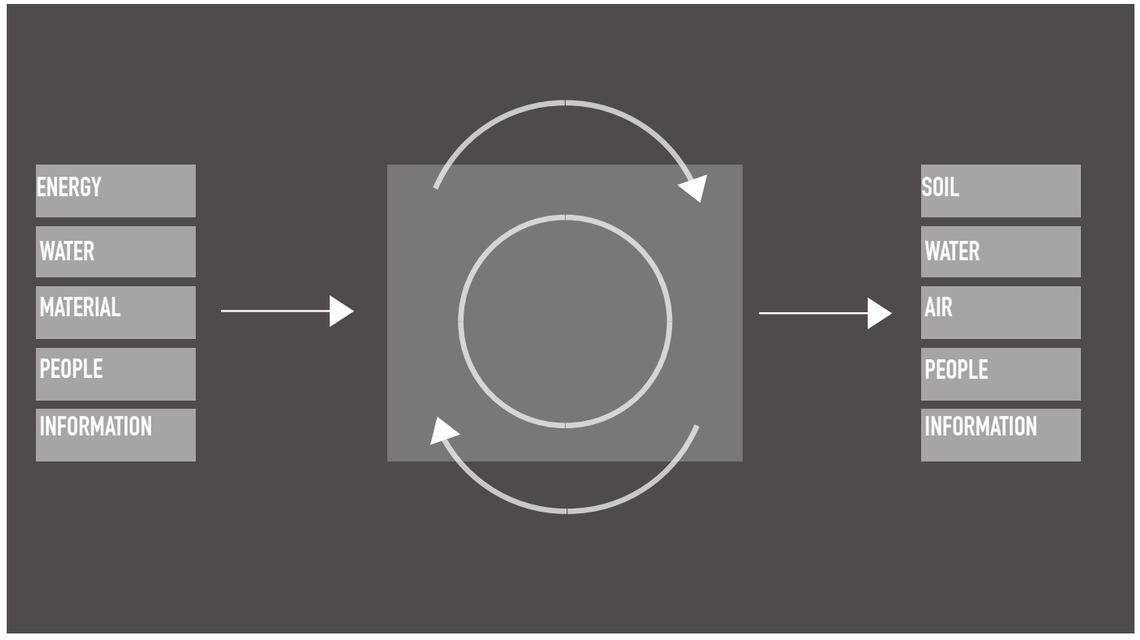


Figure 51: Circular Urban Metabolism based on source: based on Urban Metabolism For Resource-efficient Cities: From Theory To Implementation, UNEP and sustainability institute 2017, figure 3, p. 7 - Authors' diagram

III. RESEARCH AIM

The objective of this project is to design a roadmap - incorporated and co-created with the vision of the local inhabitants - that leads to a circular future build on (existing) community-based initiatives. Based on the hypothesis, the aim is to match circular principles – circular resource management – with the existing community-based-organizations in the local context. The intention is to match the diagnosed waste challenges on household, court and neighborhood level in Dandora with the identified possible opportunities for the community. The roadmap provides a planning and design framework with a menu of systemic and spatial interventions as solutions. These interventions on technical, socio-economic and political level aim for the development of alternative, circular resource management that addresses the needs of the local community of Dandora. Eventually the intention is to distillate lessons learned out of this site-specific roadmap to potential 'spread-out' to whole town of Nairobi, and possible to whole Kenya.

The preliminary roadmap consists of a:

- Design component, that incorporates the local arrangements and spatial logics. This component envisions an integrative spatial and systemic concept.
- Planning component, that ensures guarantee of the requirements regarding CBO's (like community participation) as well requirements regarding circular waste management. It consists of implementation guidelines and policy recommendations in addition to the Vision 2030 for Kenya.

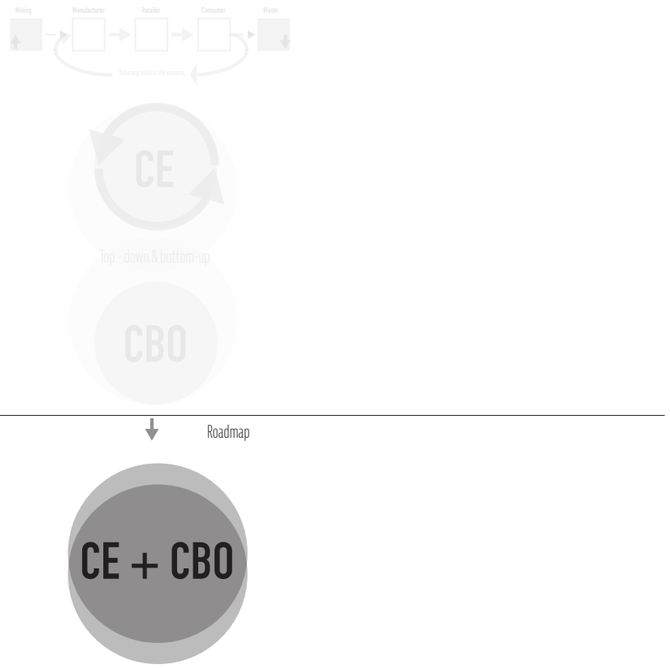


Figure 52: Research aim - Authors' diagram

IV. CONCEPTUAL FRAMEWORK

Seeking potential in both circular dynamics as community-based-organizations, these concepts form the heart of the conceptual framework. Based on the hypothesis -the opportunity to match CBO and CE regarding waste management- is explicitly visible in the conceptual framework. As the framework implies the relation with the existing body of governance and CE is on plans and strategies, currently top-down oriented. The relation with CBO is the same, however there is awareness of both potentials, as stated before (Kaza et al., 2018). To specify, the case study Dandora, is central in this figure. As the concept and aim of this thesis is mainly an exploratory research, it tries to test the formulated hypothesis and will form basis for further research. This is primarily done with case study technique, observation and reviews of previous related studies and data. Since the exploration is a combination with analytical research, it also tries to identify the different factors (or variables) involved.

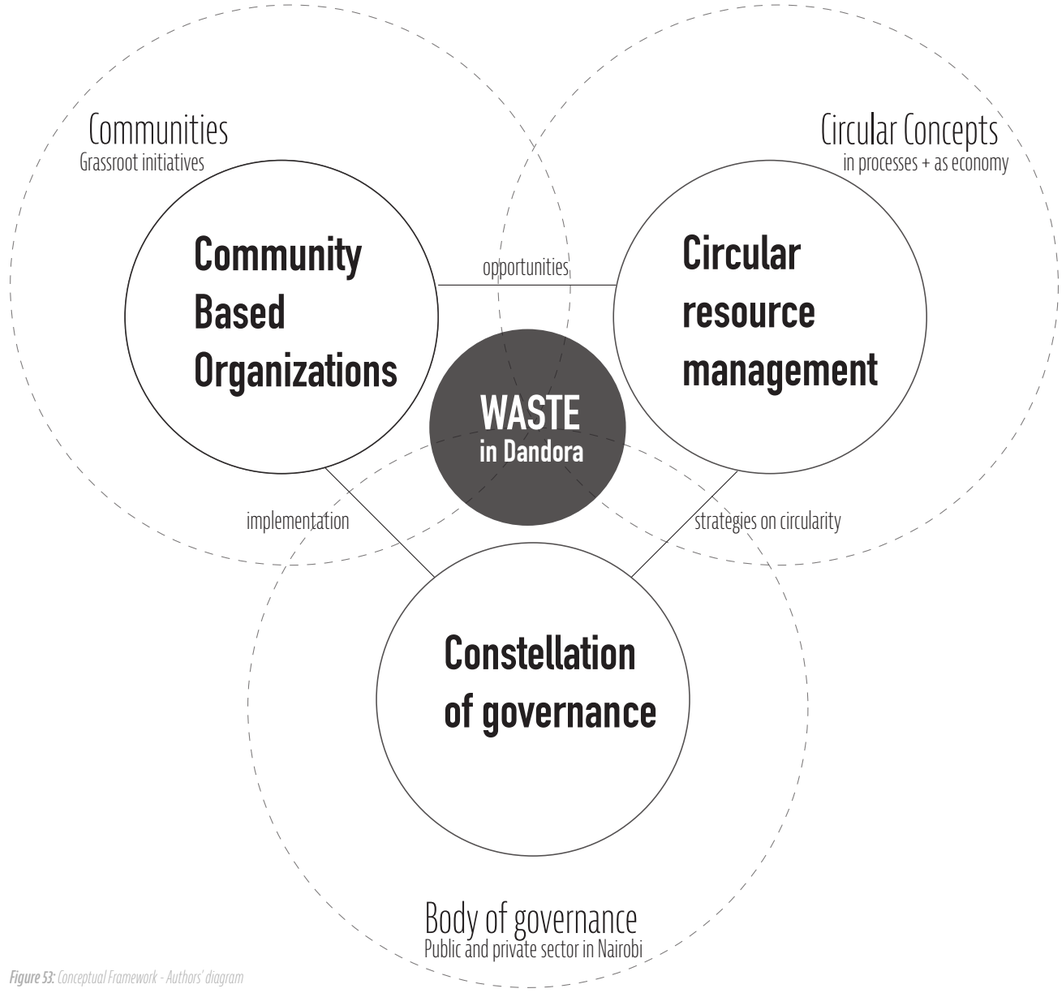


Figure 53: Conceptual Framework - Authors' diagram

V. ANALYTICAL FRAMEWORK RESEARCH QUESTION

TOWARDS INTEDED OUTCOME SCIENTIFIC EXPERTISE COMBINED WITH LOCAL PRACTICES

What is the most effective way to use combined knowledge to guide local resource management into implementation of circular concepts in the north-east section of the Nairobi River?

GOAL

Sub-questions

#1 History

1. How were the SWM processes organized in the original plans for Site and Service Scheme in Dandora? — SQ 1.1 — **History of challenges**

#2 Technical

2.1 What are the current waste management practices on household, court and town level? — SQ 2.1 — **Current processes + metabolism**

Social
Political
Economic

2.2 Which stakeholders (public, private, CBO) are involved in these processes? — SQ 2.2 — **Scales + stakeholders**

#3 Opportunity

3.1 How can waste processes being organized to become circular? — SQ 3.1 — **Principles for opportunitites**

3.2 How can circular waste processes being organized to create opportunities for the local community? — SQ 3.2 — **Roadmap**

#4 Reflect

4.1 How can a co-created roadmap for opportunities guide implementation and participation of stakeholders? — SQ 4.1

4.2 How can lessons learned out fhe site-specific roadmap scale-up to potentially spread out among an entire New Town? — SQ 4.2 — **Reflection**

Figure 54: Sub-questions - Authors' diagram

To structure the explorative character of this research, in order to answer the research questions, this thesis gathers in-depth insights by using different analytical methods. Given the complex nature of urban development due to its multiple stakeholders and economic, political and societal impacts, case study research was found to be a suitable methodology for this research. Qualitative case study research is a commonly used research approach in urban studies to understand "*complex social phenomena*", as it is a useful strategy to gather contemporary insights within a real-life situation (Yin, 2009).

In combination with reviewing existing literature on the concept of circular economy and more elaborated on community-based-organizations, the theory paper uses a deductive approach to come to a conclusion.

By analyzing academic papers on waste management in sub-Saharan African areas and the opportunities to solve this problem as well comparing these with case studies on ongoing examples of existing community-based-initiatives by secondary data like newspapers, blogposts and interviews, the theory paper is an attempt to reach to a conclusion. Most of the collected data are qualitative.

Apart from the standard analytical part, a significant part of this research is based on insights gained from field research. As implicit knowledge is complex to make explicit, drawing, mapping, co-creating, workshop sessions and (developing) videos are a substantial part of the methods towards answering the research questions.

Main approach: case study

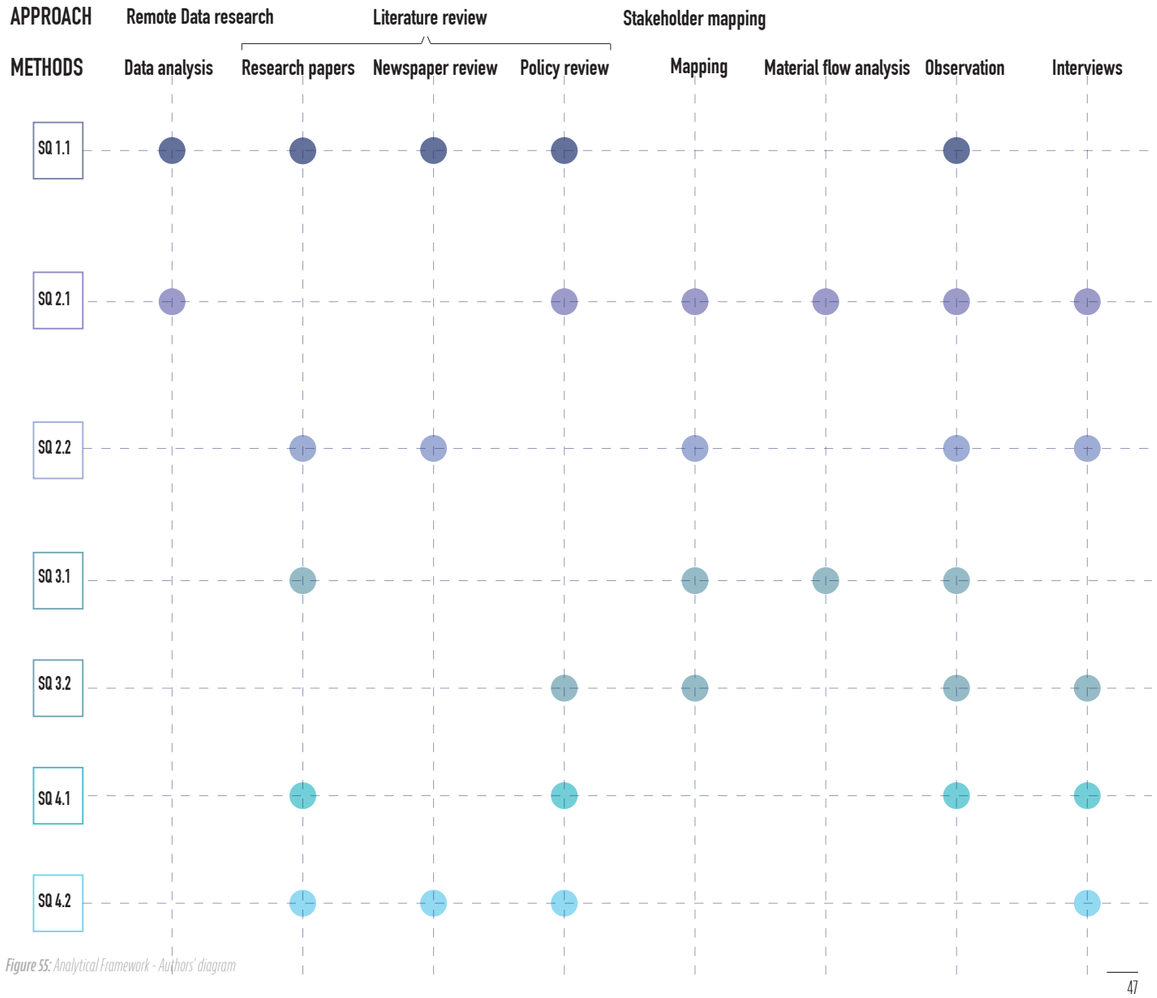


Figure 55: Analytical Framework - Authors' diagram

VI. TIMELINE

To visualize the different parts of this project in time, provides an overview of the steps towards the expected outcome.

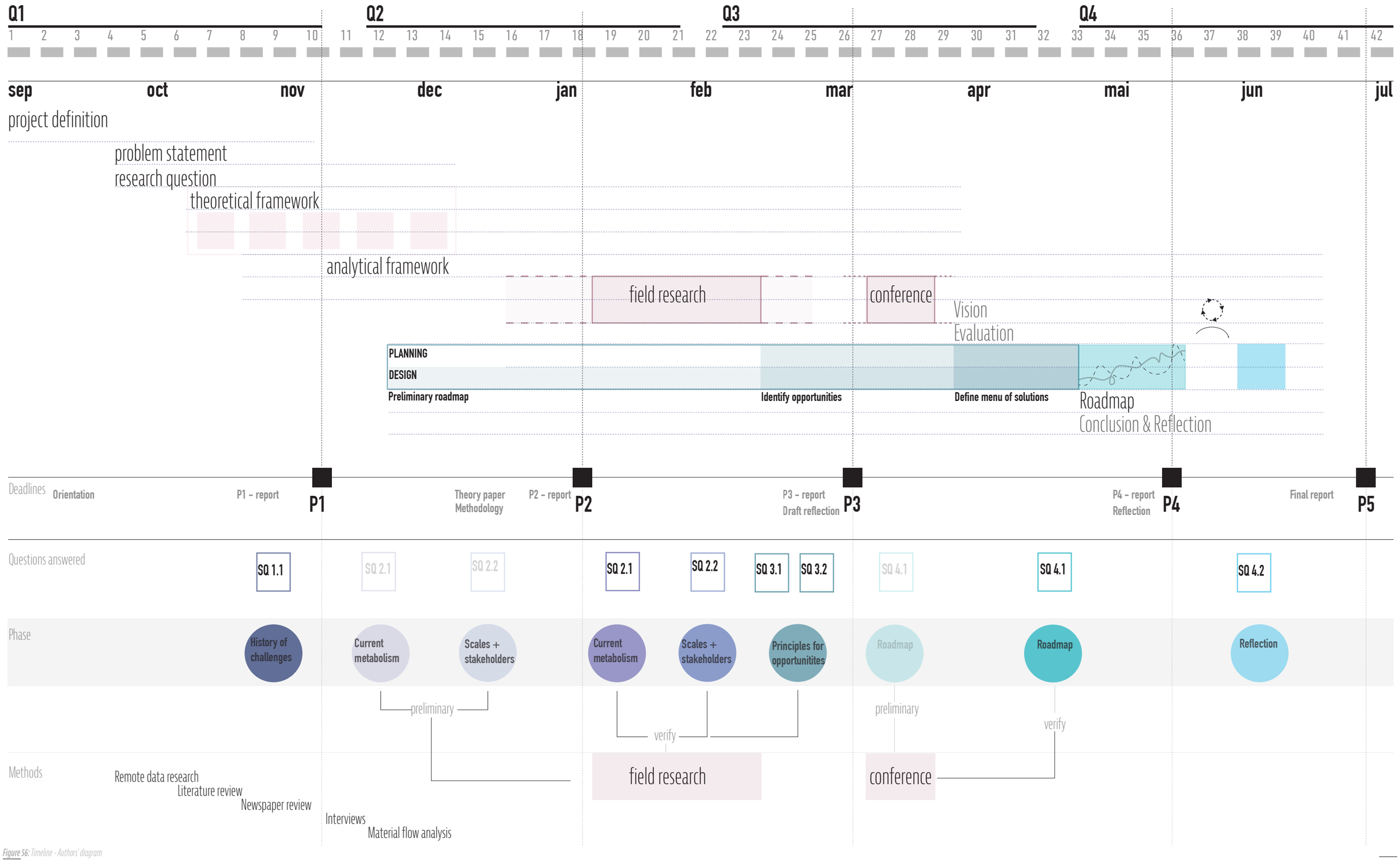


Figure 56: Timeline - Authors' diagram

VII. FIELD RESEARCH

The fieldwork forms an empirical part of the methodological framework and forms an important supplement for different reasons. Firstly, it adds important input of local actors that contribute to the qualitative research of local knowledge (on both the local behavior regarding waste as the implementation of planning component) by the conduct of several (semi-)structured interviews.

Secondly, the fieldwork forms a qualitative method to support the development of the knowledge framework through observation. Furthermore, the field visit provides the chance to verify and adjust the preliminary results in waste flows, actor analysis and the development towards solutions as part of the future roadmap.

In order to verify these preliminary results, the field trip includes different components. Meeting different actors within public and private sector ensure the quality and justification of obtained data. The planning in figure

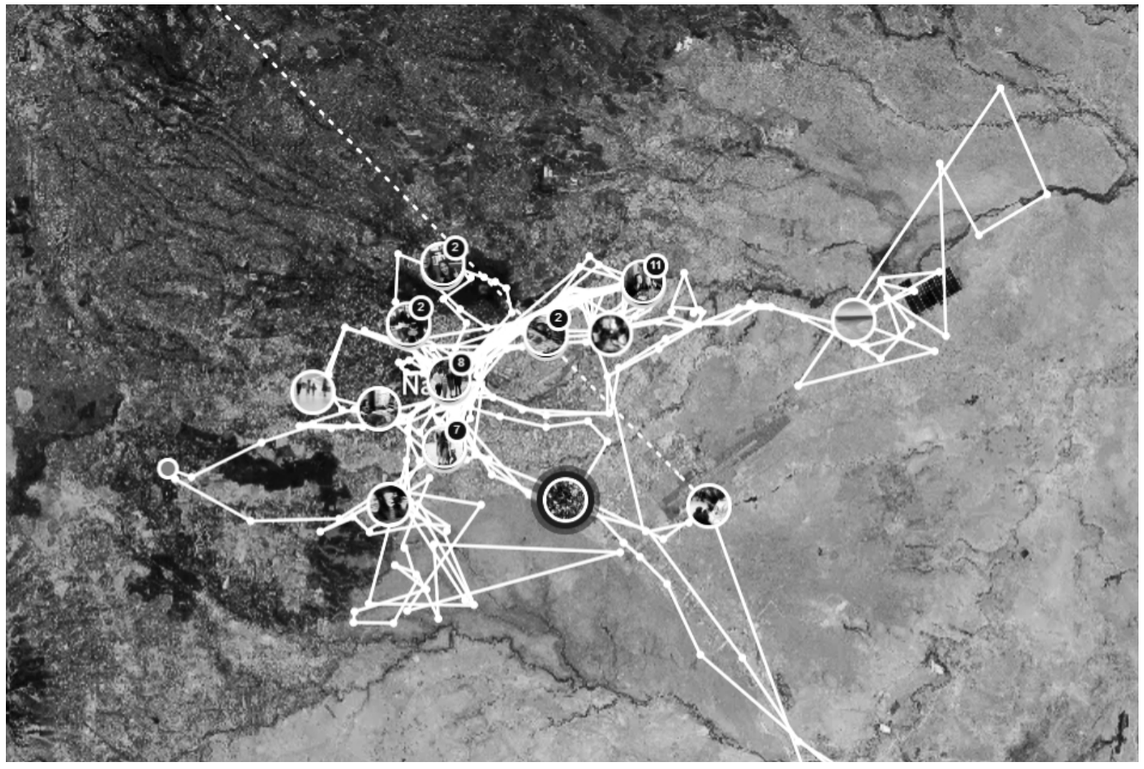


Figure 57: Overview of location visits in Nairobi - data retrieved through Polarsteps - Vera van Maaren 2019

DAY	LOCATION	CONNECT TO	Organisation
27-01	Lucky Summer	Benard Ochieng, Lydia Akyni	MYTO - leader MYTO
28-01	Lucky Summer Mathare	John Vincent Okech Benard Ochieng Dominic Otieno	MYTO junior academy Lucky s MYTO head school 'Why not' school
29-01	Gigiri	Mark Ojal Cecilia Andersson + Jose Chong Nao Takeuchi	UN-habitat UN-habitat UN-habitat
30-01	Dandora Korogocho	Charles Lukania + Shakes Ariwi Clement Ochieng Charles Gachanga Frederik Okinda	Dandora Hiphop City/GKIT Dandora Jewellery maker Dandora Transformation League KOMB Green solutions
31-01	Mathare Obama estate	Julius Calvin ceo Kellomacc David + head teacher	Pamoja Foundation Trust School MYTO school Junior Academy
01-02	Moi Avenue CBD Kilimani	Tinu Sammy Juliani Faith Peter Odiengo Anna Tehlova	KAM Nairobi City Council Customer Bora KAM National Treasury and planning Public Space Network
02-02	CBD	Christine Waithera Michelle Wanjiru	University of Nairobi University of Nairobi
03-02	Arboretum		Yoga
04-02	SameerBusiness Kilelesha	Keiran Smith Daniel Paffenholz	Mr Green Africa Taka Taka Solutions
05-02	Karen	Moraan Gilad	Direct Democracy
06-02	Strathmore Uni	Pjotr	Everest Energy
07-02	Upperhill	Joyce Wanjiru	PETco
08-02	CBD	Ramses Grandé	UN-Habitat
09-02	Ruai	Charles + Shakespear Dan Priest	Briquette Factory – Green Champ Planting Trees Community
10-02	National Park		
11-02	Westlands	Tinu Hodja	KAM Manufacturers
12-02	Dandora Dumpsite	Abdoul Evan	Informal Dandora 360 TV channel
13-02	Upperhill	Erik Akotsi Eunice	National government of environment Forestry Water Resource Authority
18-02	Mathare	26 teachers	6 different schools

Figure 58: Overview of planning and people met in Nairobi - Vera van Maaren 2019

Picture: Authors own image

III.

THEORETICAL.FOUNDATION

i. Theoretical foundation
   i. *Community-based-organizations*
   ii. *Circular economy*
   iii. *Theory of change of behaviour*

ii. Theoretical framework conclusions

iii. Considerations and limitations

iv. Relevance: societal and scientific



I. THEORETICAL FOUNDATION

In this paragraph firstly is zoomed in on the theoretical research on CBO's as well CE.

Community-Based-Organization

To understand what is meant by community-based-organization, firstly it is of importance to define: What is a Community-Based-Organization?'

In the book 'Community-based-interventions', Murphy (2014) explains what CBOs are in the following words: Community-based organizations are predicated on participation and enable communities to deal with their problems, as every facet of their planning and executing is a collective effort. Not only participation, but also the emphasis on widespread inclusion and the accompanying proliferation of ideas are characteristics of CBOs. Community-based projects, additionally, are bound together by moral convictions, ideals, and particular commitments (Murphy, Chen, & Powell, 2014).

As Murphy precisely points out, various authors (Chaskin and Greenberg 2015; Logan and Rabrenovic 1990; Yates 1973) elaborate on the fact that CBOs working closely with communities to promote neighborhood democracy by taking on some executive functions of informal governance and strengthening the sustainability of the community (Chaskin 2003; Chen and Webster 2005). Since CBOs are frequently formed from everyday conversations among friends, they are often informal in nature.

Moreover, community-based organizations are not simply characterized as informal due to their absence of hierarchy, they gain legitimacy by confirming the reality constructed by a community and operating within these confines (Murphy, 2014). As key issue is identified that community-based organizations should have traits that foster participation, as Murphy states that these organizations should be a vital part of communities. He also stresses that since these organizations are loosely-coupled and based on interaction, their stability is achieved through ongoing dialogue. This is an important matter to take into account for the design output of this thesis.

Since in the definition organization is included, it is important to understand the management of these kind of organizations. As Rothschield and Whitt believe is that as the emphasis of employee participation in the design of tasks and the overall operation of the organization, it is referred to 'self-management' or 'self-governance'. As a result, persons at all levels can participate meaningfully in designing their jobs and giving direction to an organization. As Murphy follows up on his colleagues Manz and Sims (1980), hierarchy begins to dissolve, the control of the organization is no longer centralized (Murphy, 2014).

As Rauws understands self-governance as self-organization and sees this kind of organizations applied in many studies on civic initiatives in urban development, he continues to explain 'self' in a complexity-inspired understanding, where the 'self' is referring to the 'unplanned' emergence of organization 'by itself' or 'spontaneously'. He cogently argues that 'self' foremost is referred as 'do-it-yourself': a network of citizens, interest groups or entrepreneurs taking action more or less independently from governments (e.g. Van Dam et al., 2009). 'Do-it-yourself' initiatives sometimes have a rebellious character, working their way around established governance networks (Rauws, 2016).

As conclusion, the usual claim that loosely-coupled organizations like CBOs will be chaotic and inefficient is contradicted by Murphy. His statement is that a decentered and porous organization, instead, is illustrated to be responsive to a community and an effective provider of social services. To use a phrase adopted by Onyett (2003, p. 166), these organizations rest on "authority from below," and thus have a purpose and direction that are socially relevant. The claim of 'authority from below', could be an answer to the expressed necessity of new innovative systems towards the CE paradigm.

Reflecting on the above-mentioned CBO called DTL in Dandora and the theoretical review on CBOs, this organization is indeed formed by everyday conversations on their dissatisfaction on the degraded public space by waste. Their initial set up was informal, based on interaction and ongoing dialogue. As it grows organically, their network of citizens taking action was increasing and established a self-governance way of working. As Rauws reveals 'self' in two different ways, in the case of DTL self is as well referring to the unplanned emergence of the organizations as well to the independently from governments acting group of entrepreneurs.

Requirements:

Subsequently these example case studies, general rules for a well-functioning CBO could be set up. The following resulted from as well reviewed literature, the case studies as analysis of newspaper articles:

- Important in a CBO is **the willingness of members to participate**, since members often join a project because of their ideals and desire to change their surroundings (Murphy, 2014). Almost all the case studies emphasize the significance of a participatory process (Chege, P, 2006; Mongkolnchaiarunya, 2005; Colon & Fawcett, 2006; Ishani & Lamba, 2018; Simon, 2008). Many case studies address the lack of participation as crucial factor (Simon, 2008).
- Members in CBOs, do not feel necessarily rewarded by climbing an administrative ladder. Therefore a requirement for members can be found in **enriching experiences and relationships**, combined with feelings that they have improved the quality of life in a community (Murphy, 2014). This is expressed in the contribution of the residents in Yala, improving their direct physical surrounding (Mongkolnchaiarunya, 2005).
- **Education fosters independence and dignity** of community members. In Murphy's book this process of disseminating knowledge throughout a community without monopolizing the learning process, identified as key principle (Murphy, 2014). This requirement is illustrated by the conclusion of the case study in Nairobi, which claims that without education their aim would not be reached (Ishani & Lamba, 2018). In addition, as the implementation of CBWM was successful, it identified education as key factor (Sekito et al., 2013).
- **Involvement of stakeholders** from the level of tokenism to the level of citizen power. Shifting from 'informing' stakeholders, to 'delegated power and citizen control'. Professionals including architects and urban designers should be involved in the planning process, to create shared goals and to improve legitimacy of decision-making (Vogel, n.d.).
- Planning, as Portugali suggests that planning should be 'just-in-time' rather than 'just-in-case'. The just-in-time planning should however consist of actual plans, albeit short-range and micro in scale, rather than letting the postmodern milieu take over (Portugali, 2012). In extension, the importance of **creating a planning together** with all involved stakeholders has been mentioned multiple times (Chege, P, 2006; Colon & Fawcett, 2006).
- **Sense of self organization** as defined by Wunsch in urban development as example for citizen involvement initiatives for spatial interventions that originate in civil society itself, via autonomous community-based networks of citizens, outside government control. (Wunsch, 2013) As addition, Rauws describes self-organization either as emphasizes the spontaneous and emergent character of some civic-led urban development, as well as 'do-it-yourself ': a network of citizens, interest groups or entrepreneurs taking action more or less independently from governments (Rauws, 2016).

Opportunities

As emerging CBOs gain momentum for specific reasons, this analysis results in the following opportunities for CBOs:

- **Public private partnerships** involved in waste management are likely to be successful if decisions are made at the very beginning of project or processes. Partners should comprise different sectors including public, private, individuals and business institutions (Simon, 2008). The research by EXNORA also implies to promote public-private partnerships in this field (Colon & Fawcett, 2006).
- In a community-based organization, **everyone is expected to be a leader and share their skills**, so that various persons can emerge at different times to give advice or direct a particular task. A single leader would be a liability by dominating an organization and inhibiting the necessary adjustment (Murphy, 2014).
- The youth of Eastern Africa are the key to establish positively reinforcing values and norms since they are mobile and self-organized within peer and other groups to a large degree. **To engage with them, crucial is to understand the way the youth is integrated** in formal and informal systems of governance, and their right to participate in constructing their own future (ICLEI & UCLG Africa, 2014).
- In succession of the former opportunity, ICT and **media platforms can play a key role in spreading awareness**, holding formal institutions responsible and in creating accountability. They provide an alternative regulatory framework to formal institutions of governance and can create transparency in new ways. (ICLEI & UCLG Africa, 2014).
- **Evolving in self-sustainable CBO** without depending on donor funding, is by operating as a commercial entity. In different waste management activities, it employs various employment opportunities (The Herald, 2015; Ishani & Lamba, 2018).

Challenges

Learning from best practices of CBOs in these LDC, the following challenges can be found:

- When an CBO get no financial aid or funding by NGO, an external partner or by the government, it has difficulties to sustain. To illustrate by an example of Mathare: when the Clean-up-Nairobi campaign started, the NCC helped by providing equipment and financial support but now the coalition has collapsed as the NCC is no longer giving its support (Ishani & Lamba, 2018).
- When l**ocals do not have an incentive in order to participate** in the CBO, they are likely to not cooperate in projects. As the case study of Chennai reveals, local community was willing to participate in waste related activities, due to the financial opportunity included (Simon, 2008).
- **Single leadership** would be liability by dominating an organization and inhibiting the necessary adjustments (Murphy, Chen, & Powell, p. 54, 2014). Moreover, in the case of EXNORA leaders have been unable to delegate responsibility; nor to develop representation (Simon, 2008).
- **Top-down strategies** for urban change require grounding in grassroots realities, which is the primary role of participatory processes. A secondary, but equally beneficial, role is the engenderment of political constituency at the grassroots level (ICLEI & UCLG Africa, 2014). This results in innovative system, where a linkage and overall supervision between different actors are both crucial and often lacking (Simon, 2008).
- **By fostering collective action**, a CBO should be porous and contingent, without losing their identity. In this way, these organizations can merge with communities and reinforce solidarity (Murphy, Chen, & Powell, 2014).
- **Lack of feeling of responsibility,** formulated as the phenome of NIMBY (Not In My Back Yard) has been a treat explained in the case of the two south Indian cities by the NGO called Exnora (Simon, 2008).
- Finally, but no less significantly, the communities have a limited business orientation. Therefore, strategies are not based on a good understanding of cost-recovery, leading to f**inancial non-viabilit**y of the projects (Simon, 2008).

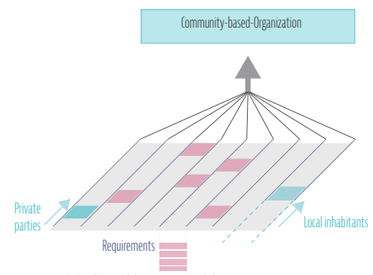


Figure 59: CBO influential factors -Authors' diagram

CIRCULAR ECONOMY

Definition

Circular economy (CE) is currently gaining momentum both in academic world as in business. It includes directions of solutions regarding waste management, as it is a regenerative system in which resource input and waste, emission and energy leakage are minimized by slowing, closing and narrowing energy and material loops (Kirchherr, Reike, & Hekkert, 2017). This can achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, recycling, and upcycling (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). This is in contrast to a linear economy which is a 'take, make, dispose' model of production (Ellen Macarthur Foundation, 2013).

The Ellen Macarthur Foundation (n.d), defines a circular economy as following: 'A circular economy seeks to rebuild capital, whether this is financial, manufactured, human, social or natural. This ensures enhanced flows of goods and services'' (The Ellen Macarthur Foundation). A linear economy converts natural resources into waste via production. **When an economy becomes circular, waste will be returned in the economy as a resource with the highest possible value.** In a perfect functioning circular economy, there is no loss of value and the net effect on the environment will be zero. A circular economy works according the principles of the three R's. Within the circle there should be a Reduction of resource use and a focus on Reusing products or components. When reuse is not possible the materials should be Recycled.

In the circular economy action plan of the European Union, a circular economy is explained as an economy 'where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised' (European Commission, 2018a, p. 1).

Need for an alternative strategy

Apart from the multiple notions that reduce and reuse is preferred to recycling waste, various researchers moreover express the required radical alternative solutions needed in order to achieve a complete system innovation towards the CE (Ness & Xing, 2017). Recognizing the complexity and interconnections of the system, numerous research ply for the combined top-down and bottom up approach (Pomponi & Moncaster, 2017).

In the research in the paper 'Toward a Resource-Efficient Built Environment' expresses the circular economy strategies relied on waste management, where reduce and reuse is preferred to recycling waste (Stahel 1997). However, from different perspectives various researchers **conclude that radically alternatives solutions are required** (Ghisellini et al. 2015)**. It states the importance of complete systems innovation**. The approaches all seek to find interconnections between systems, leading to solutions that address multiple problems at the same time, namely, "win-wins" (Wilson et al. 1998). In this regard, systems innovation aims to improve the performance of an entire system, rather than focusing on its individual components (O'Brien et al. 2013).

In addition on that, the paper 'Circular economy for the built environment: A research framework' builds on the interconnections in six dimensions and adds the top-down and bottom-up approaches as seen in figure 60. As shown in this diagram, a 'six pillars' framework is based on the fact that to successfully meet the goals of today's sustainability research it is necessary to combine the use of different disciplines, such in trans-disciplinary research Firstly, the peripheral arrowed arcs represent the need for a **holistic approach and a harmonized collaboration** of research initiatives in each of the six pillars. Secondly, the inner dashed lines stress the importance of practical links between each pillar and the others. In some cases, indeed, not all research dimensions may be needed in practice and the framework also allows for sub-groups of two, three, four, and five dimensions. Top-down and bottom-up approaches are considered equally as the impact of **grassroots innovation could be equally important to that of forward-thinking governmental policies** (Pomponi & Moncaster, 2017).

Moreover, as the article 'Against wasted politics: A critique of the circular Economy' by Valenzuela and Böhm stresses, all of these insights on the re-conceptualization of waste, showing the emergence of circularity ideals, have elucidated for us a fundamental consequence: the depoliticization of the discourse on (and against) the unattainability of capitalism (Böhm and Valenzuele, 2016).

Eastern African cities

Specifically in Eastern African cities, urban waste provide many circular opportunities and they are key for area development. **Informal waste recycling already exists but jobs are often unsafe, poorly paid and taken up by the most marginalized among the urban poor**. Waste removal and processing policies and other supportive instruments (e.g. regulations and strategies) for moving waste recycling towards safer, more profitable and socially valued occupations are needed. (ICLEI & UCLG Africa, 2014). **Diversifying to local, medium scale waste markets can help migration towards circular resource management if solid waste is reused in the CE school of thought.**

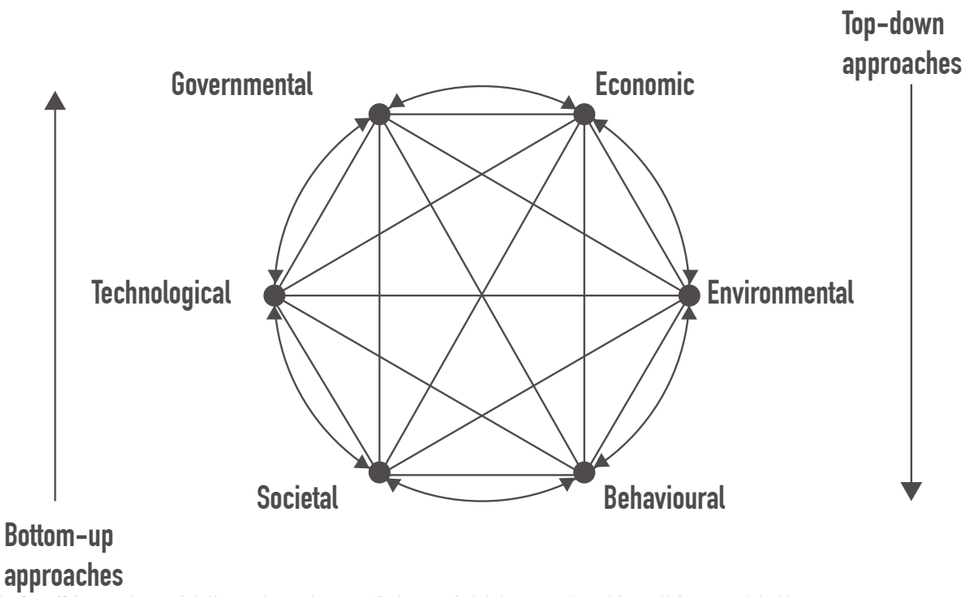


Figure 60: Based on. Frame of References: six dimensions for building research in a circular economy - 'Circular economy for the built environment: A research framework' - Pomponi 2017 -Authors' diagram

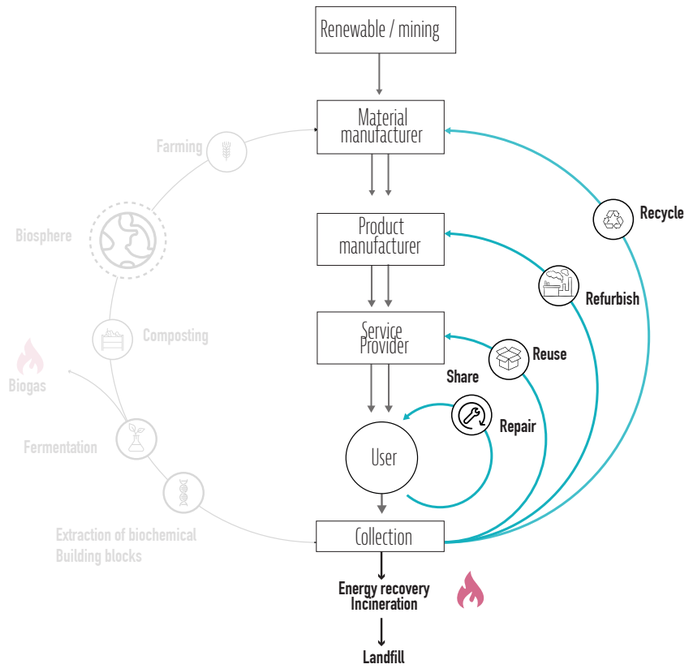


Figure 61: Based on butterfly diagram Ellen MacArthur foundation 2012 -Authors' diagram

Change of Behaviour

Being aware of the implication to change an attitude towards waste, this brings in social and economic science towards change of behavior. In this paragraph shortly an brief overview of possible relevant theoretical models and in which way it could or could not be used.

Figure 62-a shows the Attutide-Intention-Behaviour model, in which De Vries stressing the fact that a specific intention towards a phenomenon can lead to a certain behavior, **provided no barriers and the required skills.**

Bandura points out in his Social Learning Theory that **new behaviors can be acquired by observing and imitating others.** In addition to the observation of behavior, remarkable is his notion of learning by observing **rewards an punishment**s. When a specific behavior is rewarded commonly, it will most likely continue. At the same time, if a particular behavior is repeatedly punished, it will most likely halt (Bandura, 1971).

In addition on this, Ajzen elaborates on personal believes as on subjective norms and perceived behavioral control (Ajzen, 1991). Mainly the subjective norm points out the **importance of the perception of the social environment surrounding the behavior**.

Merging these social and economic theories, social psychologist of behavior change Reint Jan Renes and his colleagues developed a new model, Persuasive by Design Behaviour Change Model. They stress that despite increased interest in applying psychological theory to the practice of designing behavioral change interventions, design professionals often lack adequate knowledge and resources to do so.

As Renes explains; **the model inspires designers to consider the distinction between automatic (impulse, habitual) behaviour and controlled behaviour;** the former takes the form of a simple cue-response-chain, whereas the latter is more reminiscent of a thermostat, in which a person compares their own behaviour with a set goal, and given enough motivation, opportunity, and capabilities, regulates their behaviour (Renes, R.J., 2014).

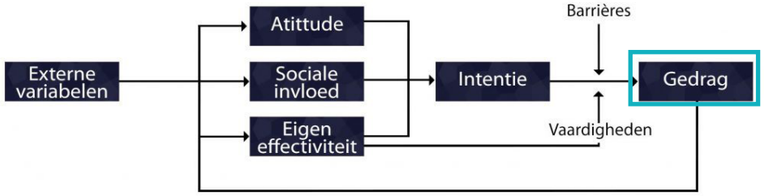


Figure 62-a: Attitude-Intentie-Gedrag-model (De Vries, 1988)

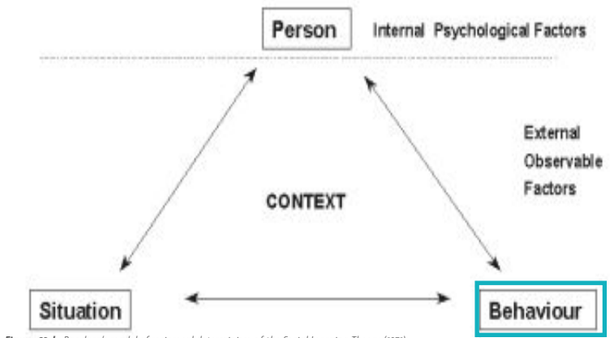


Figure 62-b: Bandura's model of reciprocal determinism of the Social Learning Theory (1971)

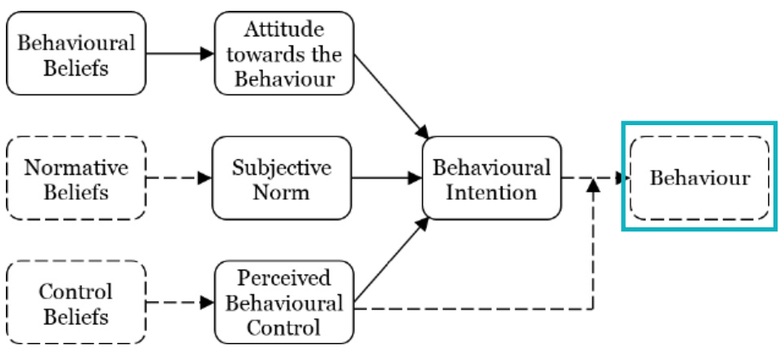


Figure 62-c: Theory of planned behavior (Ajzen, 1985)

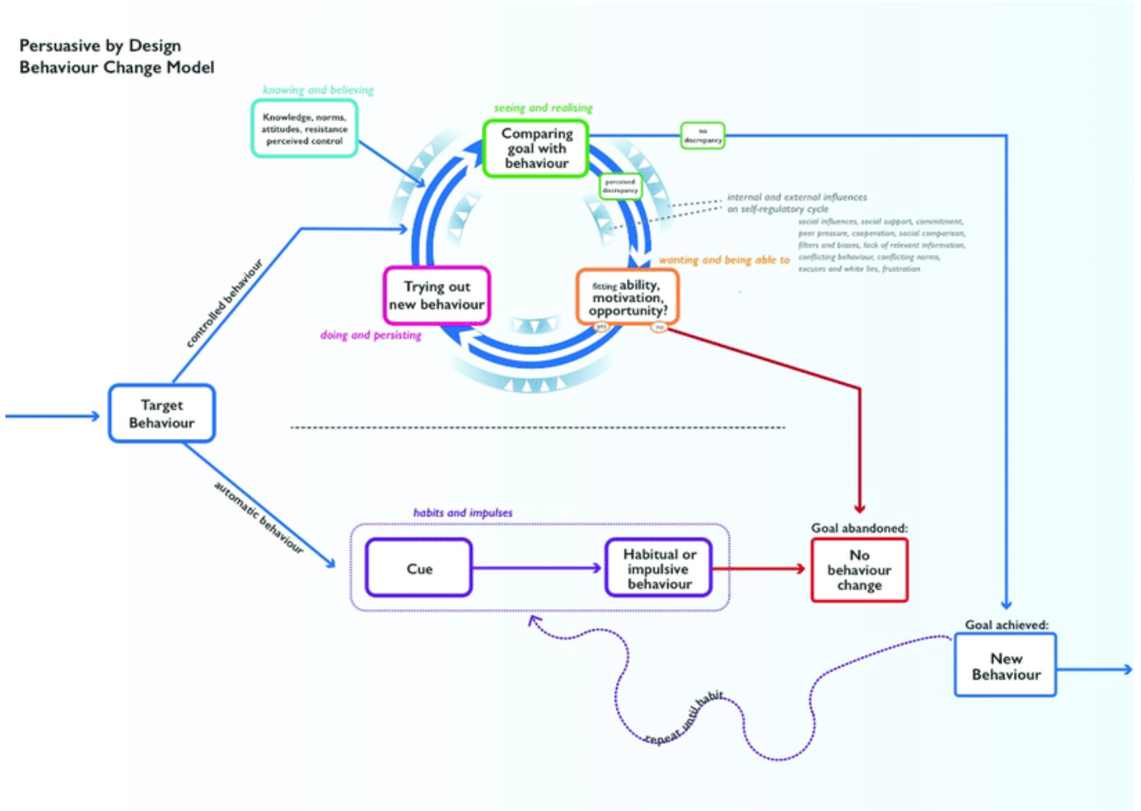


Figure 63: Reint Jan Renes - persuasive by design behavior change model - 2014

II. THEORETICAL FRAMEWORK

Reviewing existing literature on as well CE as well CBO delivers in-depth insights and understanding in both concepts.

After outlining the definition of CBOs and analyzing different case studies in LDC, this resulted in an overview of requirements, challenges and opportunities for CBOs and their impact. The theory paper concludes in challenges and opportunities for CBOs to be a suitable solution for the current waste management system. These lessons can be learned to improve the working of the CBO in Dandora, the DTL and DHC. As key requirements in order for a CBO to work sufficient, the paper identifies first of all the **willingness to participate by locals, secondly education to foster independence of members, thirdly involvement of stakeholders in creating a shared planning and vision and at last a sense of self-organization**. As main opportunities public-private-partnerships are mentioned by various sources, as well the chance to cooperate with the youth. Moreover, over-time changing leadership is identified as a major success factor. The treats as discovered by the analysis, mainly include financial restrictions to sustain CBO or waste management activities, lack of local incentives to participate and the missing management to supervise the linkage between different actors and scales.

To apply this on the Dandora case, DTL as well DHC could improve on educational tools to foster different community members towards more independently oriented actions. In case of scaling up and spreading out their concept, as the DTL vision formulates, the sense of self-organization should be not forgotten. Currently DHC is working on reaching out to the youth, already by (social) media, and since this is identified as key opportunity, this could be enhanced even more. Considering the fact that DTL initially started off as competition between courts, different members could become winner and leader for a period of time. However, to make sure there will be no single leadership dominating, supervision to be changing from time to time is key.

At last, current collaborations with various stakeholder could be complemented by public-private-partnerships specific on circular resource management.

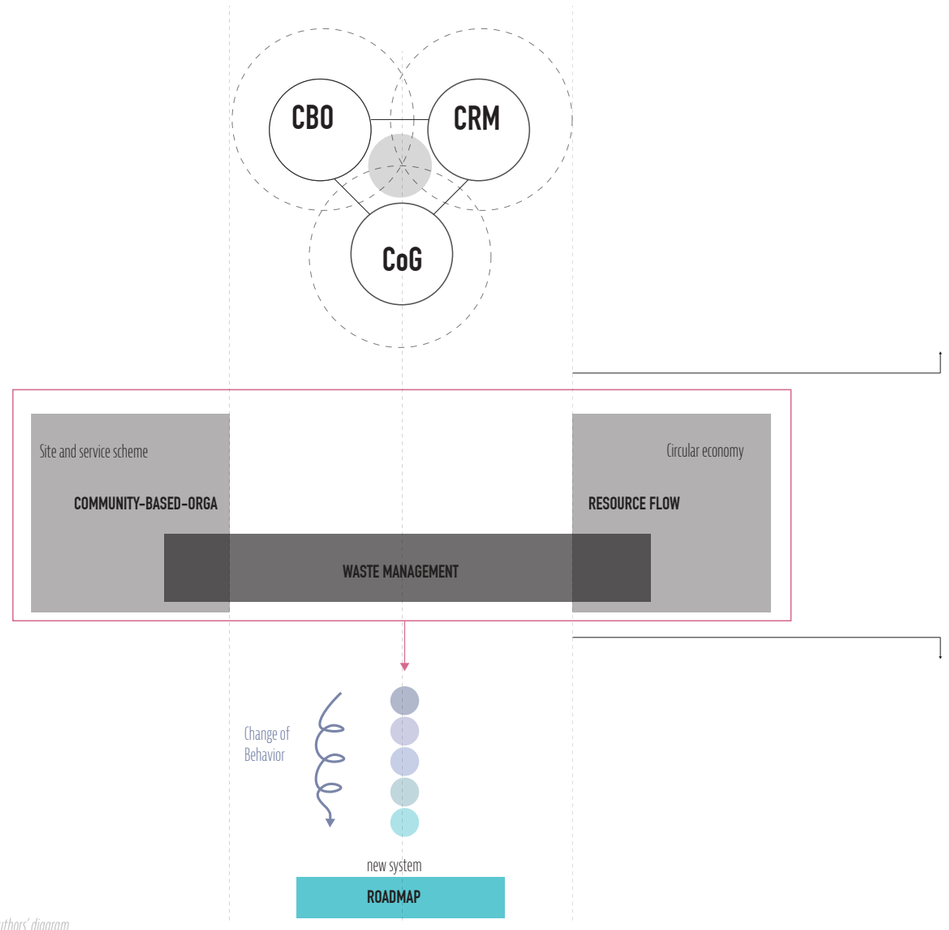
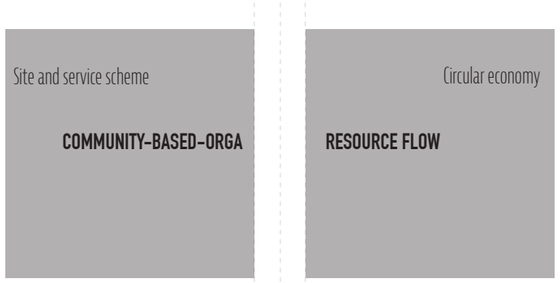
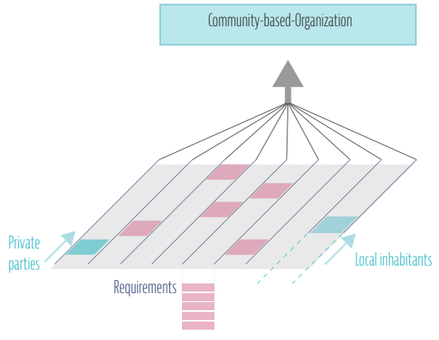


Figure 64: Theoretical Framework - Authors' diagram





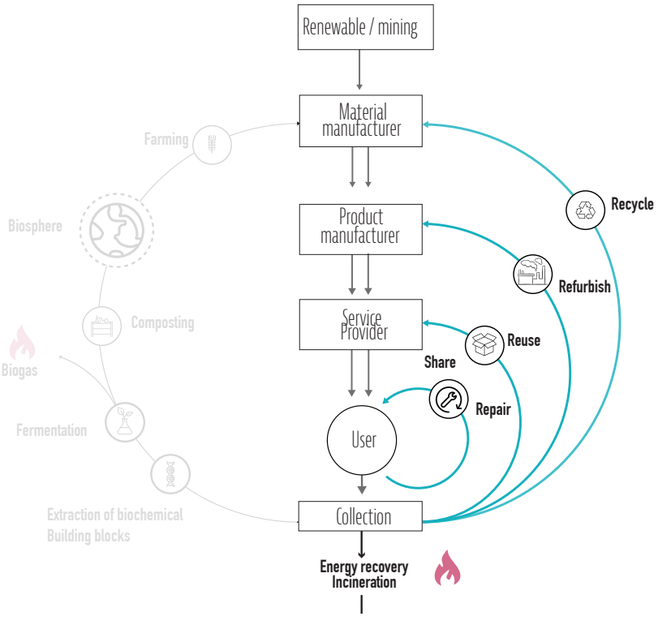


Figure 65: Theoretical Elaboration - Authors' diagram



Picture: Authors' own image - 2019

IV.

RESULTS

SQ 1.1 1. History of waste management plans in site&service scheme of Dandora

SQ 2.1 2.1 Current metabolism

- i. Conclusions on system
- ii. Conclusions on spatial realm

SQ 2.2 2.2 Stakeholder perspective

- iii. Conclusions of social construct
- iv. Conclusions on governance

SQ 3.1 3. Potential and trends

- i. Paradigm in its context
- ii. Identified opportunities and existing examples

SQ 3.2

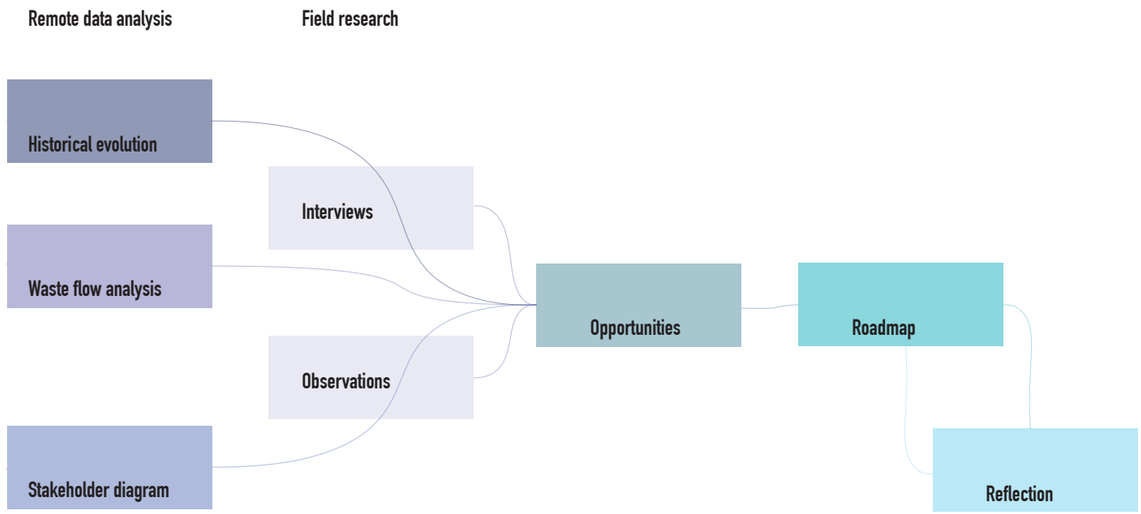


Figure 66: Structure results thesis - Authors' diagram

1. HISTORY OF WASTE MANAGEMENT IN SITE&SERVICE PLANNING DANDORA

1. How were the SWM processes organized in the original plans for Site and Service Scheme in Dandora?

SQ 1.1

History of challenges

Reflection site&service scheme Dandora

The Dandora project was initiated to test the legitimacy of the sites and services strategy in providing low-cost shelter for low-income households. The philosophy was to combine public investment in land and infrastructure with mobilization of the savings and labour of the individual family. Self-help housing was on the agenda of the international agencies, with much inspiration from Latin America.

In Nairobi, unemployment, inadequate incomes and a severe shortage of low-cost housing to cope with post-independence population growth and migration had resulted in the flourishing of squatter settlements and various forms of informal rental slums.

By 1974, neither the formal private sector nor the public sector could meet more than a fraction of the need for housing accessible to low-income people. The public sector catered for 10 per cent of the annual need, the formal private sector produced nothing for low-income people. **In any case, one third of the population could not afford the cheapest public rental housing, even if they had access to it.**

While under-performing, Dandora's service and site scheme appeared to be a success to the world bank. Compared with Dandora, the Second Urban Project's sites and services schemes are more stratified, as
mixed development was promoted. This included plots for sale on the open market, the provision of community facilities and small scale industries. As Dandora was considered a success, the issues of allocation procedures and beneficiaries which caused so many conflicts and heated discussions during the preparation of Dandora and Makongeni, were not on the agenda, while the discussion of development of standards continued to be a subject of conflict.

According to the plans, the 6,000 units should have been completed in the period 1974-78. Construction of houses did not start until 1977/78 and still by 1980 less than 1,000 units had been constructed. The issues causing the delays are officially referred to as "governmental and administrative weaknesses", and "halfhearted acceptance by the city council of the principles involved", main the principles of impartial plot allocation. The process has so far taken ten years as opposed to the five years originally intended (World Bank, 2013).

In reviewing experience to date, it appears that Dandora has achieved many of its objectives, despite many constraints. It may be that in terms of size and expectations, the project was on too big a scale and too ambitious for the skill levels, implementing capacity, and prior experience of financing. A simpler initial project with fewer plots and fewer components might have given the local staff involved in the project execution a better chance of learning by doing. The technical division suffered from shortages of manpower resulting in supervision which was not always adequate. Slow approval procedures led to delays in construction. Many allottees built extra rooms with no or improper permission. In reality, control on the development of business on or adjacent to the plots was abandoned.

The impact of Dandora on the lowest income groups is nil and its impact on the low-income group is quantitatively limited. Therefore, in the absence of other privately or publicly developed alternatives, unauthorized housing has proceeded largely unaffected.

A dramatic illustration of this can be found in the Korogocho slum area adjacent to Dandora, where the population has increased much faster than in Dandora itself. Dandora has undoubtedly made that area attractive for informal landlord development, but of course is not the direct cause of this development.

Thus, the World Bank concludes, there is no sound argument for abolishing the sites and services strategy. *(World bank, C:3., 2013)*

Waste situation Nairobi

In Nairobi each of its estimated 3.5 million residents generating between 200 and 800 gram of solid waste every day.

Nairobi has no means of safe disposal, and only 400600 tons of its waste reaches the Dandora dumpsite every day. Two thirds of the waste generated in Nairobi cannot be accounted for (Ngau, 2013).

The following points summarize the key challenges of solid waste management in Nairobi.

-■The public sector struggles to run an effective and efficient waste management system. The resources available to Nairobi City County (NCC) are insufficient. Commonly cities in developing countries spent 20-50 per cent of their budgets on waste management. NCC spends only US$5 million of its US$300 million budget on waste management, representing not even 2 per cent of the total (Institute for Social Accountability, 2014).

For a city of 3.5 million inhabitants, NCC only has around 20 functioning waste collection trucks at any time. This, combined with contract private companies, only allows for collection of waste in the city centre and public markets.

-■Current private sector waste management models do not offer a solution to this problem either. This is because firstly, waste collection companies only collect waste for the purposes of disposal; and secondly their services are too expensive for the majority of Nairobi's population.

-■Private sector waste collection companies collect waste from households and businesses for disposal at Nairobi's only official dumpsite, Dandora or at various illegal dumpsites. As a consequence, very little of the collected waste gets recycled.

-■The collection-for-disposal approach of waste collection companies makes their services too expensive for most Nairobians.

First, not recycling collected waste has immense opportunity costs: Revenues from selling recyclable materials would help in lowering collection fees.

Second, disposal at Dandora dumpsite (or at the illegal dumpsite) is extremely inefficient and time consuming, involving long queuing, getting stuck due to lack of roads and inefficient manual off-loading. Thus, Nairobi's waste companies can only do one collection trip per truck per day. This level of inefficiency then results in high collection charges.

As a result, existing private sector companies in Nairobi collect waste only in middle to higher income areas, while not engaging in any recycling of organic waste. This leaves two thirds of residents without any proper waste management services.

Waste recycling and composting

Waste is a resource and has considerable economic value. Organic waste, which constitutes 69 per cent of Nairobi's waste, can be converted into compost. Recyclable waste such as paper, plastic, glass and metal (16 per cent of waste) is used by industries for manufacturing new products (JICA, 2010). For these waste-to-value products, there exist large underserved markets in Kenya.

Currently in Nairobi, more than 2000 people earn a living through their engagement in resource recovery, at 250-300 ton per day of recyclable/reusable material recovered, they account for only about 8% of the waste stream. Recycling rates of the order of 20% are achieved in many other contemporary cities.

Dandora waste specific

Current research upon determination of levels of income generated from Solid Waste Management (SWM) practices, assesses contribution of the income to participating households (HH) and make policy recommendations to exploit existing potential in SWM practices. In this research the following main outcomes derive:

- SWM practices provides positive influence on socioeconomic lives of participants. As this research recommends separation of waste at household level for easier collection, disposal and recycling; regular waste collection to avoid creation of mini-dumps in residential areas; and support for research and popularization of adoption of appropriate and low cost SWM technologies locally available to reduce handling cost of recyclable waste (Wangatia, 2013).
- Dandora Slum is particularly complex, because of the Dandora dump site occupying 32 acres of residential land, creating congestion, insecurity for scores of unemployed households (HHs) who resort to SWM practices for lack of alternatives for a livelihood (Wangatia, 2013).
- The situation Analysis of SWM in Nairobi reveals that, until the mid-1970s the Nairobi City Council (NCC) singly collected over 90 per cent of the waste. In the late seventies, the Council owned 118 waste collection trucks which still had great difficulties collecting 800 tons of waste generated daily then. In the year 2002, Nairobi City Council admitted that it was unable to manage waste effectively in the city and of particular concern was the proliferation of informal medical facilities, some of which are located within residential areas. Even though collection of Solid Waste has been partly outsourced to the private sector, the council currently has less than 20 trucks which are expected to collect about 25 percent of the estimated 2,600 tonnes of solid waste generated daily and dumped at Dandora dumpsite whose capacity has been exceeded (UNEP, 2005). The problem has been compounded by the high population density settlements that have emerged in Dandora approximated at 36,253.8/km2 occupants spread within HHs some of which live within less than the recommended one kilometre (1km) buffer between the waste and the settlements posing serious social, environmental and economic problems to the residents and indeed the entire City of Nairobi (NCC, 2010).
- SWM practices in Kenya envisage the "polluter pay principle" where every polluter must meet the cost of disposing the waste in question. Similarly, every waste generator has a duty to ensure safe disposal of the waste. According to Afullo and Odhiambo, (2009), an individuals' the choice of involvement in a certain SWM practice, together with the technical and organizational nature of appropriate solutions, depends significantly on the country's economy and on the economic; situation and context in the particular environment where they live.
- ■

Conclusions

- Majority of the population participating in SWM practices were motivated by the income generated from the practice.

- Currently, out of the 118 waste collection trucks, only 20 are running in the city of Nairobi.

- Although the NCC was collecting around 90% of waste in the mid 1970s, since 2002 they admitted not being able to manage sufficient and nowadays it is resulting in illegal and poor circumstances.

2.1 CURRENT METABOLISM

2.1 What are the current waste management practices on household, court and town level?

SQ 2.1

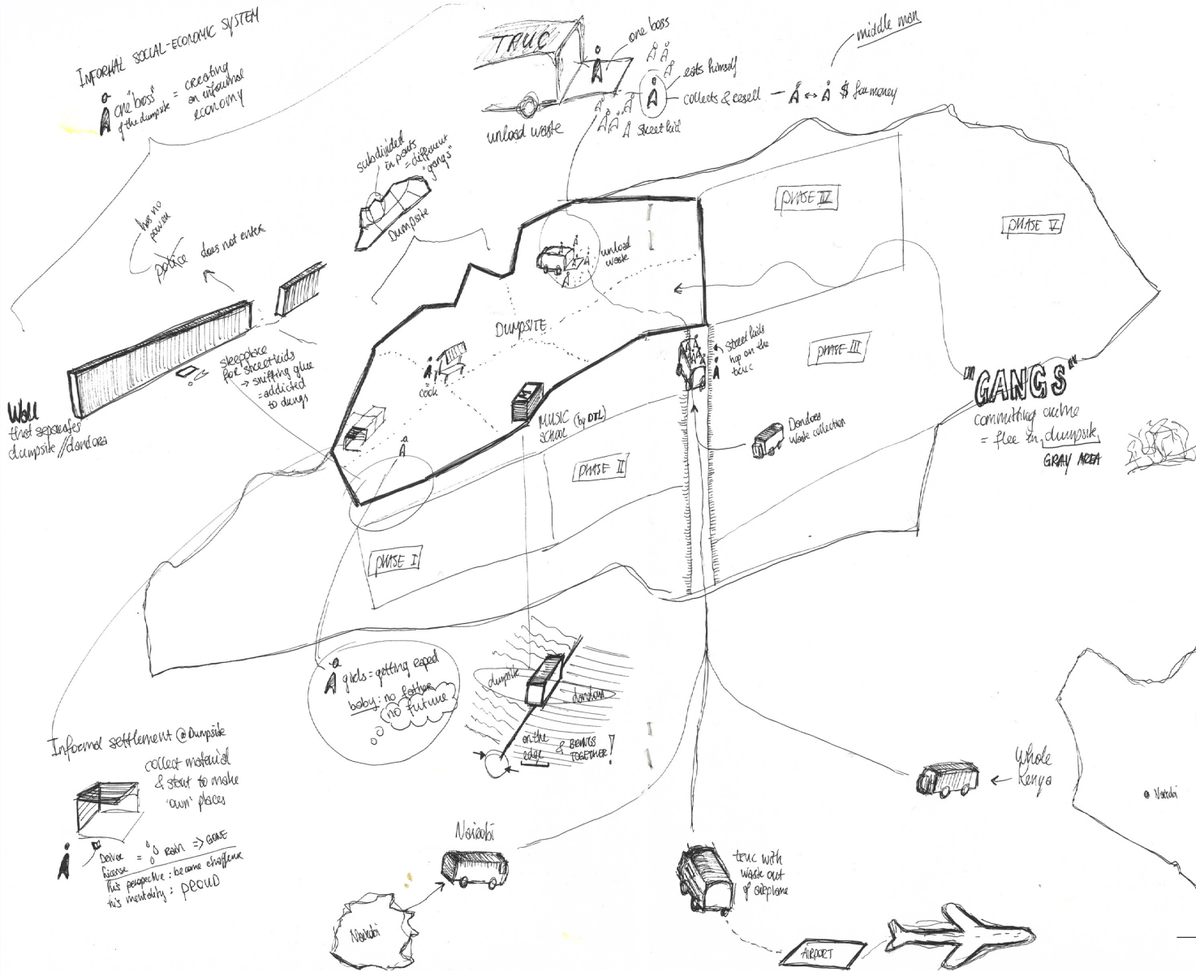
Current processes + metabolism

Before understanding what the current waste management practices on household, court and town level are, it is important to recognize that the Dandora Dumpsite plays a big role in this system. The drawing gives an indication on the dynamics in and around this dumpsite. Most remarkable is that the whole dumpsite is ruled by informal groups, or gangs, and even the police does not have power over them. The waste is coming not only from town, it is also coming from the international Kenyatta Airport and contains the left-over food of the flights.

Figure 76: Location of Dandora and the international Kenyatta Airport in Nairobi - Authors' map



Figure 77: Practices in and around the dumpsite of Dandora - Authors' diagram



2.1 CURRENT METABOLISM

behaviour	regarding throwing of waste
governance	lack of feeling of responsability
economy	dangerous jobs

HUMAN BEHAVIOR REGARDING THROWING OF WASTE PLAYS A SIGNIFICANT ROLE IN THE URBAN SYSTEM. THERE IS A LACK OF KNOWLEDGE ON HOW TO ACT DIFFERENT.

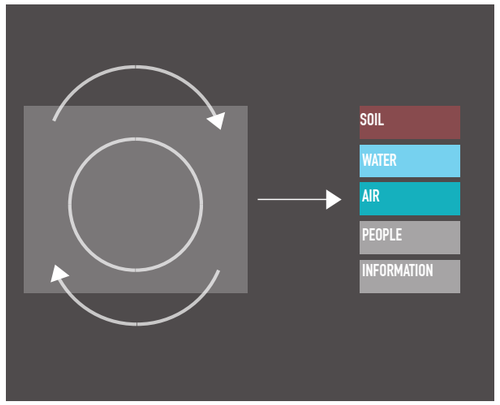
behaviour	regarding throwing of waste
governance	lack of feeling of responsability
economy	dangerous jobs

LACK OF FEELING OF RESPONSABILITY BY GOVERNANCE, INDIVIDUALS AND PRIVATE COMPANIES

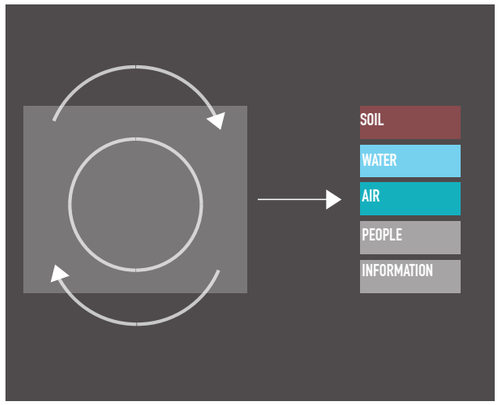





2.1 CURRENT METABOLISM



CONTAMINATES SOIL AND WATER
WATER QUALITY HIGH RISK FOR HEALTH



THREATENS ECOLOGY AND NATURAL HABITAT OF ANIMALS









Authors' own pictures

2.1 CURRENT METABOLISM

environmental and climate change impacts

depletion of natural resources

behaviour regarding throwing of waste

governance lack of feeling of responsability

economy dangerous jobs

HIGH AIR POLLUTION OF BURNING WASTE
AIR QUALITY HIGH RISK FOR HEALTH



DANGEROUS AND INFERIOR JOBS



2.1 CURRENT METABOLISM

i. Conclusions on system

iii. Problem in system of urban metabolism

Understanding the local context and the complexity of the urban system, the diagram below visualizes the main problems around the inadequate waste management. As urban flows are in somehow linked to each other, the figure overlaps according to the degree of connection between flows. The diagram shows the consumer as main actor in the problem field. The diagram on the right highlights the focus within the broad scope of waste management as well the identification of potentials such as bins for the collection and separation system.

Figure 78: Overview of urban flow according to the concept of urban Metabolism - Authors' diagram

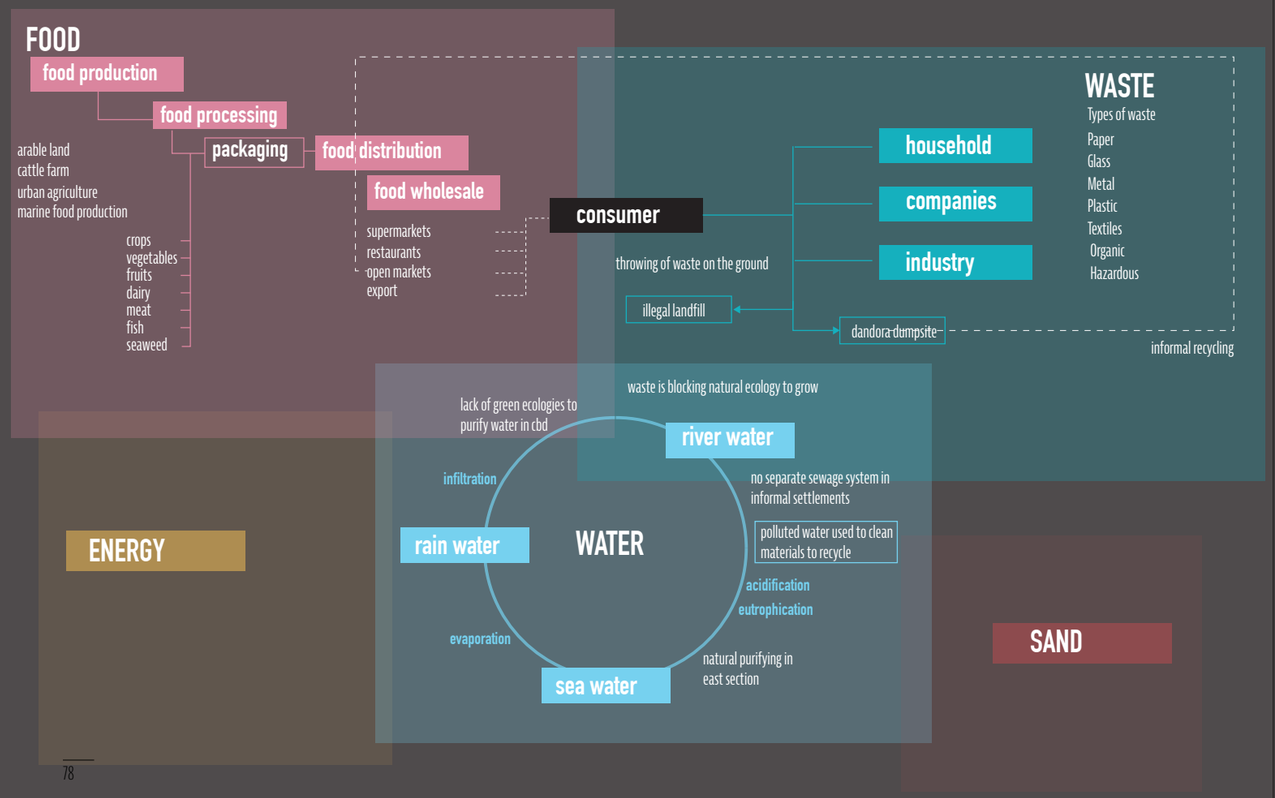
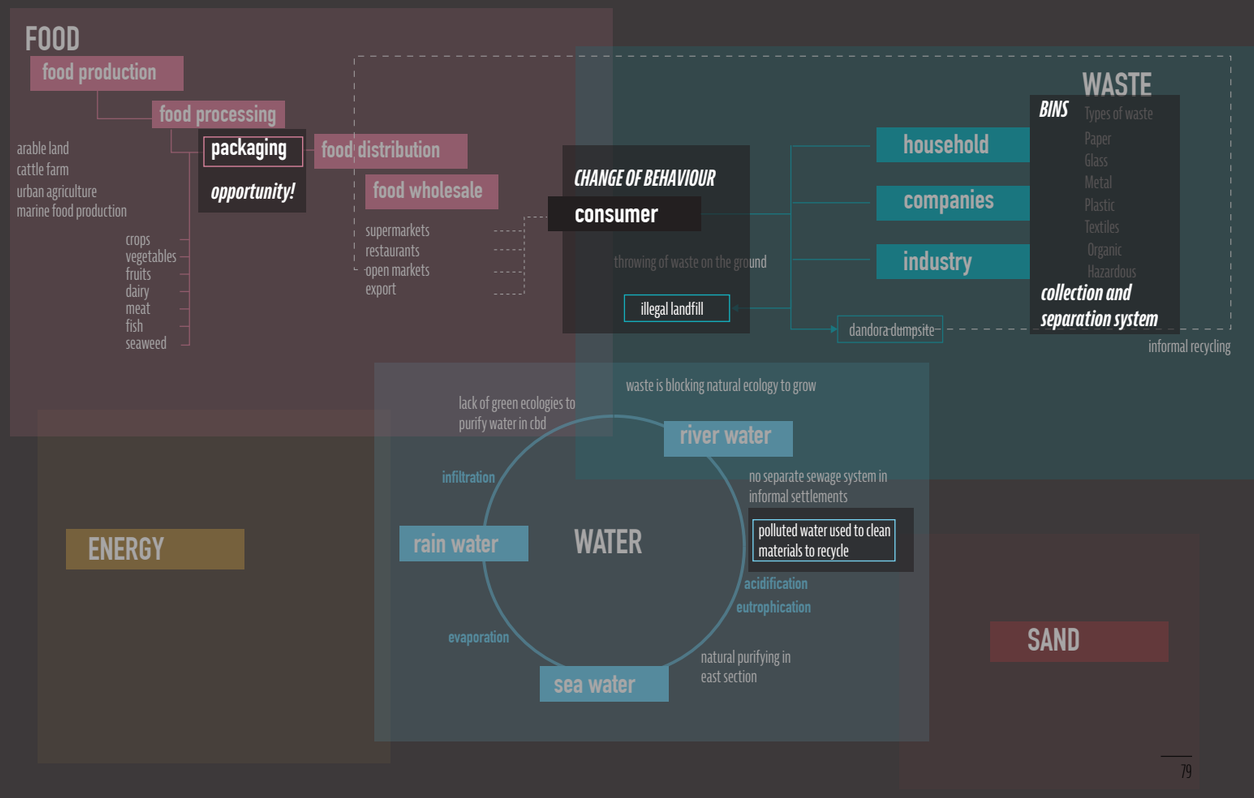


Figure 79: Focus points and identificaton of potentials within the urban flow according to the concept of urban Metabolism - Authors' mapa - Authors' diagram



2.1 CURRENT METABOLISM

i. Conclusions on system

iii. broken ecoysystem

Identification of problems in a systematic manner, placed in context helps to locate the shortcomings of the waste management system. As far as the data allows to produce a Sankey diagram, the diagram on the right clearly highlights the inadequate collection system. Remarkable is that separation sometimes happens after the dumping of waste. This is characterized by the informal economy at the dumpsite. Another noteworthy aspect is that the - almost only - separation which takes place, only PET and HD-PE are. These plastics, type 1 and 2 - shown in the diagram on the right above - are recyclable and profitable. Since there is a business case behind these materials, people understand the value of collection separating and reusing it. However, the two third of not collected waste effects land, water, soil and sand. It interrupts with the ecosystem. The interruption of the ecosystem at the Dandora Waterfalls is shown in an abstract way in the collage below.



Figure 80: Broken ecosystem Dandora Waterfalls - Authors' collage 2019

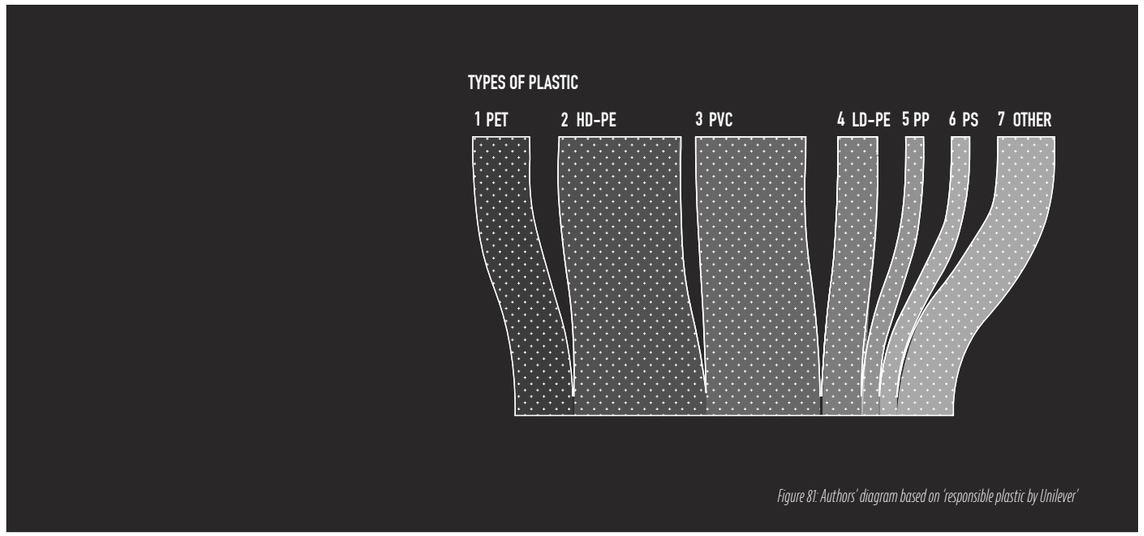


Figure 81: Authors' diagram based on 'responsible plastic by Unilever'

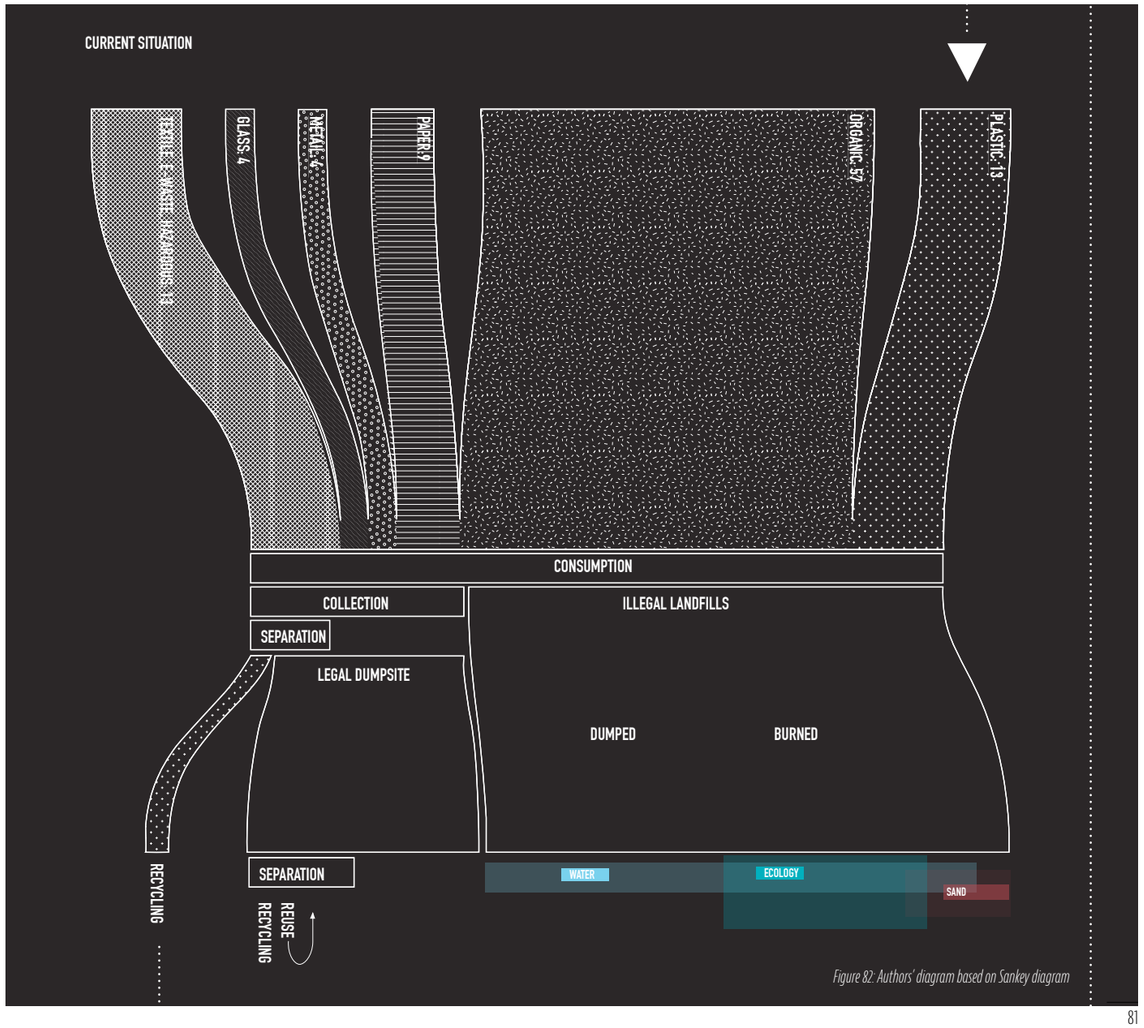


Figure 82: Authors' diagram based on Sankey diagram

2.1 CURRENT METABOLISM

i. Conclusions on system

iv. Behaviour regarding waste

As the system is lacking, the knowledge how to treat waste in another way and how to change this behavior is also lacking. The thesis of Simone Andersson explicitly reveals local knowledge around waste management, but especially the required communication about this knowledge. Her research, called Environmental Communication for sustainable development in Kenya - A qualitative study focusing on solid and liquid waste - gathers perspectives on effective ways to communicate to reach goals of a sustainable development, by means of interviews.

Particularly interesting for this graduation research is that one of the interviewees explains '*there was already so much garbage laying around*' as reason to litter. At the same time another citizen illustrates his change of behaviour as he got fined by the authority for offence.

Another relevant aspect Andersson addresses in this research is the perception of the current environmental communication that is happening (2018). Shown on the right page is the 27% of (social) media which provides this. Even more relevant is her next finding on what respondents think would be an appropriate way to educate and communicate on waste and water matters. **'A majority (30 of 47 people) mention schools as the given establishment.'**

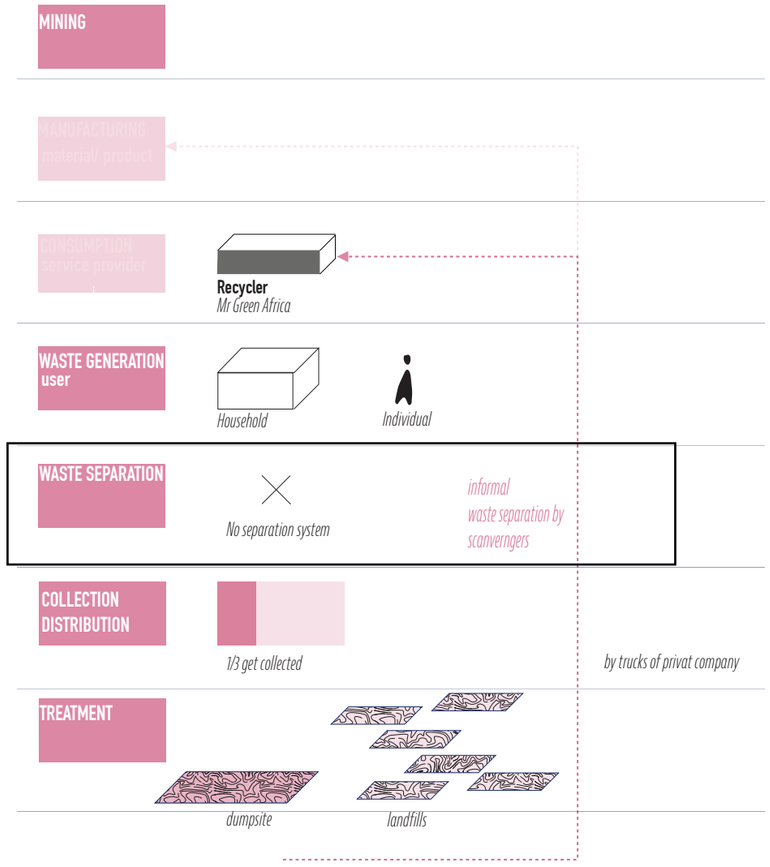


Figure 83: Systematic overview of waste management problems - Authors' diagram 2019

PEOPLE'S VOICES

"Seeing is believing!"
Man 58

"The county wastes a lot of money on health sector, yet not taking the main issue, which is water and dirty water. If you don't make good budgets for the citizens, you end up killing them in return."
Woman 39

"Me, you, the county government."
Man, 36 yrs

"Multisectoral approach is needed, health officers to be more efficient and budgets allocated to county government for grassroot management of water and sewage."
Man, 30 yrs

"With technology, any waste is a resource."
Man, 53 yrs

"If the government does its part, I will do mine."
Woman, 25 yrs

"People must be shown the benefits of living in a clean environment and the governor should be in the forefront to show people to conserve the environment."
Man, 46 yrs

"Cleanliness starts with oneself."
Woman, 25 yrs

Figure 84: Quotes of presentation Environmental Communication for sustainable development in Kenya - by Anderssson 2018

Figure 6. Perception of what kind of environmental communication is happening today, in relative abundance of total number of suggestions mentioned (78) by 47 respondents.

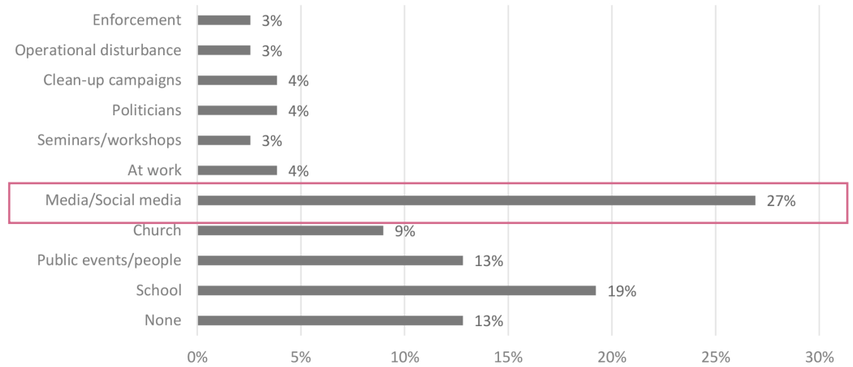


Figure 9. Spontaneous opinions of how/where/when environmental communication should be provided in society, in relative abundance of total number of suggestions mentioned (123) by 47 respondents.

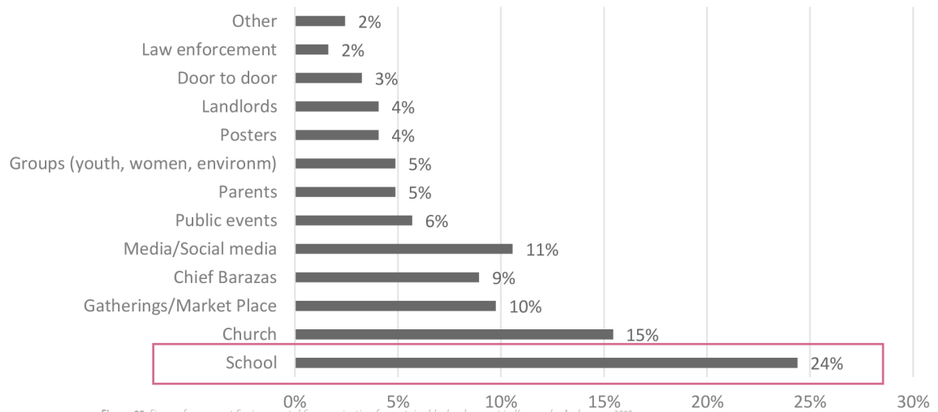


Figure 85: Figures from report Environmental Communication for sustainable development in Kenya - by Anderssson 2018

2.1 CURRENT METABOLISM

ii. Conclusions on spatial matter

Geological location of Nairobi, estimated on an altitude of 1.795 meter above sea-level. The spring of the Nairobi River originates just in the West of Nairobi itself. It continues as Thika river heading East and ending just above Mombasa.

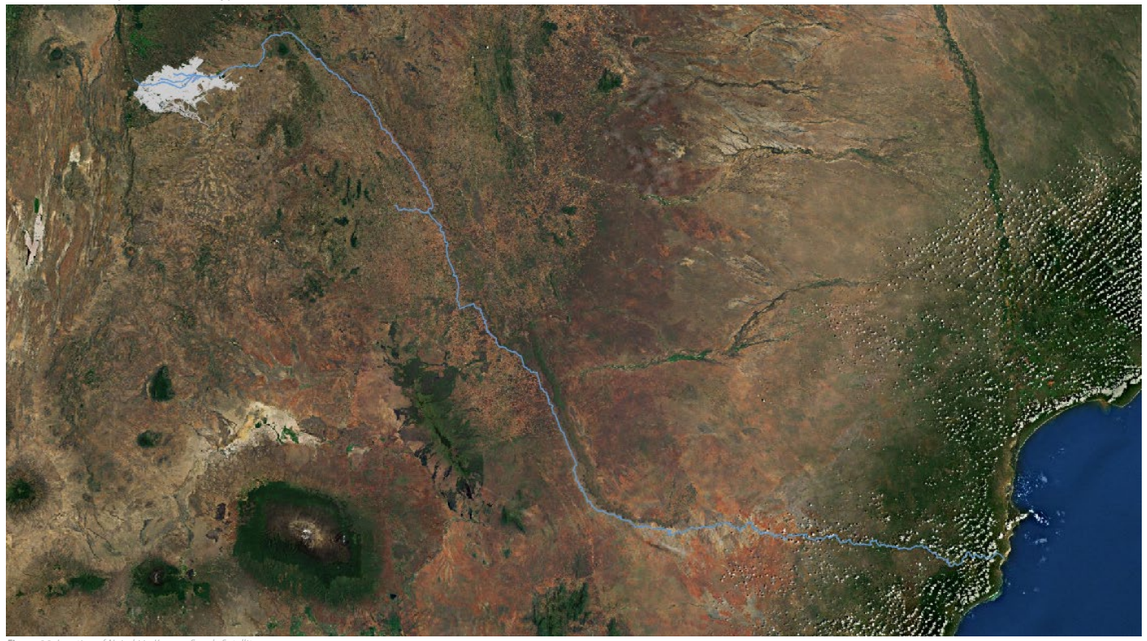


Figure 86: Location of Nairobi in Kenya - Google Satellite



Figure 87: Nairobi divison of West (dark red), Central Business District (dark) and Eastlands (pink) - Authors map 2019

Zooming in on East of Nairobi, various slums contribute to the pollution of the water by dumping their (human) waste directly in the river. Kibera slum, Mukuru slum, Mathare slum and Korochogo slum share the biggest stake in the pollution. Zoom in on Korochogo slum, which together with Dandora and Lucky summer heavenly contribute and are effected by the polluted water.

Location of slums along Nairobi River that contribute to pollution of the water

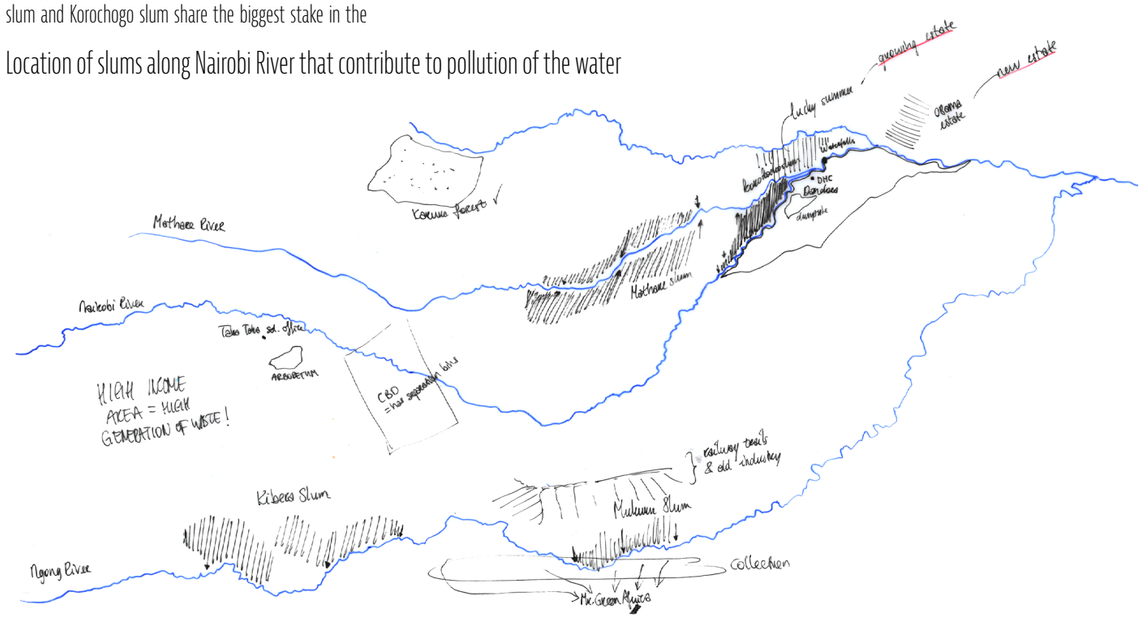


Figure 88: Nairobi and its slums polluting the urban rivers - Authors'map 2019

Zoom in on Korochogo slum, which together with Dandora and Lucky summer heavenly contribute and are effected by the polluted water

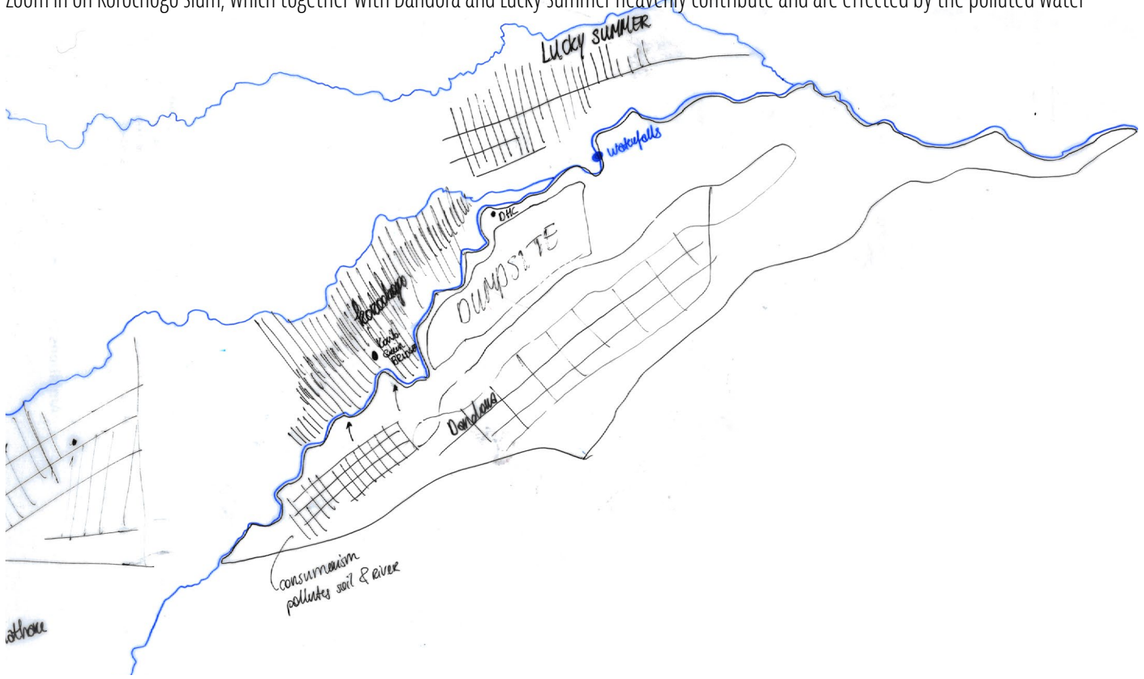


Figure 89: Zoom in on Korogocho and its influence on the urban rivers - Authors'map 2019

2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions of social construct

2.2 Which stakeholders (public, private, CBO) are involved in these processes?

SQ 2.2

Scales + stakeholders

Multiple stakeholders are contributing to various campaigns as stressed in the previous chapter. UN-Habitat is collaborating in the two main movements, the DTL and PSN. Governmental and research institutes are doing investigations in the field of waste, circular economy, community-led-innovation and privat-public-partnerships. Currently as well the government, the Dutch embassy, UN-HABITAT III in Quito and other international organizations are enlarging their attention to these movements. In the beginning of 2019, the Making Cities Together movement with its trial project the Model Street in Dandora, was top 10 listed for World Habitat Awards 2018.

To confirm the hypothesis as described in chapter II, Elinor Ostrom (1998) points out, *"national governments are too small to govern the global commons and too big to handle smaller scale problems"*. Government officials, isolated from the problem they aim to solve, have little ability to adapt their policies to specific local context (Tehlova, 2017). To understand the interrelation between public, private and civic parties, the diagram does a first attempt to map them, see figure below.

The next pages will give an overview of the (local) people I have conducted information from. Information was obtained by phone calls, emails, meetings but most of the time through (semi)-structured interviews. . This synopsis expresses shortly their background and the key findings. Interviewed people are structured by the conceptual framework. So according to their expertise or experience on either CE, CBO or constellation of governance.

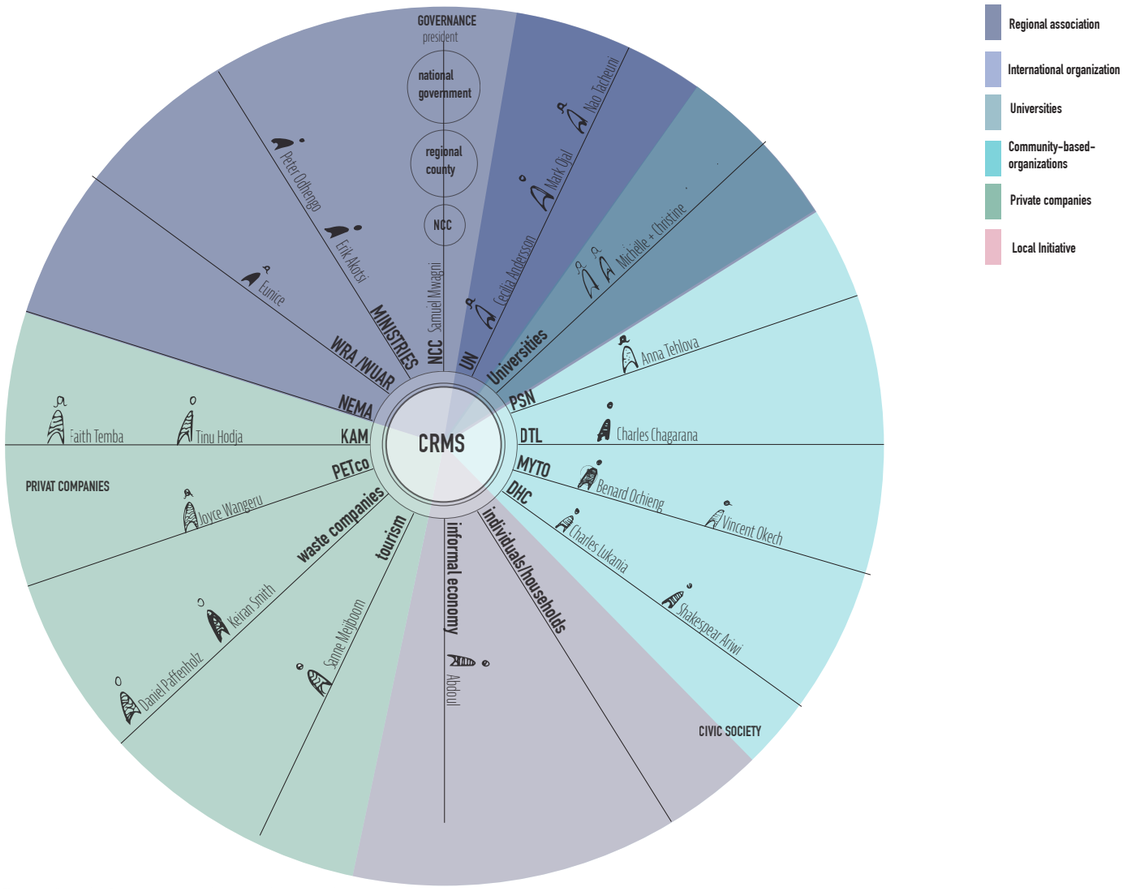
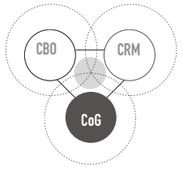


Figure 90: Stakeholder Diagram interrelations based on public, private and civic sector - Authors' diagram

PAULINE BEZEMER



SQ 1.1



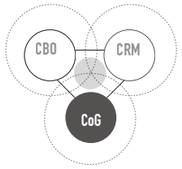
UNIVERSITY OF GRONINGEN
PHD ON HISTORY OF URBAN PLANNING

- **Site&service scheme** = self build scheme. Planning a lot on paper, realized not even half of it. Dandora was massive project, big and in a need of fast solutions.

- Waste management: in 70's and 80's, after independency, privatizing housing market, also rise of private systems, so waste, electricity and water by private parties. Government has a form of control, but no execution. Nairobi city council, they are never in Dandora. Eastland's are seen as slums.

- Government is not working, since they are **not working with locals.**
- Never us the word 'bottom-up' or 'circular economy', they will not understand.
- Local people will not understand maps, they remember places like 'mindmaps'
- Social groups are **self-organized**, they work with a leader
- Neighborhoods can be organized with **governor** from colonial era.

MARK OJAL



SQ 2.1

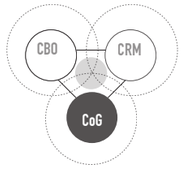


PLACEMAKERS
+ UN HABITAT NAIROBI

- Waste indeed is a local problem. Known by government. No knowledge yet by the people.
- Local people will come to action if they understand the problem and **share the vision** for a solution
- Governance has a lack of presence, occurs: informality and illegality
- He says: good idea to focus on **waste** and waste management, by educating young local people how to re-use it.
- Young people reclaim the space by simple approaches = community-based **competition** between courts
- Urban planners do not really travel much. They don't use public transport.
- One of the key things is to recognizing energy. To enhance an **existing momentum**.
- The community has to see why they do need something
- What is the key to spread out this community-based-action groups

= **Everyone wants to be a winner.**

CECILIA ANDERSON



SQ 2.2



UN HABITAT
MANAGER GLOBAL PUBLIC SPACE PROGRAM
AMBASSADOR CHANGING FACES COMPETITION

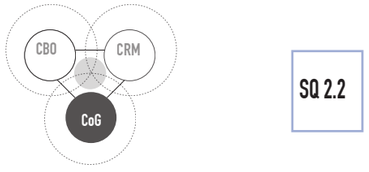
- Around 3000 people make living from the dumpsite
– **Be aware of that informal economy**
- Dumpsite could not move. Council has an urgent problem and lacks solutions.
- 225 slums in Nairobi: plan for it. Korogocho is the poorest slum where people make living from the dumpsite.
- High income area: producing more waste. Low income: less waste generation.
- Example of making art: Wrambo Wasini.

2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions of social construct

v. contacted people

SIMONE ROTS



SQ 2.2

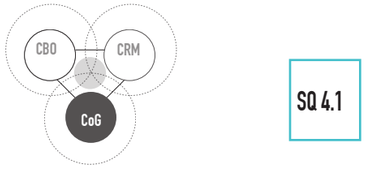


DIRECTOR OF INTI
+ PROJECT IN NAIROBI WITH UN HABITAT

- Site&Service scheme, so-called aided self-help in developing countries. Starts with a plot grid, water and roads, infrastructure for services, core-houses, planned public space. **No plans yet for waste management.**
- Formal and informal growth goes hand-in-hand.
- Global movement in 50s, but stopped around 80s. Afterwards commercialized, no place for the urban poor. Government starts with social housing.

History in Nairobi starts with Naomi Hoogervorst.
Step 1: inventory with students, remarkable is that doing this kind of research is new for the universities. Step 2: design lab with international team of experts, with among others Charles DTL and Jason Hilgefort. 3: competition collaboration with Cave, UN, IFHP, INTI and Placemakers, called: Making Cities Together. DTL in Dandora won this competition . 4: Mind-craft workshop & Building Party with locals was a great success. 5: Quito III Habitat, project was a leading example.

ZAHRA KASSAM



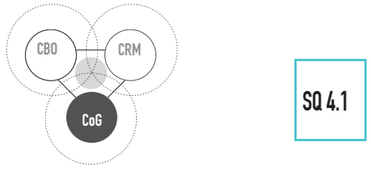
SQ 4.1



KUWA WITH CHANGING FACES COMPETITION

Talk about history of DTL, KUWA, Placemakers, Changing Faces Competition and Public Space Network. Verifying my history of the process (preliminary result).
- Idea of making sports out of dustbins.
- Acknowledging the school idea, give kids points to invest in planting in community gardens or in sport stuff.
- Interesting of Dandora is that men can physically see the dumpsite.

MICHELLE WANJIRU



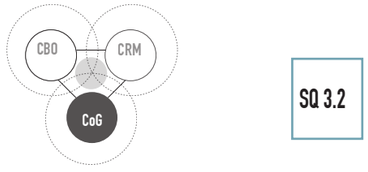
SQ 4.1



LAISON WITH INTI
UNIVERSITY OF NAIROBI

Local tour with Michelle Wanjiru and Christine Waithera. Talked about the way universities are involved in practice and in which manner the government determines the curriculum within education.

SAMUEL MWANGI



SQ 3.2

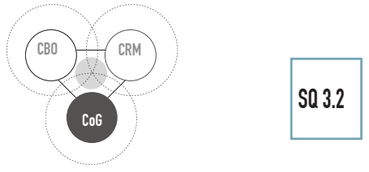


COUNTY CHIEF OFFICER ENVIRONMENT AND FORESTRY

Left hand of Mr. Makori.
- Remarkable: **he was questioning why the government is expected to be responsible for waste management problems.** As role: regulatory.
- In history: JICA that ISWM-masterplan, but implementation went wrong because firstly they had to decommission the Dandora dumpsite and set up a sanitary landfill in Ruai. **Result is that it never happened.**
- Polluter-pays-principle does not work. Have to come up with a new mechanism. Same with water system.
- Each county is independent, so in his eyes: no cross-border collaboration possible. For now, county has to solve the problem on his own. **And for now, incineration is the best option. It is not the best, but is the fastest.**

= On long term: education is.

ERIK AKTOSI



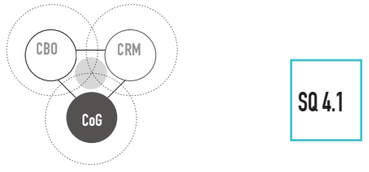
SQ 3.2



MINISTRY OF FORESTRY

In his eyes the national government's role is to create policies. The county government is supposed to be in the county, which management is not adequate.
- they do tree planting, but just on places where there is place. **There is no structural plan**.
- Question: do you think the urban river can be restored? Yes, it can. But the issue is the domestic waste, there is necessity of sewer system. Specially in the places, like informal settlements, where its not there. Although, even where there is sewage, in high rise buildings, there is too much pressure. The capacity is not enough, which is causing flooding. Problematic is the informal settlement areas, where people dump illegally.
- River: domestic waste is main polluter. Organic waste is not a problem. The solid waste, although currently reducing mainly in CBD and with the plastic bag ban.

PETER ODIENGO



SQ 4.1



NATIONAL TREASURY AND PLANNING

Spoke with him at his office in CBD.
- Learned about the concept 'nala-hypothises'

= mostly learned about the hierarchy in Kenya.

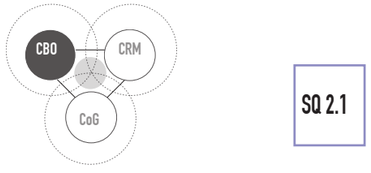
Afterwards I was astonished by the way I was treated as white Western woman in this highly hierarichal and man-oriented environment.

2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions of social construct

v. contacted people

CHARLES GACHANGA



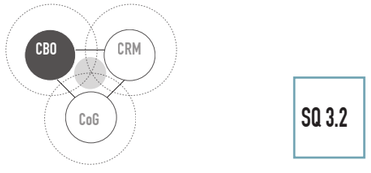
SQ 2.1



CARLOS CEO OF DTL
INSPIRATIONAL LEADER

Enthusiastic storyteller of the success of DTL. Participating in the Changing Faces Competition. Understands the value of qualitative public spaces and underpins the importance of participation of all stakeholders.

CHARLES LUKANIA



SQ 3.2

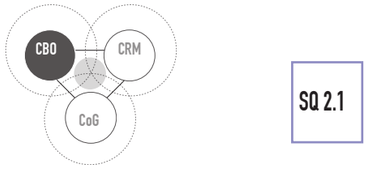


MANAGEMENT OF DANDORA HIP HOP CITY
INITIATOR TAKA BANK

- Artivism: use art to address issues.
- Taka bank = customer borra program, **reward responsible consumers**, links with DTL and includes various collection points. They are connected to different recycle companies.
- Necessity to change behavior: nowadays people throw away all their trash in 1 bag.
- Youth groups: high rate of unemployment.
- Link with universities and ministries.

Local guide together with Shakespear Ariwi.

BENARD OCHIENG



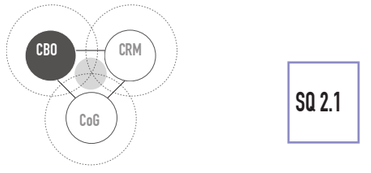
SQ 2.1



MATHARE YOUTH ORGANIZATION
COMMUNITY LEADER

Local host of the guest-house in Lucky Summer.
As inspirational community leader, Ben knows everybody around him in Mathare, Lucky Summer and Obama. Remarkable was that people know the way by the way public transport (Matatu's) are organized.
- Organized site visits and schools visits
- Coordinated workshop with over 26 teachers from 6 different schools.

VINCENT OKECH



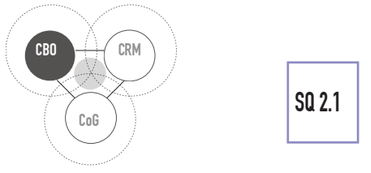
SQ 2.1



MATHARE YOUTH ORGANIZATION
HEAD OF SCHOOL LUCKY SUMMER

Teacher in Lucky summer youth education.
Guide through Mathare Valley.
Expresses his concern for the lack of sewerage system in the informal settlements.

DOMINIC OTIENO



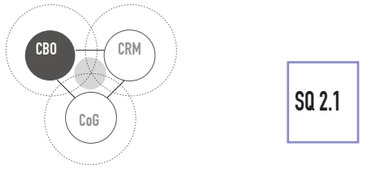
SQ 2.1



WHY NOT SCHOOL
HEAD OF WHY NOT SCHOOL

- Pitched the idea of bringing waste to school = can make up a new system: points every day, more points if you bring separated waste, more points if you can make something out of it.
- **Education as key to success** – acknowledged by as well Dominic, Ben, Vincent.
- As you learn a kid new behavior: means a change as they will teach their parents.
- Sports: way to bring people – especially kids – together.
- Garden as place to rest, harvest and farm. Dominic loves this piece of land, since its one of the only places to come and take a breath. Educational garden: teaches kids about different plants and how to harvest.
- **Water is holy.**
- **Role-model is inspirational.**

FREDERIK OKINDA



SQ 2.1



ENVIRONMENTALIST
HEAD OF KOMB SOLUTIONS

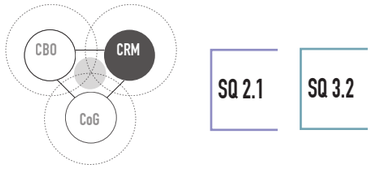
Former robber at the most dangerous bridge in Dandora. Now initiator of a green park next to this bridge, along the Nairobi river in the direction of Korogocho. The idea, which he organised together with Christopher Waithake, was to make a green and safe place. Moreover to restore the riparian zone along Nairobi River together with youths. With youths and for youths, specially for young kids. The NGO Small Step Project created a playground near to the green park. In April of 2019 they won the Changing Faces Competition.

2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions of social construct

v. contacted people

KEIRAN NICHOLAS SMITH

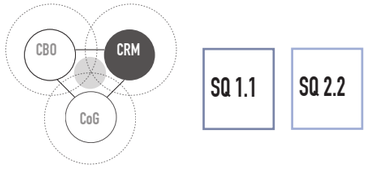




CEO AND FOUNDER OF MR. GREEN + MR. GREEN AFRICA

Organization started in Swiss.
- Realization that waste is not waste, it has a value
In Kenya there was no recycling infrastructure at all and a huge informal market. Important to include.
Great opportunity in Kenya. Lot of plastic waste lying around.
- How it works: subscription = come to collect material. Decentralized aggregation points. Trading points. People bring material. 3 types of plastic.
- Organic waste: includes transport of water. Reprocess, you loose a lot in transport. Big challenge.
- Mr Green started with investment money. Like normal start-ups.
- Challenge to integrate consumers. Incentive with something tangible, a reward. What drives them to change? If it is not impacting us directly.
- If there is no business case, no private company will do something.

ANNA TEHLOVA

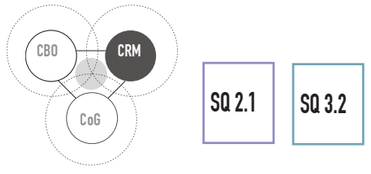




MASTER THESIS DANDORA AND DTL HEAD COORDINATOR PUBLIC SPACE NETWORK

- Current waste management system: people do not separate, they burn all their waste. **As soon it is not in their property = people don't care.**
- NCC: try more. Regular clean up days. Against littering. Currently governor: Mike Sonko. **Every first Saturday of the month: clean up event.** Unfortunately, often after this 1 clean up – second day its dirty again. No real measures = core problem is not addressed.
- **Involve communities from the beginning. So the people feel that its there project. Not coming from outside. If they are involved in a roadmap, very important.**
- Public Space Network is already scaling up to the entire city. Empowering environment for community-driven projects. Work with community-leaders on the ground. Mobilize other groups if this leader understands the value.
- Government = very fragmented. They are not working together, not easy to work together.

DANIEL PAFFENHOLZ





TAKA TAKA SOLUTIONS SOCIAL ENTERPRISE IN WASTE MANAGEMENT

- Why should people change? If there is no incentive, people won't change.
- Disincentive might works in the Netherlands (like taxes, fines) but since there is no exclusive selection source in Kenya, it would not work.
- Low grades (for example yogurt wrapping) is not yet being done. However specifically these are ending up at the river.
- Problem of data. JICA data 2010 is most reliable. **The data of the government absolutely not,**
- Plastic bag ban is working, but only the 1% of the waste. However, it works, because of 50% is going down. But, could have been done without policy.
- His opinion: **youth groups to collect waste are not the answer. They do only primary collection, not secondary.** That's problematic. It is subsidized by the governance, but not effective.

HIMANSHU DODHIA

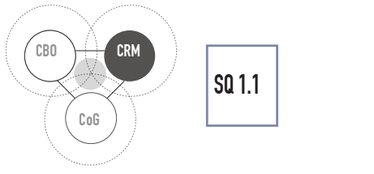




KENYA ASSOCIATION OF MANUFACTURERS - KAM CURRENT INTEREST IN PET SECTOR

- National government is talking about a huge incineration plant with different countries like China and Japan. They think this is the solution to get rid of the waste in Dandora Dumpsite. To burn it all. **This is a quick fix, without a tackling the real problem.**
- Talk about PET bottles. It contains 4 different types of PET. The biggest share is type 1 PET. The top is mostly a mixture of PE and PP (type 7 and 5). However, ideally it is type 2, HDP. The seal and the etiquette are mostly type 3, PVC which is not recyclable. An opportunity, possible these types are made from PET and 100% recyclable. However, the type cannot be distinguished by eye. This should come from the manufacturer.
- PVC has a lower price. **As manufacturer you can make the change. Change the design**.

NAO TAKEUCHI

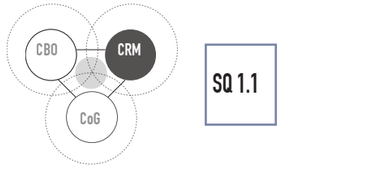




WASTE MANAGEMENT EXPERT AT UN-HABITAT (UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME)

- Advice: Make a strategy according to the waste phases (waste generation, collection & transport, treatment or recycle, disposal). Quantify waste flows.
- Main barrier: financial aspect
- Solutions in her eyes
= Transfer station. Have to check feasibility.
= Online application
= PPP
- Lack of overall vision, difficult accurate data. 119 active CBO on waste, informal collection.
- Acknowledged: people do not know how to treat waste. Low awareness.
- School/education is important, but is not directly affecting the enormous amount of waste right now.
= Reduce: it's the first thing to do.
= Disincentive: charging for waste generation (polluter pays principle)
= Tax: cannot work in informal settlement where people do not have a physical address.

JOYCE GACHUGI WAWERU





COUNTRY MANAGER OF PETCO NAIROBI
PETCO Kenya is a non-for-profit organization, established to promote SWM and recycling of post-consumer PET productS.

- Plastic bags, so useful specially for low income people. Also our agriculture and food industry are heavenly reliant on PET.
- Gap in the waste supply chain: kerb side collection.
- No accurate data, JICA research should be updated.
- SWM national government has no say. County has no idea and is not in control.
- Agrees on the problem of low grade plastic as a big problem. Packaging ends up in the river. As long as there is no business case, this problem will grow.
- Waste to energy plant is ridiculous, makes no sense because of not making use of full capacity and returning it into low value.
- Government does not do its role! NEMA is taking good leadership
= PETco position, what is position?
- Building network in 5 years, more structured and formalized jobs. The strategy is to also make scavengers be part of CBO. Segregation at source. Pilot: collect and separate in specific neighbourhood. Pick up every week. Schedule different day per neighbourhood, already in line with NCC.

2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions of social construct

Perspectives

To get an overview on all these kind of different perspectives, the Circular Resource Management Strategy is positioned as spider in the web. The drawing below sketches the different connection between various actors. The diagram on the right, structures the different stakeholders and their role in the transition towards a circular, green and healthy future.

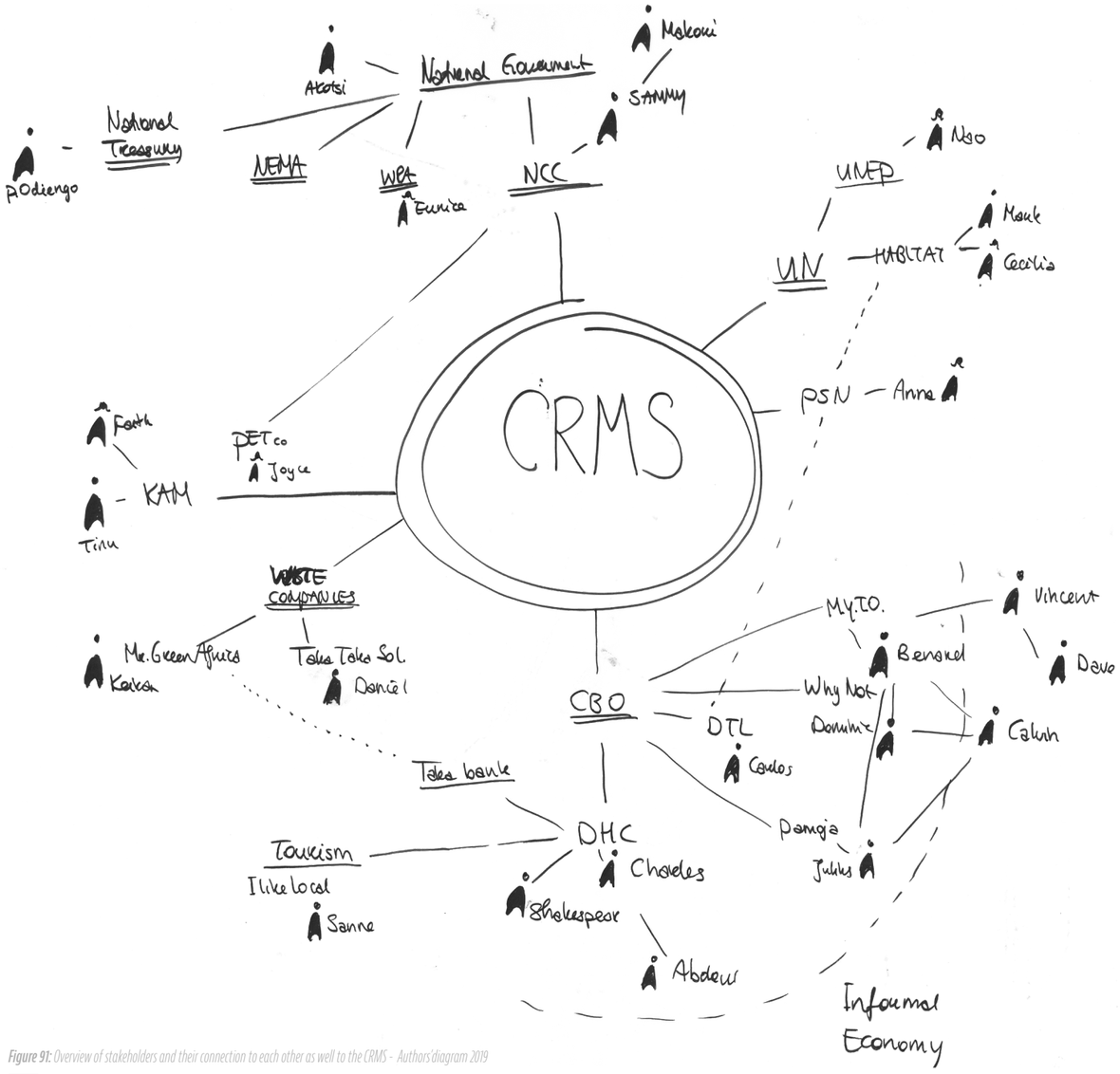


Figure 91: Overview of stakeholders and their connection to each other as well to the CRMS - Authors'diagram 2019

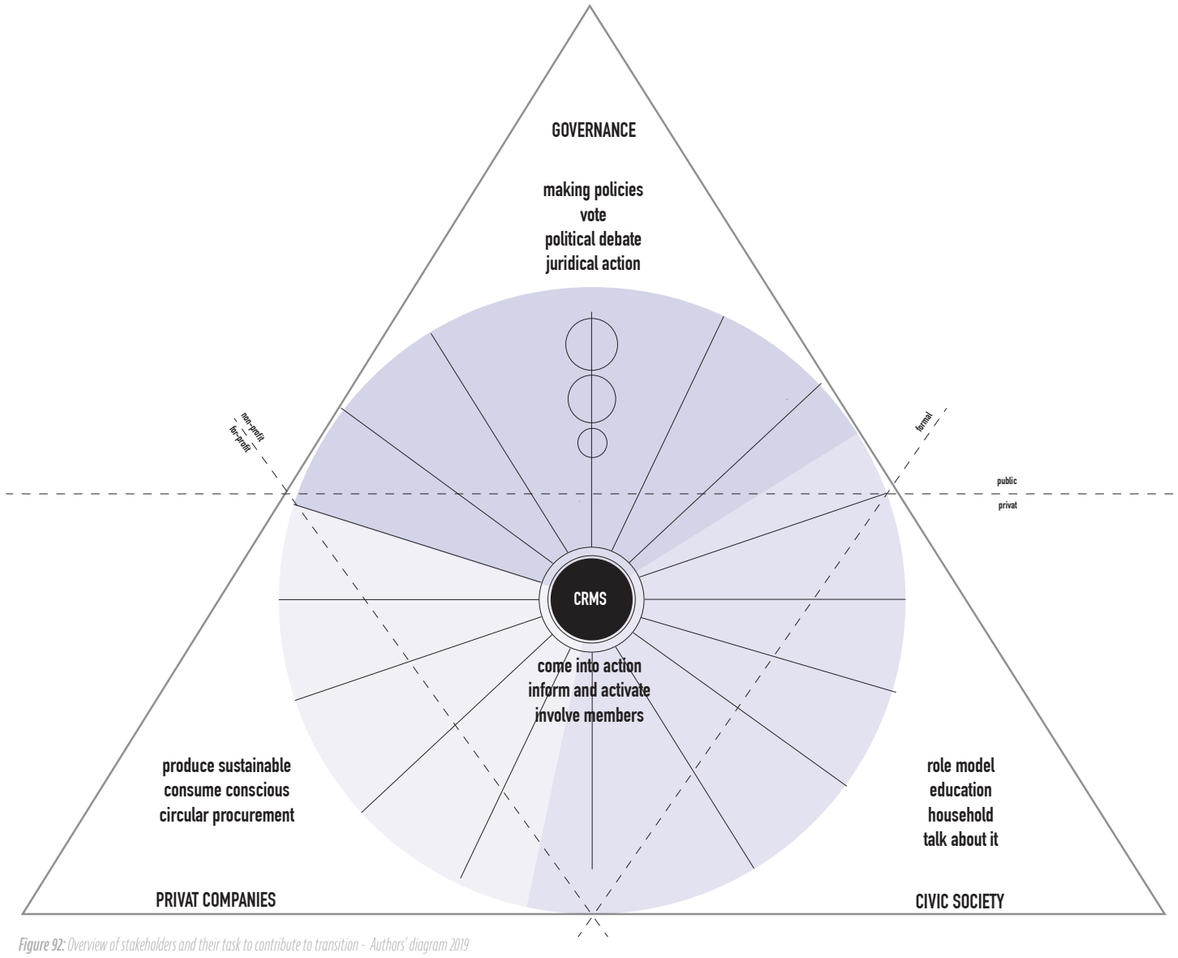


Figure 92: Overview of stakeholders and their task to contribute to transition - Authors' diagram 2019

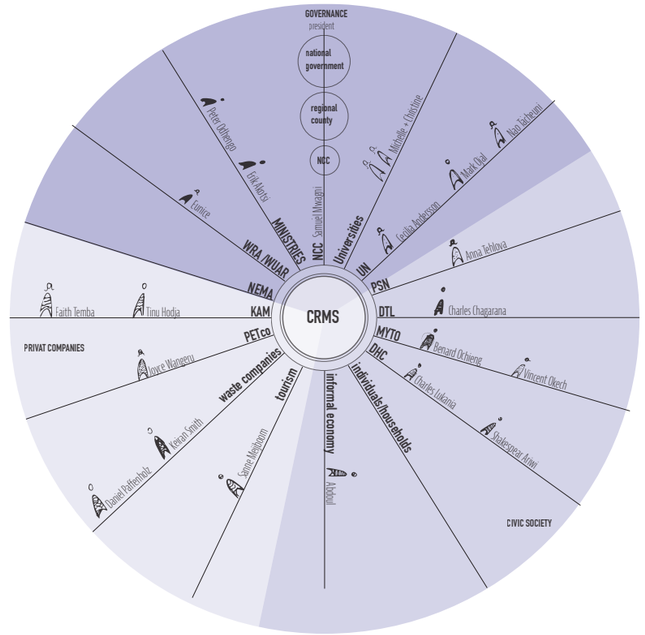


Figure 91: Overview of stakeholders and their connection to the CRMS - Authors' diagram 2019

2.2 STAKEHOLDER PERSPECTIVE

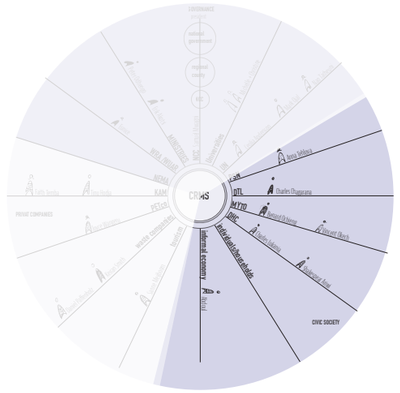
iii. Conclusions of social construct

Perspectives

Within the civic society, understanding a few important notices. First of all the one of the kids. For their parents it is a wish to let them play in a clean and safe environment. At the same time they do not know how to treat waste. Based on spontaneous interviews, local inhabitants of Dandora have told they do not have space to store nor separate waste.

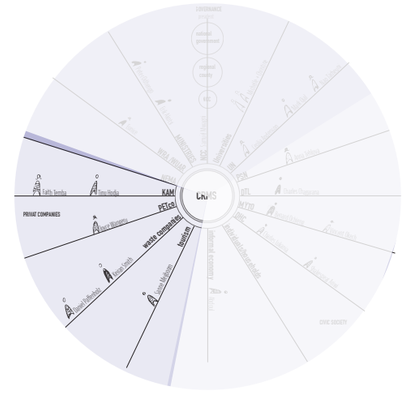
Simultaneously, community-based-organizations have already shown action on the aspect of waste management like the Taka Bank initiative of DHC.

'Thousands of people make a living out of waste. Even though they are used to it, these jobs have no sense of dignity'



The business perspectives highlights the necessity of a business model and the need of an incentive to change. However, the Kenyan Association for Manufactures emphasizes the danger of micro plastics and the responsibility to manufacture conscious by changing the design.

'There is no local demand for recycled plastic in Kenya.'



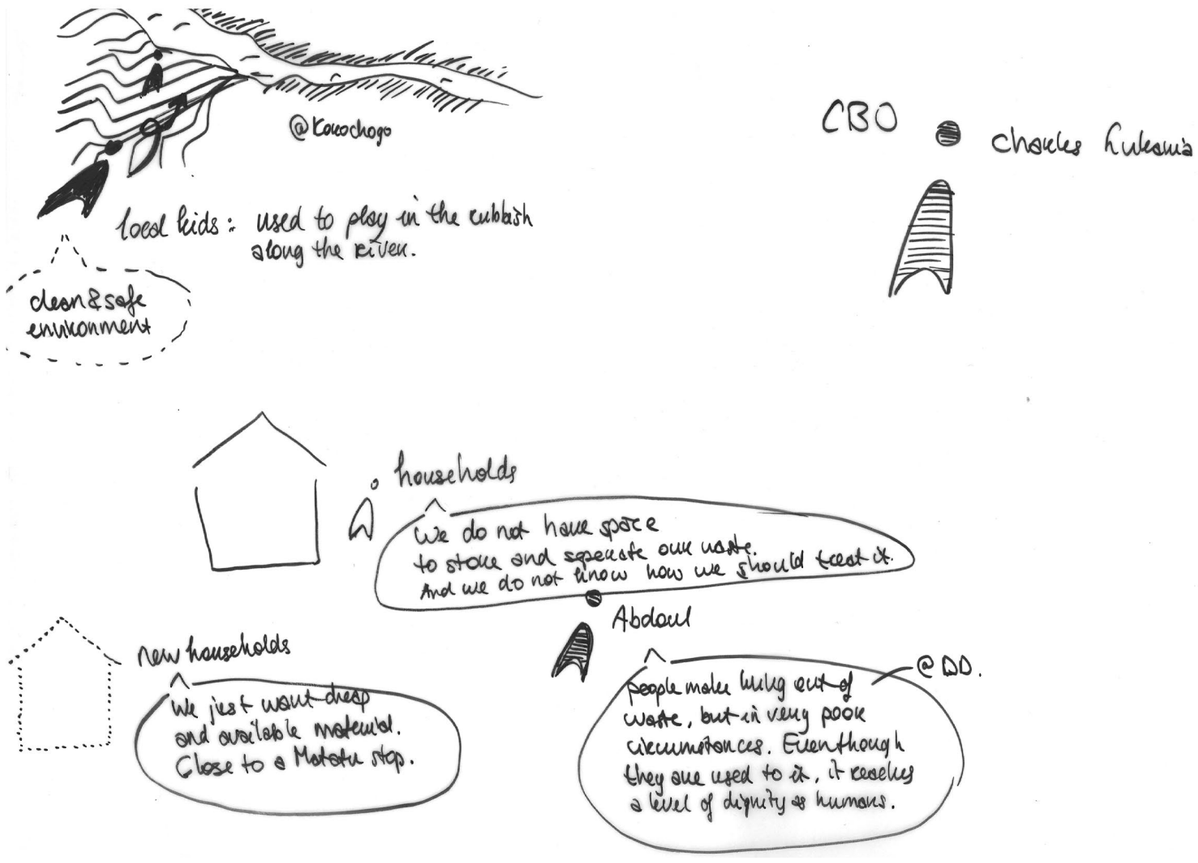


Figure 92: COMMUNITY BASED ORGANISATION - Authors' diagram 2019

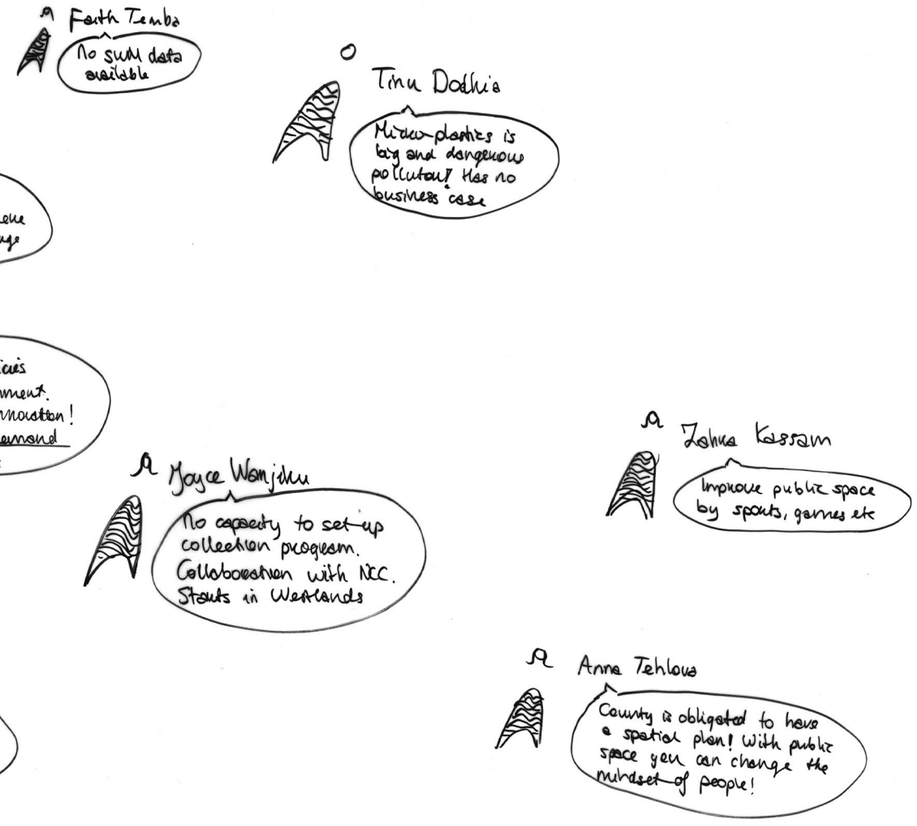


Figure 92: PRIVATE SECTOR - Authors' diagram 2019

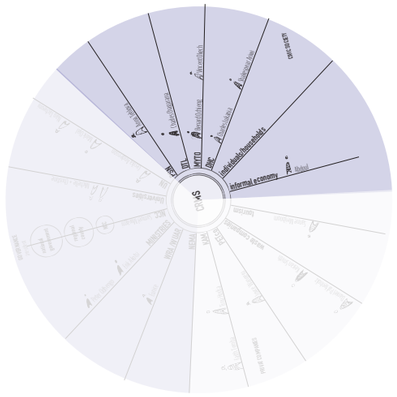
2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions of social construct

Perspectives

Most remarkable quote of the Nairobi city council, was the questioning why everybody expected the government to be responsible for waste management and waste management services. Their quick fix is to implement a incineration plant to burn down the Dandora Dumpsite. UNEP consultant Nao Takeuchi researches the possibilities for 'transfer stations', as she requests for a feasibility study for these stations.

'Why are we expected to be responsible for SWM?'



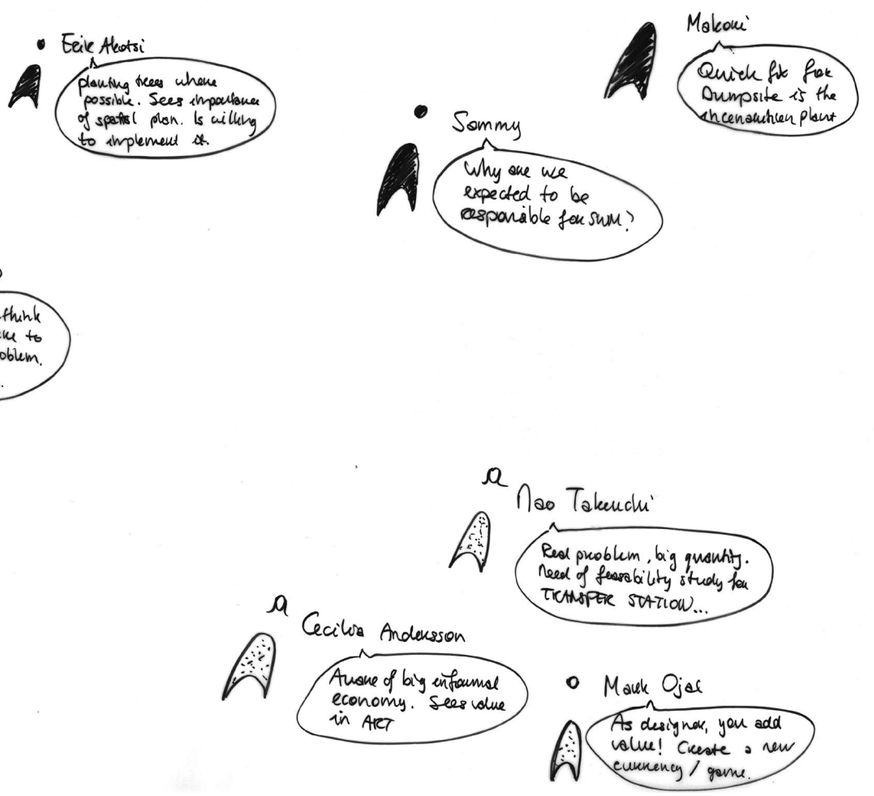


Figure 94: GOVERNMENT- Authors' diagram 2019

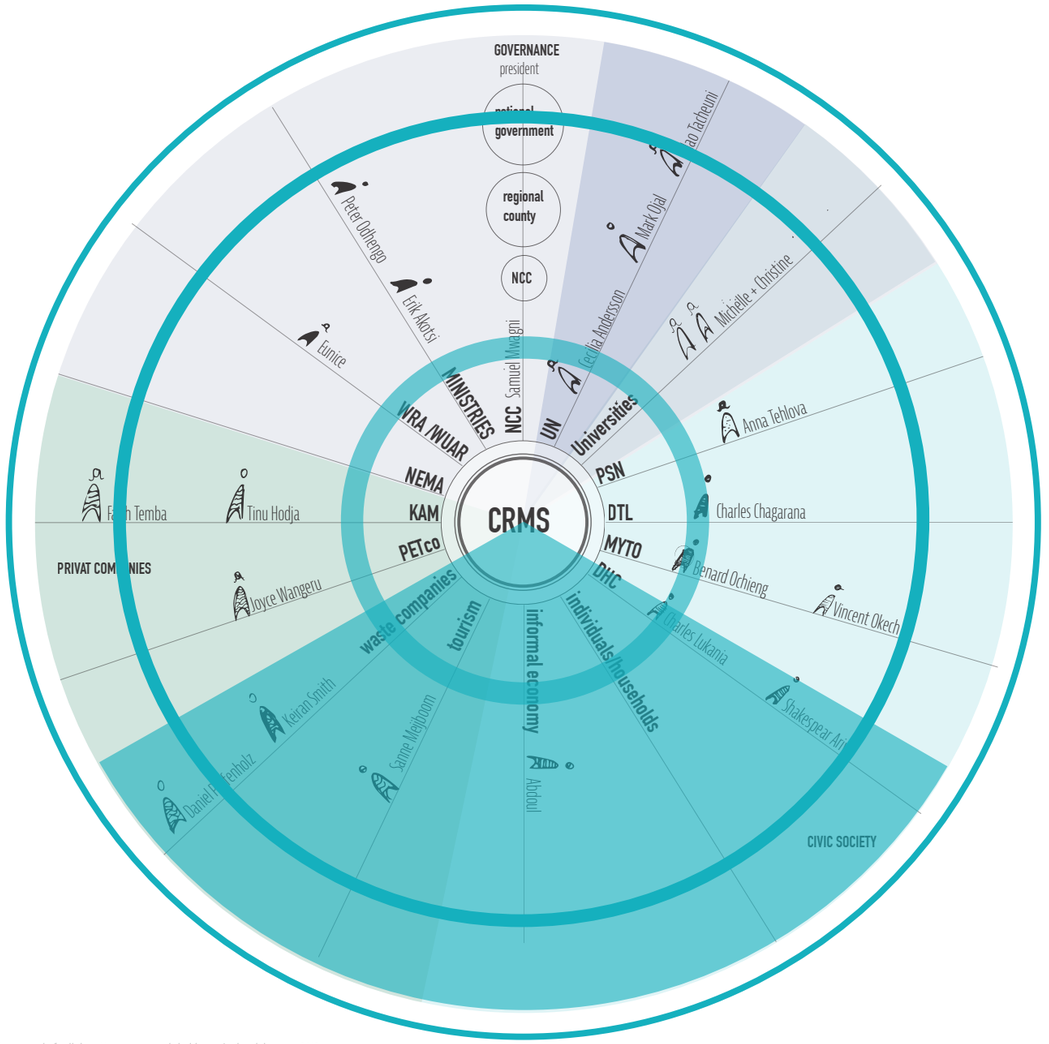


Figure 95: proposal of collaboration among stakeholders - Authors' diagram 2019

2.2 STAKEHOLDER PERSPECTIVE

iii. Conclusions on governance

Grasping local context by talking with inhabitants in Kenya brought out one way of understanding. But to understand the governmental structure, one should be conscious of the Kenyan System as it is on paper. The handbook for urban planners in Kenya, made by UN Habitat, gives an overview on the system, rules, laws and regulations in this country. First of all, the difference of the national level (government line ministries and authorities) and the county level (executive in committees and utility agencies). Within those utility agencies, water and sewerage agency, solid waste management and energy agencies exist.

Nonetheless, zooming in on the utility sector, the SWM service incorporates private as well public agencies. **Clearly said by Daniel Paffenholz, that because of the lack of one ruling (private or public) party, the feeling of responsibility has disappeared.**

As urban planner operating in the spatial planning area, grasping the constellation of laws and regulation as explained in the diagram on the right page. Hooking in environmental management and coordination act, which falls under the Kenya Vision 2030. The roadmap and its design operates within the borders of the physical planning act.



Figure 95: Governmental constellation - Authors drawing based on UN-habitat handbook for urban planners in Kenya p.19

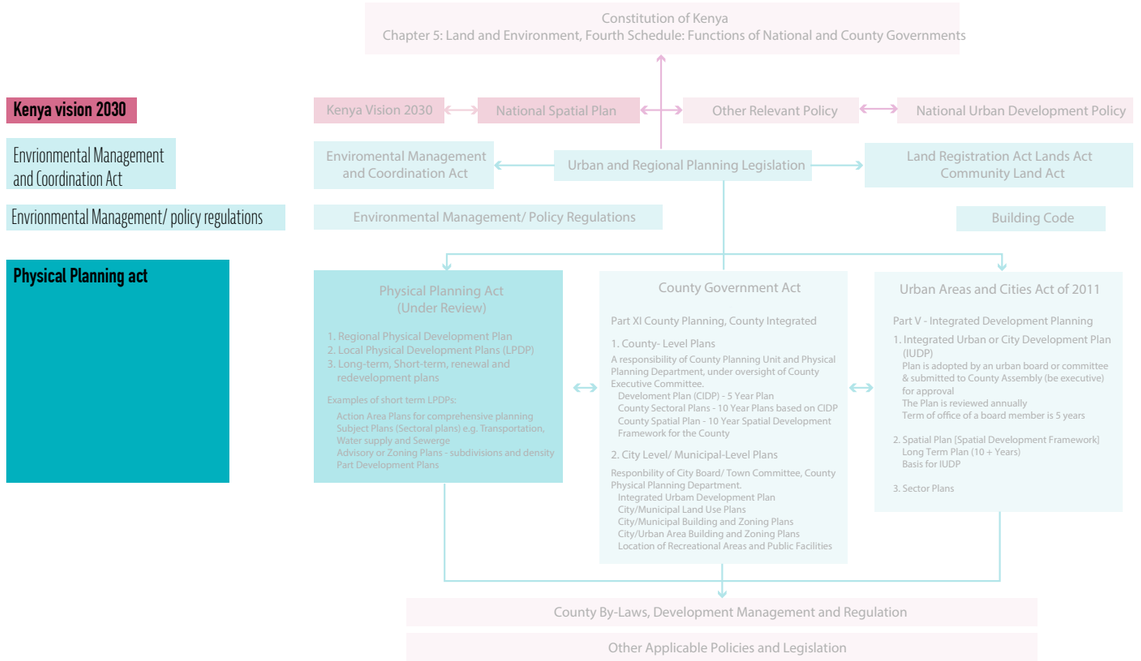


Figure 97: Policy and legislative framework for spatial planning in Kenya- Authors drawing based on UN-habitat handbook for urban planners in Kenya p. 91

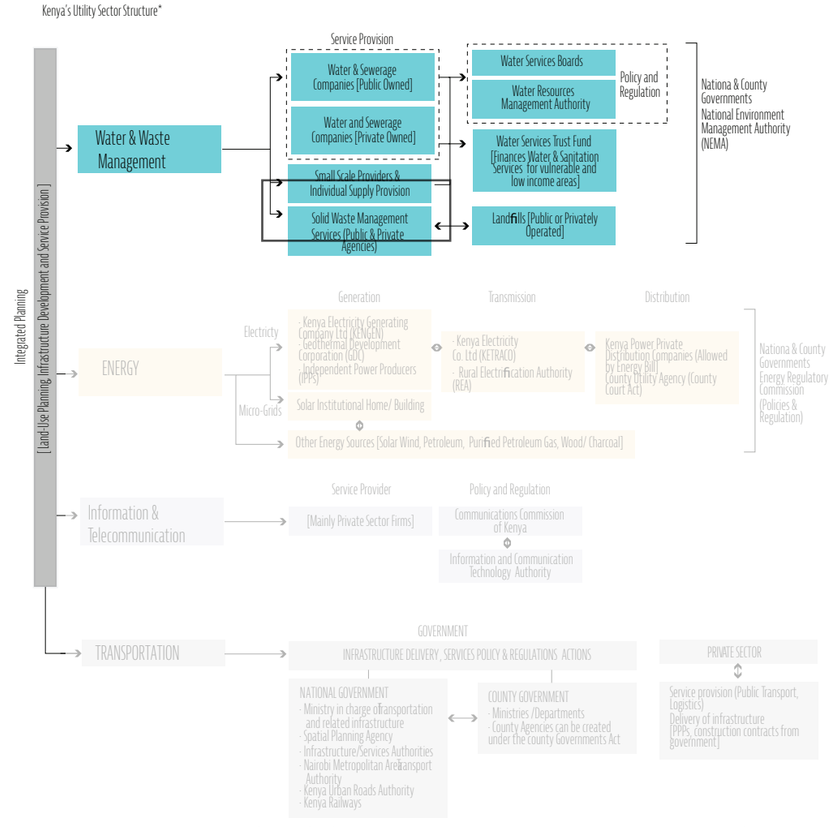


Figure 96: Kenya's utility sector structure - institutional framework for infrastructure and service provision in Kenya - Authors drawing based on UN-habitat handbook for urban planners in Kenya p. 91

3. POTENTIAL AND TRENDS

i. Paradigm in its context

GREEN BELT MOVEMENT WANGARI MAATHAI

Understanding the Zeitgeist by a few remarkable Kenyan as well worldwide trends on the planet, gives context to the roadmap design. To begin by a very special woman; Dr. Wangari Muta Maathai. She was a Kenyan environmental and political activist. She has founded the environmental organization Green Belt Movement. In 2004 she became the first African woman to win the Nobel Peace Prize for her contribution to sustainable development, democracy and peace.

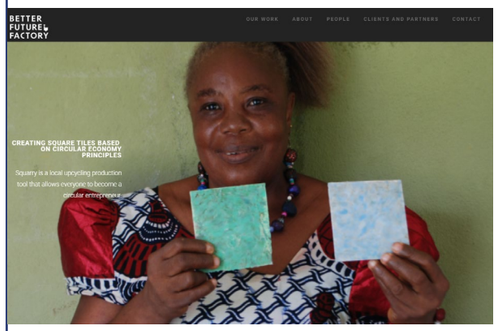


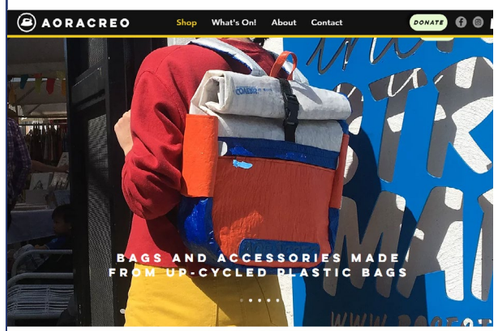


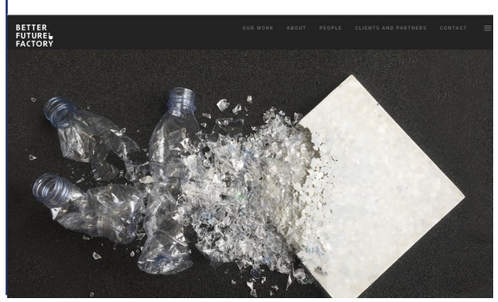
Wangari Maathai - Green belt movement

RECYCLING TOWARDS CIRCULAR ECONOMY (EXAMPLE OF BEST PRACTICES ALL AROUND THE WORLD)

Before Ellen MacArthur sailed around the world and definied the circular economy as concept, the recycling economy trend has begun. Different best practices around the world display this trend. Interesting examples by Better Future Factory and Aoracreo;





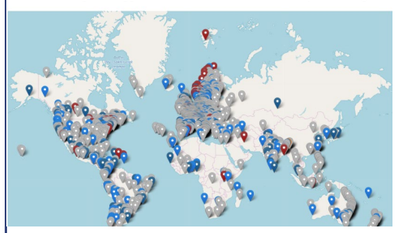


Better Future Factory - best practices

(ECO) SCHOOL: EDUCATION IS POWER (WORLDWIDE) + CLIMATE STRIKES

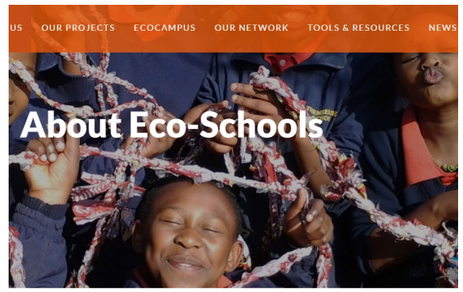


An estimated 1.5 million school students worldwide turned their back on lessons last week to stage the biggest wave of climate strikes since the protests began.





Great Thunberg on World Economic Forum 2019



It all starts in the classroom

Eco-Schools is a growing phenomenon, which encourages young people to engage in their environment by allowing them the opportunity to actively protect it. It starts in the classroom,



FEE EcoCampus

Eco school foundation

V .

TOWARDS A DESIGN BRIEF

i. Objective

ii. SWOT analysis

iii. Identified opportunities and best practices

iv. Nala hypothesis

v. Design brief (delimitation towards river and schools)

I. OBJECTIVE OF PROJECT

i. Summary on problems

In order to identify how waste management processes can be optimized and organized in a circular way, one should incorporate the problems in the current management. Since not all problems which are identified are within the borders of management nor they are in spatial, a holistic view is necessary in order to solve these.



HUMAN BEHAVIOR OF THROWING OF WASTE



NATURAL ECOLOGY IS DISRUPTED



AIR QUALITY HIGH RISK FOR HEALTH



LACK OF FEELING OF RESPONSIBILITY



NO KNOWLEDGE HOW TO ACT DIFFERENT



DANGEROUS JOBS



WATER QUALITY HIGH RISK FOR HEALTH



NO SPATIAL PLAN, PLANTING TREES RANDOM

I. OBJECTIVE OF DESIGN BRIEF

3.1 How can waste processes being organized to become circular?

SQ 3.1

Principles for opportunitites

problem

To solve all the observed problems is ambitious and seen the limited time for this graduation process, too ambitious. In order to come to a solution, it is necessary to target on a specific problem. The diagram above highlights the depletion of resources (mining phase) as well the composition of household waste in Kenya. The two biggest stakes in this composition are plastic and organic material. **Moreover the problem of a lacking system is that there is no separation at all. This mixed waste gets illegally dumped and burned**. Dumped on the ground and in the river. This results in contamination of the ecological system, dangerous health circumstances and degrades public space.

hypothesis

The hypothetical diagram, based on the philosophy of circular economy, shows the p**otential of waste as a resource.** Within a circular economy waste becomes a resource which could lead to a reduction in natural resource use. A linear system results in a negative net effect since value has been lost. When an economy becomes circular, waste will be returned in the economy as a resource with the highest possible value. In a perfect functioning circular economy, there is no loss of value and the net effect on the environment will be zero.

solutions

Since the core of this problem has a complex nature, laying in different scales and dimensions, **a combination of solutions should be find in order to solve this. Some parts of the problem have more systemic nature, some a spatial.** In order to recycle, upcycle or compost resources, it should be collected and separated. The collection could be improved on both public and private level. This implies a systematic change. The diagram shows an abstract and more systemic solutions, the roadmap should imply the spatial translation of these.

problems

Systemic

Spatial

solutions

Systemic

Spatial

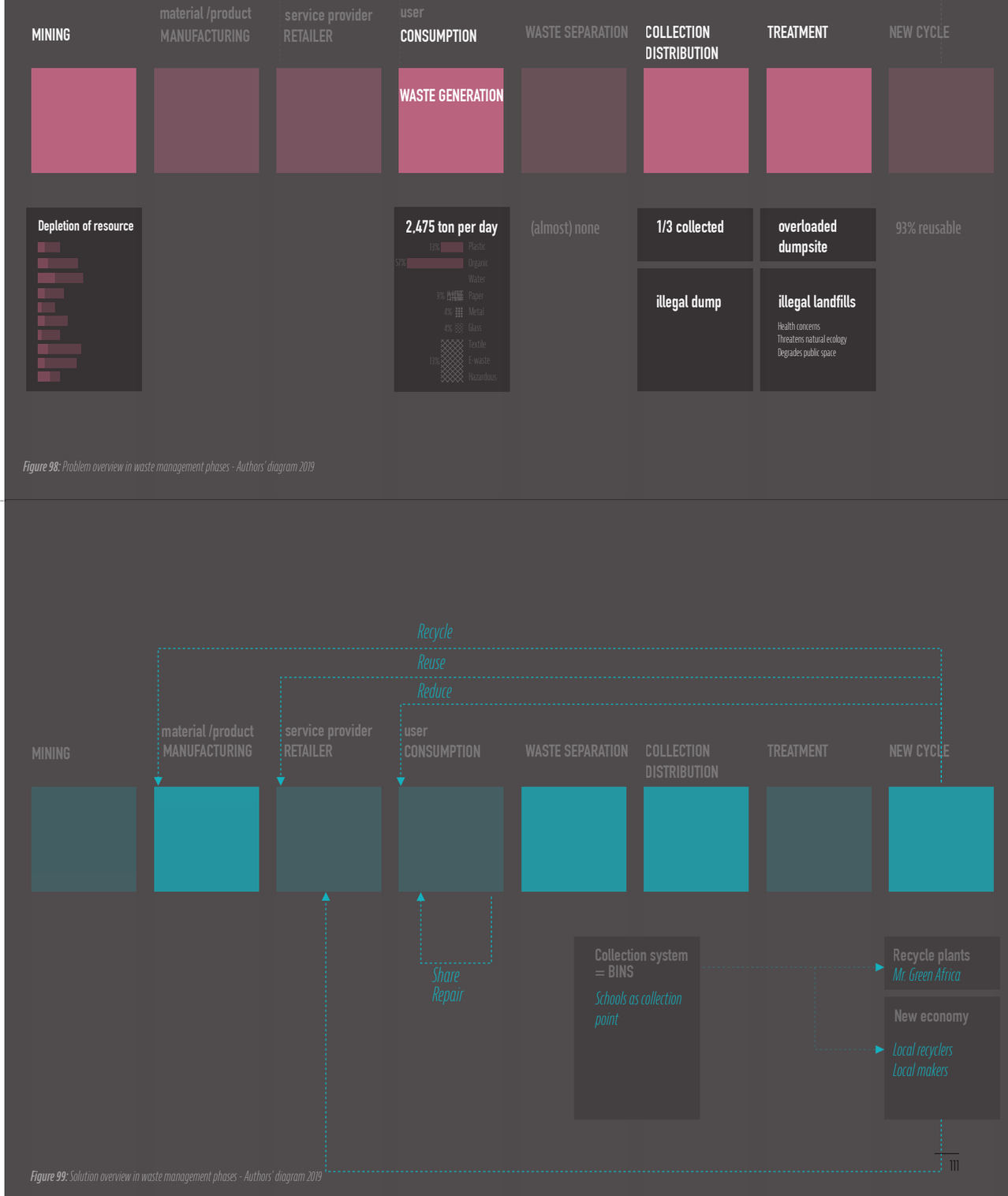


Figure 98: Problem overview in waste management phases - Authors' diagram 2019

Figure 99: Solution overview in waste management phases - Authors' diagram 2019

II. SWOT ANALYSIS ON WASTE MANAGEMENT SYSTEM

Understanding different actors and scales, an attempt to cluster threats and opportunities has been made in this diagram. The highlights are indicating the focus points for the roadmap.

	MINING	MANUFACTURING	service provider RETAILER	CONSUMPTION WASTE GENERATION	WASTE SEPARATION	COLLECTION DISTRIBUTION	TREATMENT	NEW CYCLE
Opportunity		**Responsible producerism** New (creative) industry	Supermarkets promote	**Change of behaviour** Transforming space, transforming people	Introduce separation bins system	**Intervene in points in daily life** Innovative way of transportation	Need more recycling plants	Design for reuse
Threat		No local demand for recycled material (yet)	Behavioral pattern ingrained in culture	Public space already filled with trash	Lack of funding and space	Informal economy (with its rules and job opportunities	Not enough capacity	Accurate network and spreading of knowledge
Strength		KAM is aware and active	People will follow role-model and adapt fast	People will follow role-model and adapt fast	People believe in the power of education	People will invent new way of transport	Willingness to improve and to earn money	**CBO have a lot of power in informal communities**
Weakness		Cheapest option now: micro plastics		Accurate spread of knowledge		Informal settlements: not accessable for truck		No market locally = export international

Figure 100: SWOT analysis - Authors' diagram 2019

III. IDENTIFIED OPPORTUNITIES

3.2 How can circular waste processes being organized to create opportunities for the local community?

SQ 3.2

Principles for opportunitites

Based on the theoretical research, field research and empirical foundation principles for opportunities can be identified. As explained before, projects by DTL and Making Cities Together are focused on upgrading public space. The Public space network (PSN) and Changing Faces Competition are besides community-engaging also focused on scaling up this strategy. However, they are not tackling the core of the problem; the current treatment and behavior regarding solid waste, since their focus is principally on upgrading public space.

Community-based-organizations have shown in research (see chapter III), that they have strengths aligned with weaknesses in the waste management. Acknowledging this, and understanding the daily routine of local people, schools can be a point of intervention. An intervention that would include the separation waste and enforces its users to do so. At the same time, educate the scholars about resource management and circular economy. In addition to schools, during the field research playgrounds and sport facilities have shown to be formulas of success to upgrade public space. Since handicraft is not underrated activity, art centers and makers-spaces locally and more widespread embodiment of reusing resources. Moreover, understanding the beauty and importance of the soil, urban gardening gains increasingly refocused attention in Nairobi.

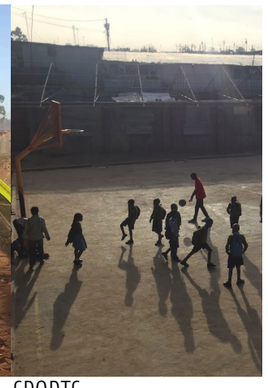


EDUCATION



ART AND MAKERS SPACE





PLAYGROUND SPORTS



URBAN GARDEN

RIVER FRONTS

Learning from another theoretical foundation based on practical case studies, are the opportunities and relevance of urban river fronts. Defined in the research paper of Claudiu Forgaci as Urban River Corridors (URCs) - as urban spaces where the overlap between the urban systems (carrying the 'social-') and the river system (carrying the '-ecological') is at the highest intensity—as strategic spaces with a potentially high contribution to urban resilience (Forgaci, 2019). As a result, the quality of riverside public spaces does not meet its social and ecological potentials. Current riverfront regeneration projects around the world signal a trend of establishing a more sustainable and resilient relationship between the natural dynamics of the river and the socio-economic importance of riverside public spaces. The design of those spaces is crucial for both people and ecosystems and it requires an integrated approach.

In his thesis he addresses four spatial problems arising from the loss of synergy between natural dynamics of rivers and the spatial configuration and composition of urban areas that they cross. In order to design for the strentghs he developed four principles; **Interconnectedness, Absorptive Capacity, Social-Ecological Integration, and Interscalarity,** derived from the key properties specified in the spatial-morphological definition of URCs. nally, the design principles are translated into four corresponding design instruments—**the Connector, the Sponge, the Integrator and the Scaler**— visible in the diagrams below.

Using these principles as principles of opportunity in the area of Dandora where the Nairobi river is seen mostly as barrier and as dumping space. Reconnecting land and social-ecological integration can be taking into spatial design.

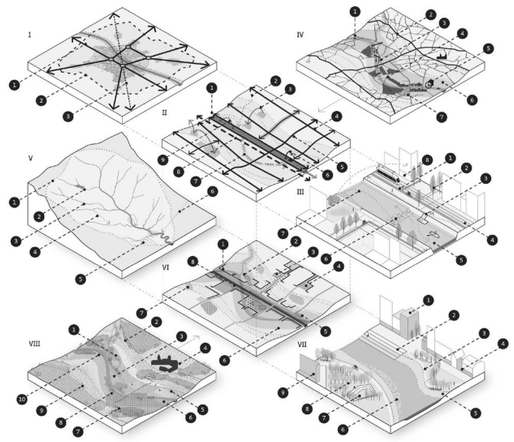


Figure 101: Illustration of the spatial-morphological definition of URCs -p. 87 - based on Integrated Urban River Corridors, C., Forgaci

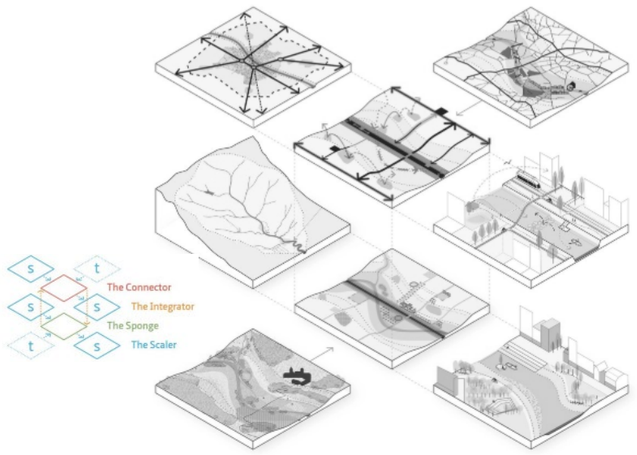


Figure 102: The design instruments developed in this chapter (bottom right), represented in relation to the spatial-morphological definition of URCs: The Connector, the Sponge, the Integrator, and the Scaler, including spatial scales (s) and temporal scales (t).

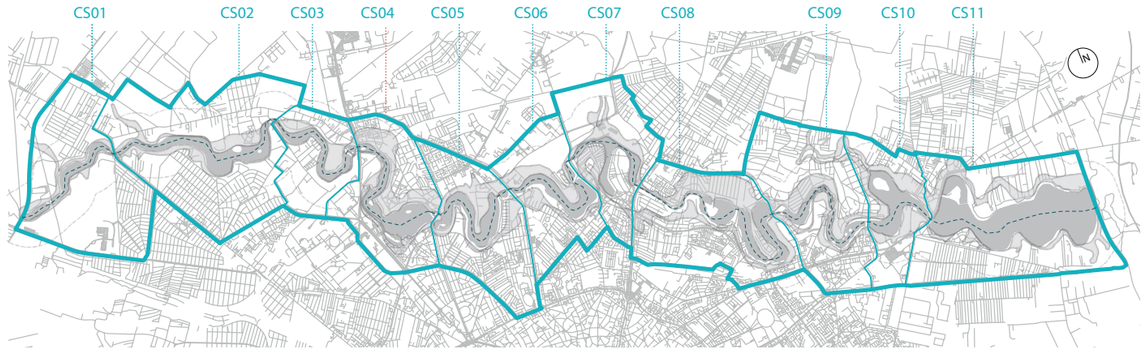


Figure 103: The delineation of URC Dâmbovița and its segments.-p. 172 - based on Integrated Urban River Corridors, C., Forgaci

IV. NALA HYPOTHESIS

What happens if there would be taken no action at all? That is the question the nala hypothesis answers. It is the worst case scenario, an undesired vision. For the case of Dandora Waterfalls, been seen in a historical picture on the right, the worst case scenario will be if there would be no systematic change in the waste management strategies of Nairobi. In that scenario, the Dandora dumpsite will expand till the river front. This waste will pollute the water into poisonous water. This extremely contaminated water will cause trees to die and unables new plants to grow. This again results in animals like birds dying, since their natural habitat is demolished. The human perspective displays images of kids playing in mountains of waste, growing up like it is normal. Waste scavengers working in these trash landscapes are living on the edge of society with a high risk of getting ill by infections of the polluted water or air. Since the consumerism continues to deplete natural resources and the degradation of natural soil, this causes an irreverisable effect on the planet.



Figure 104: Historian photo of the Dandora Waterfalls

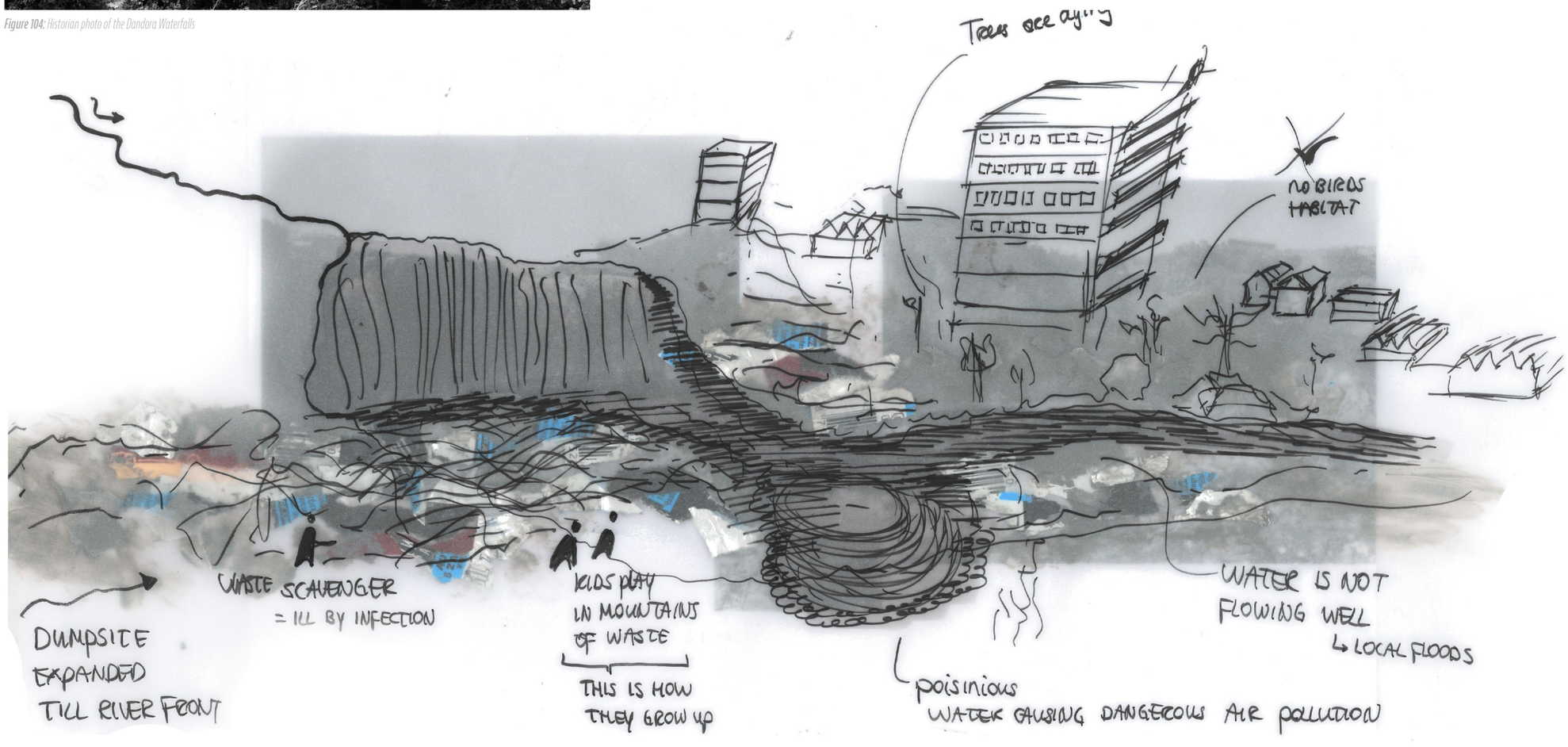


Figure 105: The undesired future vision - Nala Hypothesis - Authors' drawing 2019

V. DESIGN BRIEF – MANIFESTO

In order to know what to design for - a clear design goal should be formulated.
The goal for the design part of this graduation project is:

Empower the (members of) community-based-organizations and local inhabitants living in (in)formal settlements around the dangerously polluted Nairobi river to treat their waste in a circular way. Aiming for a climate resilient river-front by educating the youth combined with a spatial design. enhance existing CBO design and hidden qualities in such a way that local inhabitants are able to revive their initial potential.

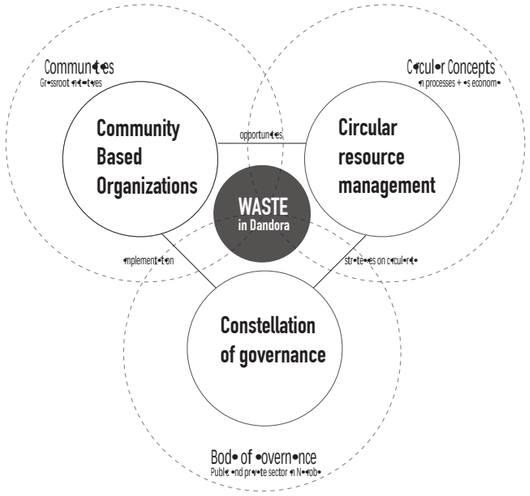
Design a circular resource management strategy with the river restoration as main component, achieved by adding program to the green belt (eg. park, community garden, playground, sports field) with a continuous responsibility to schools. The schools as main component, for educational program as well as collection point in the urban metabolism.

The result of the design of the roadmap should aim for change of behavior, by a transformation of ones mind. In order to ensure implementation by mutual reinforcement, public private partnerships are seen as key ingredient for success. The outcome should effectively leverages grassroot initiatives for greater impact. Bringing together multiple schools for a ripple effect across stakeholder groups.

CBO

Requirements deriving from literature review on CBO's and their strengths, as follow:
- **Willingness of members to participate**, since members often join a project because of their ideals and desire to change their surroundings (Murphy, 2014).
- **Enriching experiences and relationships**, combined with feelings that they have improved the quality of life in a community is key for its' members (Murphy, 2014).
- **Education** fosters independence and dignity of community members. In Murphy's book this process of disseminating knowledge throughout a community without monopolizing the learning process, identified as key principle (Murphy, 2014).
- **Involvement of stakeholders** from the level of tokenism to the level of citizen power. Shifting from 'informing' stakeholders, to 'delegated power and citizen control'.
- Planning, as Portugali suggests that planning should be **'just-in-time'** rather than 'just-in-case'.
- **Sense of self organization** as defined by Wunsch in urban development as example for citizen involvement initiatives for spatial interventions that originate in civil society itself, via autonomous community-based networks of citizens, outside government control. (Wunsch, 2013)

SCHOOLS



CE

This requires companies to think radically out of the box; to look beyond the linear economy of take, make and dispose. To develop new business models, products and value chains – accelerated through honest collaborations across fields and borders.

'A changemaker's guide to the future' contains the theories, methods and real-life examples of how to do so. And as you'll discover throughout the book, the transition to circular economy should not be seen as a burden to the corporate world; it is a golden opportunity.

Flemming Besenbacher
Professor dr.scient at Aarhus University
Chairman of the Carlsberg Foundation and

RIVER FRONTS

PUBLIC SPACE TO TRANSFORM MINDS
PPP AS CONSTELLATION BOTTOM-UP AND TOP-DOWN
RIPPLE EFFECT TO CONTINUE AND SPREAD


Admin

VI. ROADMAP

i. Role of urban design(er) and planning *regarding CE, waste management and urban metabolism*
ii. Vision, ambitions, trends and indicators for the future
iii. Menu of solutions
iv. Roadmap to the future
v. Concepts zoom in

- A. Schools
- B. Community garden
- C. Sportsfield/playground
- D. Artspace
- E. Production scape
- F. Phasing

vi. Linkage problems and solutions
vii. Storyline

I. ROLE OF URBAN DESIGN

As urban designer, it is of high importance to understand your role from a more holistic view. How to position yourself humble, and what is the impact in the professional field. The figure below shows how in this project, urbanisation strategy schemes, CBOs, waste management and CE together form a set of knowledge which feeds the urban planning and design. Connecting possible solutions to the urban environment is seen as main task. The ambition to change behaviour by urban design and the perception of waste, might go beyond tranditional tasks of an urban planner. But yet it can be a pillar to build on a strategy. Complexity lays moreover in the conceptual and more abstract theory on waste as resource, deriving from the CE which lacks in spatial translation.

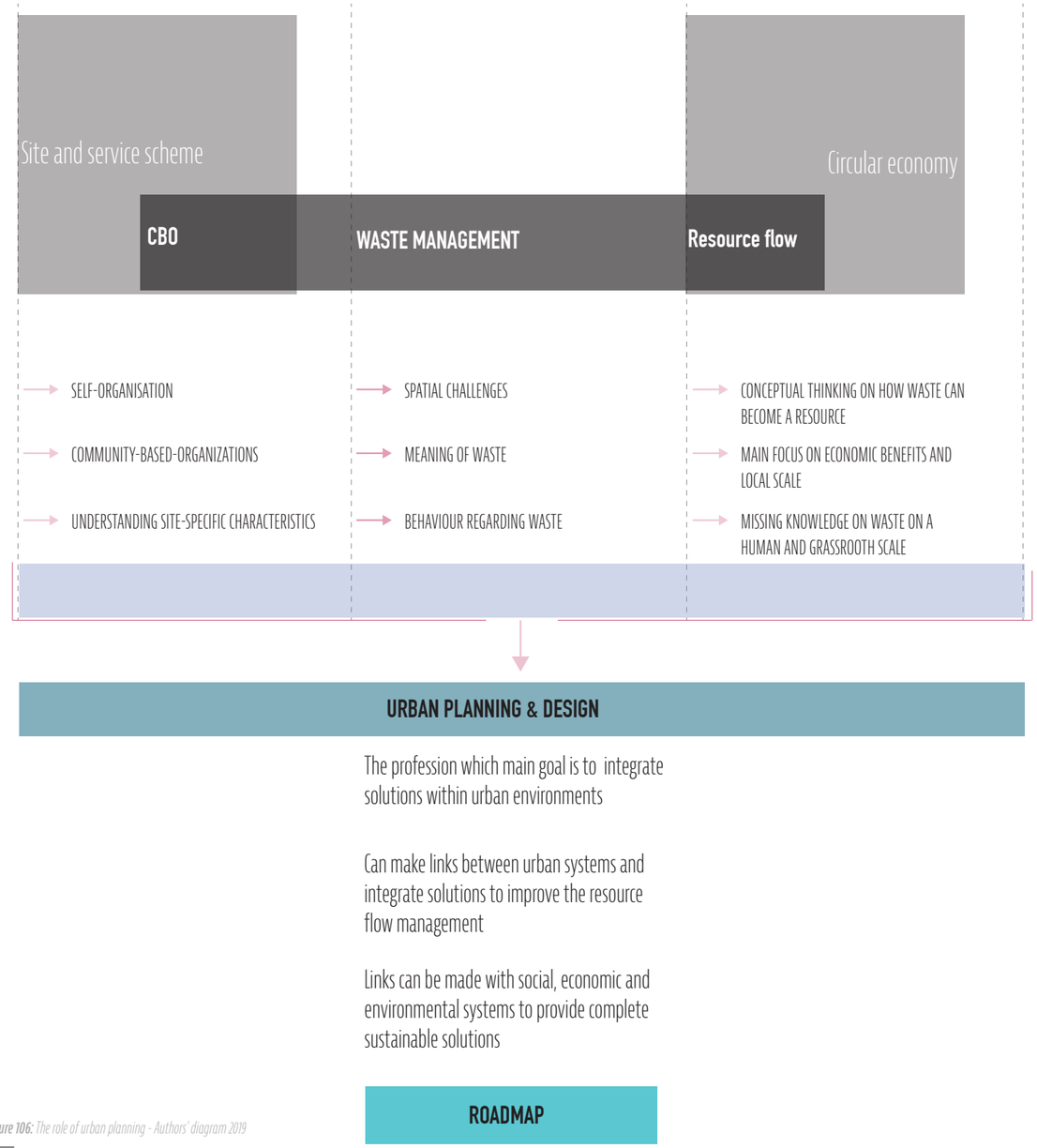


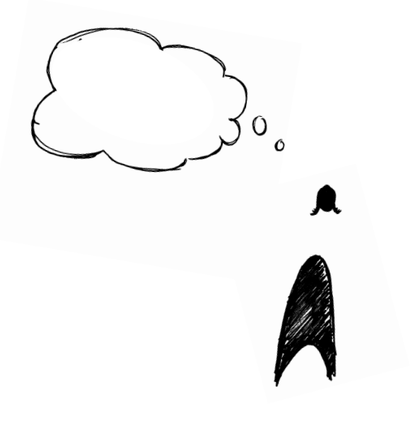
Figure 106: The role of urban planning - Authors' diagram 2019

LIMITED ROLE OF URBANIST

Said in all freedom, I see my role as urban designer to connect different ideas, visions and innovations to stakeholders and make a plan for implementation. As a foreign urban designer, I tried to plant seeds for change. For a change of the system. By engaging with the local community and its community members, trying to make my ideas in some way their dreams, in order for them to feel ownership. Ownership to continue with this idea on their own pace, in order for me to step out. Because of the existing initiative by DTL and its competition approach, the local current trend is already 'by transforming space, you transform people's minds'. Hooking in on this trend, this neighborhood project could be spread out to a city-wide movement with a role-model in Dandora.

However, I believe, we cannot solve a problem the same way we created it, we should come up with a new way of thinking. For this new way of thinking I consider myself an ambassador in Nairobi. May I be the spark to enlighten the possibilities for the local inhabitants, to come into action themselves.
I am strongly convinced that this social process which unfolds itself in spatial environment, results in a social product by developing social-ecological spatial interventions.

Nonetheless, I am aware of the limited role of urban design and its possibility to change whole systems and cultural embedded habits. To do so, design should definitely be supported by a procedural framework to gain institutional support. In the case of Nairobi, it means that as urban designer you have to convince the NCC, the ministries and National Treasury to either work with you or fund the project. Based on experiences I could say this brings another complexity as well a more political colored issue. More detailed, this political colored issue includes tribe preferences of certain politicians.



I. ROLE OF URBAN PLANNING| URBAN SYSTEM

Relating the role of urban design more to urban metabolism, UNEP together with the sustainability institute formulated in a report of 2017 formulated urban metabolism assessment tools. It pleas for resource efficiency and the integrated role of urban planning.

It says; if implemented correctly, resource-efficiency initiatives may increase competitiveness, secure growth and jobs, enable innovation, reduce resource requirements and allow improved access to resources (Commission, 2015).

Furthermore it allocated the responsibility regarding the provision of diverse public services to residents and economic activities that influence resource use and waste generation to the local governments. The challenge they face is to integrate the various aspects of the urban system, illustrated in the figure below.

The report elaborates on the concept of urban metabolism on its flow assessments and inspired ideas about designing sustainable cities (Agudelo-Vera et al., 2012). These assessments allows to identify resource-efficiency interventions.

As the concept of urban metabolism to support resource efficiency has been applied across various disciplines to theorize and assess cities' sustainability in relation to resource consumption and waste generation, its practical implementation is so far limited (Voskamp et all, In Press).

However, the idea that urban environments operate as metabolic systems has resulted in the rethinking of how environmental, social and economic factors interact to shape urban phenomena.

Looking into more detail in to the diagram, in this project the design will be focused on only the waste, and partly the water elements of the technical system. The arrow identifying urban planning and design, could result in changing urban life standards and by doing so, changing behavior.

Urban system

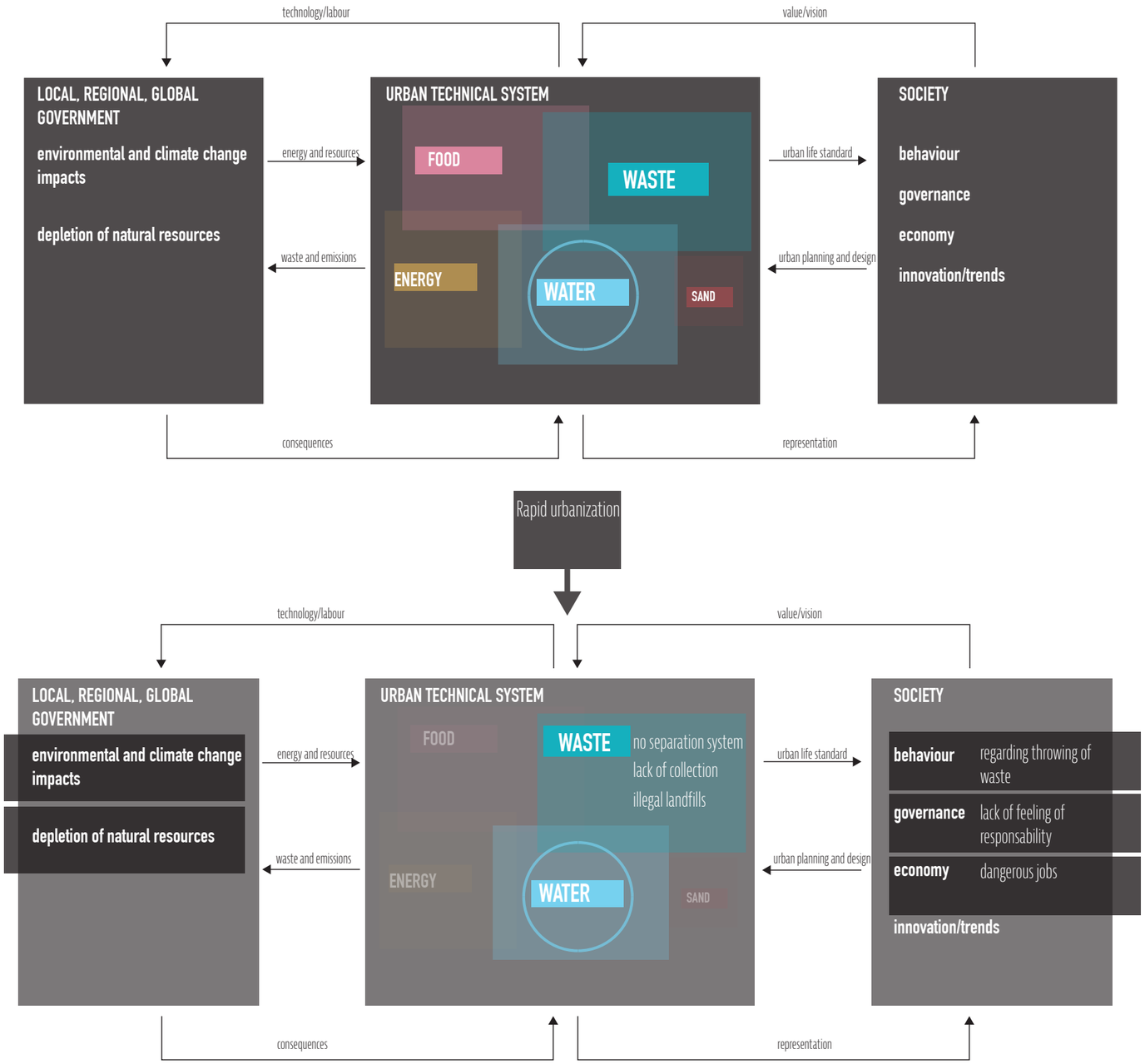


Figure 107: based on Urban Metabolism for Resource-efficient Cities: From Theory To Implementation, UNEP and Sustainability Institute 2017, figure 1 p.3- Authors' diagram 2019

The connection between the vision of the proposed roadmap to the binding governmental agenda in Kenya, the Vision 2030, is shortly explained on this page. The Vision 2030 starts with the national anthem, in the figure below it highlights the acknowledgment of the richness of resources in the own country. Together with the 'Big Four' agenda, developed under H.E. president Uhuru Kenyatta, the third term of the vision will be implemented this year. **The big 4 agenda consists of food security, affordable housing, manufacturing and affordable healthcare for all.** The Third Medium Term Plan (MTP III) 2018-2022 is prepared under the devolved system of governance, meaning it developed by involving all stakeholders, right from the grass root level. Implementation of the MTP III and its financing framework will focus on delivering the "Big Four" initiatives and is in alignment with the 2030 Agenda for Sustainable Development as well the Africa's Agenda 2063. The following paragraphs will summarize the key points for this graduation project and elaborate on the most important aspects.

ECONOMIC PILLAR

"Moving the Economy up the Value Chain"

- Agriculture and Livestock (15,4% of budget)

"Innovative, Commercially - Oriented and Modern Agriculture and Livestock Sector

= urban-agriculture

- Manufacturing (38,6% of budget)

"Robust, Diversified and Competitive Manufacturing Sector"

= local (re)manufacturing

- Tourism (9,2% of budget)

"To be a top 10 long haul tourist destination offering a high-end, diverse, and distinctive visitor experience"

= sustainable tourism by planting trees

POLITICAL PILLAR

"Moving to the Future as One Nation"

- Devolution

"Making Devolution Work: A Catalyst for Holistic, Transformative and Sustainable Development"

= power to the people

Challenge: ■

Weak civic education and public participation mechanism;

= education by a decentralised network of CBO's

THE NATIONAL ANTHEM

Swahili	English
Ee Mungu nguvu yetu	O God of all creation
Ilete baraka kwetu	Bless this our land and nation
Haki iwe ngao na mlinzi	Justice be our shield and defender
Natukae na undugu	May we dwell in unity
Amani na uhuru	Peace and liberty
Raha tupate na ustawi	Plenty be found within our borders
Amkeni ndugu zetu	Let one and all arise
Tufanye sote bidii	With hearts both strong and true
Nasi tujitoe kwa nguvu	Service be our earnest endeavour
Nchi yetu ya Kenya	And our homeland of Kenya
Tunayoipenda	Heritage of splendour
Tuwe tayari kuilinda	Firm may we stand to defend
Natujenge taifa letu	Let all with one accord
Ee, ndio wajibu wetu	In common bond united
Kenya istahili heshima	Build this our nation together
Tuungane mikono	And the glory of Kenya
Pamoja kazini	The fruit of our labour
Kila siku tuwe na shukrani	Fill every heart with thanksgiving

Vision 2030 - National Anthem

SOCIAL PILLAR

"Investing in the people of Kenya"

- Health

"Equitable, Affordable and Quality Health Care of the Highest Standards"

- Population, Urbanization and Housing

"Quality Population with Adequate and Decent Housing in a Sustainable Environment

challenges:

- Extreme poverty in informal settlements and ASAL areas;

- Weak governance and accountability structures/systems;

> SWM in budget, source of funds: GoK. Implies transfer stations, but the budget in years is going to decrease from 20,000 KSH million to 3,000.

- Education and Training

"Globally Competitive Quality Education, Training and Research for Sustainable Development"

>Capacity building by teachers is included in this program as well the reconstruction of the curriculum into competence based learning. In addition to that, into the curriculum should be included course material on circular economy and resource efficiency.

- Environment, Water, Sanitation and Regional Development

"Enhancing development in a clean safe environment and, sustainably managed Natural Resources, Access to Water and Sanitation Services"

> Situation analysis:

Rehabilitation of Urban Rivers: Approximately 270 Km of urban rivers were rehabilitated; reclaimed lands along the riparian zones at the Michuki Memorial Park; constructed 2.5 Km river banks embankment; and planted 270,000 indigenous trees along Mathare, Ngong, Nairobi, and Sosian river banks.

> Challenge:

= Inadequate institutional framework for management of trans-boundary resources;

= Pressure on natural resources due to population increase;

> lessons learned:

Collaborative Framework between the National and County Governments is essential for sustainable environmental management

Flagship project 2018-2022

Waste Management and Pollution Control: This programme will focus on disposal of human and industrial waste, e-waste, elimination of harmful emissions including those from factories and motor vehicles. In addition, the National Government, in close collaboration with County Governments will establish at least two proper waste management systems in each county as well as providing incentives to investors to establish waste to energy infrastructure for Nairobi, Mombasa, Nakuru, Kisumu and other counties.

Rehabilitation of Urban Rivers: The programme will continue to rehabilitate the Nairobi rivers and other urban rivers within counties. (Budget 1,500 KSH by GoK). Whereas the forest conservation and management program has 41,511 KSH, and includes the increase of bamboo.

Promotion and Piloting of Green Energy: The programme aims at promoting green energy options by piloting innovative options that can be commercialized in order to make Kenya a world leader in its green energy mix.

The Plastic Bags Initiative: The programme involves continuous monitoring, compliance enforcement and stakeholders' engagements on the total ban of plastic bags pursuant to the Gazette Notice No. 2334 of March, 2017 on the ban on use, manufacture and importation of all plastic bags.

Green Technologies and Innovations Programme: Under this programme, the sector will focus on creating awareness of green technologies and initiatives; recognizing and rewarding best practice; and creating an enabling environment for the promotion of green growth as well as promoting financial inclusion and investments.

> Suggestion according to this graduation project would be to include not only green but also circular programs.

Gender, Youth and Vulnerable Groups

Flagship project 2018-2022

Community Mobilization: The programme will entail development and implementation of a National Community Mobilization Strategy in collaboration with other government agencies; Establishment of community development centres, and undertake capacity building to enhance community involvement/participation in programmes and projects.

Kenya Youth Employment and Opportunities Programme (KYEOP): The programme will continue to address unemployment among youth in the 18-29 age bracket and with up to form four education. This will be achieved through: provision of training and work experience to 280,000 youths; job creation; improving labour market information system and strengthening implementation of youth policies.

School of agribusiness: This will aim at developing abilities of students for resourceful and innovative agricultural production.

Environmental degradation: Although there is no system in place to collect data on air quality in Kenya, pollution levels in Nairobi are estimated to be 45µg/m3, three times higher than the World Health Organisation (WHO) recommended level of 15µg/m3.

Sports, Culture and the Arts

"Celebrating the Best in Us"

Enactment of Sports Act, 2013 which provides the legal framework to facilitate growth and development of sports industry.

Lessons learned:

A one-stop shop for sports, arts and culture industry in each county is necessary to promote growth and development of the sector;

THEMATIC PILLAR

CLIMATE CHANGE

"Enhance climate actions towards a low carbon and climate resilient development"

Climate Change Act, 2016: The implementation of Climate Change Act commenced in May 2016. The Act aims to strengthen climate change governance and coordination structures. It outlines the key climate change duties of public and private sector entities and also recognises the complementary roles of the national and county governments towards addressing climate change.

Climate Finance: The National Treasury developed a draft National Policy on Climate Finance that establishes the institutional framework for mobilization and management of climate finance. Kenya accessed climate funding from international sources including Global Environment Facility (GEF), Green Climate Fund (GCF), and the Adaptation Fund (AF).

Green Economy Strategy and Implementation Plan (GESIP): The GESIP (2016-2030) was launched in July 2017 and aims at providing guidance to all development actors to adopt pathways with higher green growth, cleaner environment and higher productivity relative to the business as usual growth scenario. It will aid Kenya's transition to a low carbon development path through promotion of economic resilience and resource efficiency, sustainable management of natural resources, development of sustainable infrastructure and providing support for social inclusion.

Challenges:
- Increase in the frequency and intensity of extreme climate events, especially droughts and floods, that continue to negatively affect the livelihoods of communities making them more vulnerable to climate change impacts;
- Trans-boundary climate change issues such as cross-border adaptation initiatives.

Projects

Promote Environmental Diplomacy: Kenya will continue to play a critical role in shaping global environmental agenda, particularly on climate change and sustainable development. In addition, Kenya will continue to champion raising of Nairobi's stature as the world's environmental headquarters. The programme aims at strengthening the United Nations presence in Nairobi, thus profiling Kenya as a global leader in championing environment and climate change debate.

Capacity Building and Public Awareness Programme: The programme will strengthen both institutional and human capacity towards enhancing access to timely and accurate information on climate change. It will entail awareness creation; establishing dialogue, networking and building alliances on climate change; and integrating climate change into the education system.

Downside: there is only 100 KSH for budget, implementing agencies are ME&F,, CCD.

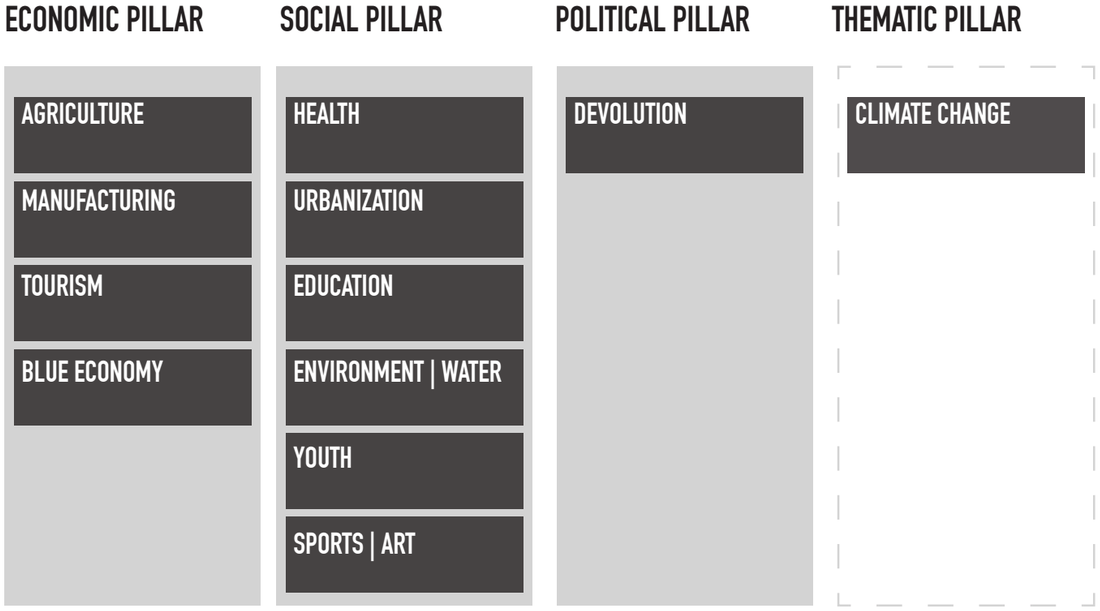
Green Growth and Employment Programme

To promote green growth and jobs in the economy. Green decent jobs created. Budget: 108 KSH.

PROPOSED PILLAR

Missing pillar in this foundation is the environmental-ecological pillar. The thematic pillar of climate change has been created for this third part of the vision, whereas it should have been there from the beginning. What is clearly visible, is the inequality in which the budget has been divided. The economic pillar has the biggest share of the national budget, whereas the ecological dimensions has the least. In this project I propose the environmental-ecological pillar, to restructure the topics on the existing pillars. Topics as water, river(fronts), airquality, agriculture, blue-green infrastructure and resource management (former: waste management).

EXISTING VISION



PROPOSED VISION

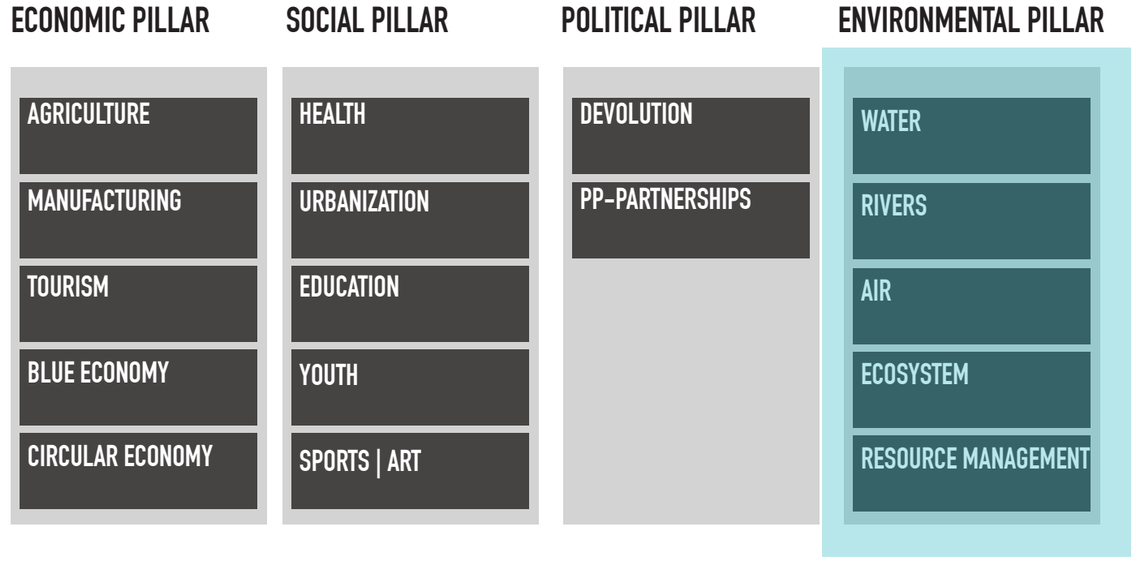
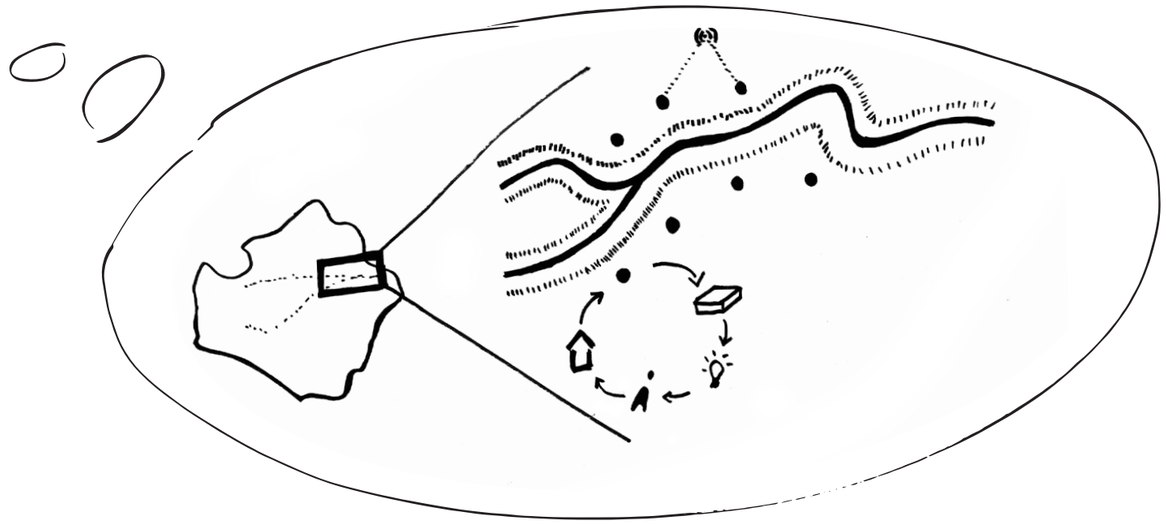


Figure 108:Vision 2030 overview of pillars - traditional and proposed pillars - Authors' diagram 2019

Knowing the Kenyan Vision for 2030, the school of thought deriving from Circular Economy and the local needs of the inhabitants of Dandora, Lucky summer and Mathare, the vision for this roadmap can be formulated as following:

Vision

Realizing a green, circular and healthy future by 2030 in the north-east section of the Nairobi river by a circular resource management strategy which offers a menu of solutions by social-ecological spatial and systemic interventions



Ambition

Implement **circularity** in systems and dynamics.

Restore natural ecology at north-east-section of the Nairobi river for a clean, safe and liveable evironment for **flora, fauna and human**

Give answer to rapid urbanization and its necessary needs, by creating high quality public spaces with a **programmatic spatial strategy**

Change of behaviour regarding waste as resource by creating **awareness, education and (socio-economic) opportunities.**

Improve governance-framework by proposing **policy recommendations**, laws and regulations in order to enhance implementation of the strategy

Dimensions

		Indicators
systematic	S	resources
environmental-ecological	E	# green
spatial-morphological	M	spatial quality
social-economic	SE	job opportunities
planning-governance	P	

II. VISION, AMBITION, TRENDS | CITY WIDE STRATEGY

This vision on the bigger scale is resulting in a green buffer zone around the riparian areas in order to prevent further demolishing of the natural zone by housing plans. The green belt is situated in Nairobi from West to East. In the higher area in West the water originates from the mountains and flows towards east in the direction of the ocean.

Figure 109: Vision of green belt along riparian area in Nairobi - Author, 2019

II. VISION, AMBITION, TRENDS | DEVELOPMENT DWELLINGS

In order to create the green buffer zone according to the vision, it is necessary to look back at recent history to understand in which manner housing schemes were expanding. In the three following maps, one can see clearly that the estate Lucky Summer in the north of the river is growing drastically. It is even growing within the original green buffer around the river. This is a high danger for the original ecological situation.



Figure 110-a: Border of built dwellings - Growth of houses in Lucky Summer in 2014 - Authors' map based on GIS data retrieved through Sentinel Satellites

2014



Figure 110-b: Border of built dwellings - Growth of houses in Lucky Summer in 2018 - Authors' map based on GIS data retrieved through Sentinel Satellites

2018



Figure 110-c: Border of built dwellings - Growth of houses in Lucky Summer in 2019 - Authors' map based on GIS data retrieved through Sentinel Satellites

2019

The spatial effects of the inadequate waste management system is resulting in polluted river water as shown in the drawing below, the necessity for a change in the system becomes clear. The industries are dumping their waste in the river, so do the car wash stops. A significant amount of dwellings in the slums of Mathare, Korokocho, Lucky Summer and Dandora are not connected to sewage system, which means that a serious share in the pollution of the river is human waste. The research of the Urban River Restoration Plan within the ministry of Environment, water and natural resources, confirms the raw sewage directly coming from adjacent buildings next to the river as heavy share of pollution.

Since the focus of this graduation project is bound to the waste management system, the vision and roadmap will focus on the waste on the ground, ending up in the river. This is another important polluter, not only for humans, but also for local flora and fauna.

The drawing below of the vision implies the green buffer belt, taking into account **flooding lines, height-lines and the historical natural soil committed to natural ecology.** Incorporating programmatic interventions in the green zone, prevents the green space from being taken over by housing cooperation to build on. This is build on the experience of Keeton, who has seen this progress happening in various countries in Africa during her research about New Town in the African Continent. By giving a new impulse in the green zone, an attractive public open space can be revived. To ensure openness, **accessibility and connectivity are of high importance.**

SPATIAL RESULT OF INADEQUATE WASTE MANAGEMENT

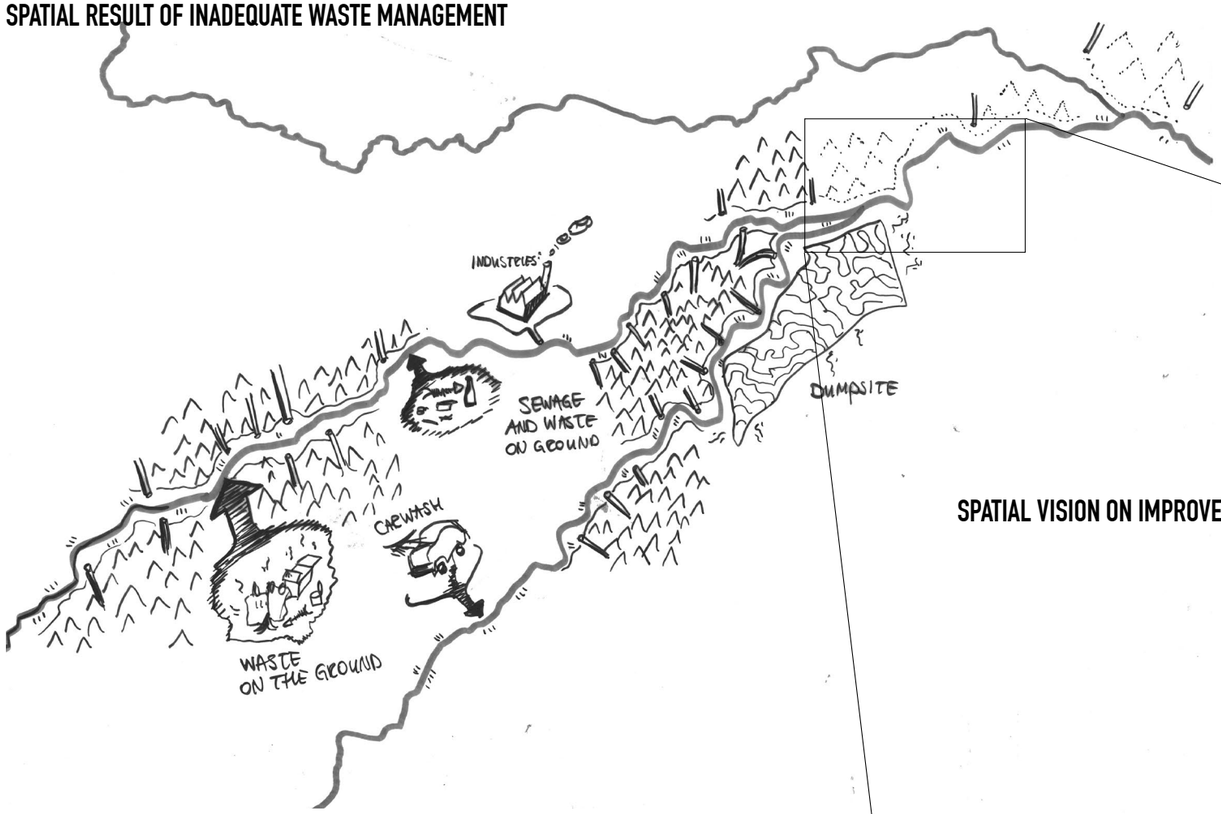


Figure 111: Spatial result of inadeauate waste maangement - Authors' drawing

SPATIAL VISION ON IMPROVEMENT RIVERFRONT WITH GREEN BUFFER

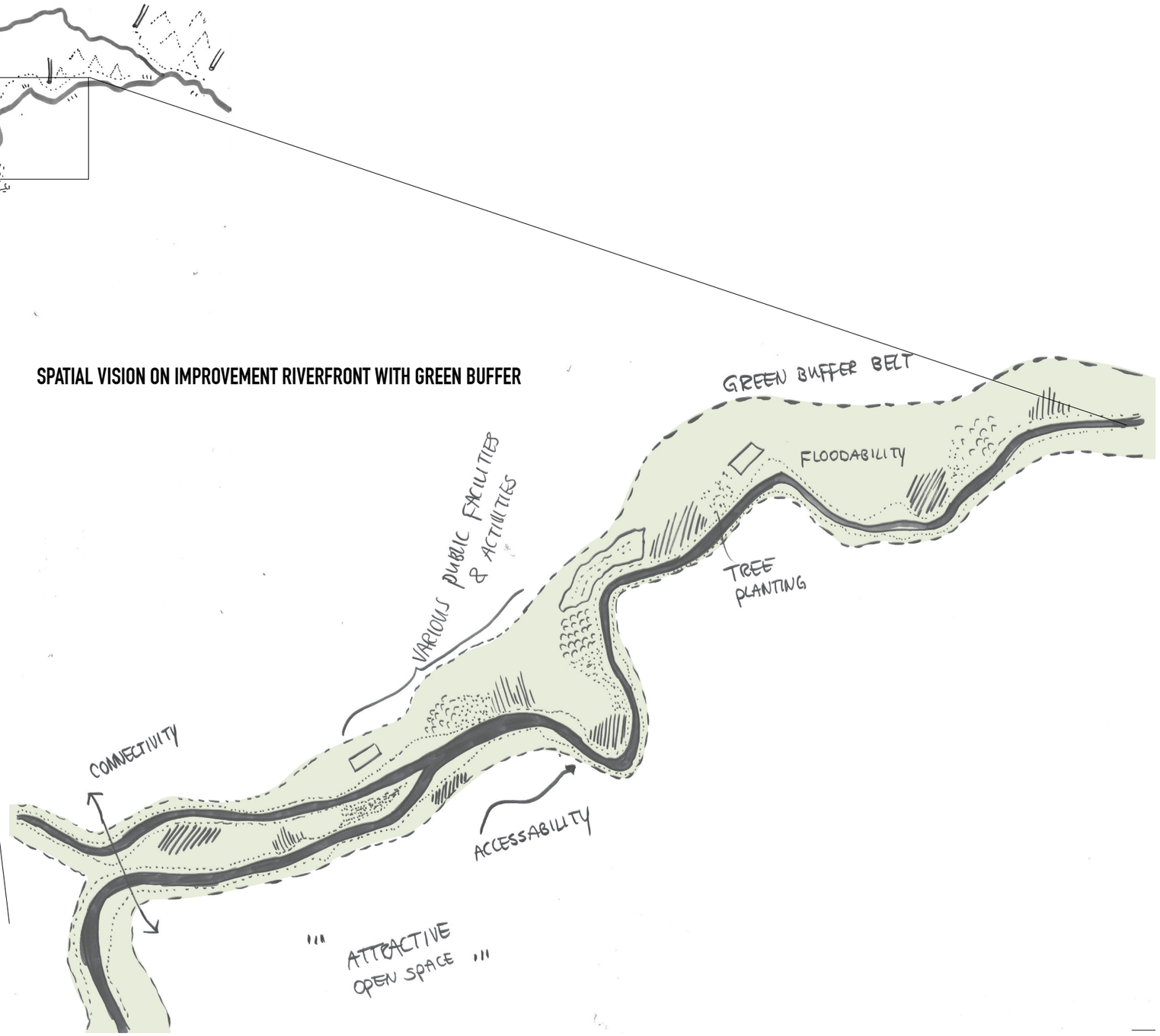


Figure 112: Spatial vision on improving riperian area with a green buffer zone - Authors' drawing

To achieve a green, sustainable, circular and inclusive urban river front in 2030, **education, green space program and community-based-organizations** are proposed as key ingredients. The future short term vision is for local inhabitants in Dandora and Mathare Valley, to show them in an ambitious yet realistic drawing revealing the **beauty of the waterfalls and opportunities for the close future**. The drawing shows people living happy and safe while they separate their waste in separation bins. The waste gets locally recycled to new products. Products to be proud of. Incorporating the ecological dimension: birds can sleep in enough trees as there is enough healthy soil to grow on. Fishes can live in clean water. Locals can enjoy to take a breath in the garden/park while living in urban areas. New jobs give people less insecurity and less seducation to crave towards criminality. This is a design for 'soft' spaces as it falls in different administrative borders of what it spatially effects**. Turning the river instead of a separator into a connector between multiple estates.**

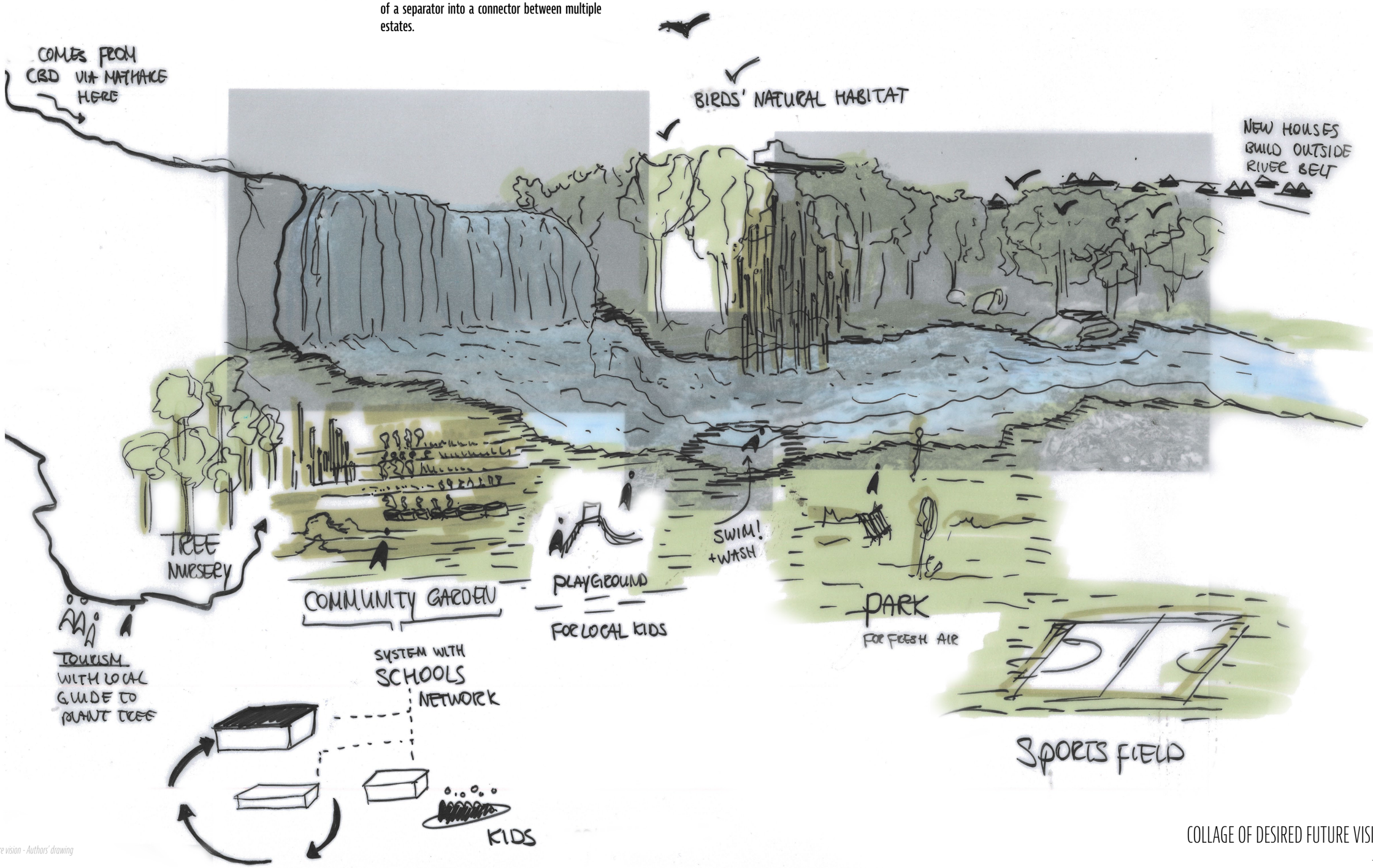


Figure 113: Collage of desired future vision - Authors' drawing

COLLAGE OF DESIRED FUTURE VISION

III. MENU OF SOLUTIONS

4.1 How can a co-created roadmap for opportunities guide implementation and participation of stakeholders?

SQ 4.1

Roadmap

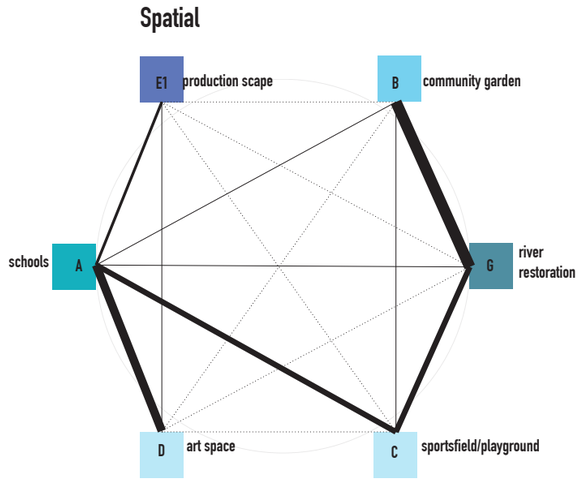
In order to answer the research question regarding a roadmap, multiple steps has been taken. Deriving from the different dimensions and translating it into spatial elements brings out a spatial strategy. Since the lack of data regarding the flow of resources, it would not result a precise flowchart. In order to still solve the problem systematically as well spatially, the allocation of collection points at schools is identified as suitable solution.

The ecological dimension requires green structure and as explained before the protected buffer zone around the river should connect green scapes and restore the natural ecology.

As the trend of rapid urbanization has its spatial effects, a housing strategy can be developed by diluting houses around the protected green belt around the river zone whereas densify houses on the area of which is the dumpsite now, so called Phase VI. A specific long term roadmap elaborates on this strategy. This long term strategy includes the production scape which evolves from socio-economic dimension. This manufacturing (makers) space, should create new dignified jobs, produce local and circular products and at the same time - as it incorporates a waste to energy plant - cleans up the dumpsite.

Since not all these spatial strategies with their programmatic interventions would happen at the same time, phasing this strategically and with the right stakeholders should be in line with the institutional and governmental context. Before the interventions would have an effect, the first important elements of the phasing should be implemented: clean up the existing waste on the ground and in the river, the awareness program along all inhabitants and the tree planting plan in order to purify the water as well initiate circular harvesting with reed and bamboo. All of these strategies and programmatic interventions are linked together in a spatial way to the river restoration plan.

To understand the spatial as well systemic relationship between the different interventions, these diagrams show the connection. In order of thickness of the line is the stronger connection between the different solutions.



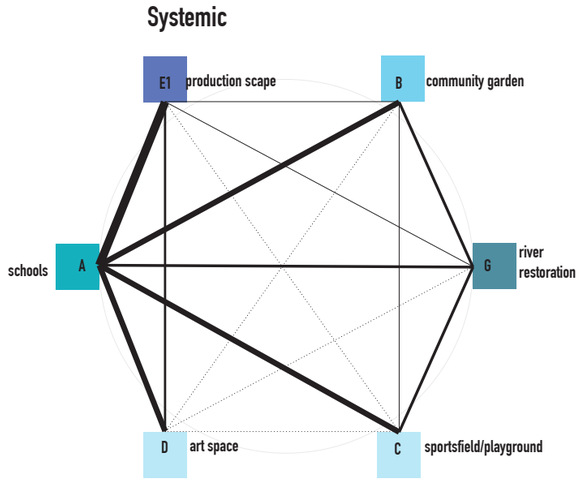
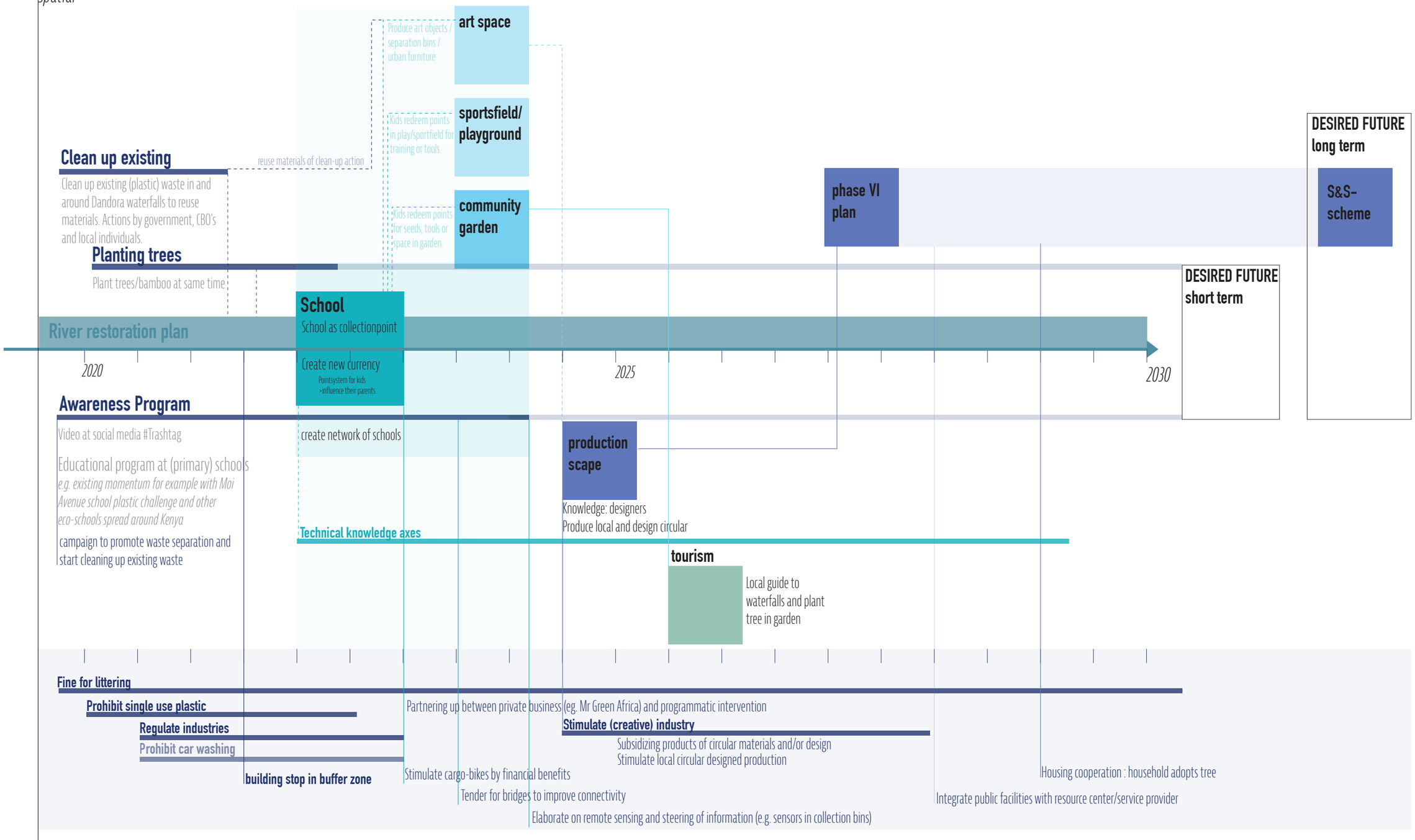


Figure 114: Overview of dimensions, indicators and interventions- Authors' drawin4

III. MENU OF SOLUTIONS IN TIME

The different interventions as described above all together in time, give the following overview. In the up-following paragraphs each interventions will be explained and elaborated in systemic and spatial way. The aim of this local roadmap is to empower local inhabitants. This result could be an advice to the government or the county. Preferable with the involvement of a private party in order to implement it. In the lowest section the procedural interventions linked to specific programmatic interventions are shown in time.

spatial

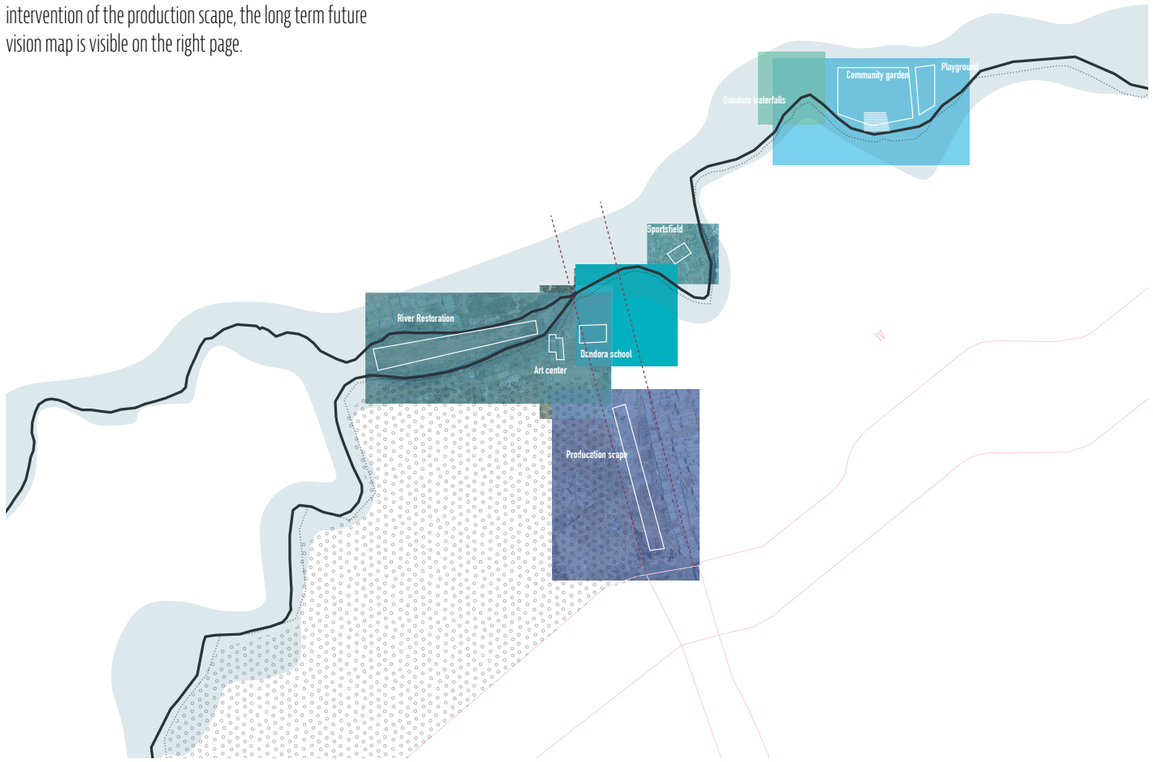


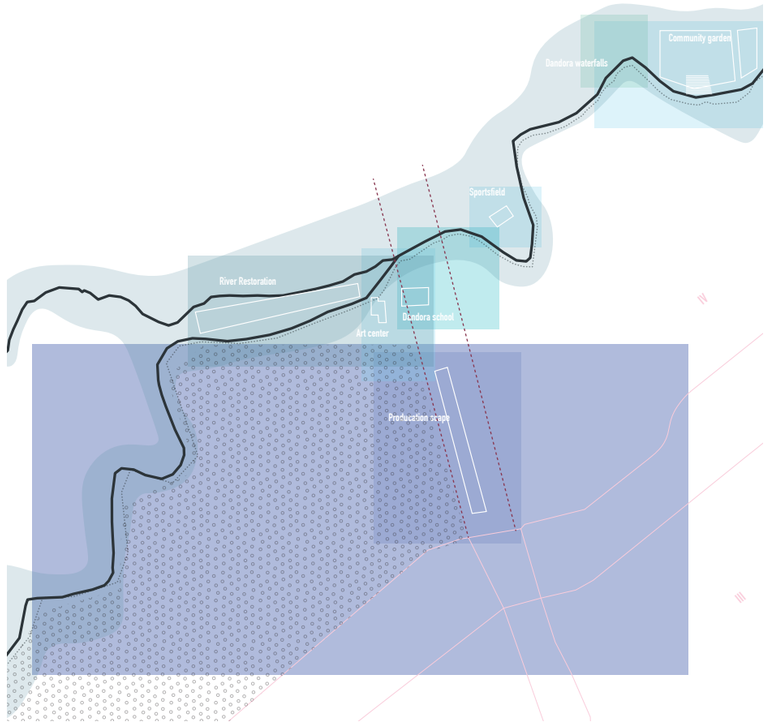
systemic

Figure 115: Overview actions, programs, interventions and their connections in time - Authors' diagram

IV. ROADMAP TO DESIRED FUTURE | SHORT AND LONG TERM

Complementing the overview of the different solution-based interventions in time with the contextualizing of these interventions in a spatial way. For the close future, the elaboration on the interventions on the next paragraphs will explain how to come there. In the specific intervention of the production scape, the long term future vision map is visible on the right page.





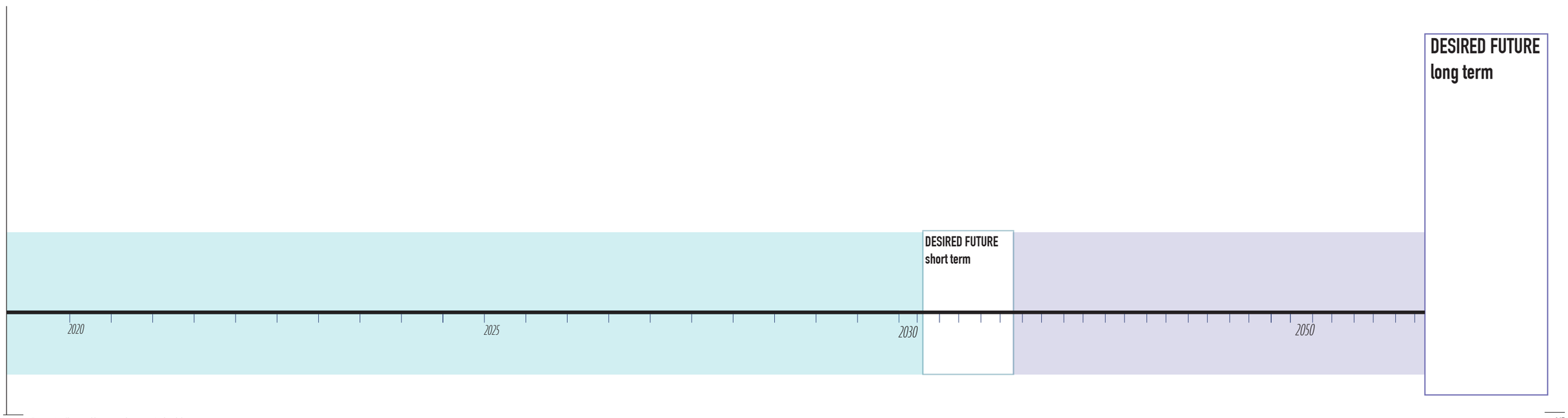


Figure 116: Short and longterm planning - Authors' diagram

IV. ROADMAP | VISION WITH INTERVENTIONS

Spatial vision with the spatial implication of the interventions projected on the north-east section of the Nairobi River.
Green: Buffer zone around river
Pink: based on Placemakers' vision


Dandora school


Production scape


Community garden


River Restoration


Art center


Sportsfield


Playground





public function

the leaveway

the godowns

I

II

III

IV

V

ROADMAP VISION NORTH EAST SECTION OF NAIROBI RIVER AND DANDORA 115000

Figure 117: *Spatial vision with interventions with green buffer zone along Nairobi River - Authors' map - 1 to 115000*

IV. ROADMAP | CURRENT SITUATION

Spatial situation of the current situation zoomed in on the Dandora area.



Figure 118: Current situation of interventions in North East section - Authors' map – 1 to 5000

NORTH EAST SECTION OF NAIROBI RIVER AND DANDORA 1:5000

IV. ROADMAP | SPATIAL CONCEPT

Conceptual explanation of spatial vision of the interventions projected on the north-east section of the Nairobi River. Integral spatial concepts that guide the spatial design of the separate interventions. These guidelines direct towards a holistic approach.

INTEGRATE
PROGRAM IN GREEN

Dandora waterfalls

Community garden

Playground

CONNECT
ESTATES AND PEOPLE

Sportsfield

PROTECT
NATURAL ECOLOGY

REMEDIATE
SOIL AND WATER

CREATE SPACE
HIGH QUALITY

River Restoration

Dandora school

Art center

Production scape

ACCESSIBLE
OPENNESS

CONNECT
TO VISION

NORTH EAST SECTION OF NAIROBI RIVER AND DANDORA 1:4000

IV. ROADMAP TO DESIRED FUTURE | SYSTEMIC OVERVIEW

In order to understand the systemic interventions, the two figure below visualize the current situation of the waste management system and the proposed system with circular principles. Based on the butterfly diagram developed by the Ellen MacArthur Foundation in 2012, the left figure shows the problems of mining resulting in depletion of resources and the waste generation which is almost 25 tons of waste per day in Nairobi. As the data of 2015 reveals the low waste-collection rate of only 33%, in reality this is even lower. This results in not-separated waste in illegal landfills squattered around the city.

An important feature of the current system is the informal economy around the dumpsite. As Cecilia from UN-Habitat explains, '***around 3000 people make living from the dumpsite - be aware of that informal economy - it is enormous.'*** Out of the 225 slums in Nairobi, the poorest slum is Korogoco where people are make a living from the dumpsite. The Nairobi city council has problem with the dumpsite as it could not be moved somewhere else. This urgent problem lacks in solutions. However, **the core of the problem is the behavior regarding waste and the non presence of a separation and collection system**. In order to make a system that intervenes with the daily life of inhabitants, this strategy proposes a (primary) school as collection point. These collection points separate different kinds of waste and can be additionally connected through sensors. The kids have to bring their separated household waste weekly to school in separated bags. This effects the household and their family members to separate waste as well. As the kids gain points by bringing waste to their school, they can redeem these points in for example the community garden, the sportsfield or the art space. This **new currency mviringo coin** - circular coin in Kswahili - should be an incentive for the kids. This means that the resources will flow back towards either the service provides, like supermarkets or to material or product manufacturers. This is according to the principles of the Circular Economy. Reduce on waste generation, Reuse materials directly and Recycle resources.

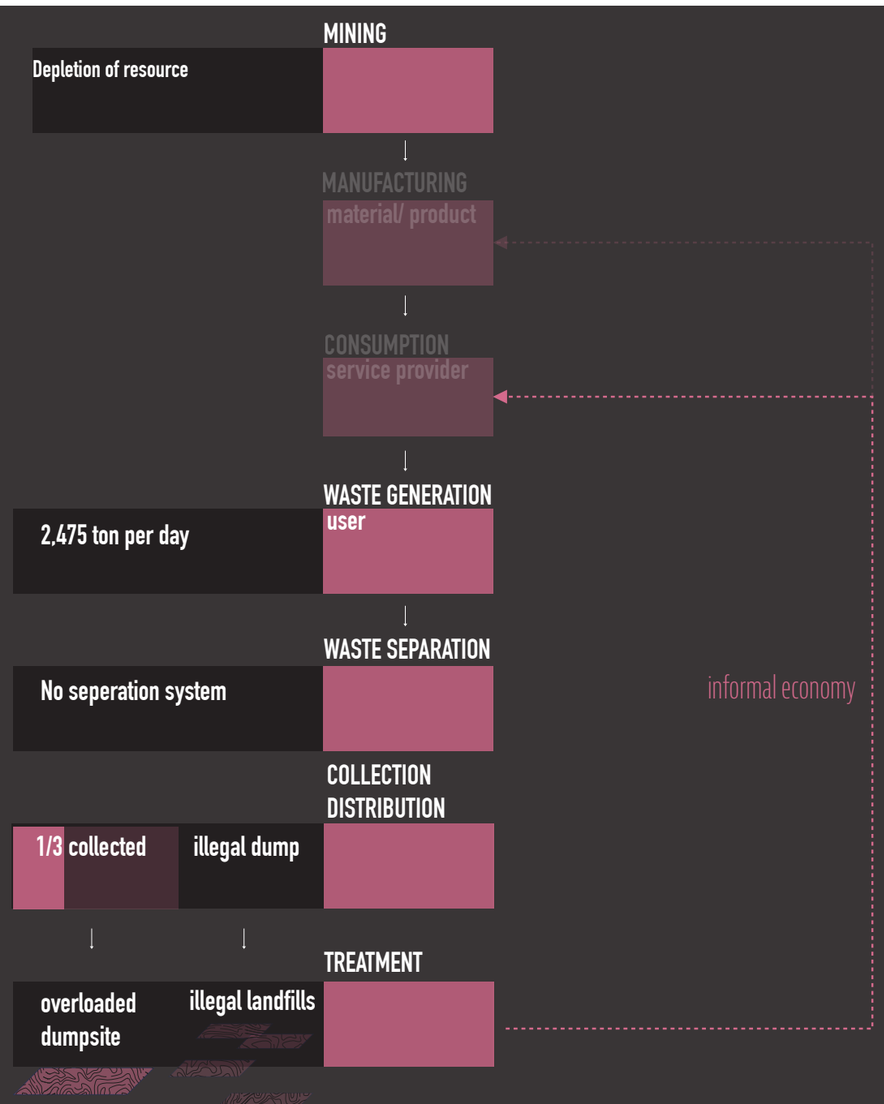


Figure 120-a: *Current situation of waste management system based on EllenMacArthur Butterfly diagram - Authors' diagram*

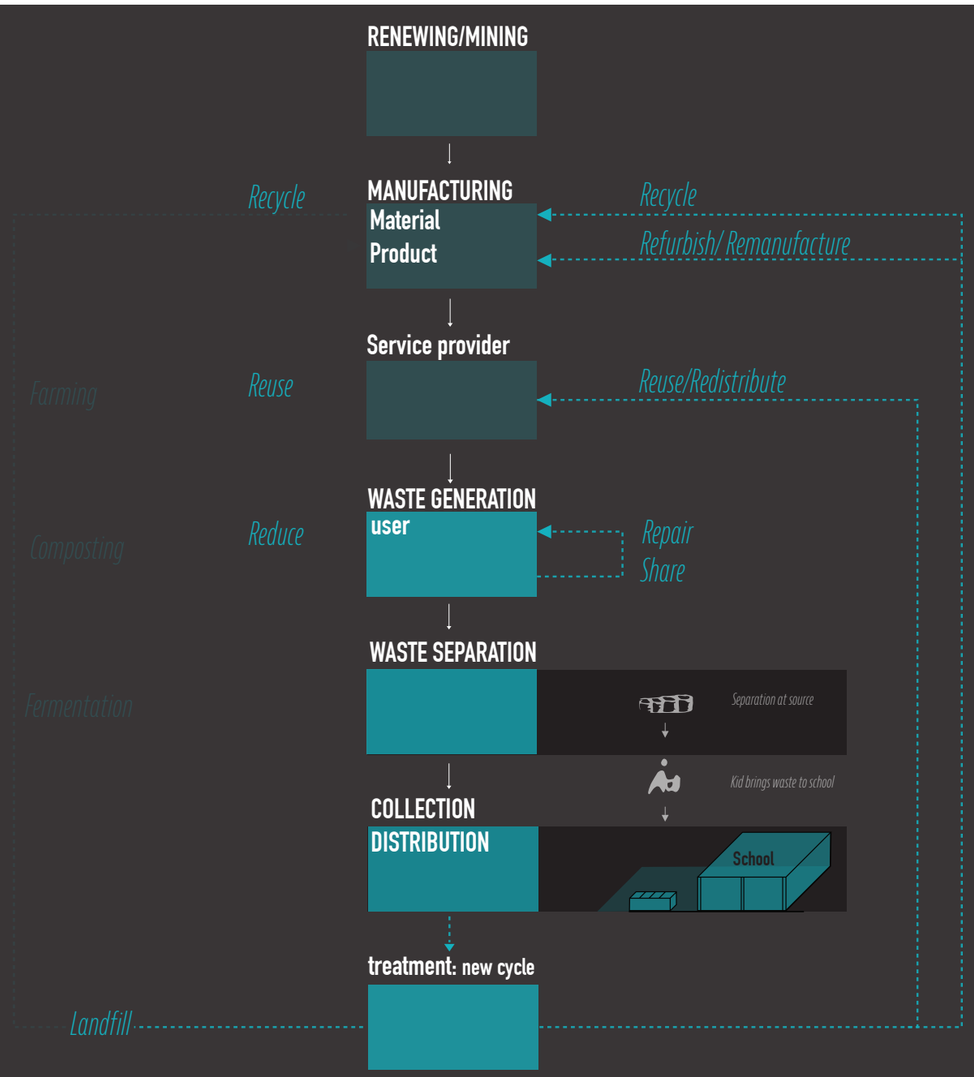


Figure 120-b: *Proposed situation of resource management system based on EllenMacArthur Butterfly diagram - Authors' diagram*

IV. ROADMAP TO DESIRED FUTURE| OVERVIEW OLD SITUATION

At this moment there is one recycler, Mr Green Africa, operating throughout whole Nairobi. His business model is to buy waste from waste pickers and distribute it to their recycling plant in the south of Nairobi. However, this still does not cover the real problem. Moreover, the waste scavengers remain in their inferior job of picking waste from the streets as well the waste on the ground still pollutes its environment. The focus of Mr Green Africa is only on HDEP and PET plastic, since there is a business case for these sorts of plastic. The problem is, as long as there is no business case for other waste sorts, like for example micro plastics, there will be no incentive to recycle those.

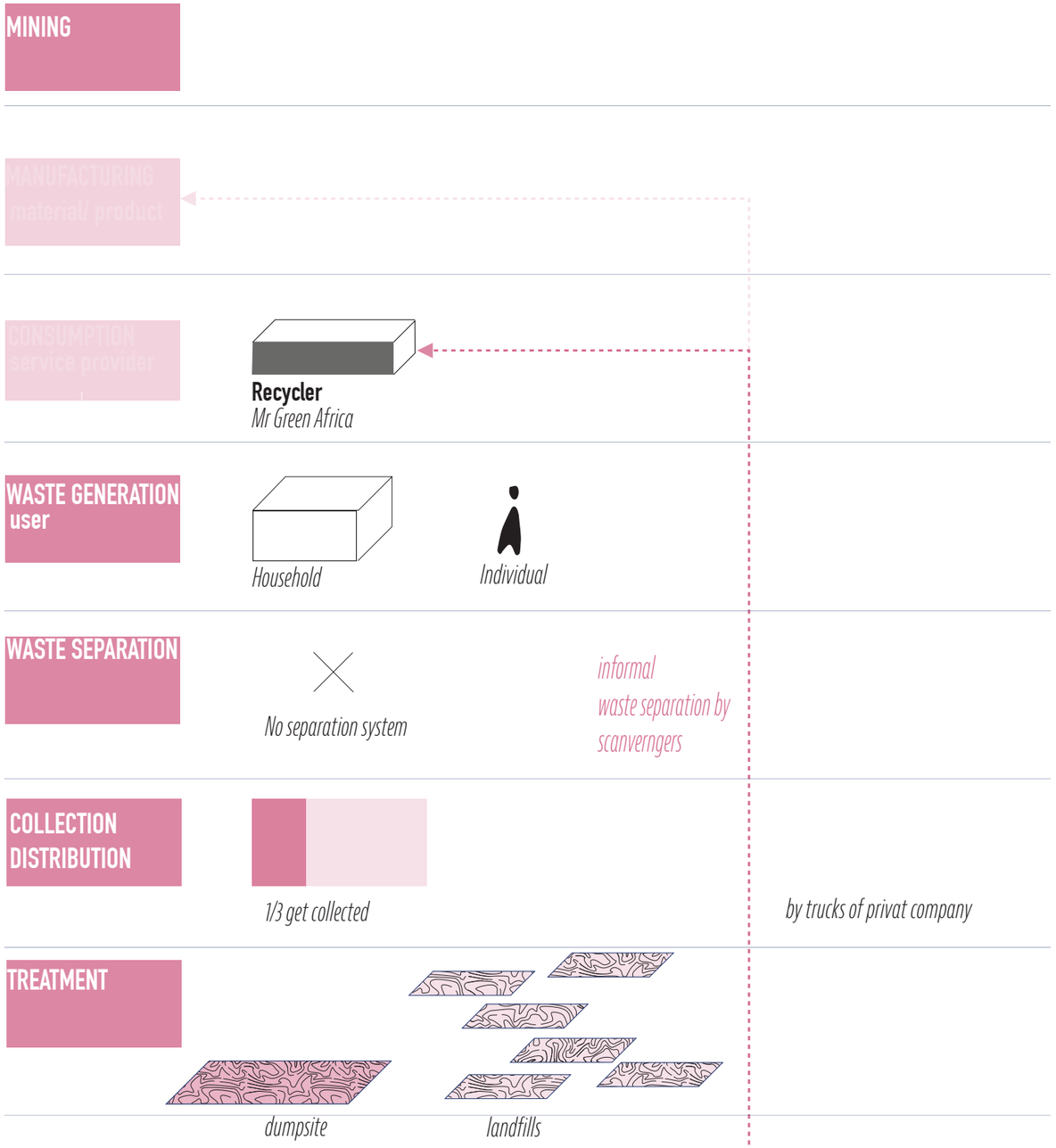


Figure 121: *Current problems in waste management system based on waste phases and the EllenMacArthur Butterfly diagram - Authors' diagram*

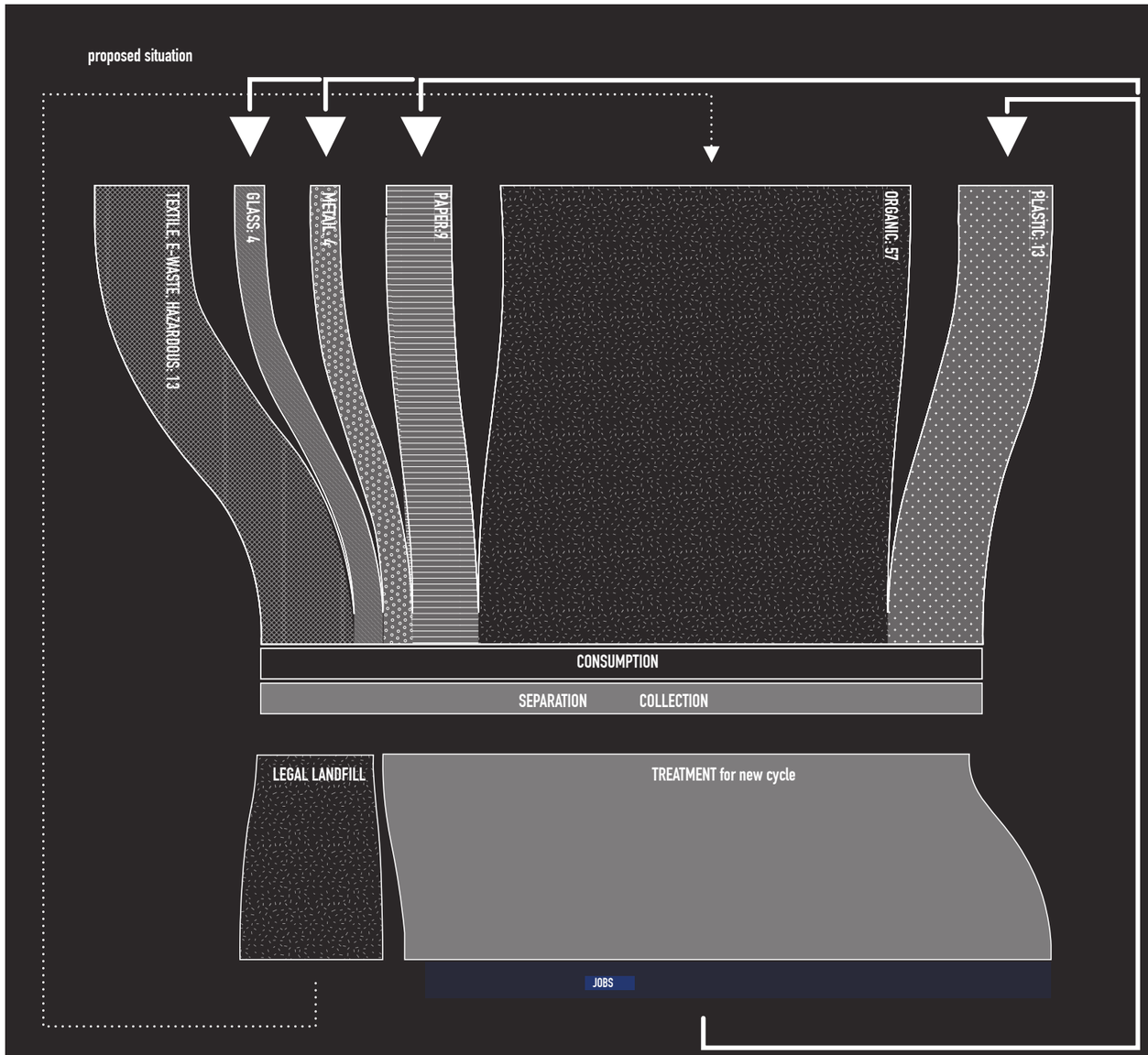


Figure 122: *Proposed situation of waste management system based - Authors' diagram*

V. ROADMAP TO DESIRED FUTURE| OVERVIEW NEW SITUATION

The proposal of the new situation in a systematic way in a complete overview is given in the diagram. As all interventions are related to eachother and to external players, their connections have been made clear. The specific focus of this roadmap design is highlighted in the left diagram. Understanding the bigger picture, that a system cannot work by only one scale or player but by multiple, this diagram gives a brief overview. Starting to read the image by at the waste generation as a user. Imagining living as a kid in a household where we separate waste in different bins with different bags. Every week, 5 days a week, I will bring one of the bags to school. At school the collection point stores the resources temporary. Either we reuse the resources in school, to make something new out of it, or we sell it to the recycler who comes by cargo-bike to pick it up. From there the resource will be brought to a service provider, a new recycler or an existing one (e.g. Mr Green Africa). Those recyclers sell the resource to material or product manufacturer. This roadmap introduces a local producation scape, which at the same time also functions as a service provider by selling the products made. From there one, the cycle starts again. The next pages will explain these interventions more into detail.

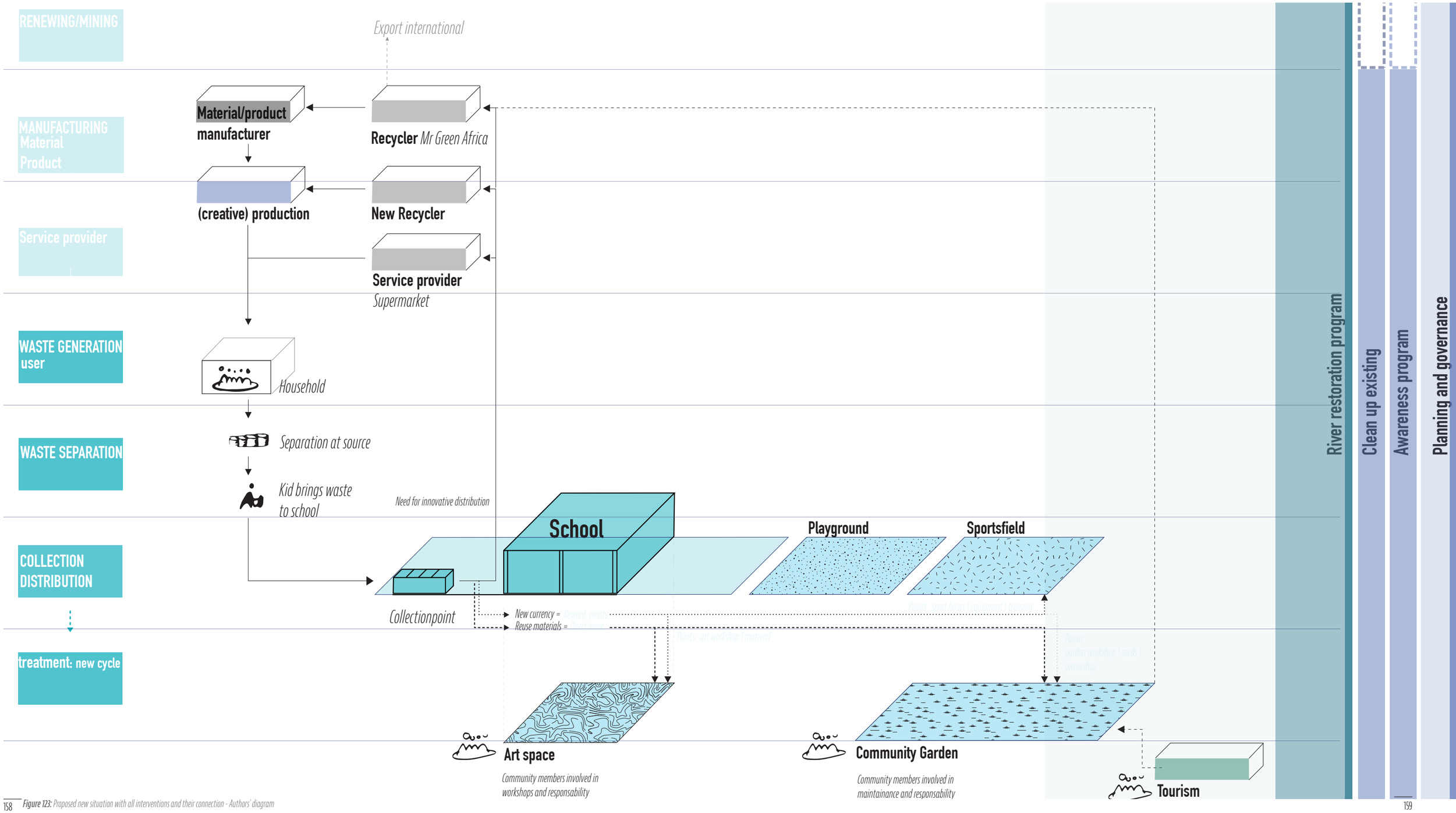
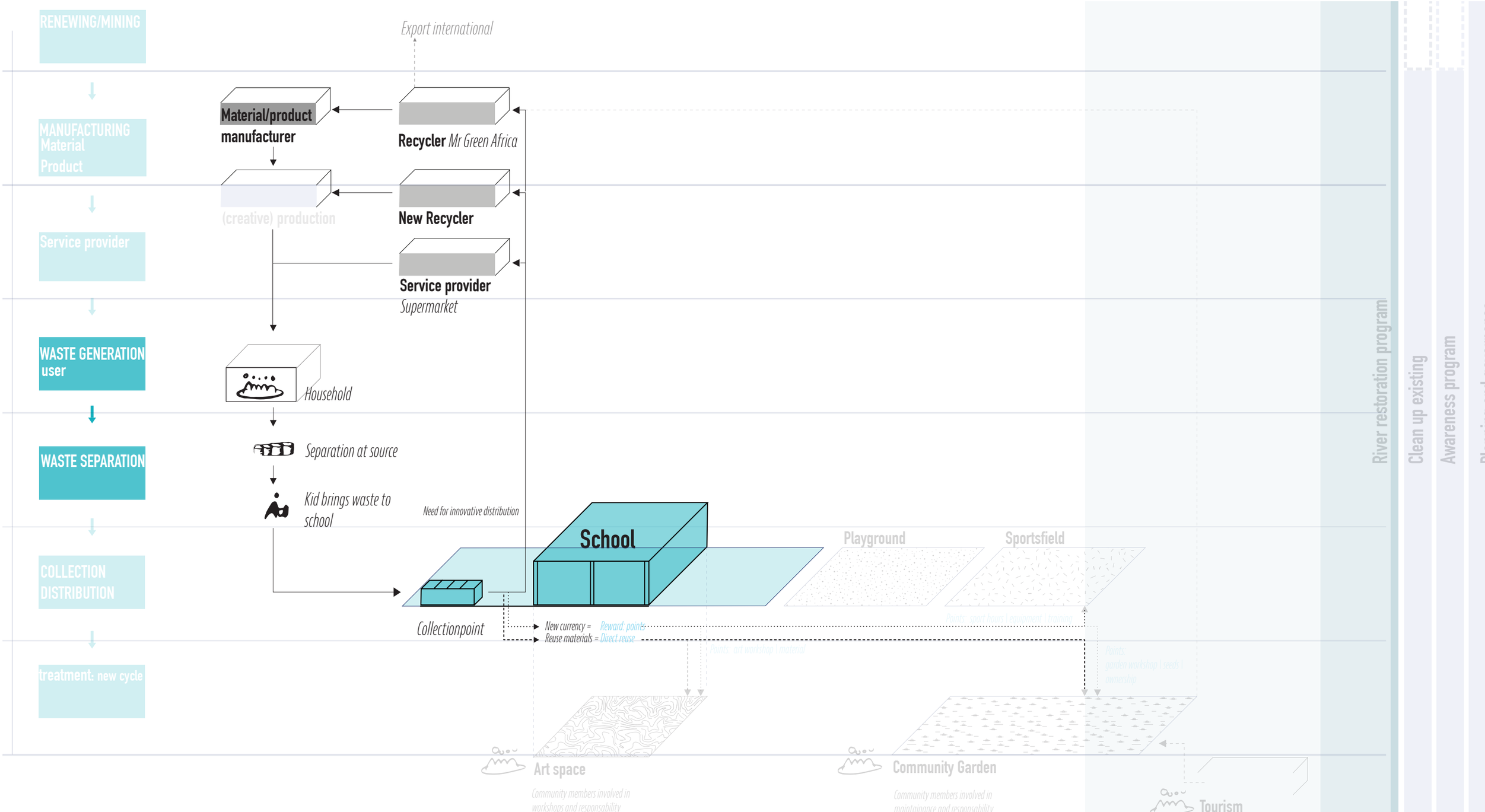


Figure 123: Proposed new situation with all interventions and their connection - Authors' diagram

V. CONCEPT ZOOM IN | SCHOOL

The position of the school intervention in the proposed new situation in a systemic way:



160 ***Figure 123-a:*** *Proposed new situation with school intervention highlighted - Authors' diagram*

V. CONCEPT ZOOM IN | SCHOOL

systemic dimension

The main intervention is the school as collection point. Systematically it functions in the separation and collection phase of the traditional solid waste management classification. The resource collection point can be either situated within the school border or outside. In the example school next to Dandora HipHop City the collection point is situated outside, taking into account possible smell. Making use of existing technology like sensors and remote controlling, these collection bins can automatically communicate with the collection network wether a bin of a type of resource is (almost) full. Supporting sustainable transport and making use of the innovative handicraft of the local craftmans, cargobikes are proposed as new way of transport.

In order to teach the kids about resource management and circular economy, the teachers should be educated first.

To make the new currency of the collected points per kilogram waste a success, the associated recycler should pay the school collection points per gram. This money the school can use to pay for the connected interventions like sportsfield, artspace and community garden.



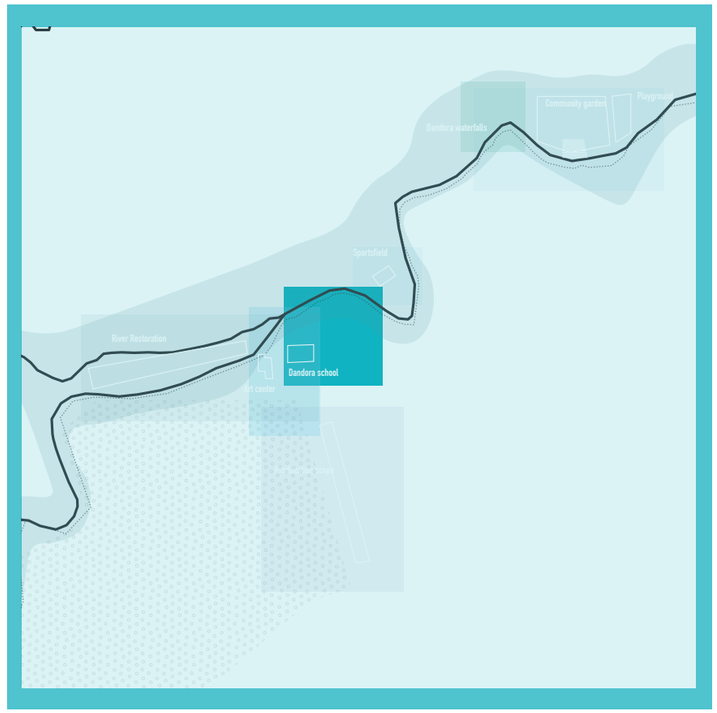
planning-governance dimension

Implementing the school concept happens in phases, step by step. The first step should be the allocation of the collection bins, and with this, the usage of separation bags at home. In addition to the connection path, a line of trees should be planted. In this specific case, first the big tree at the connection point between the two paths. This tree than can grow out to become a big characteristic tree as landmark. Just as the Green Belt Movement initiator Wangari Maathai.

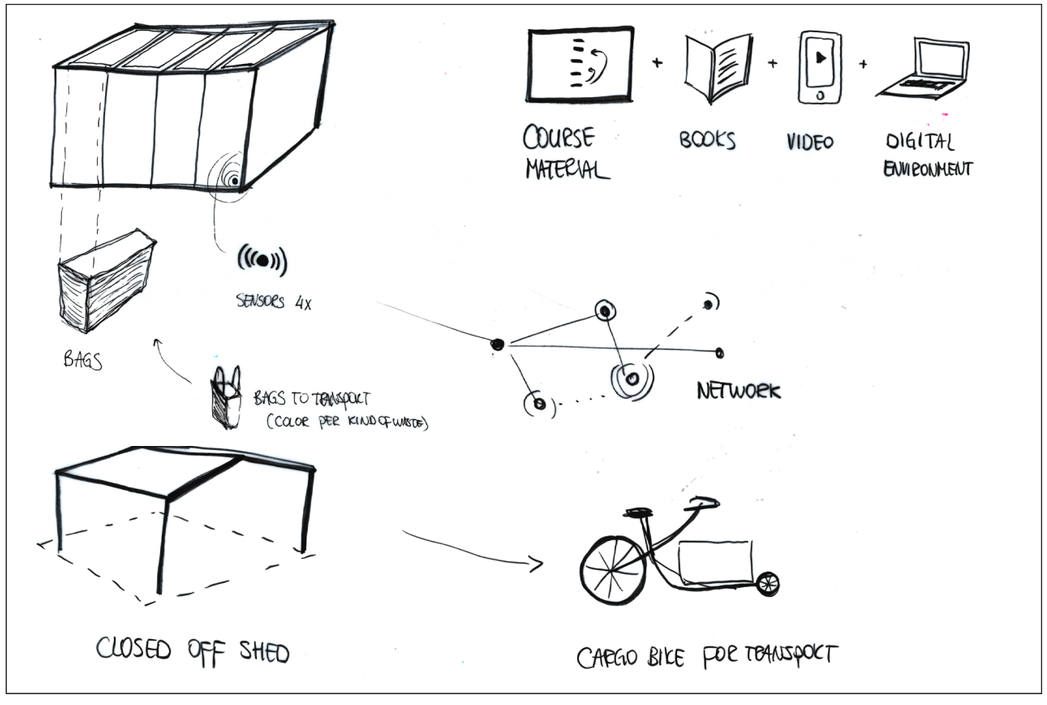
This connection point has view on the bridge, which is the next step in the phasing. This bridge could be made out of bamboo. Bamboo which is planted at the tree planting program firstly, as this plant has fast growing qualities.

spatial-morphological dimension

Concept: school

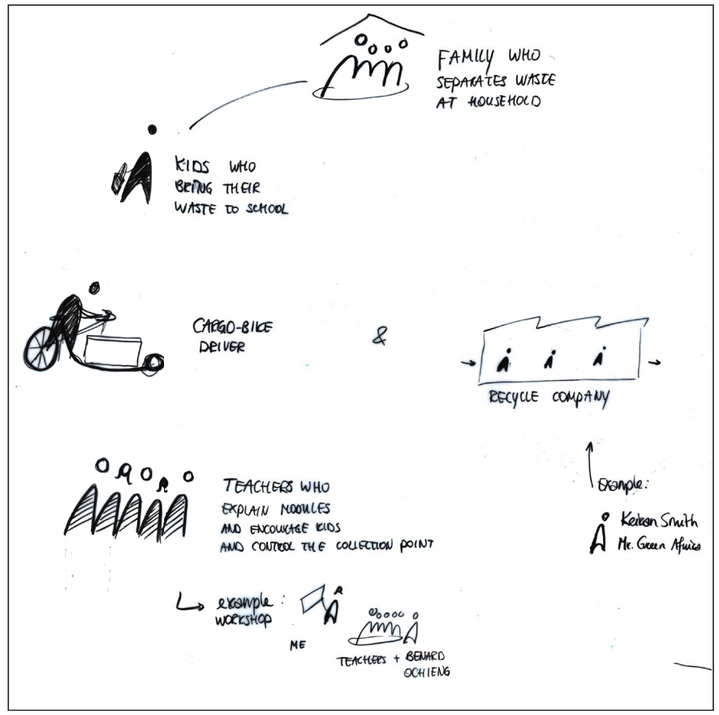


Material resources

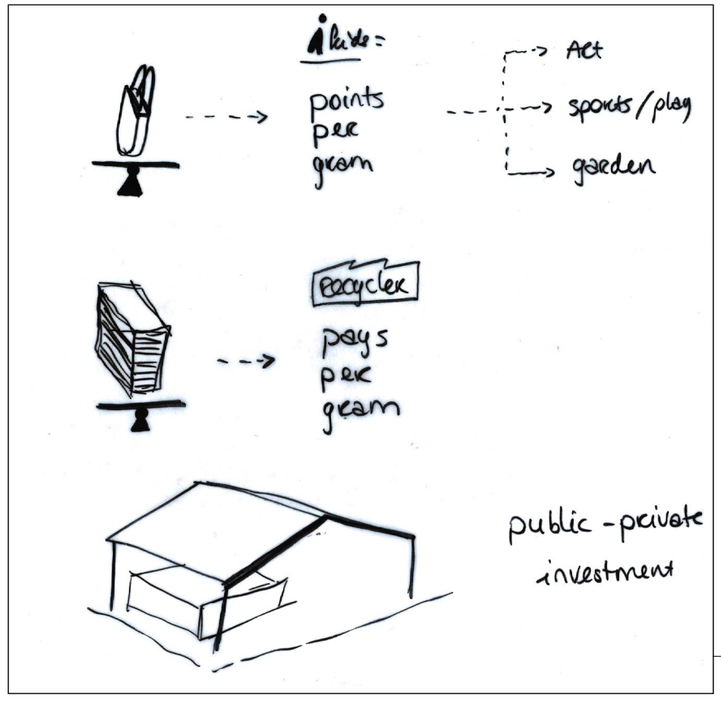


social-economic dimension

Human Resources



Financial resources



V. CONCEPT ZOOM IN | SCHOOL

The spatial position of the school is directly adjacent to the river, and just north of the dumpsite.

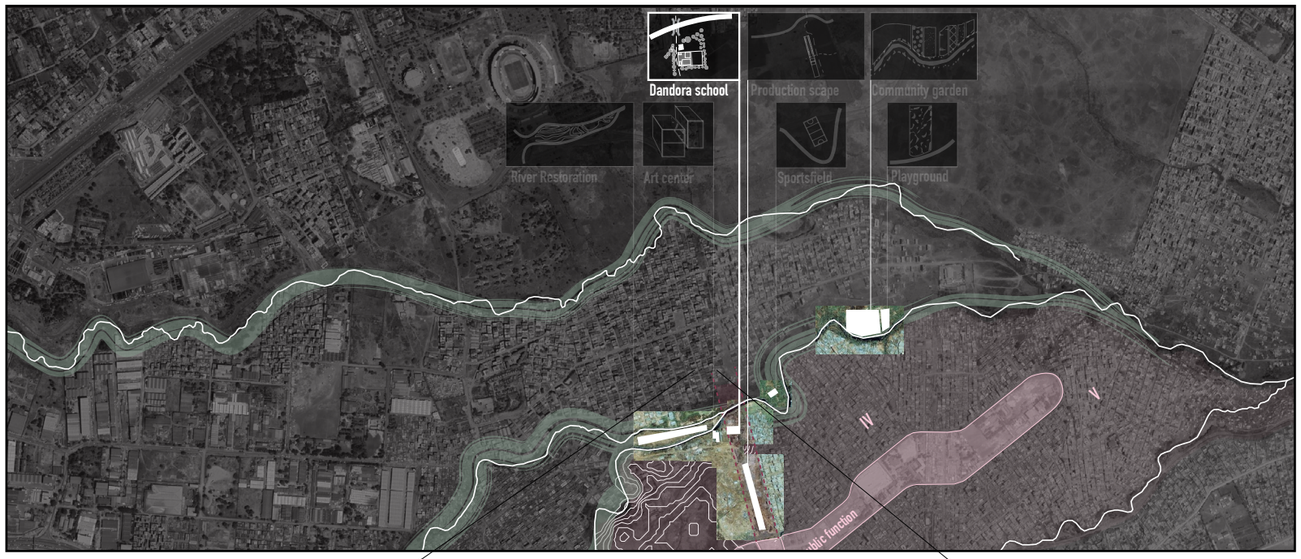


Figure 124: School intervention in spatial roadmap - Authors' map

1 TO 10.000

The spatial design reveals the way the school is situated and how the connection paths are crossing just in front of the river and the bridge. Important is the accessibility for the cargo bikes. The north part of the design is the border of the new estate Lucky Summer, of which some houses are coming close to the green buffer zone. To close. The connection path is related to the main way to go to the river in Lucky Summer estate.

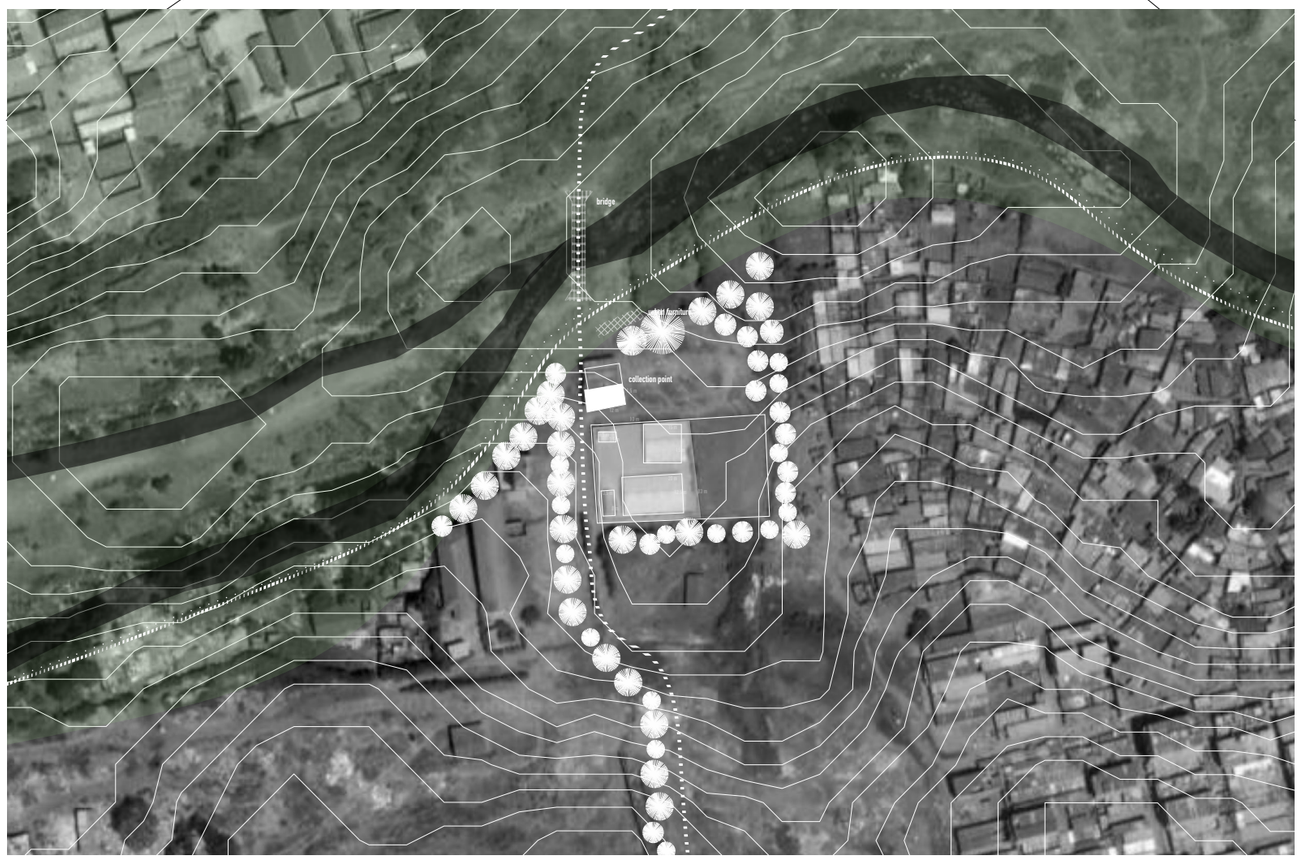


Figure 125: School intervention in spatial features - Authors' map

1 TO 2.000

V. CONCEPT ZOOM IN | SCHOOL

To specify, the collection system focusses on household waste, glass, paper, metal and plastic. Seen in the diagram on the right. As an example, the separation system in universities in the Netherlands. This simple design has the possiblity to be reused multiple times.

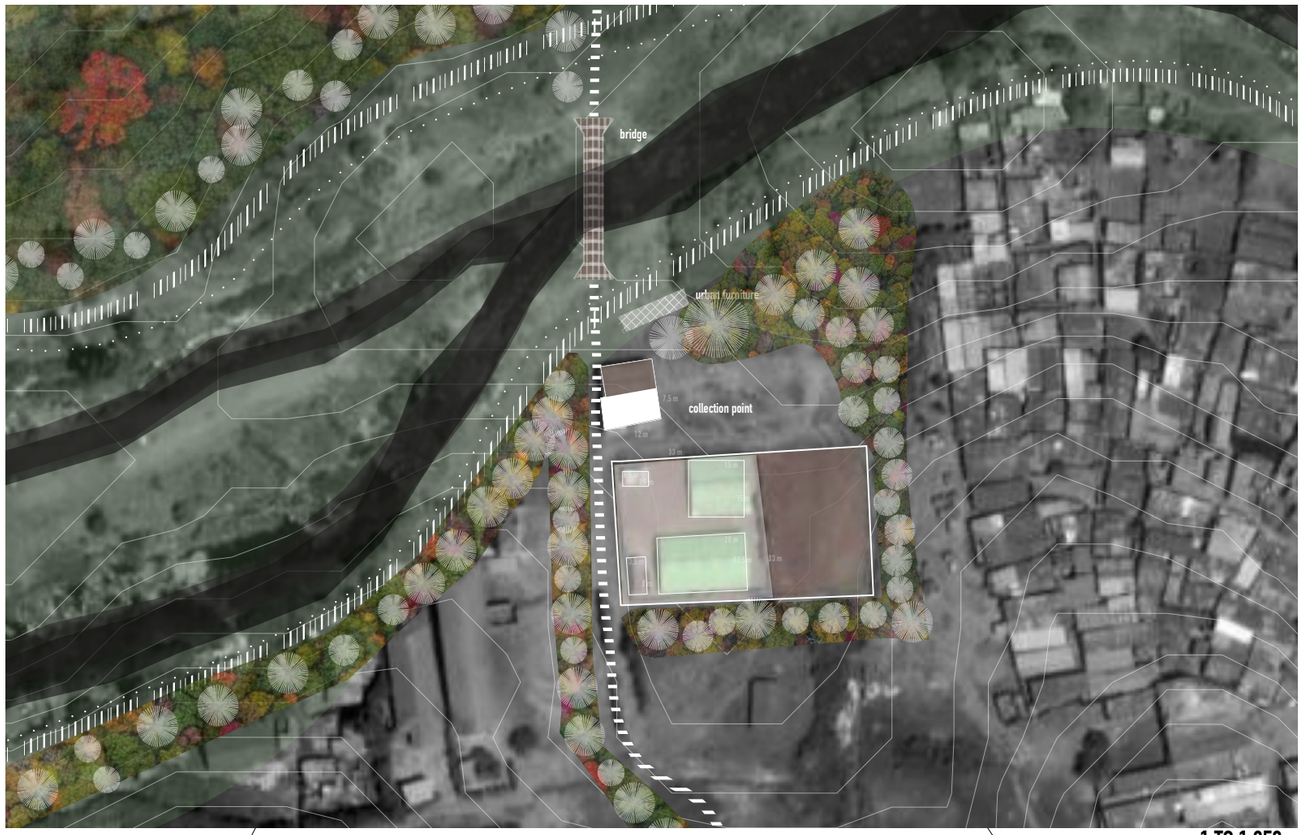


Figure 126: School intervention in spatial features - Authors' map

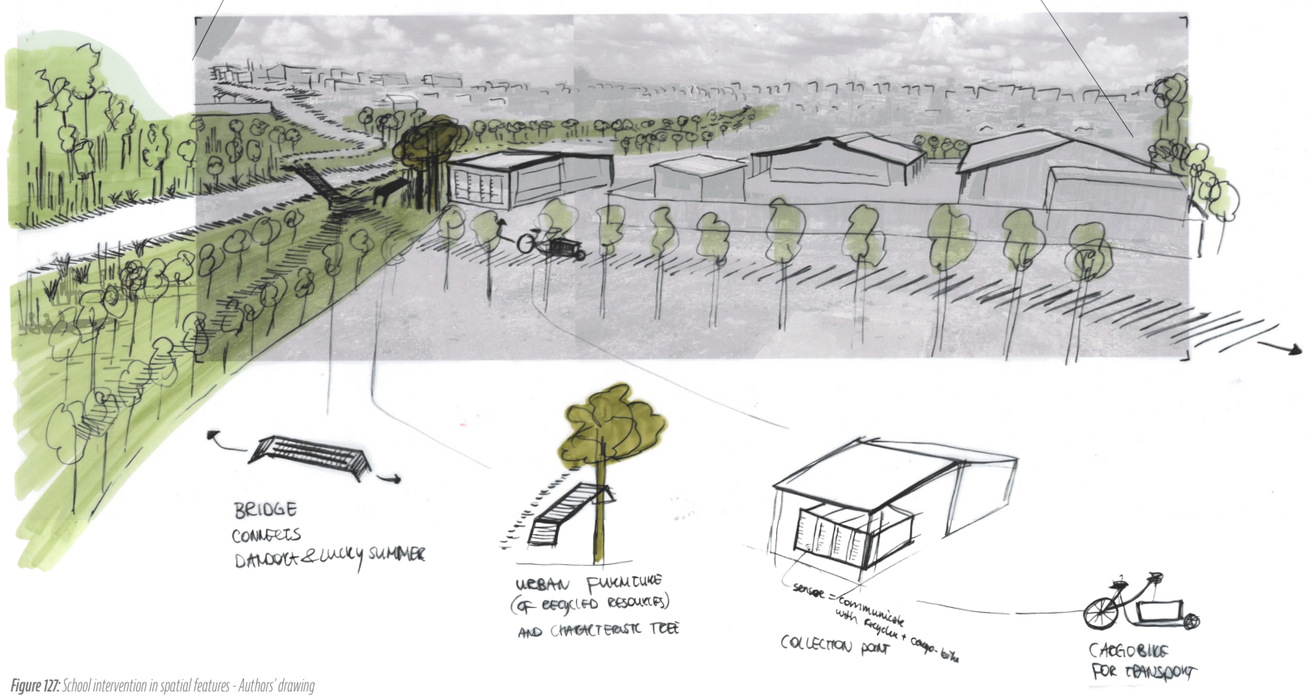


Figure 127: School intervention in spatial features - Authors' drawing



Reference on collection bins in universitiy in the Netherlands - Authors' own image



View on the school - Authors' own image

V. CONCEPT ZOOM IN: COMMUNITY GARDEN

The systemic position of the community garden in the proposed new situation

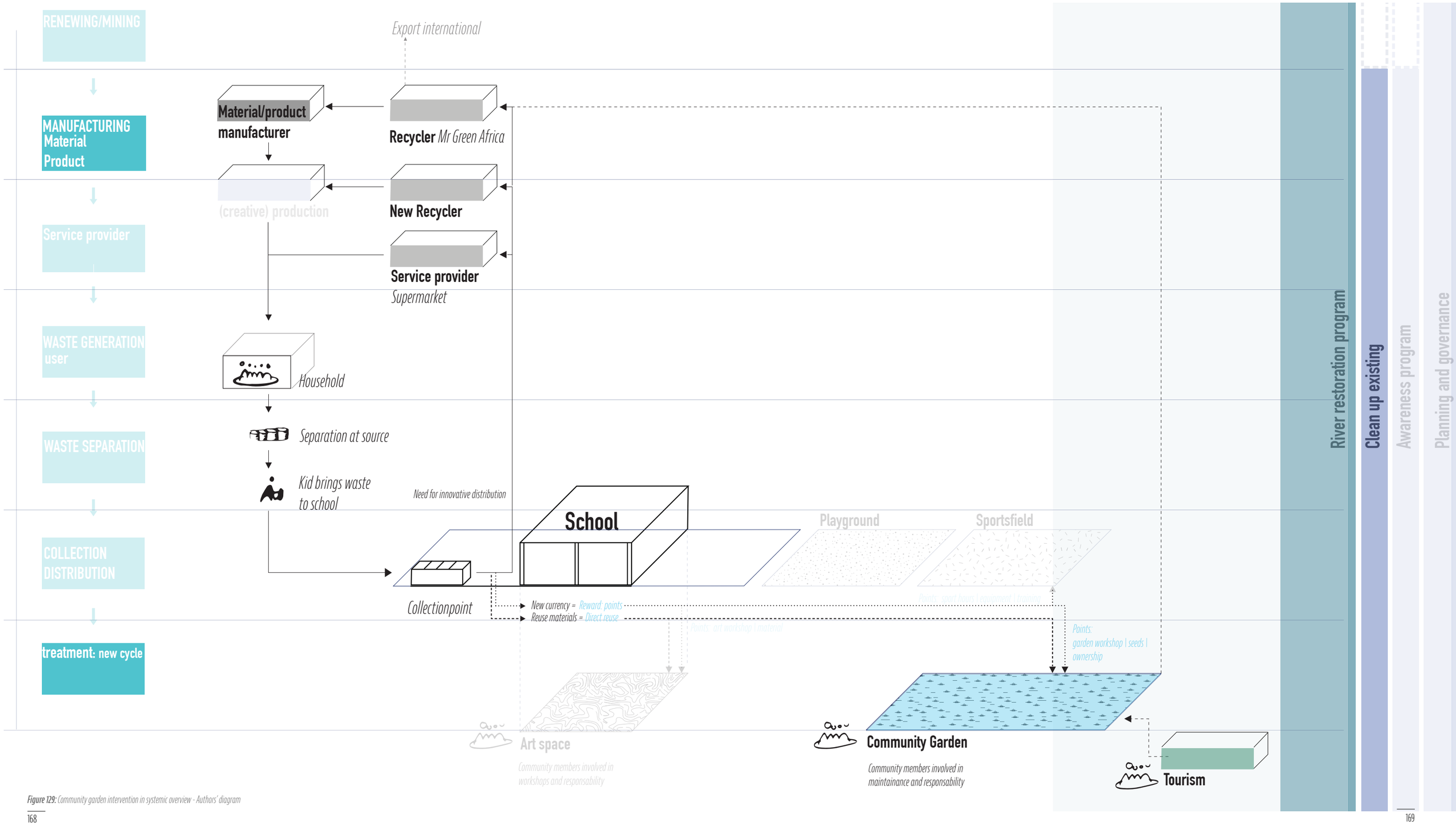


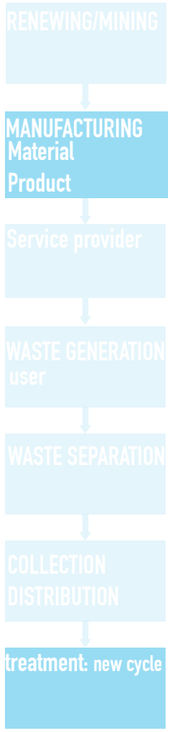
Figure 129: Community garden intervention in systemic overview - Authors' diagram

V. CONCEPT ZOOM IN: COMMUNITY GARDEN

systemic dimension

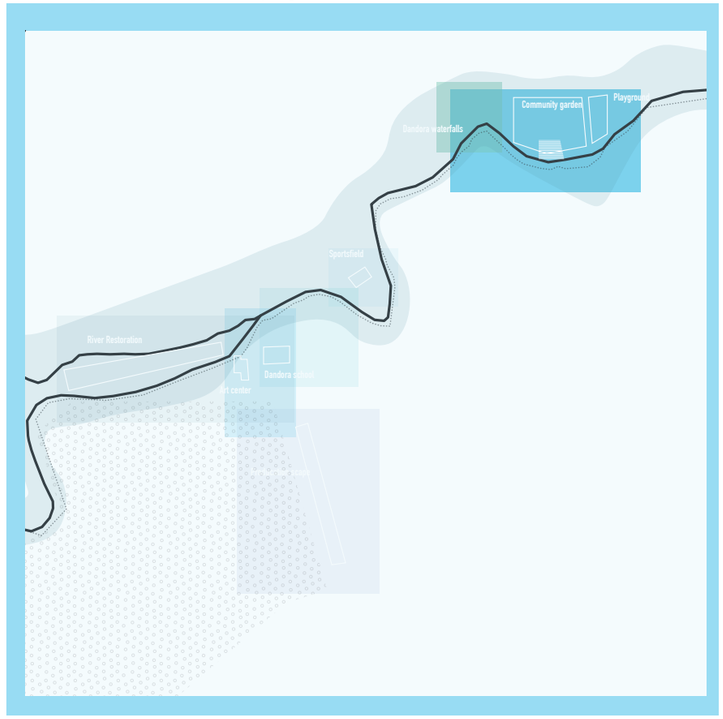
The community garden has two systematic purposes. First of all it is connected to the currency system of the school. The proximity of the garden to the school is of relevance. This should not be more than 15 minutes walk, as walking is the main way of transport for kids in this age and this location. Secondly, the community garden contributes to the manufacturing of crops. Urban agriculture has been an increasing trend in Kenya and is promoted by the government - see Vision 2030. As third, some of the materials collected at the collection point can be reused at the garden, for example for the tree nursery.

In order to be able to harvest crops of high quality, the gardeners should be aware of the quality of the water. This is the reason of their own responsibility for the water remediation. Water remediation takes place directly adjacent to the riverfront, in the flood risk zone. Reed can be harvested here, and after 2 years been sold as biomass. Upstream, the remediation zone has a special constructed wetlands zone.



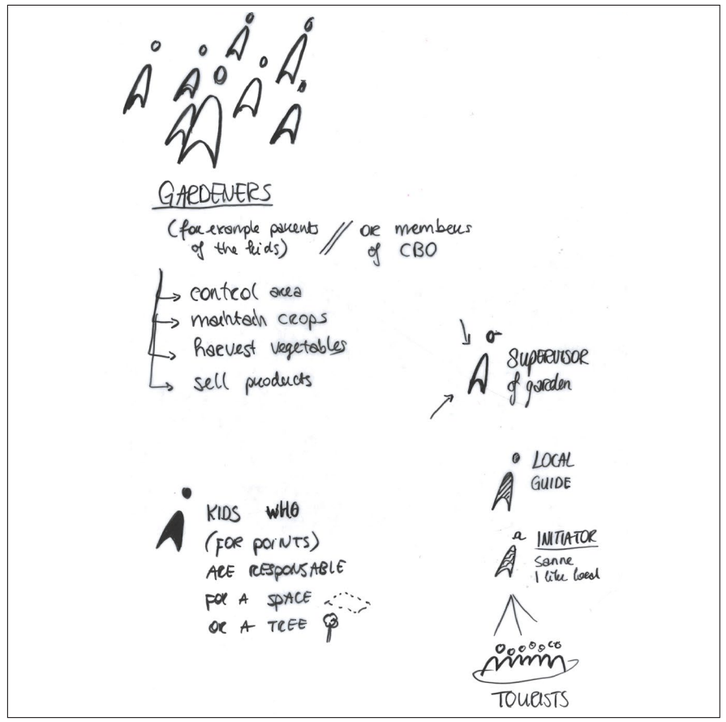
spatial-morphological dimension

Concept: Community garden



social-economic dimension

Human Resources

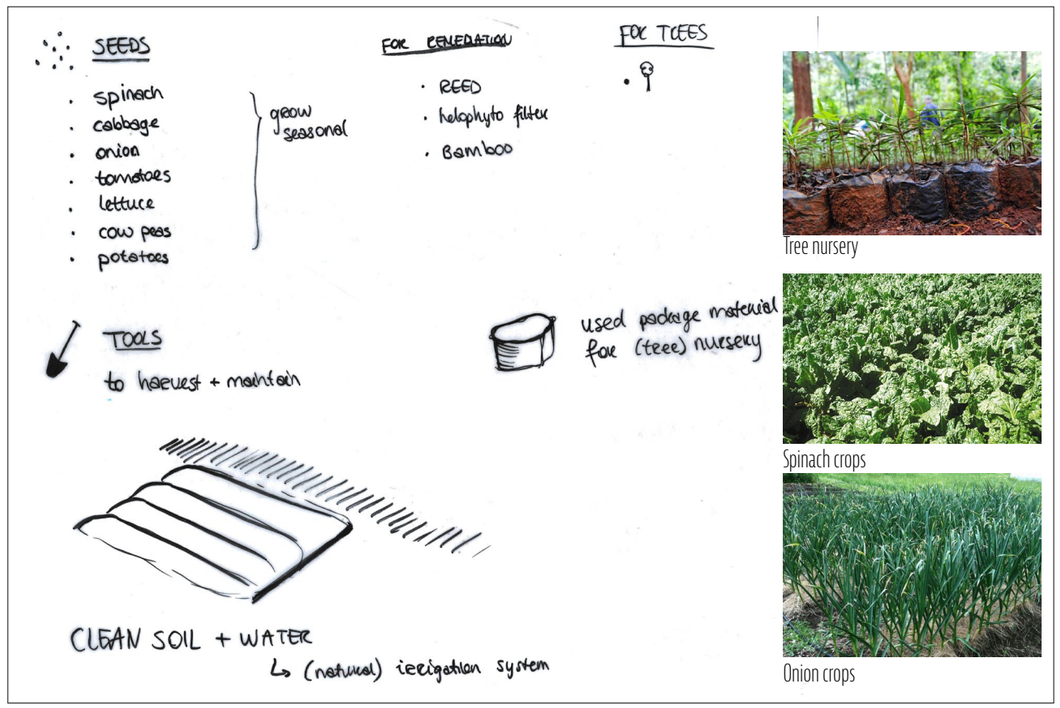


planning-governance dimension

The land will be divided into smaller pieces in order to give every community member a sense of ownership. This pieces of land can have various crops. The most known and harvested crops are spinach, cabbage and onions. An important notice is the season, dry and rainy season require to gardener to be smart with the land and the crops they harvest.

As the community garden also has a place for a more recreational park, this could attracht tourists. Together with the 'I like local'-foundation, a sustainable touristic experience could be organized. This experience could include a walk down towards the waterfalls and planting a tree in the recreational park.

Material resources

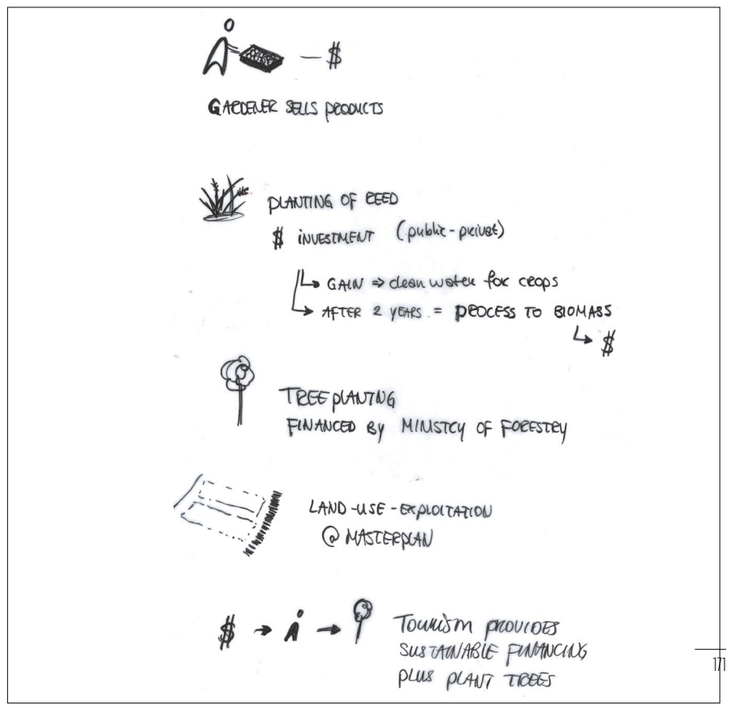


Tree nursery

Spinach crops

Onion crops

Financial resources



V. CONCEPT ZOOM INS: COMMUNITY GARDEN

Situated just after the Dandora Waterfalls.

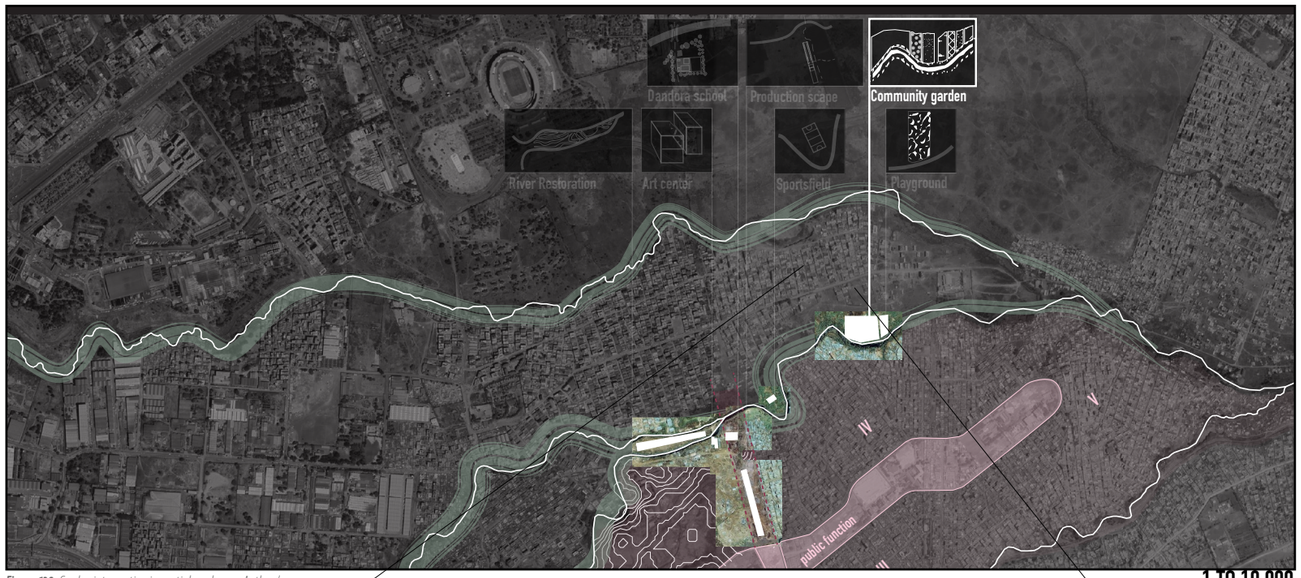


Figure 130: Garden intervention in spatial roadmap - Authors' map

On advice of experts in the field of landscape architecture, the constructed wetlands are the main body of remediation. Since this area also should be maintained, giving the responsibility to the gardeners because of their direct need - would be an appropriate possibility.

The possibility for bamboo around the riverfront and desirable as building material influences the overall design in a positive way. Directly adjacent to the river and on steep surfaces bamboo plants will be places, contributing to the green zone and it's ecosystem.

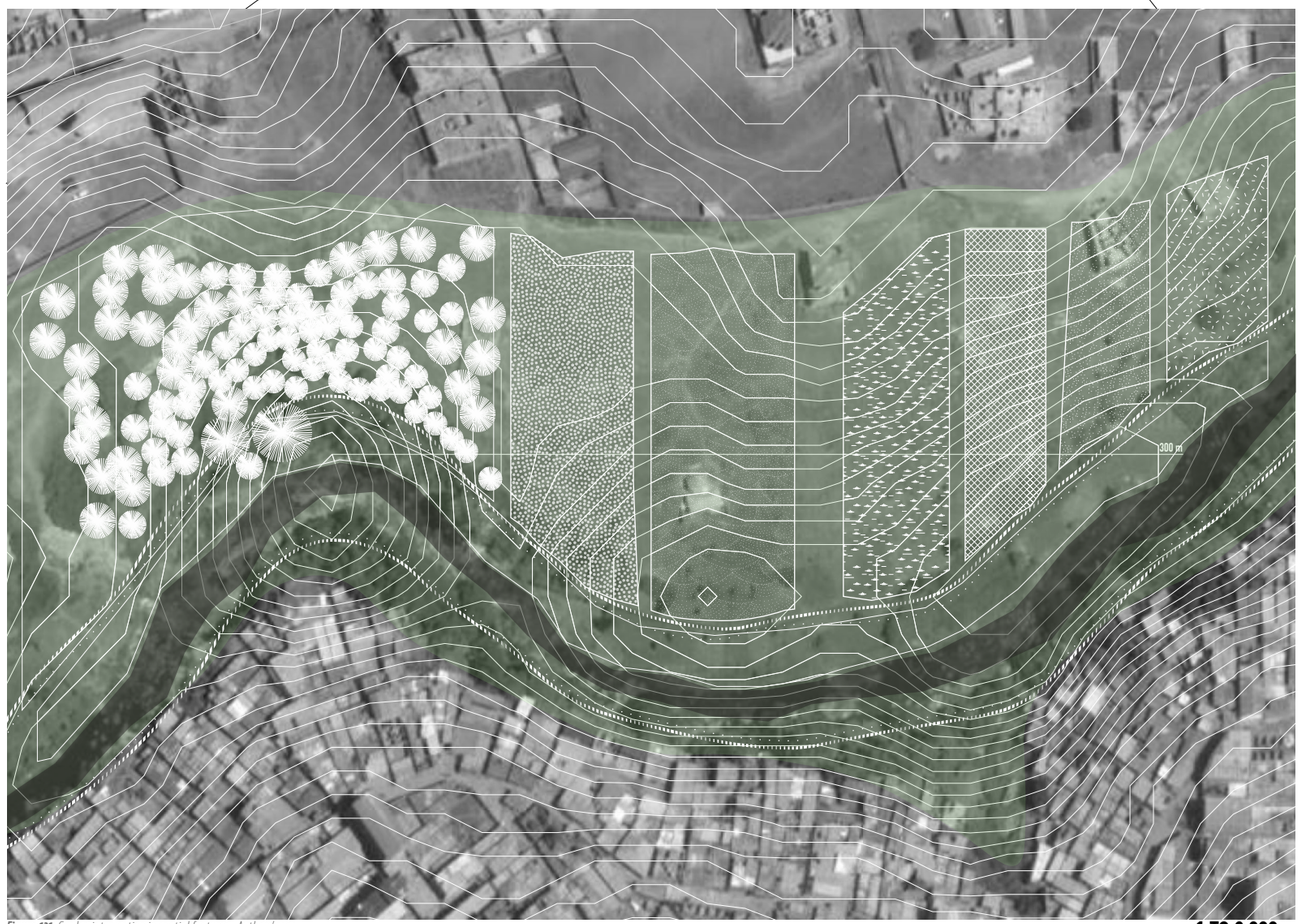
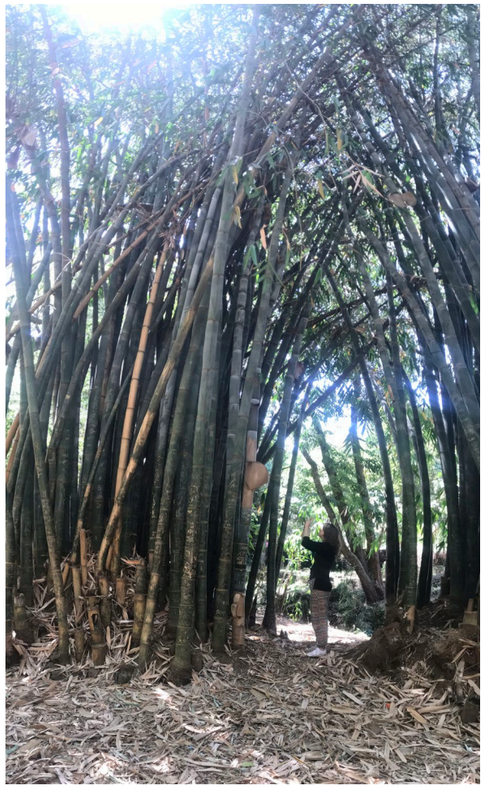


Figure 131: Garden intervention in spatial features - Authors' map

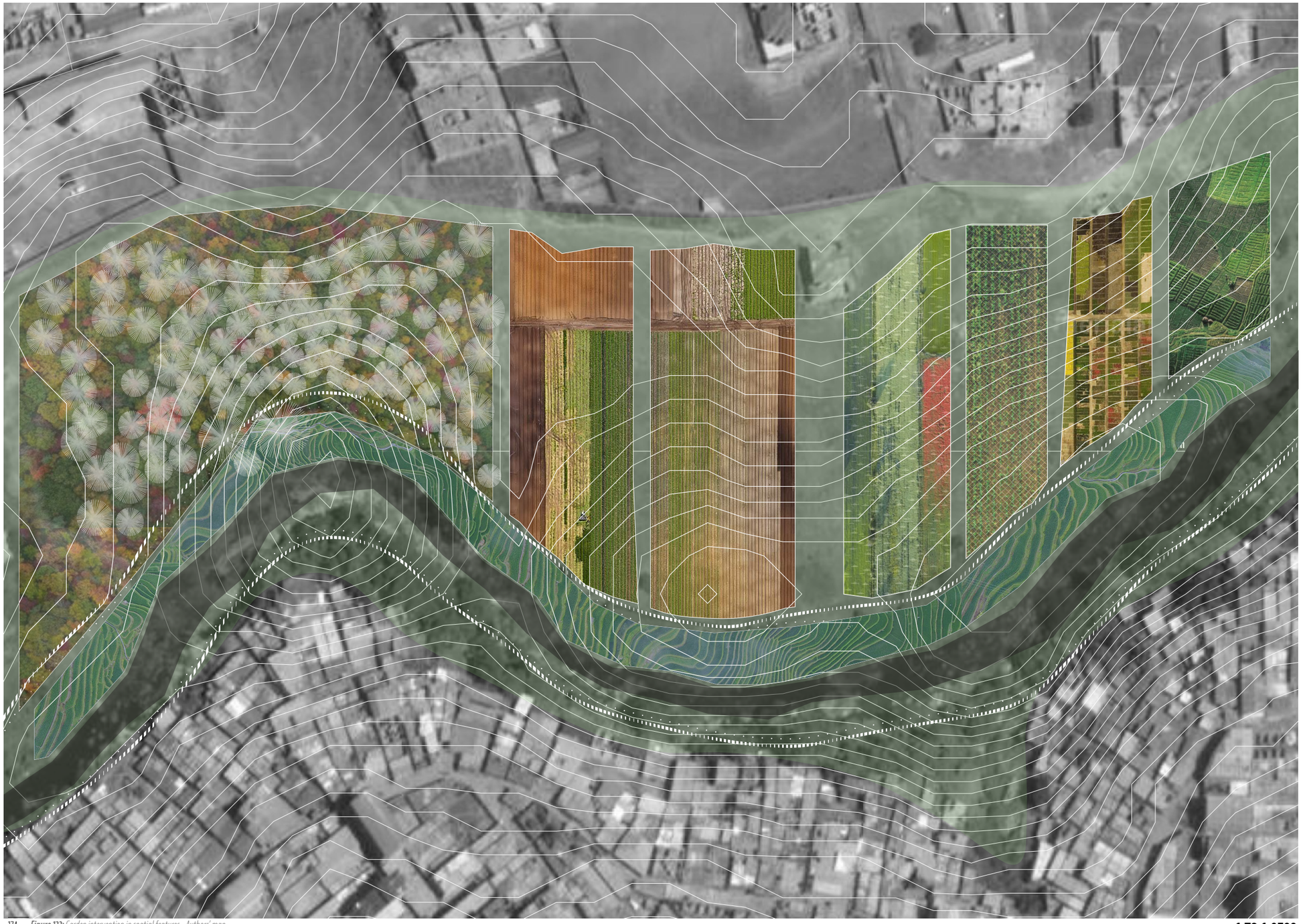




Bamboo in Nairobi Arboretum - Authors' own image 2019

V. CONCEPT ZOOM INS: COMMUNITY GARDEN

Since the landscape has a lot of height differences, the land pieces are divided according to that. The water-repairon zone also functions as drainage system for the crop lands.



1 TO 1.2500



Flowers growing in Nairobi CBD community garden - Authors' own image



Flowers growing in Nairobi CBD community garden - Authors' own image



Tree Nursery Kenya - Green Belt Movement



Tree Nursery Kenya - Green Belt Movement

 Figure 132: *Garden intervention in spatial features - Authors' map*



 Figure 133: *Impression garden and nursery in green belt along the Nairobi River - Authors' map*

Areal perspective- Author's own drawing

Wet soil | Dry soil | Edible | Reduces erosion | Clean polluted soil | Aquaponic system

VEGETABLE



Cassava
Manihot esculenta

Character:
height 15-30cm,
harvest after 14 month,
flesh is chalk-white/ yellow

Vegetable:
root is long and tapered,
15 to 30cm,
cassava leaves have a lot of protein



Maize
Zea mays subsp. mays

Character:
height about 3m,
growing about 60 to 100 days,
moistured soil needed,

Grain:
edible yellow corn,
starch is used in various products such as cosmetics or medicin



Rice
Oryza glaberrima

Character:
height about 90cm,
growing around 5 month,
growing in drought prone, favors medium depth; waterlogged, submergence, and flood prone

Seeds:
seed harvest once to twice a year,



Amaranth
Amarantus

Character:
growing all year,
leafy greens,
cope with heat and dry conditions,
height 5-15cm,
nutritious leaf/grain,
broad leafed and moderately tall,
round or lance shaped,
flowers big tassles or tiny globes

Grain:
edible grain



Sweet Potato
Ipomoea batatas

Character:
growing all year,
harvest after 3 to 4 month,
sensitive to cold water,
crop good for sandy soil,
ready to harvest when leaves turn yellow

Vegetable:
10-20cm sweet potatos



Banana
Musa sapientum

Character
harvest once to twice a year
grow in variety of soils (60cm deep),
largest herbaceous flowering plant, good in compost area

Fruit:
edible fruit,
appears in large hanging cluster,
harvest in green colour,



African spinach
Spinaciae hades

Character:
growing all year,
harvest after max 45 days,
up to 30cm height,
flowering stem,

Vegetable:
edible leaves,



Tomatos
Solanum lycopersium

Character:
growing all year,
harvest after 90 days,
height up to 180cm,
flowers are 1–2 cm yellow,
grow as a series of branching stems,
flowers appear on the apical meristem

Vegetable:
edible fruit,
yellow, red or green

Figure 134: Analysis of different vegetables being able to grow in sub-saharan Africa - Authors' diagram based on research of fellow students Zum Felde and Härmann - graduation thesis: 'Courtyards and chinampas for urban water management in Dar es Salaam' - 2018 - p. 88-91

V. CONCEPT ZOOM IN: RIVER RESTORATION

Enhancing the advice of an landscape architecture expert, the river restoration plan indicates a few important locations. To elaborate on the one just north of the Dandora Dumpsite, where a constructed wetland area is proposed. Two rivers are coming together at this point, and the existing land is underused. A small research into the pollution of the soil, the possible plants to re-mediate this soil, a reference and another master thesis are used to underpin this intervention.

UNEP has an publicly accessable research about the Nairobi River Basins, see map on the right. However, data access of for example flood risks, water quality or any other water related data is very very low. Even a personal visit to the WRA and the national government of forestry did not work out. Data retrieved through GIS, satellite pictures of NASE and open source DEM data on topographical heights helped the river restoration intervention for its design.
The only data avaiable about flooding is made by 'engineers without borders' in Kibera slum. They did on site mapping themselves.
However, a strategy for the revitlisaion of the urban rivers has been published on the city wide scale, not in detail.

systemic dimension



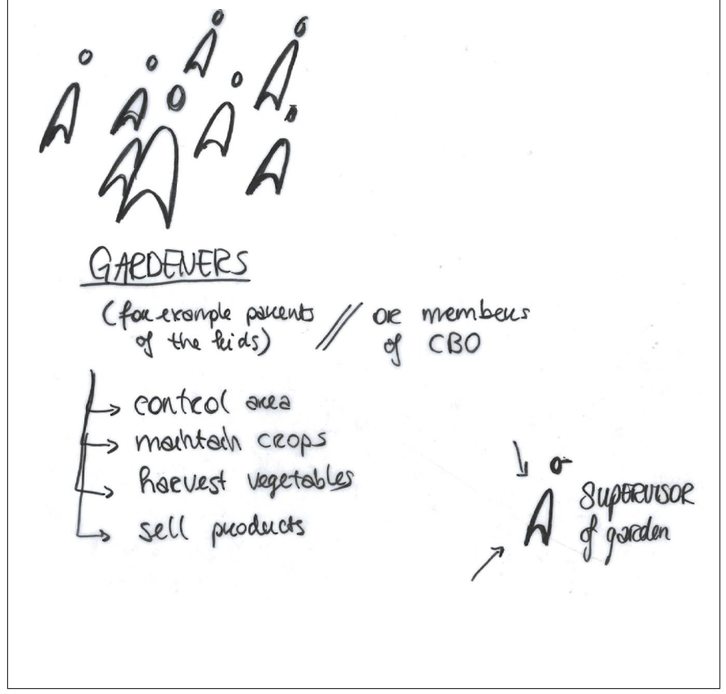
spatial-morphological dimension

Concept: river restoration



social-economic dimension

Human Resources



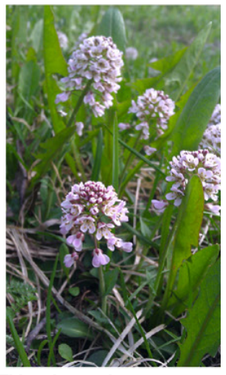
planning-governance dimension

Since the phyto-remediation takes time, it is important to start at the beginning with the planting of the most important plants, eg. reed.

The section in the Material resources part, shows the proposed plants which helps soil and water remediation. A more detailed analysis of trees, plants, vegetables and in particular wetland plants can be found on the next page.

The section of Financial resources highlights the roles of different stakeholders according to a local master thesis to the responsibility of urban waterways in Nairobi. Residents answered who is responsible for cleaning up and maintaining riparian areas. The proposal of this thesis is to combine responsibilities in a decentralized way by making use of the strengths of community based organisations.

Material resources



Thlaspi caerulescens
phyto-extractional properties to absorb zinc and cadmium



Arrabis gemmifera
is a hyperaccumulator of zinc and cadmium



Rorippa globosa
is a hyperaccumulator of cadmium



Phragmites Australis
Removal capability of uranium, thorium and lead.

Financial resources

UNEP	Facilitate river cleaning and restoration	CBO
National Government	Help with cleaning river and construction toilets	
NCC	Ensure no dwellings being built on rivers' riparian reserve Collect waste regularly	
NEMA	Create community awareness Provide trees to community	
Policitans (MCA)	Support youth and community members willing to clean river zone	
Local Community	Stop dumping waste in and around river Help cleaning up process	

Figure 138: Diagram based on p. 64 Watermangement thesis Kevin Kienja - university of Nairobi - Responsibility regarding urban waterways

V. CONCEPT ZOOM INS: RIVER RESTORATION

Making use of the natural heights, the water flows from west to east, the constructed wetlands step by step remediates the river water.

Wet soil | Dry soil | Edible | Reduces erosion | Clean polluted soil | Aquaponic system

TREES



Mango
Mangifera indica

Character:
tree,
10-15m height,
densely leafed tree,
rounded crown,
evergreen,
small creamy flowers

Fruit:
green/red fruit,
yellow when ripe,
edible fruits,
leafs are used as fodder and manure



African fan palm
Borassus aethiopum

Character:
tall palm tree,
25m height

Fruit:
large orange round fruit about 15cm long,
edible fruit, leafs are used as material for weaving



Safsaf willow
Salix mucronata

Character:
evergreen willow tree, grows along river banks, up to 15m tall, open crown



Tana River poplar
Populus ilicifolia

Character:
evergreen tree, growing along river banks, up to 30m tall, diameter trunk 1,5m red listed

PLANTS



Sisal
Agave sisalana

Character:
perennial plant,
thick fleshy leaves,
short trunk, leaves 0,6-1,2m long and 10-20cm wide,
prefers dry soi
l
Product:
leaves as fibre material



Onion
Allium cepa

Character:
biennial plant, 15 to 45cm tall, flat long leaves,
prefers dry soil

Vegetable:
edible vegetable



Sugarcane
Saccharum officinarum

Character:
large perennial grass, thick culms 2-3m tall, prefers dry soil

Vegetable:
edible juice, stems for fibre material

WETLAND PLANTS



Broad-leaved cattail
Typha latifolia

Character:
perennial plant with brown flower spike at the top, growing in wetlands,
90-270cm tall



Reed
Phragmites communis

Character:
perennial grass, common in wetlands, 2-4m tall



Water Spinache
Ipomoea aquatica

Character:
semi-aquatic perennial plant, hollow stem, arrow shaped leaves, vines up to 2,70m long

Vegetable:
edible stem and leaves



Chillie plant
Capsicum annuum

Character:
evergreen perennial plant, growing upright up to 1m

Fruit:
edible flowers, fruit, leaves



Reed canary grass
Phalaris arundinocea

Character:
tall perennial bunchgrass, common in wetlands,
0,5-2m tall



Elephant grass
Pennisetum purpureum

Character:
perennial grass, growing in diverse soil conditions, up to 4m tall, narrow leaves growing up to 1m long



Vetiver grass
Chrysopogon zizanioides

Character:
tropical grass, 2-5m tall, extensive root system, growing mostly in moist soils

Product:
roots as fiber material

Figure 136: Analysis of trees, (wet) plants for sub-saharan Africa - Authors' diagram based on research of fellow students Zum Felde and Hörmann - graduation thesis: 'Courtyards and chinampas for urban water management in Dar es Salaam' - 2018 - p. 88-91



Figure 136-a: Section of constructed wetland in phyto-remediation zone with a natural height difference - Authors' drawing



Figure 136-a: Zoom of part of constructed wetland - Authors' drawing

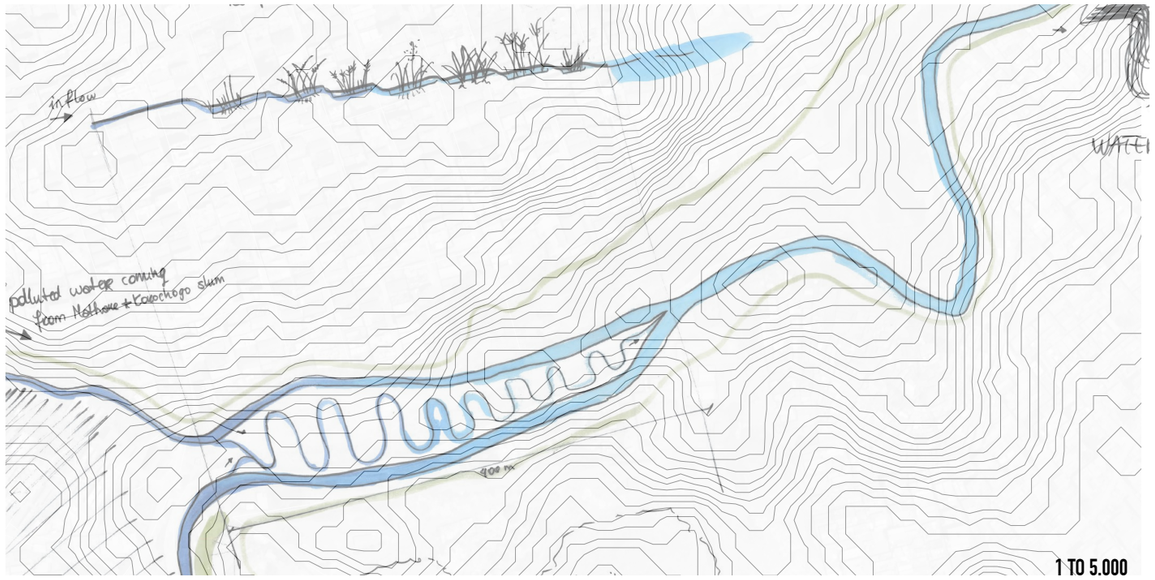


Figure 136-b: Spatial translation of the river restoration concept into a constructed wetland zone with a natural height difference - Authors' drawing

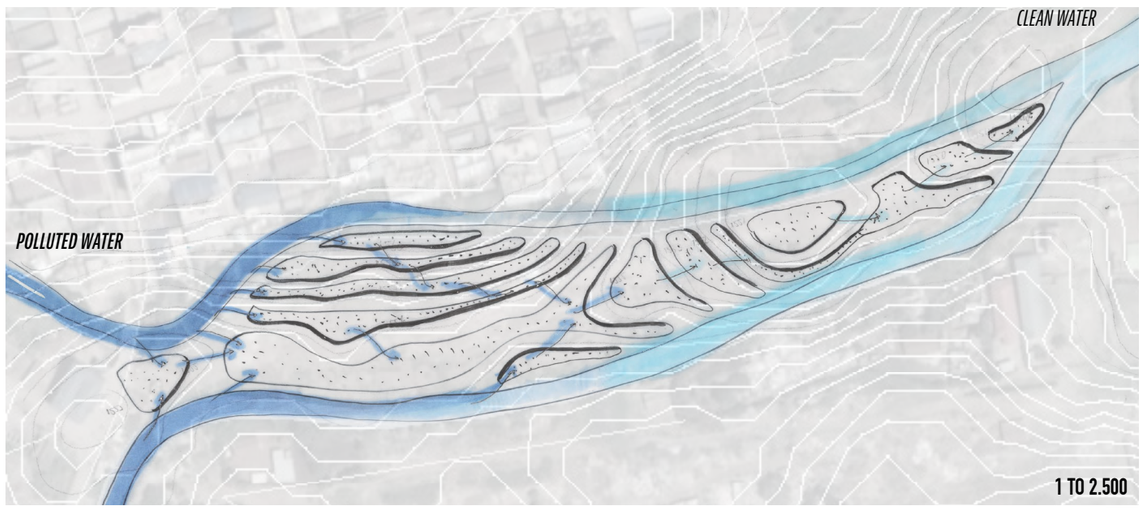


Figure 136-c: Spatial translation of the river restoration concept into a constructed wetland zone with a natural height difference - Authors' drawing

V. CONCEPT ZOOM INS: SPORTSFIELD/PLAYGROUND

systemic dimension

RENEWING/MINING

MANUFACTURING
Material
Product

Service provider

WASTE GENERATION
user

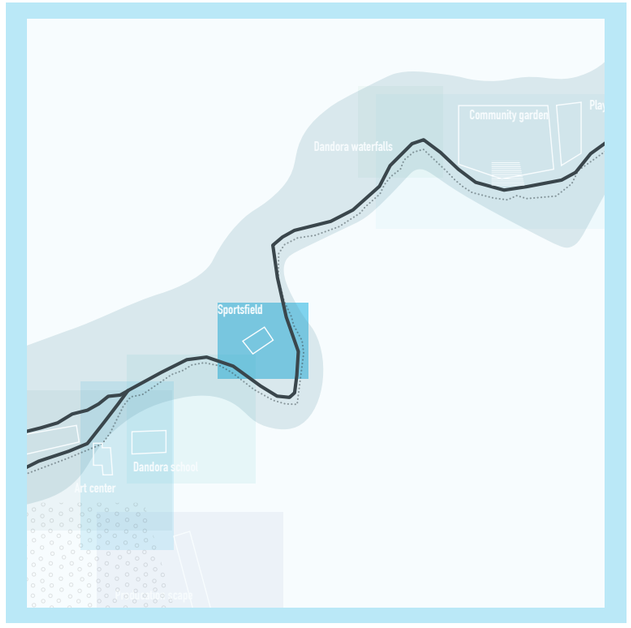
WASTE SEPARATION

COLLECTION
DISTRIBUTION

treatment: new cycle

spatial-morphological dimension

Concept: sportsfield



social-economic dimension

The activity of sports reaches throughout a whole group of stakeholders. Young and old, rich and poor. After school activities can take place at the sportsfield.

planning-governance dimension

As the Vision 2030, the third implementation plan and the current government is in favor of sports, they even incorporated a financial plan to support sports fields and centers.

systemic dimension

RENEWING/MINING

MANUFACTURING
Material
Product

Service provider

WASTE GENERATION
user

WASTE SEPARATION

COLLECTION
DISTRIBUTION

treatment: new cycle

spatial-morphological dimension

Concept: playground



social-economic dimension

Strong social control of playfield when next to the community garden.

planning-governance dimension

As promoted in the Kenya Vision 2030 and the third implementation plan, youth is an important factor. Like sportfields, playgrounds gather a various group of stakeholders.

V. CONCEPT ZOOM IN: SPORTSFIELD

Allocation of the sports field is on a near proximity of the Dandora school. Incorporating the natural landscape with its heights, the sports field is designed on a piece of land with the same height, visible in the section below.



Figure 137: Sportsfield in spatial plan- Authors' map

1 TO 10.000



Figure 138: Sportsfield in spatial plan- Authors' map

1 TO 2.000

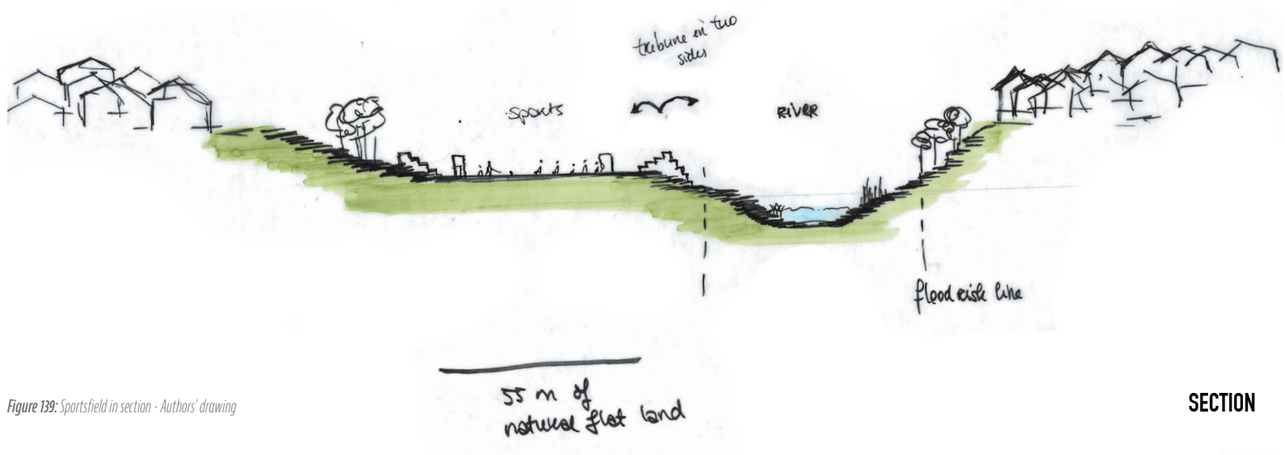


Figure 139: Sportsfield in section - Authors' drawing

SECTION

V. CONCEPT ZOOM IN: PLAYGROUND

Allocation of the sports field is on a near proximity of the community garden. Since the nature of the landscape is hilly and steep, the playground could make use of this. The precise design of the playground is of a more architectural scale, but this page gives an overview of the location, possibilities and how it is embedded in the landscape.

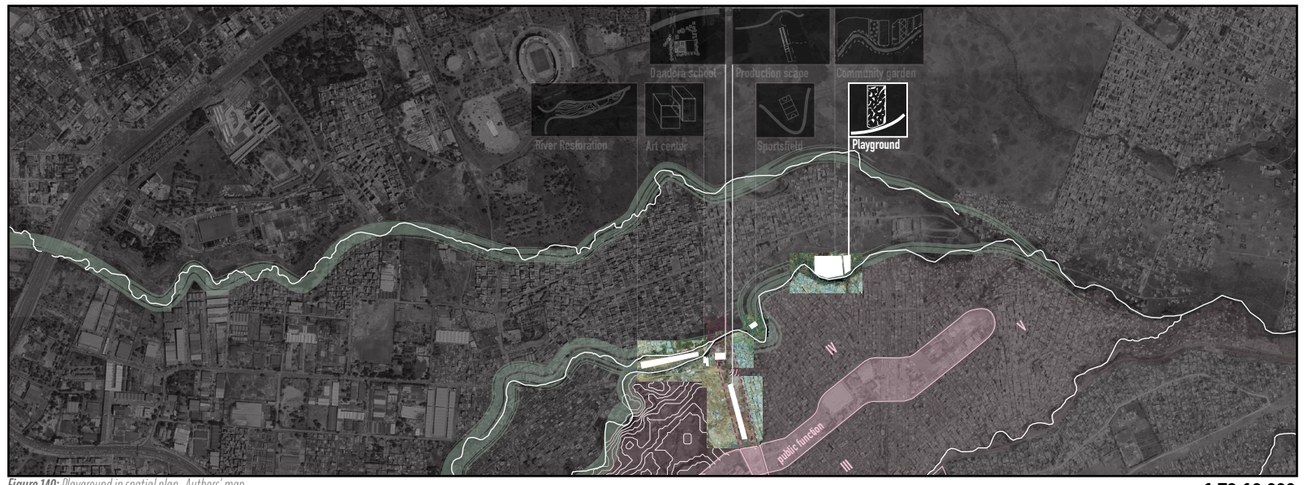


Figure 140: Playground in spatial plan- Authors' map

1 TO 10.000

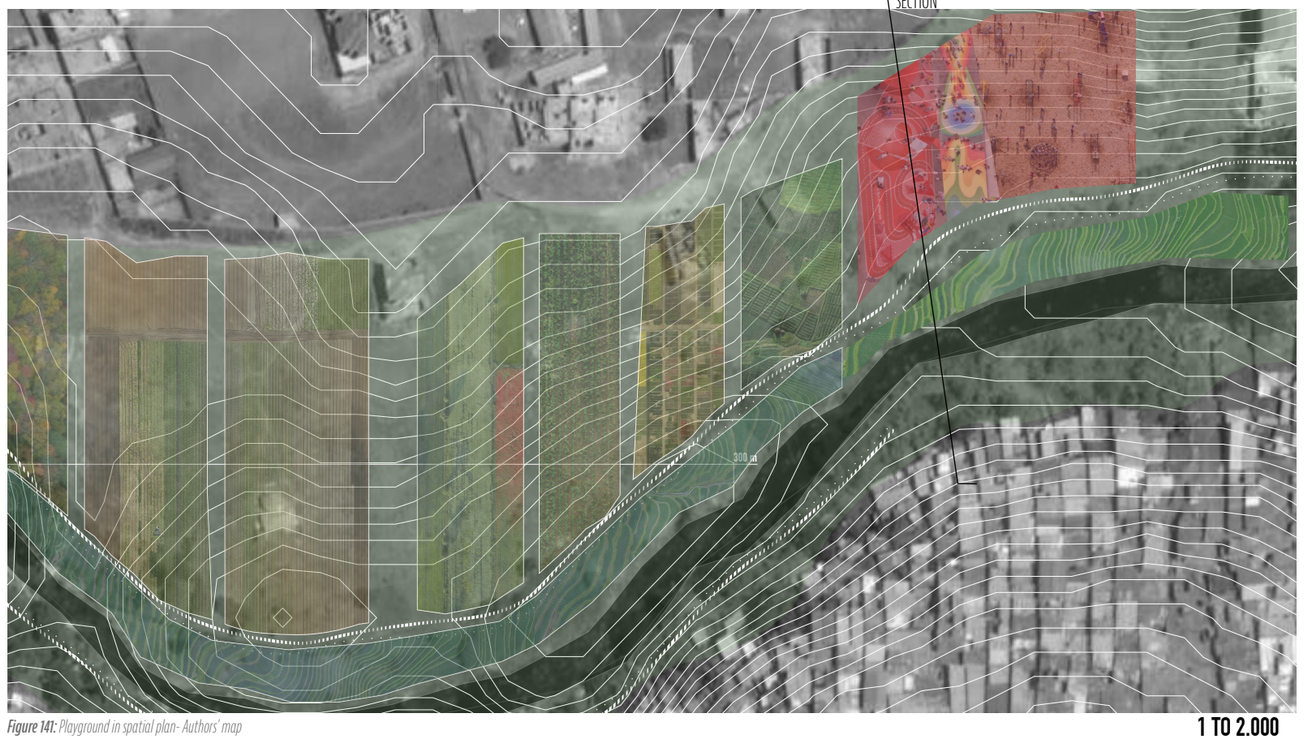
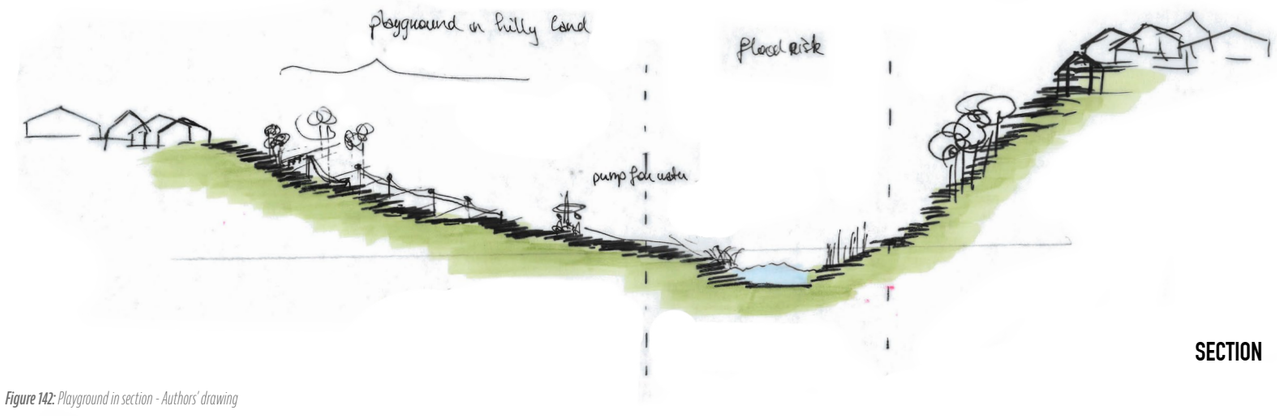


Figure 141: Playground in spatial plan- Authors' map

1 TO 2.000



SECTION

Figure 142: Playground in section - Authors' drawing

V. CONCEPT ZOOM IN: ART SPACE

concept roadmap: art space

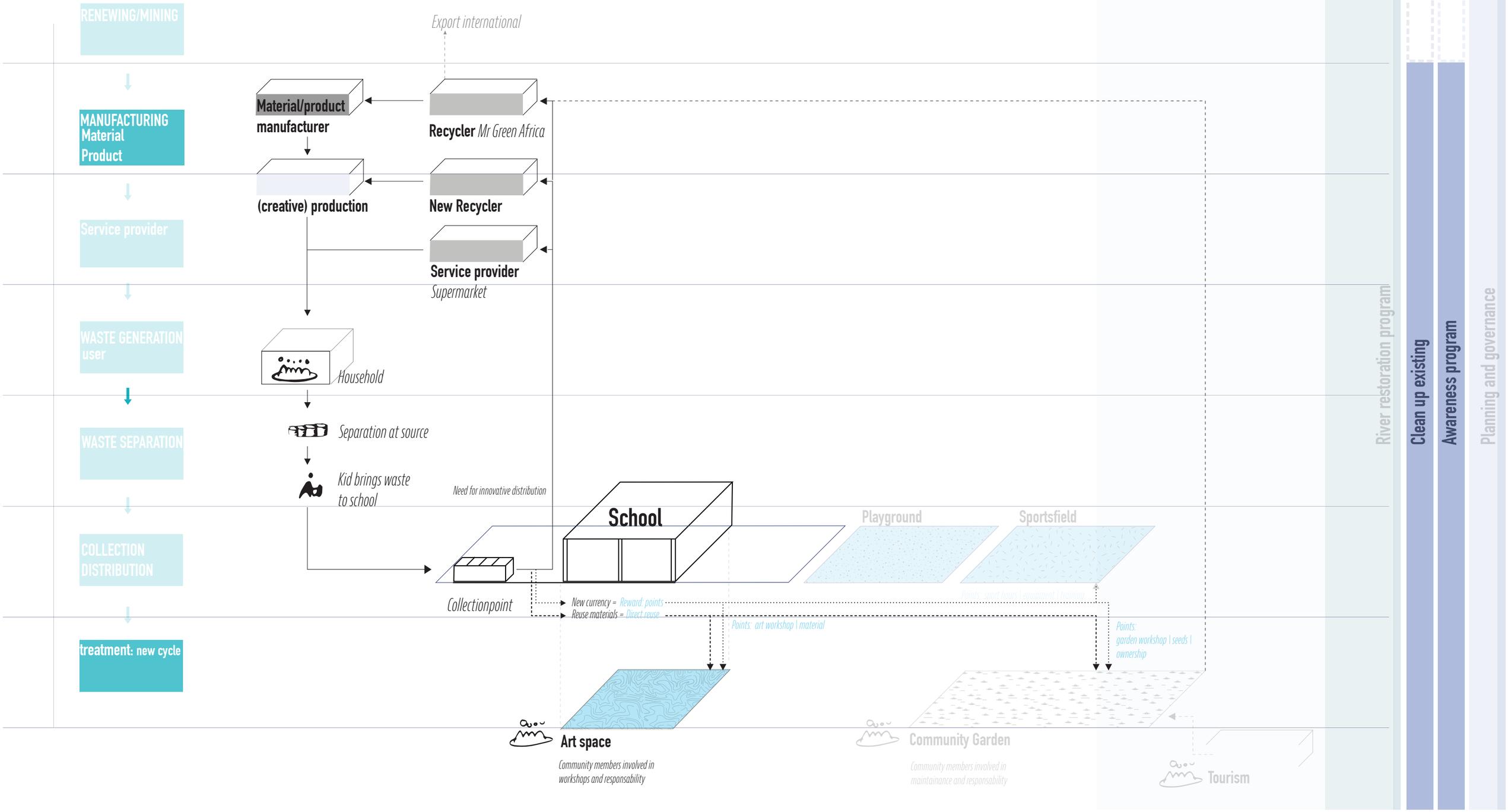


Figure 143: Artspace in systemic overview - Authors' diagram

V. CONCEPT ZOOM INS: ART SPACE

systemic dimension

The existing community-based-organization Dandora Hiphop City is defined as art space because of its possible linkage to the dandora school and the proximity of the proposed production scape. Ongoing art projects are gaining more and more attention. The closeness of the dumpsite makes it an interesting configuration. DHC is a good example of an community-based-organization with closely involved members, alternately leadership and engagement with youth.

RENEWING/MINING

MANUFACTURING
Material
Product

Service provider

WASTE GENERATION
user

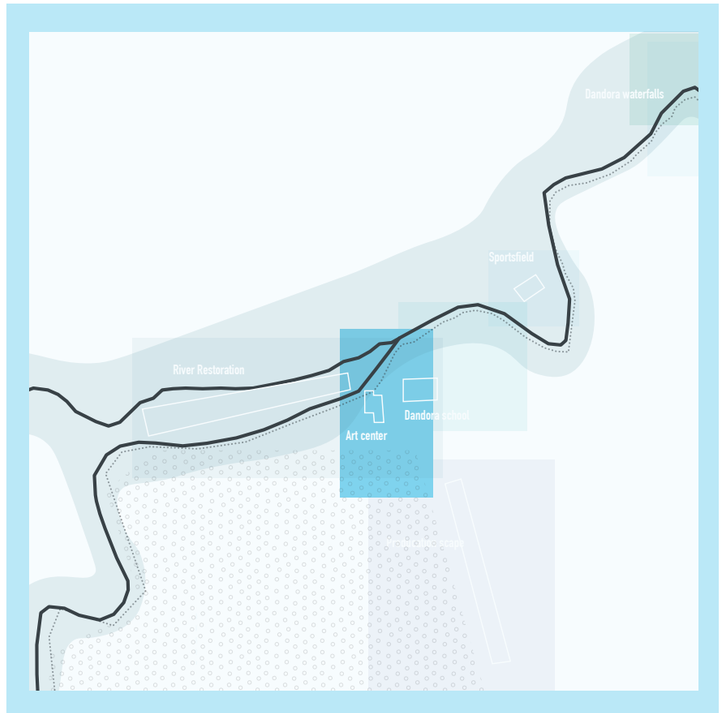
WASTE SEPARATION

COLLECTION
DISTRIBUTION

treatment: new cycle

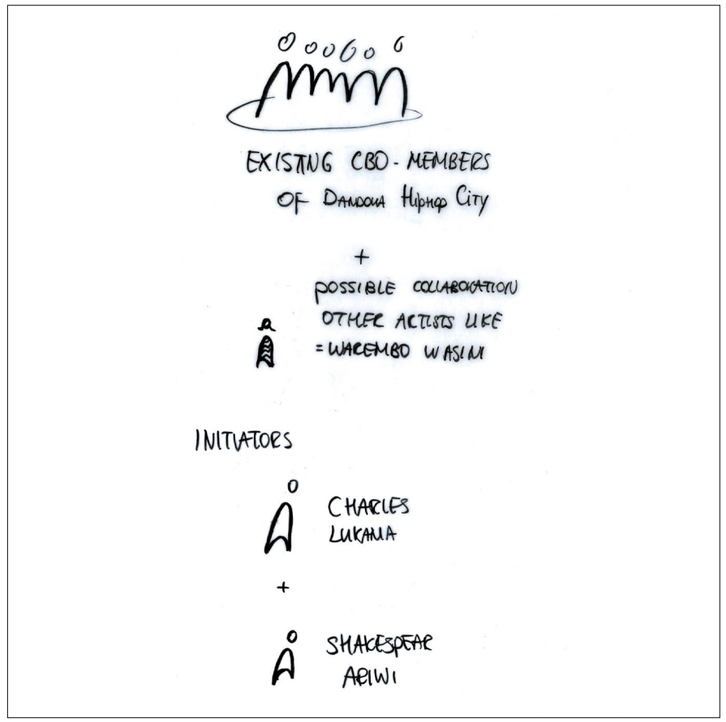
spatial-morphological dimension

Concept: art space



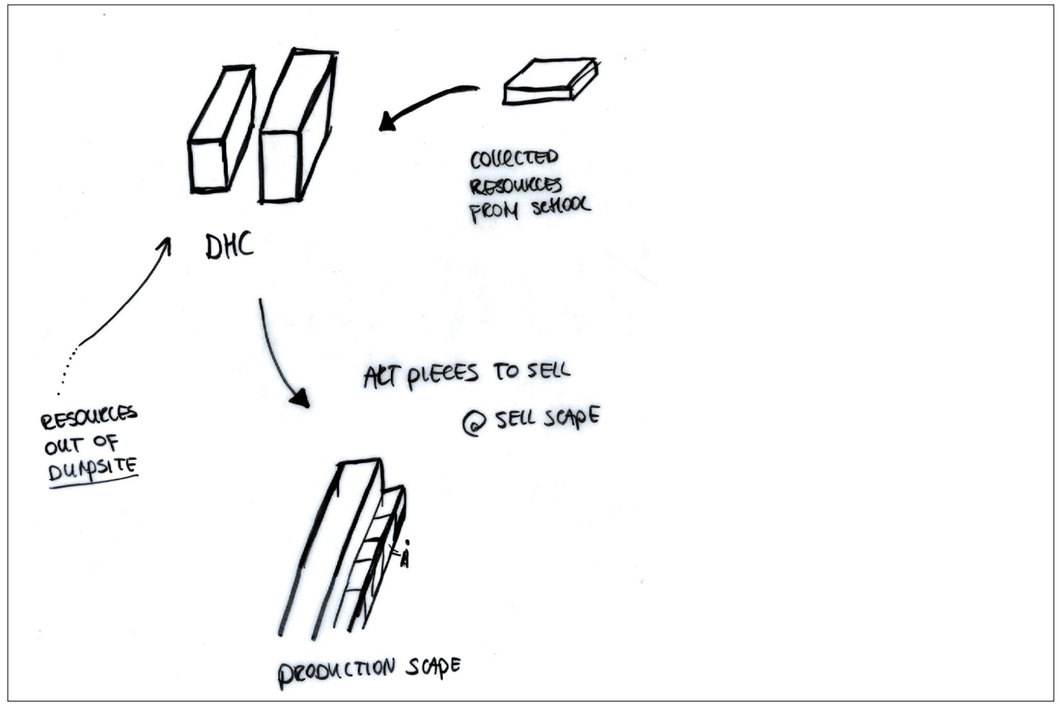
social-economic dimension

Human Resources

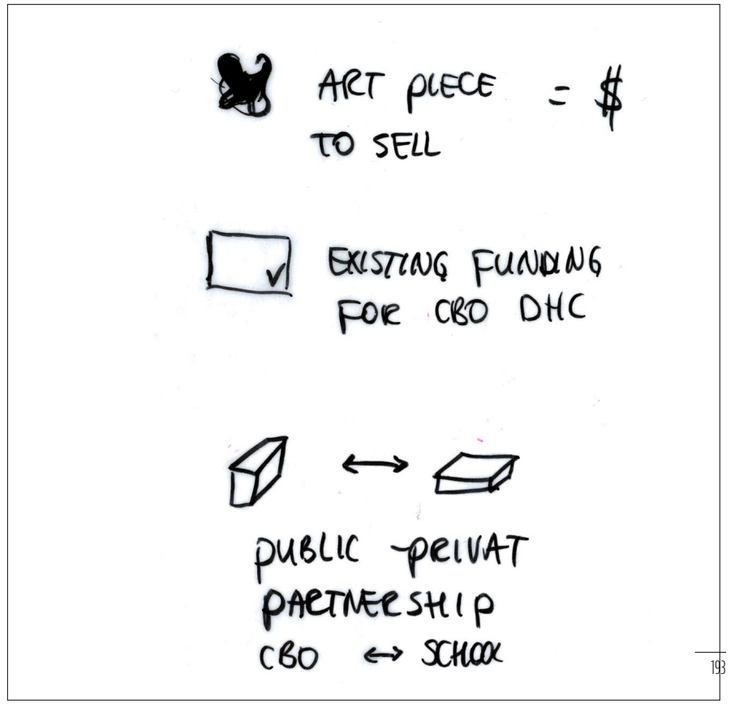


planning-governance dimension

Material resources



Financial resources



V. CONCEPT ZOOM IN: ART SPACE

Main proposal for this space is the connection with the school and production scape and foster the existing strengths of this CBO.

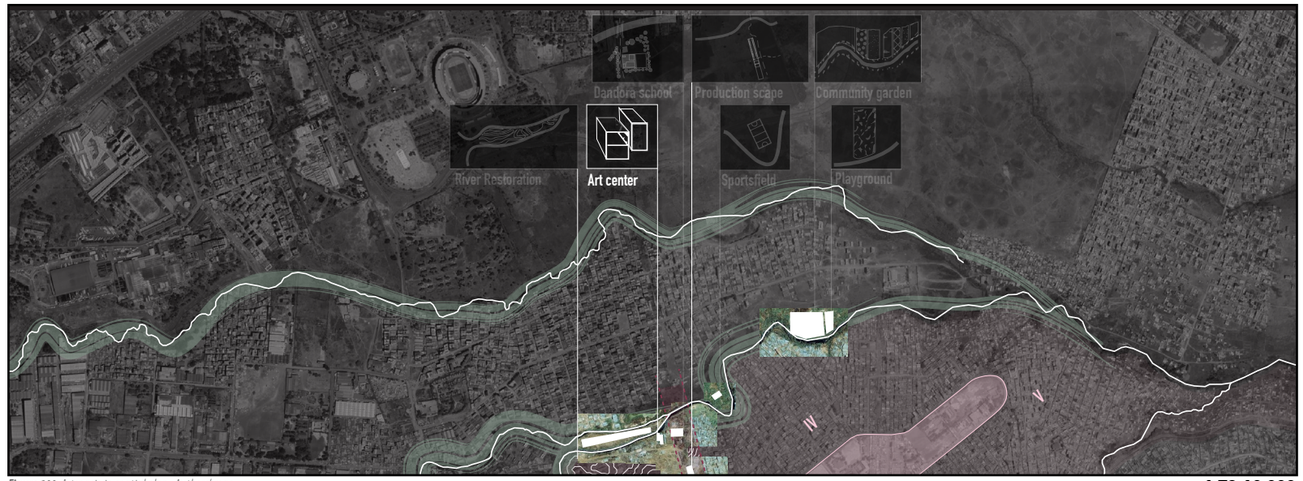


Figure 144: Artspacie in spatial plan- Authors' map

1 TO 10.000

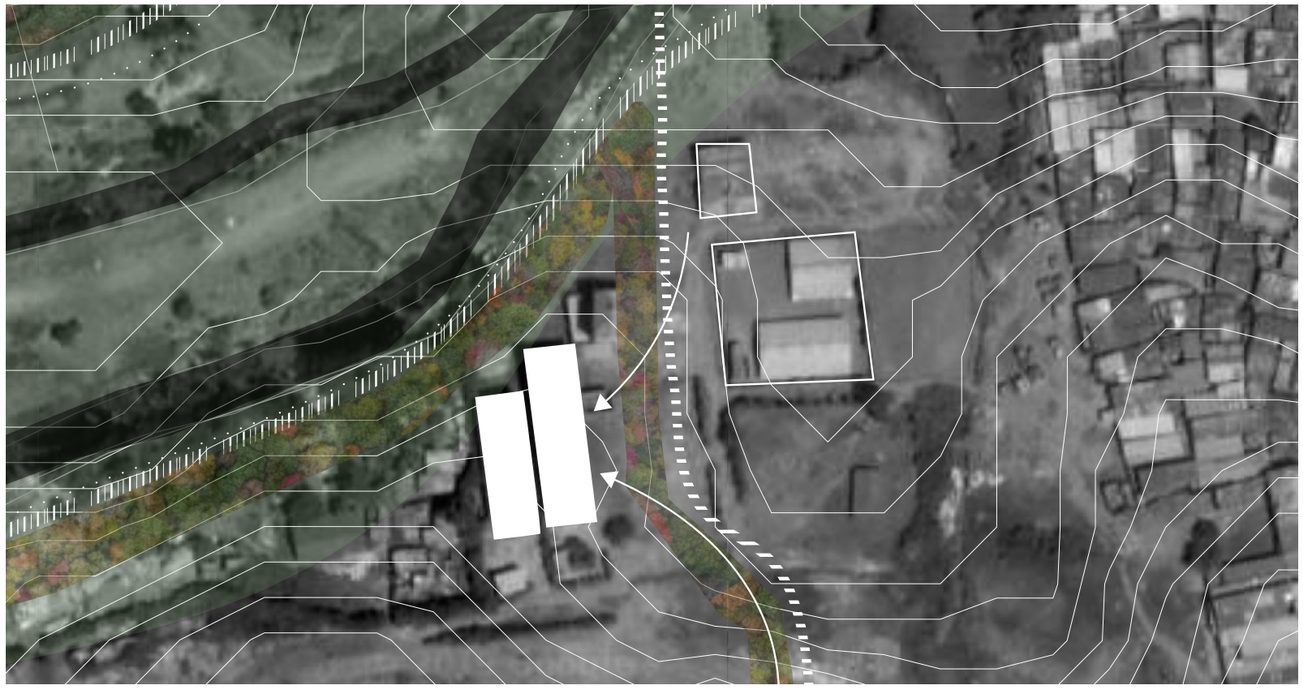


Figure 145: Artspace in spatial plan- Authors' map

1 TO 2.000

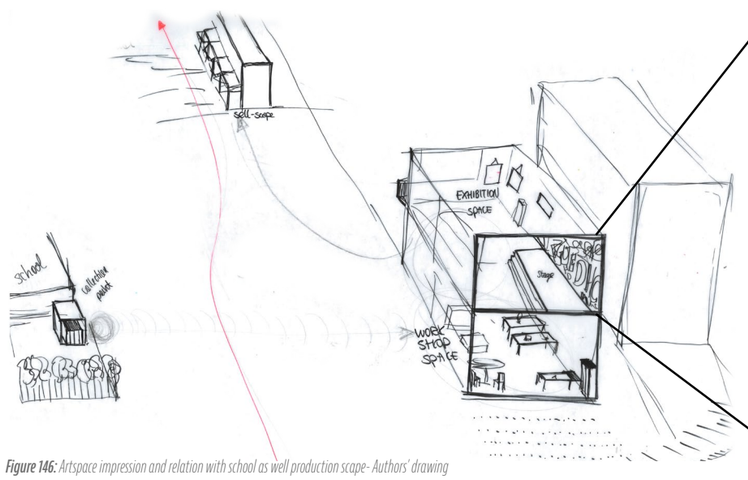
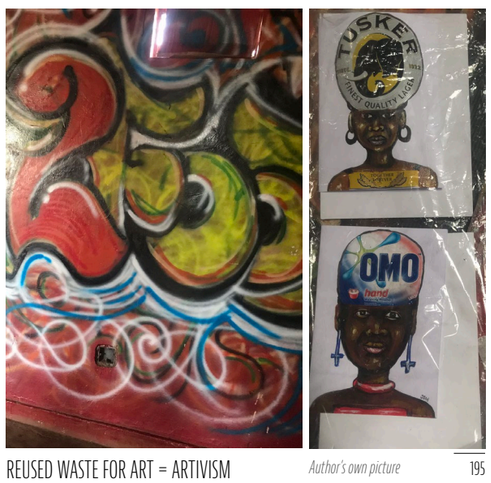


Figure 146: Artspace impression and relation with school as well production scape- Authors' drawing



DANDORA HIP HOP CITY *Author's own picture*



REUSED WASTE FOR ART = ARTIVISM *Author's own picture*

V. CONCEPT ZOOM IN | (CREATIVE) INDUSTRY

concept roadmap: production scape

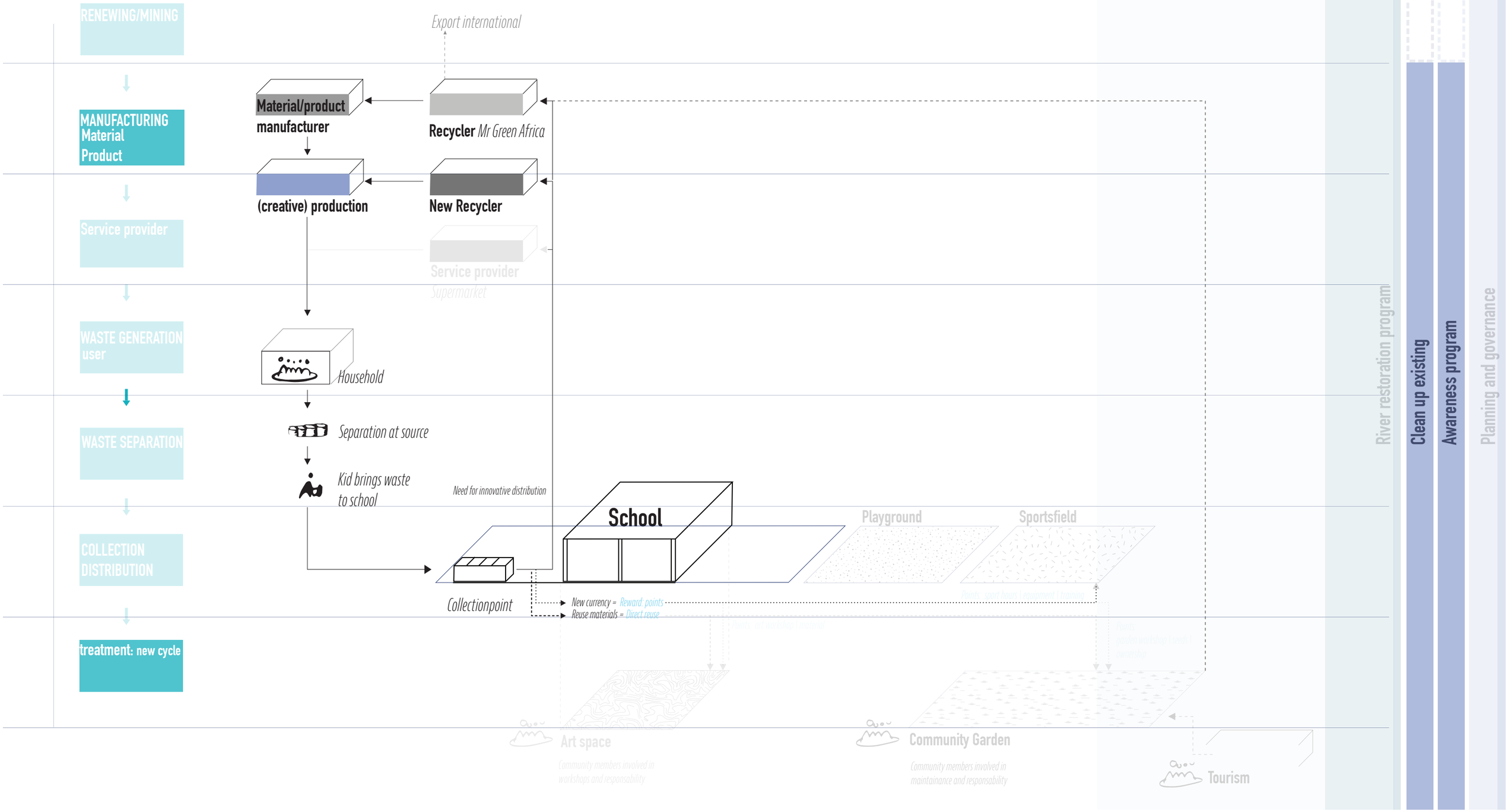


Figure 147: *Manufacturing industry in systemic overview - Authors' diagram*

V. CONCEPT ZOOM INS: PRODUCTION SCAPE

The grey zone in between the houses of phase IV and the dumpsite is an interesting piece of land. As the vision of the Making Cities Together lab in 2015 explicitly calls the southern part of it 'the leave-way', this is a continuation on this vision.

This location is a key location to be for a recycling and (re)manufacturing companies since it is very near to CBD and the availability of space.

Moreover, this provides the local residents and former waste scavengers with new, circular and dignified jobs.

systemic dimension

RENEWING/MINING

MANUFACTURING
Material
Product

Service provider

WASTE GENERATION
user

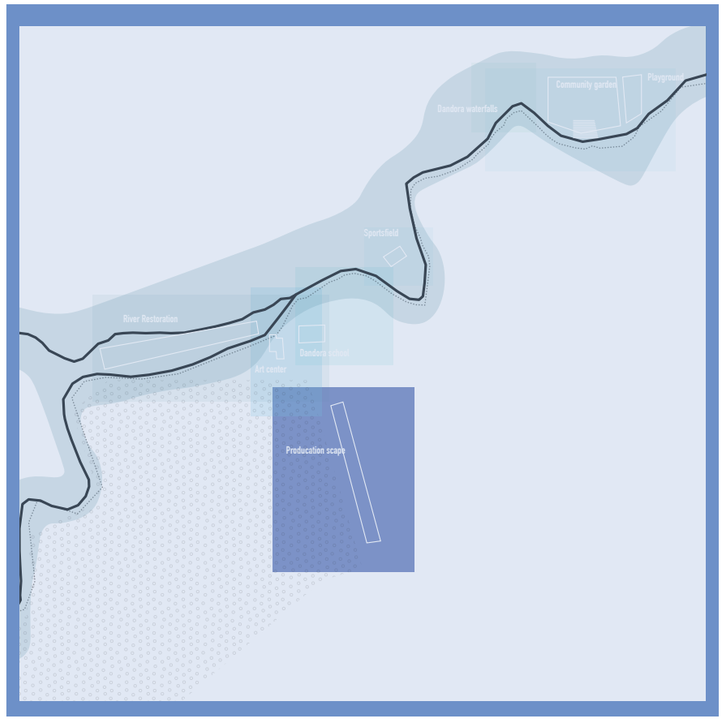
WASTE SEPARATION

COLLECTION
DISTRIBUTION

treatment: new cycle

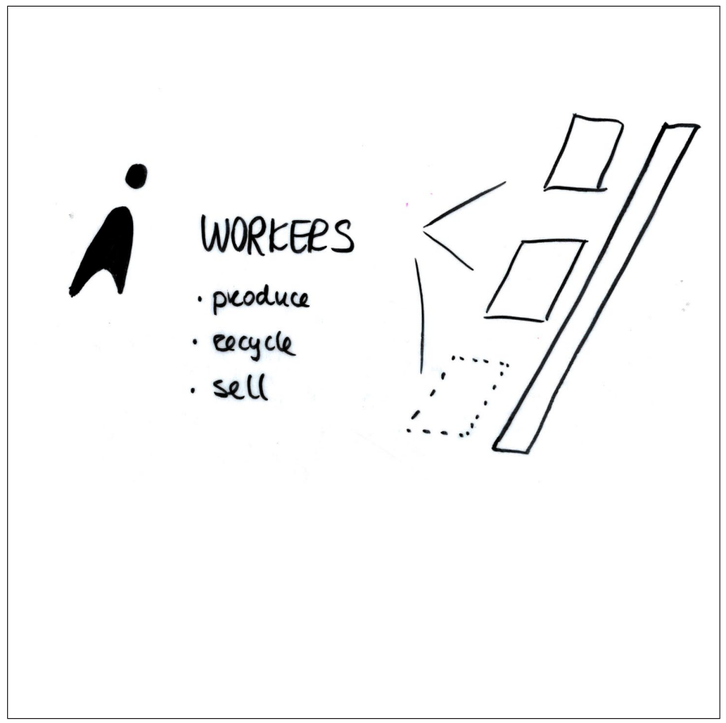
spatial-morphological dimension

Concept: production scape



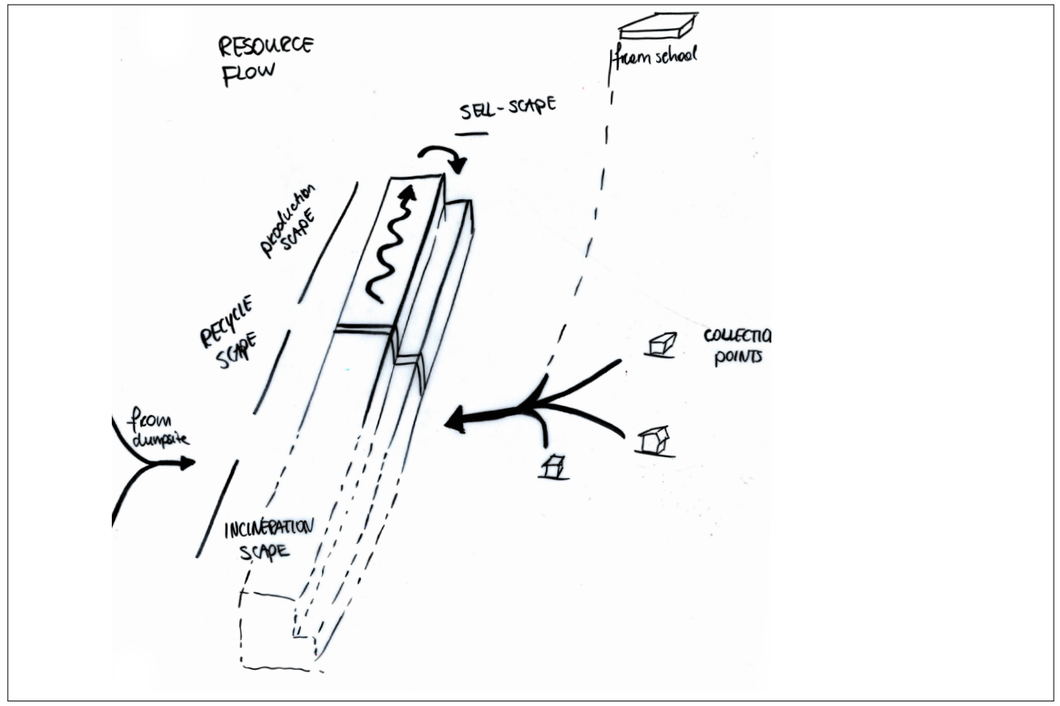
social-economic dimension

Human Resources

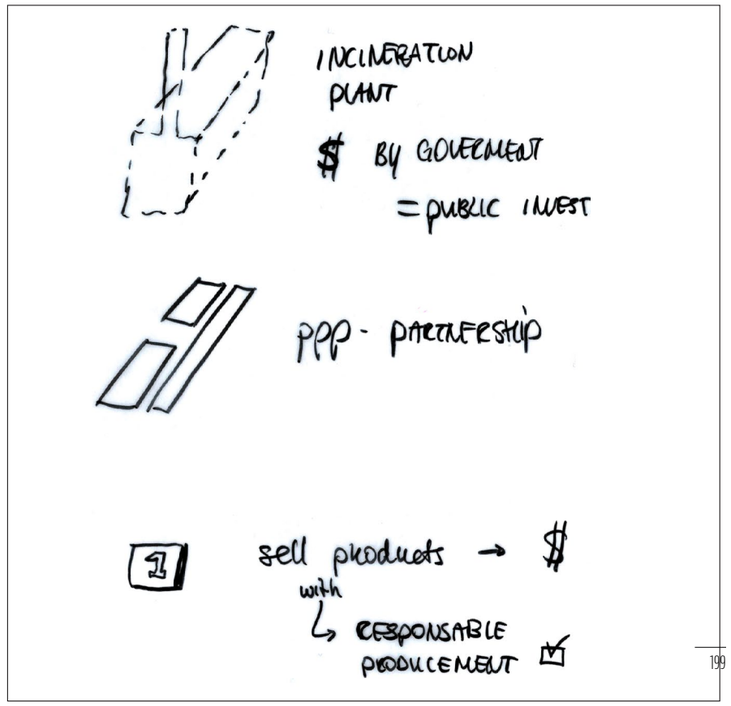


planning-governance dimension

Material resources



Financial resources



V. CONCEPT ZOOM INS: PRODUCTION SCAPE

The grey zone in between the houses of phase IV and the dumpsite is an interesting piece of land. As the vision of the Making Cities Together lab in 2015 explicitly calls the southern part of it 'the leave-way', this is a continuation on this vision.

The production scape incorporates four different scapes:
- waste to energy scape (incineration plant)
- recycling scape
- (creative) production/manufacturing scape
- sell scape.

Make use of the existing materials, by using the existing wall for the structure of the sell scape. To provide connectedness with phase VI and IV, the scape is permeable in some places. Starting with the sell scape on the right side, as the dumpsite is in process of remediation.

The technical nature of the incineration plant hampers it from reusing the factory hall for many other purposes. Most ovens have a lifetime of 15 years. From the moment a waste to energy plant starts working, it should have a continuous flow of waste in order to maintain the energy production. For the risk of explosions, there have to be taken some safety regulations. Air pollution will be caused by the emissions, but as they are more concentrated and higher above the ground than the case is now, it will be an improvement on the current situation.



Figure 148: *Production scape in spatial plan- Authors' map*

1 TO 10.000



Figure 149: *Production scape in spatial plan- Authors' map*

1 TO 5.000

V. CONCEPT ZOOM INS: PRODUCTION SCAPE

Explanation of the different elements of the production scape. The recycling scape on the right page. The sell scape is based on market stands as there are a lot throughout whole Nairobi. The different steps of bringing in resources (by cargo-bike), to cleaning and shredding and remanufactured are explained by an example of a recycler in Rotterdam. This Rotterdam based organisation is called 'community-plastics' and operates in a simular approach as the proposal of this roadmap implies. Understanding the different context of the example, the output and way of remanufacturing may be different in the case of Dandora.

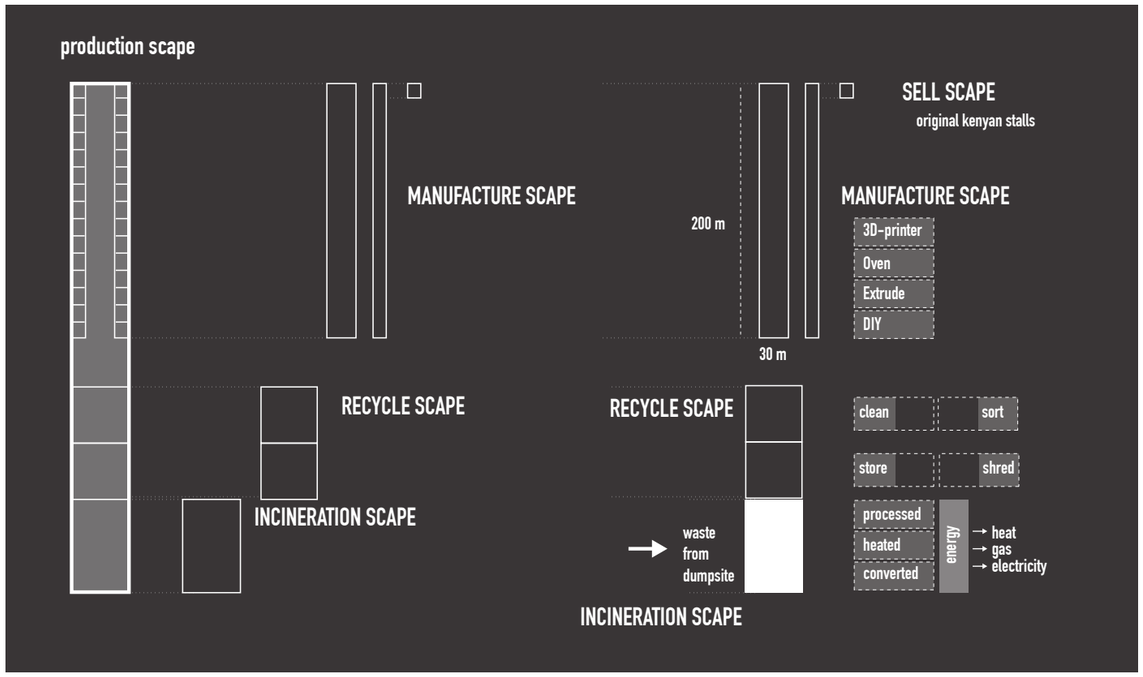


Figure 150: Production scape in process and spatial needs- Authors' diagram

COLLECT
cargo bike

SORT
storage

CLEAN
water

SHRED
machine

STORE
space

TREATMENT
remanufacture

DESIGN
products

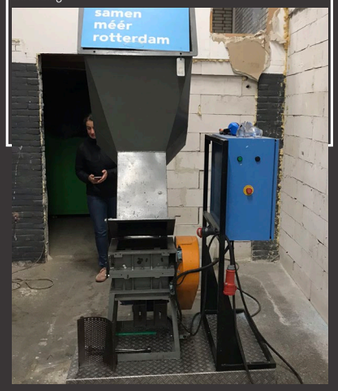
Collecting plastic by cargo bike



Separation by hand | HDPE PET



Shredding



Plastic flakes sorted on color



Malls for manufacturing



Bricks out of plastic flakes



Figure 151: Production scape in steps - Authors' diagram

Community plastics Rotterdam - Author's own pictures

V. CONCEPT ZOOM IN: F: PHASING

planning-governance dimension P

The proposed procedural interventions principles are based on a framework developed by the Ellen MacArthur foundation. These interventions are related to the spatial interventions, but make pronouncements about systemic, economic and organizational aspects. As indication, the pink colored interventions are of a restricted nature, the turquoise ones are to stimulate. The examples give an implication towards implementation of the roadmap.

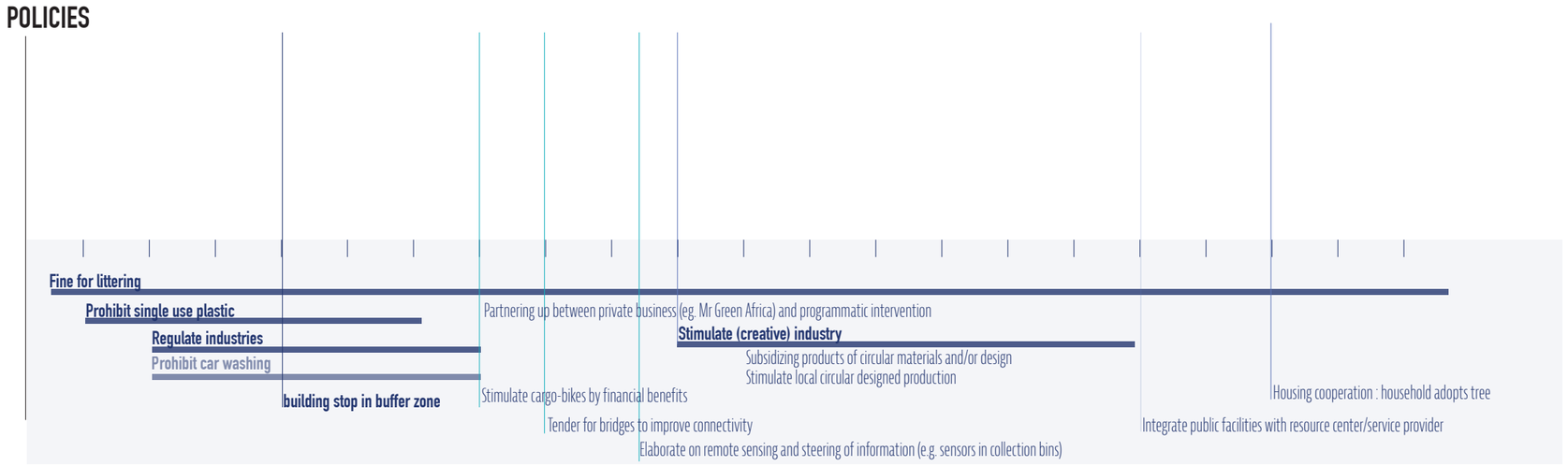


Figure 151: Policy recommendations in time- Authors' diagram

F Procedural interventions

policy interventions principles	incentive prohibit | pro-active	example
education, information & awareness	Stimulate integration of circular economy into school and university curricula	development of new course material (e.g. accessable by MOOC)
	Public communication, information campaigns and actions	campaign to promote waste separation and start cleaning up existing waste
collaboration platforms	Encouragement of collaboration, partnerships on multiple levels	Partnering up between private business (e.g. Mr Green Africa) and programmatic intervention
	Encouragement of voluntary industry collaboration platforms, encouraging value-chain and cross-sectoral initiatives and information sharing	Elaborate on remote sensing and steering of information (e.g. sensors in collection bins)
business support schemes	Financial support to business: capital to start a local producation initiative	Subsidize set up for recycle spin offs and (creative) production industry
	Technical support, advisory, training and demonstration of best practices	Integrate public facilities with resourcecenter/service provider (e.g. school as collection point)
public procurement & infrastructure	Public procurement	Tender for bridges to improve connectivity, for circular products and for circular jobs
	Public investment in infrastructure	Stimulate cargo-bikes by financial benefits and accessable infrastructure
regulatory frameworks	Product regulations, including design, distribution and product passport	Stimulate local circular designed production
	Waste regulations, including collection and treatment standards and targets the definition of waste, extended producer responsibility	Targets for recycling/incineration/landfill (e.g. recycle 50% of household waste by 2024)
fiscal frameworks	Excise duty reductions for circular products and services	Subsidizing products of circular materials and/or design
	Tax on non-circular behaviour	Fine for littering
		Prohibit single use plastic
		Taxes on produced waste per kilogram
		Regulate industries for separating waste

Figure 152: Procedural interventions based on proposal Ellen MacArthur foundation - specified on the Nairobi case - Authors' diagram

V. SPATIAL ROADMAP WITH ALL INTERVENTIONS

Playground

Dandora waterfalls

Community garden

Sportsfield

River Restoration

School

Art center

Production scape

VI. STORYLINE

By summarizing the spatial and systemic interventions in from the perspective of a kid, into one story, this map highlights the route of this kid.

Playground

Dandora waterfalls

Community garden

5
9

8 10

Sportsfield

River Restoration

4
7
2
3

School

Art center

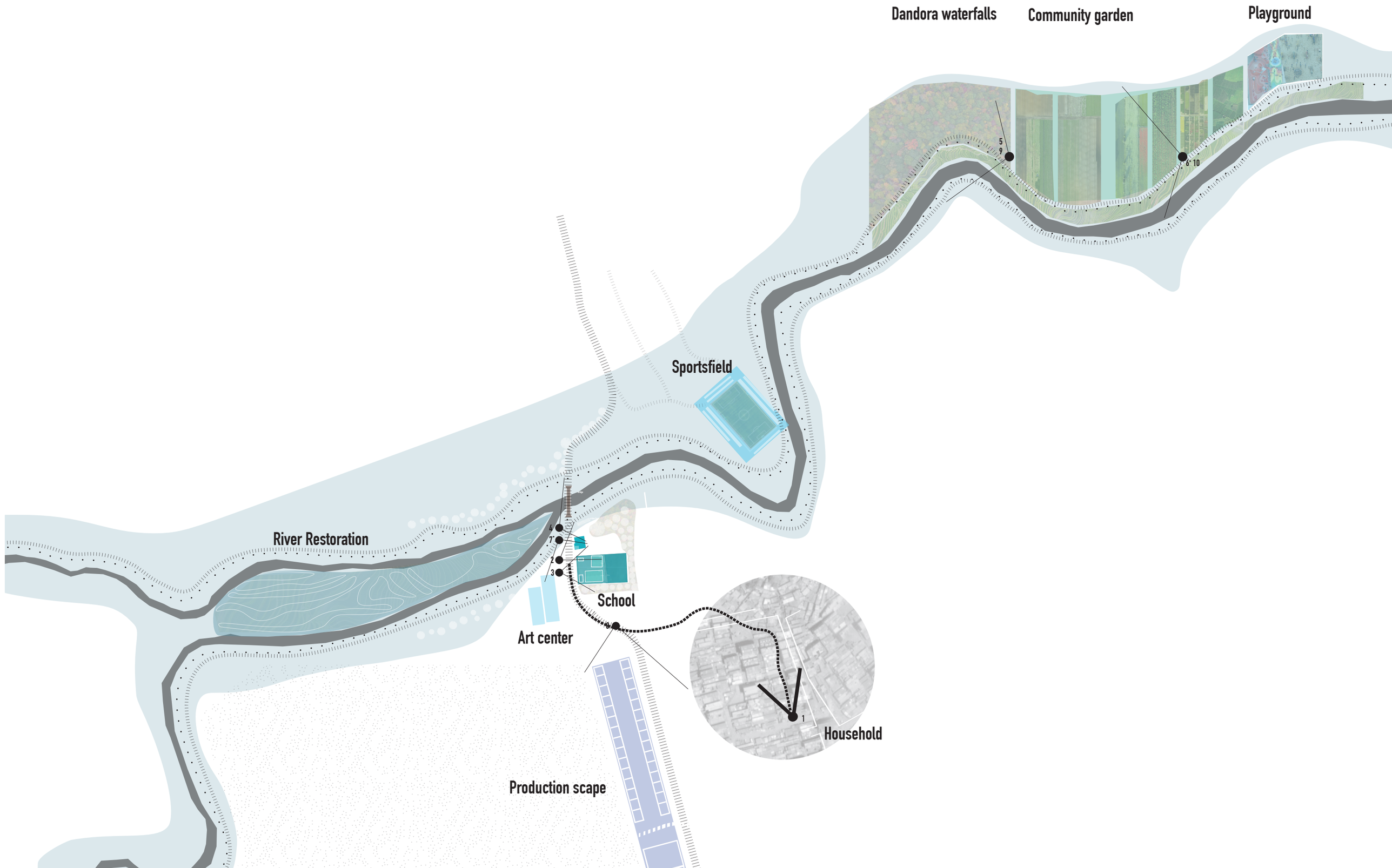
8

1

Production scape

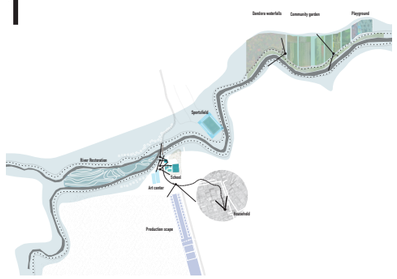
Figure 154: Storyline spatial overview - Authors' map

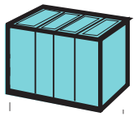
VI. STORYLINE | HOUSEHOLD TO SCHOOL
1



VI. STORYLINE | HOUSEHOLD TO SCHOOL

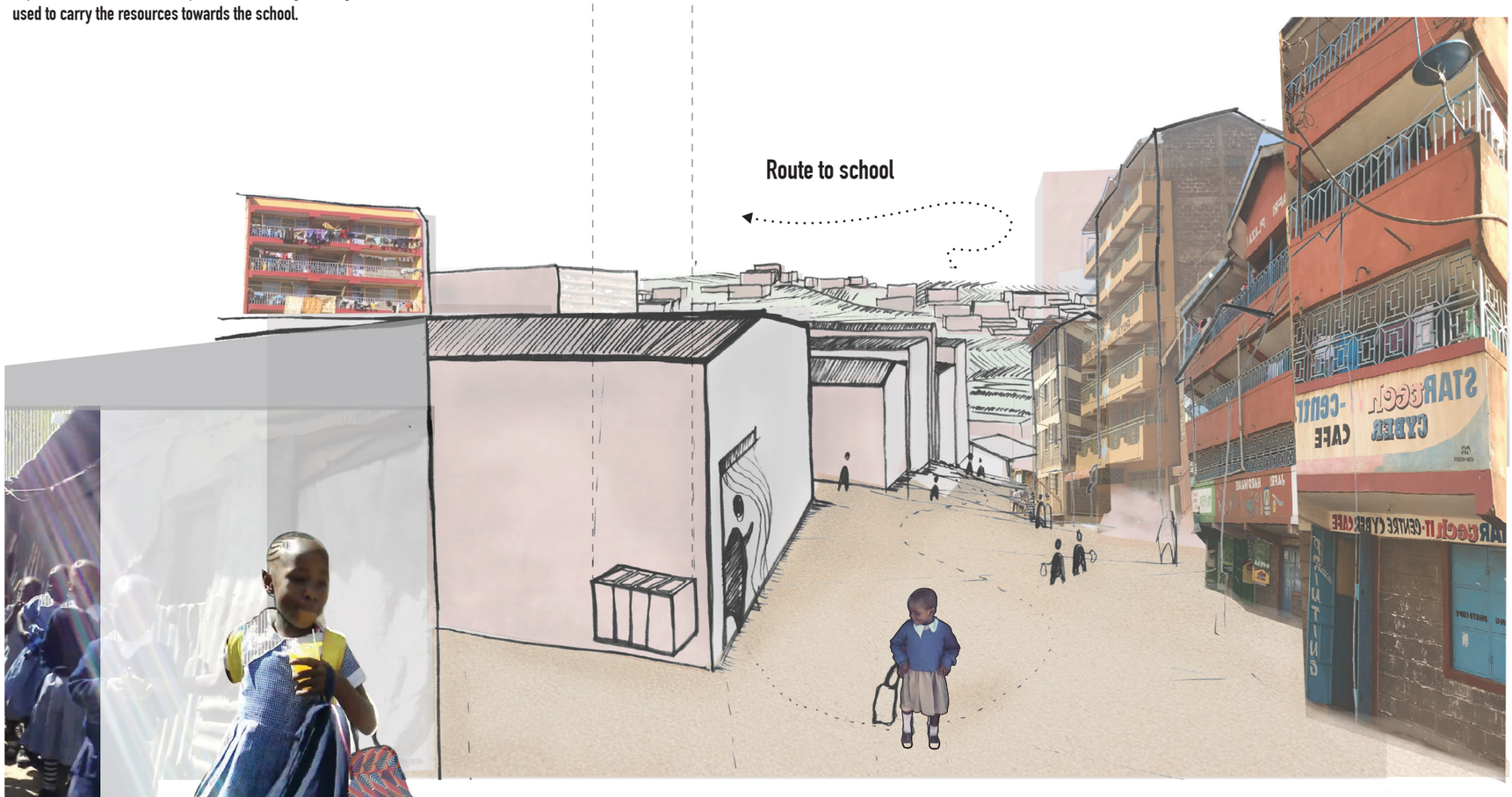
1





1

Akinyi walks to school in the morning with a bag full of resources. Her mom says 'Karibu' to her while she waits for the other schoolkids to walk together. The whole family separates their waste and a special durable bag is being used to carry the resources towards the school.



STAKEHOLDERS



Akinyi



Whole family

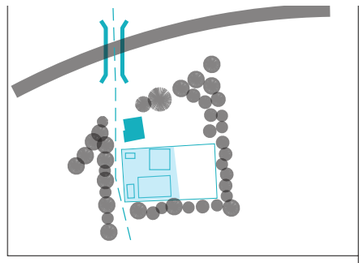
RESOURCES



Bag

Figure 156: Storyline scene 1 - Authors' drawing

VI. STORYLINE | HOUSEHOLD TO SCHOOL



Dandora school

Dandora waterfalls

Community garden

Playground

5
9

6
10

Sportsfield

River Restoration

4
7
2
3

School

Art center

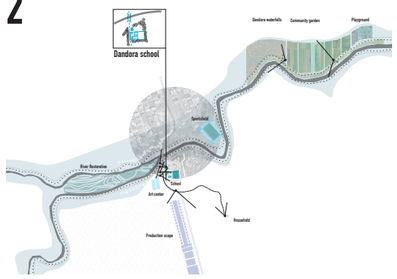
1

Household

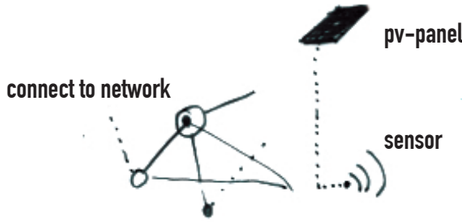
Production scape

VI. STORYLINE | HOUSEHOLD TO SCHOOL

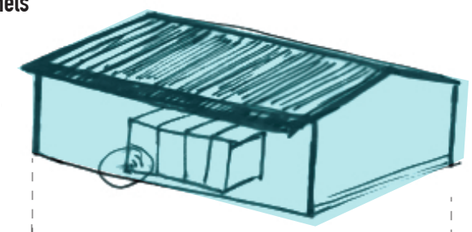
2



SPATIAL



COLLECTION POINT
shed outside school building (smell)
accessible by (cargo)bike



separation bins

2

Akinyi arrives at school and she and her schoolmates first drop their bag at the collectionpoint.



STAKEHOLDERS

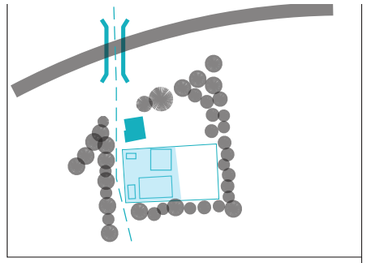
KID



CBO-MEMBER
SUPERVISOR COLLECTION POINT

RESOURCES

MVIRINGO-COIN (NEW CURRENCY)



Dandora school

Dandora waterfalls

Community garden

Playground

5
9

6
10

Sportsfield

River Restoration

4
7
2
3

School

Art center

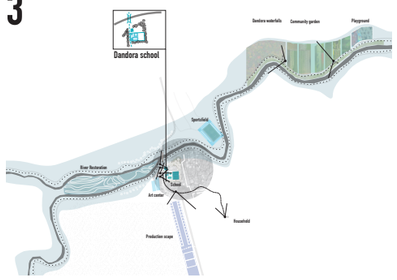
8

1

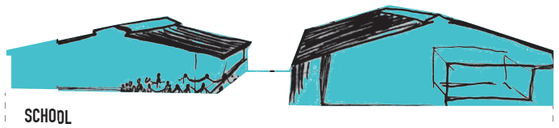
Household

Production scape

VI. STORYLINE | SCHOOL
3



SPATIAL



SCHOOL

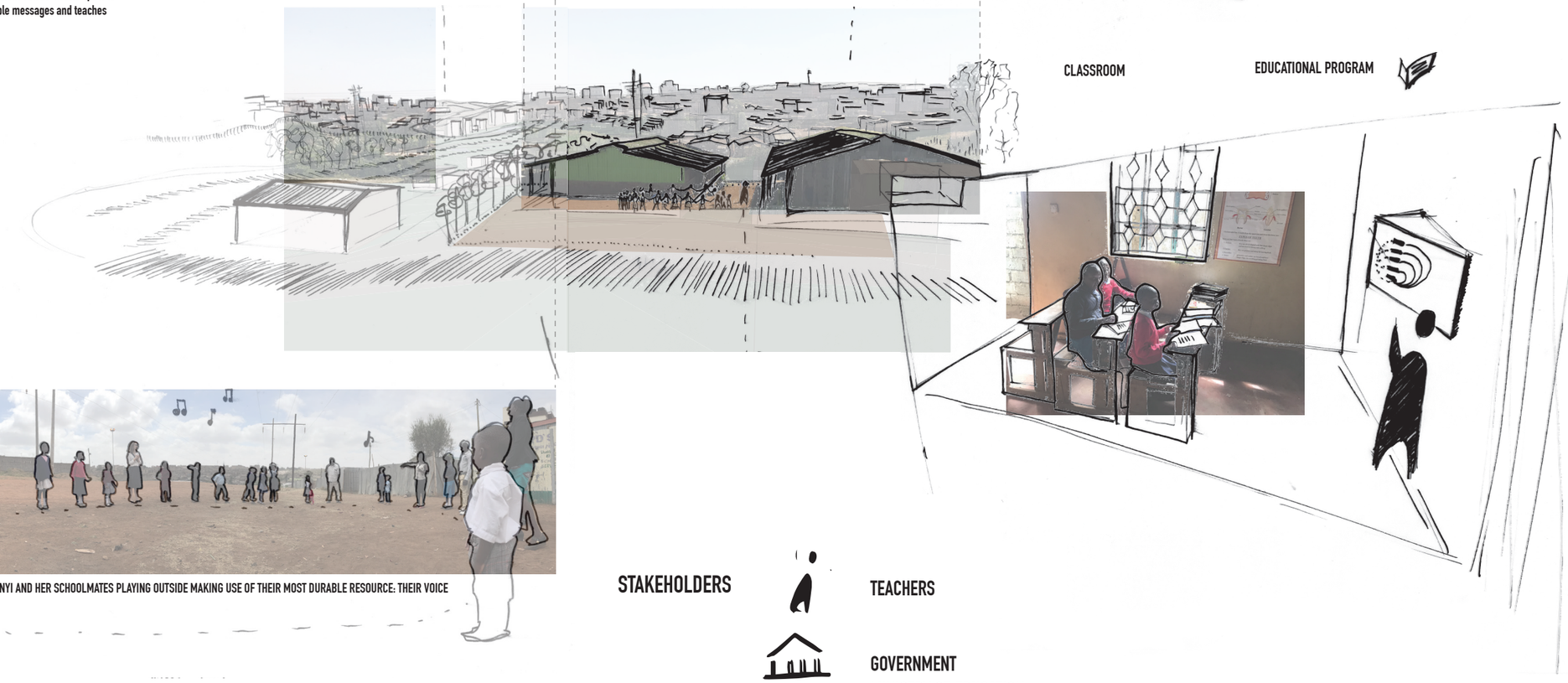


(SCHOOL) SQUARE

3

During school Akinyi and her schoolmates are playing outside using imiginary footballs or dancing while singing songs. These songs learns them values, in this specific case it contains a sustainable messages and teaches ecological ideals.





CLASSROOM

EDUCATIONAL PROGRAM

AKINYI AND HER SCHOOLMATES PLAYING OUTSIDE MAKING USE OF THEIR MOST DURABLE RESOURCE: THEIR VOICE

STAKEHOLDERS

TEACHERS

GOVERNMENT
MINISTRY OF EDUCATION

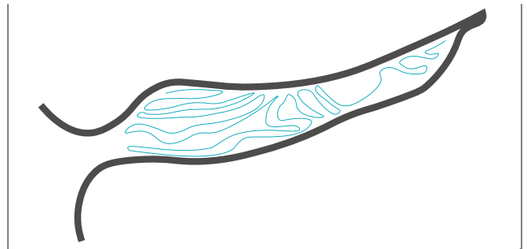
RESOURCES

COURSE MATERIAL

(SOCIAL) MEDIA
AWARENESS PROGRAM

SONGS

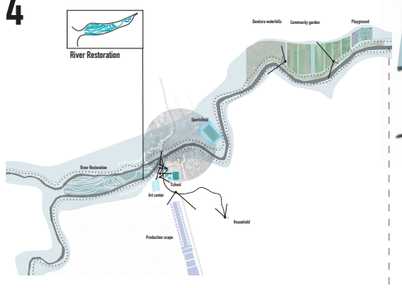
Figure 158: Storyline scene 3 - Authors' drawing



River Restoration

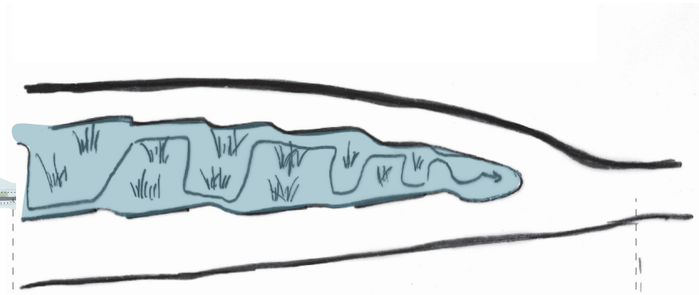
VI. STORYLINE | RIVER

4

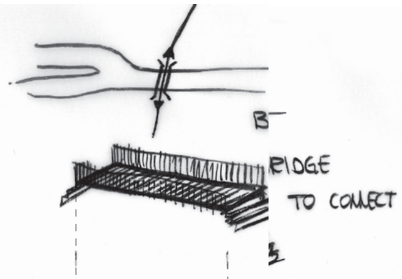


4

School kids like Akinyi walk from school along the river, the sportsfield in direction of the community garden. They cross the water by the bridge, constructed of bamboo. Bamboo is growing fast on the riparian sides. The constrcuted wetland just before the bridge is maintained and controlled by the garden-members in order to secure the water safety and cleaniless. The bridge connects the estates of Dandora and Lucky summer and at the crossing of two paths, a high quality public space is situated underneath the characteristic tree (in memory of Wangaati). The design of the space is a co-creation by locals to compete in the Changing Faces Competition.



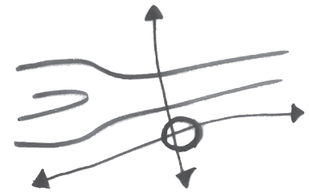
(phyto)-remediation by constructed wetland



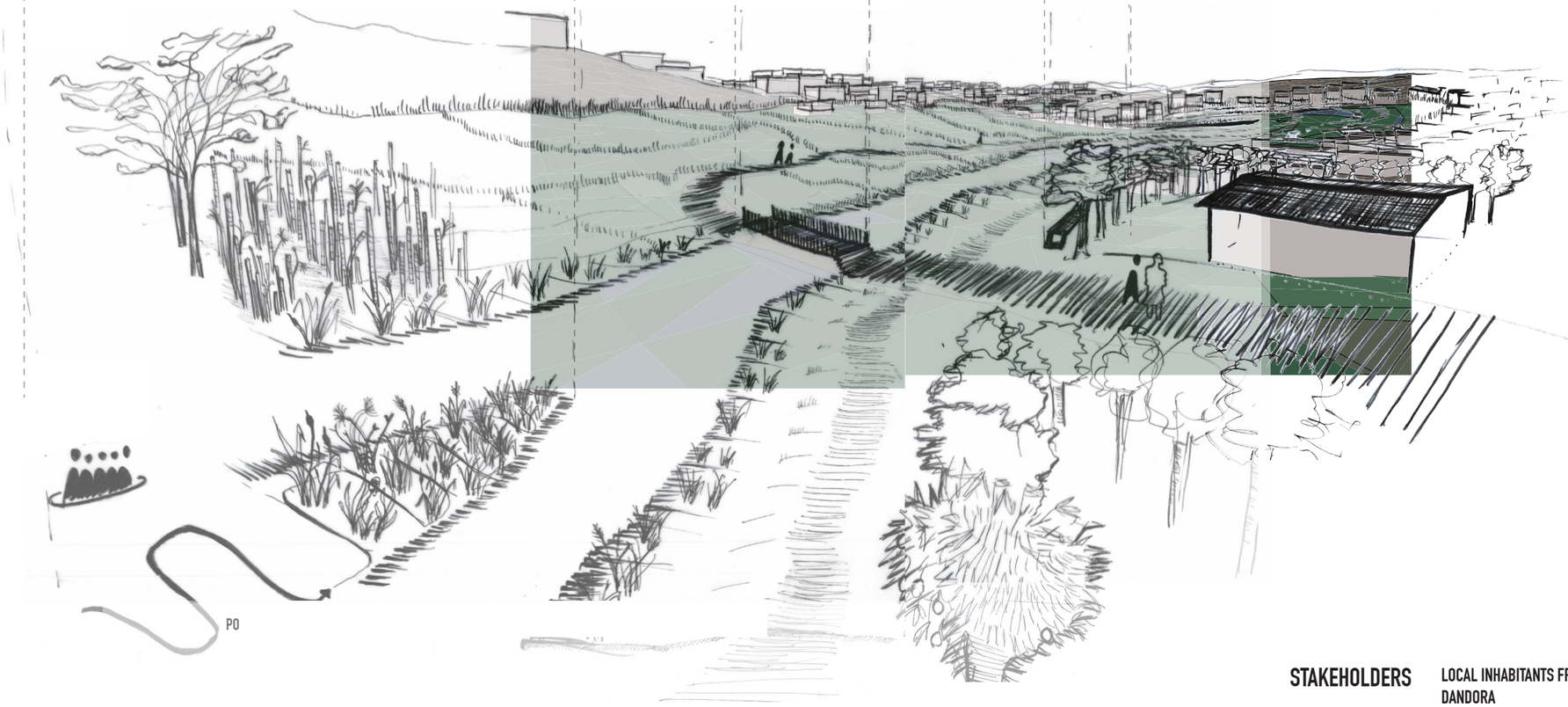
connect by bridge



urban furniture and characteristic tree



CO-CREATION PUBLIC SPACE



Zoom-in place-making

shade by trees



STAKEHOLDERS



CBO-members responsible for wetland

STAKEHOLDERS

LOCAL INHABITANTS FROM LUCKY SUMMER AND DANDORA

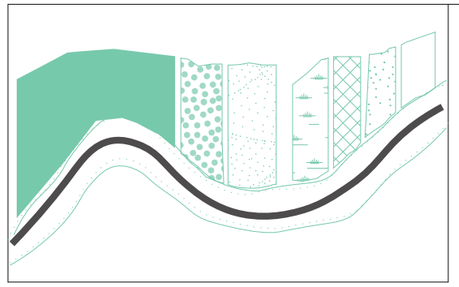
GOVERNMENTAL INVESTMENT IN INFRASTRUCTURE

RESOURCES

MANGO TREE / TANA RIVER POPLAR

BAMBOO

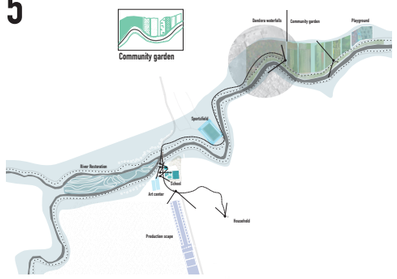
Figure 159: Storyline scene 4 - Authors' drawing



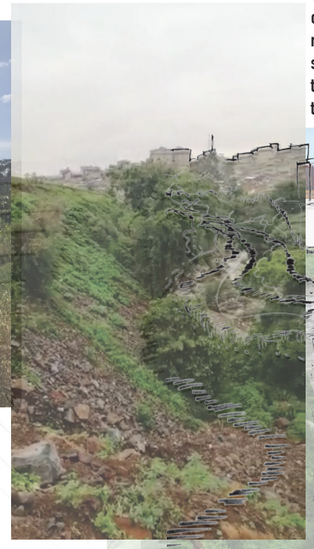
Community garden

VI. STORYLINE | COMMUNITY GARDEN

5





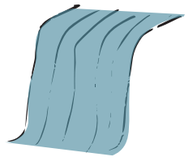


SPATIAL

BAMBOO ZONE

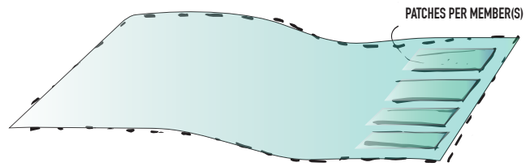


WATERFALL



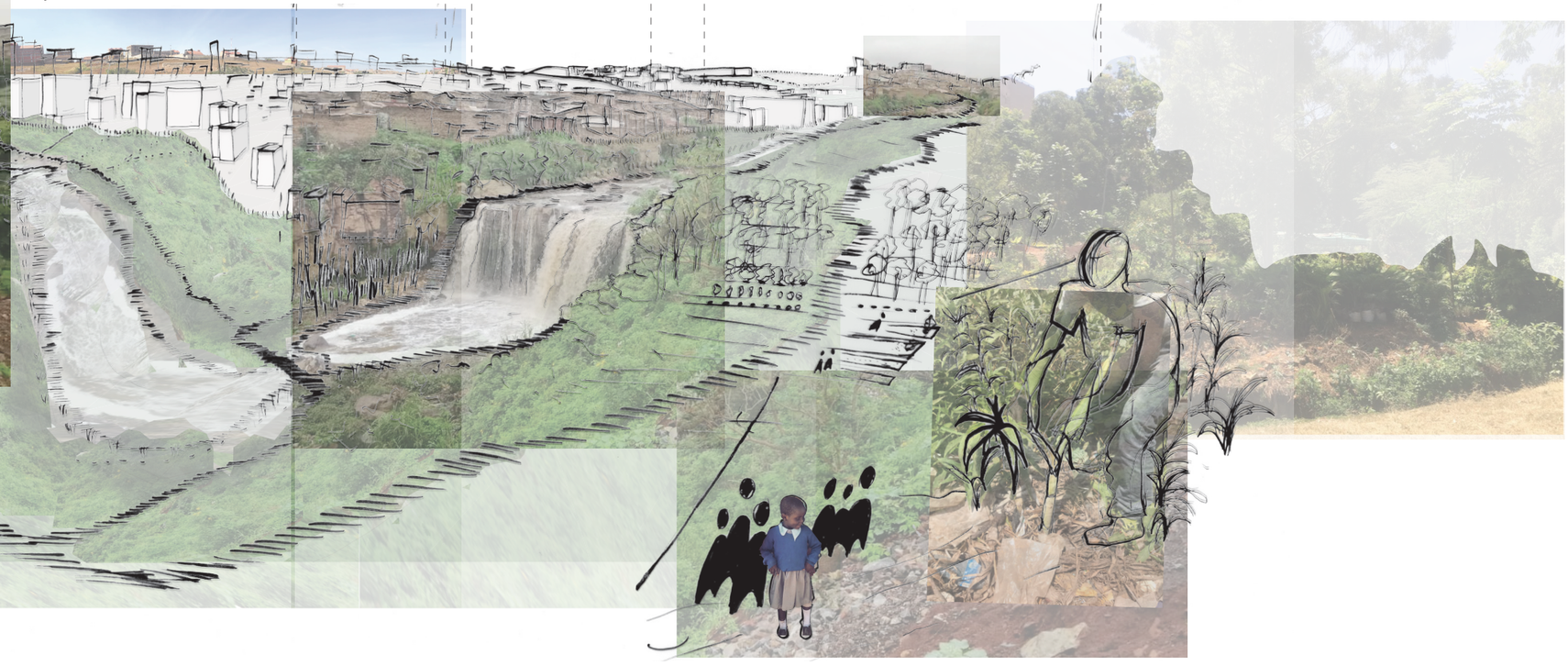
part of water
remediation process

TREE NURSERY



5

During school Akinyi and her schoolmates can choose to go to the tree-nursery as part of the community garden to take care of the plants. In redeem for their mviringo-coin, they obtain seeds, tools or space to harvest their own. In this way kids learn to have responsibility for their patch or tree.



STAKEHOLDERS



KID

CBO-MEMBER GARDEN

TREE NURSERY SUPERVISOR

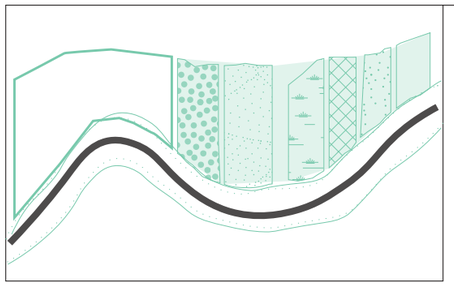
MVIRINGO-COIN

RESOURCES



SEEDS

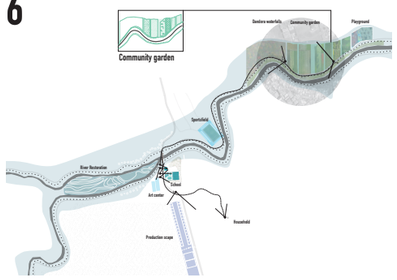
Figure 160: Storyline scene 5 - Authors' drawing



Community garden

VI. STORYLINE | GARDEN

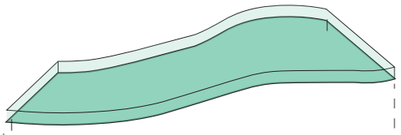
6



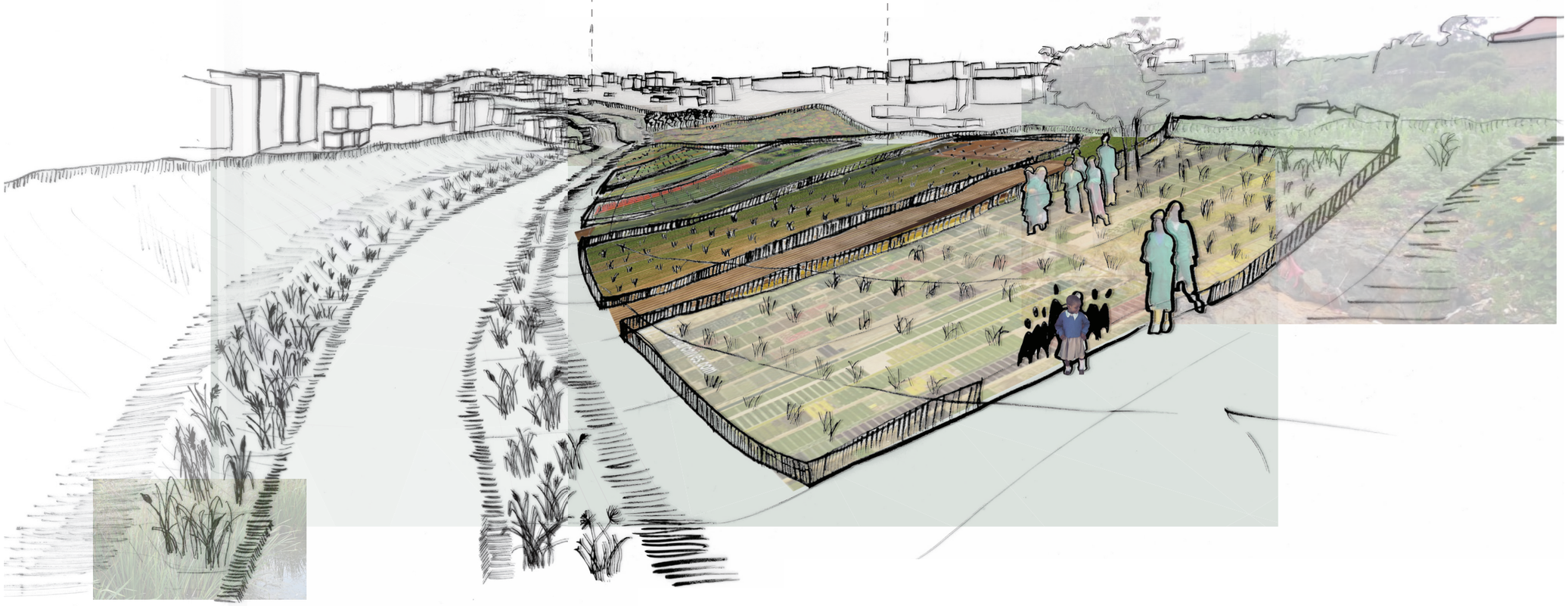
6

After school Akinyi and her schoolmates are being teached by CBO-members from the community garden about gardening, harvesting and vegetables.

SPATIAL



CLOSED GARDEN PATCHES



STAKEHOLDERS

KIDS

CBO-MEMBER GARDEN

with knowledge about gardening/soil/harvesting

RESOURCS

PODS (reused resources)

SEEDS

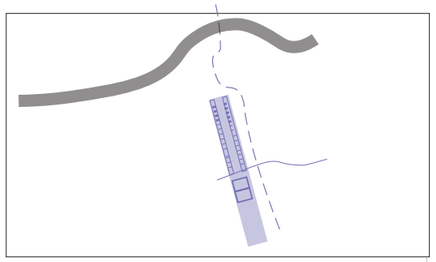
TOOLS

GLOVES

MATERIAL RESOURCES

Figure 161: Storyline scene 6 - Authors' drawing

VI. STORYLINE | PRODUCTION SCAPE



Production scape

Dandora waterfalls

Community garden

Playground

Sportsfield

River Restoration

School

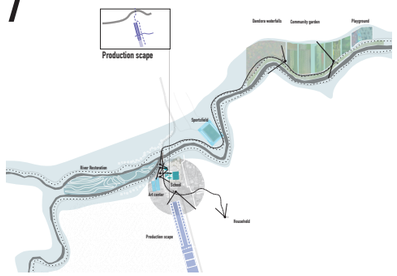
Art center

Household

Production scape

VI. STORYLINE | PRODUCTION SCAPE

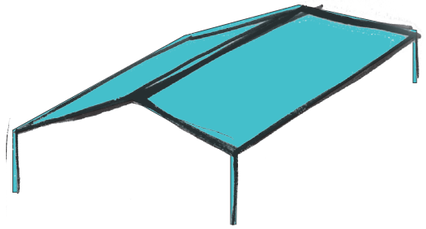
7



7

Cargo-bike-driver from a recycling CBO comes to pick op the resources from the collection point next to the school.

SPATIAL

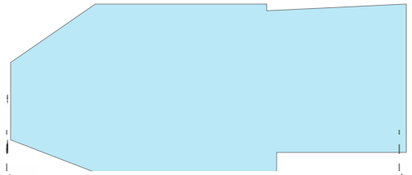


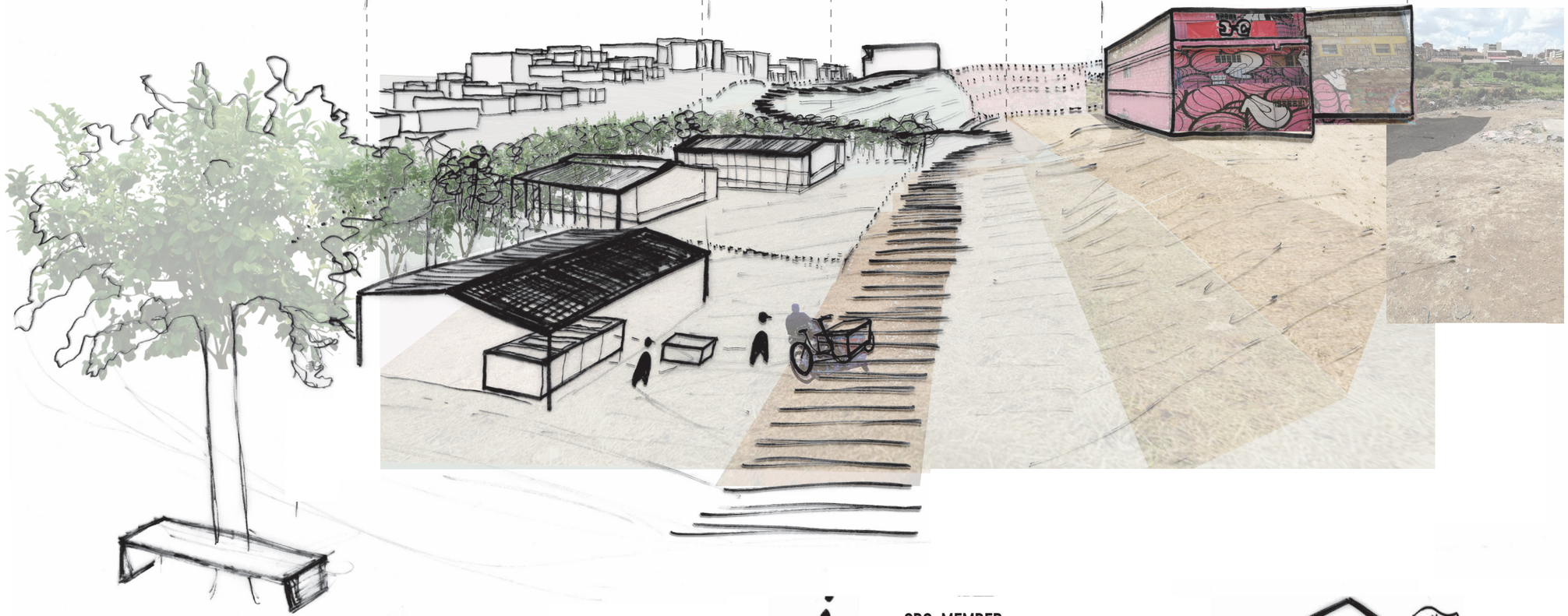
COLLECTION POINT

PAVED PATH
for accessibility



ART CBO





STAKEHOLDERS



CBO-MEMBER
SUPERVISOR COLLECTION POINT

CBO-MEMBER RECYCLER
CARGO-BIKE-DRIVER



GOVERNMENTAL
INFRASTRUCTURE
INVESTMENT

RESOURCES

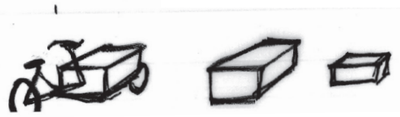
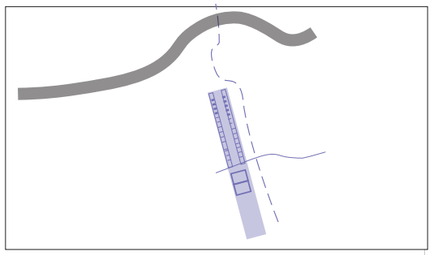


Figure 162: Storyline scene 7 - Authors' drawing

VI. STORYLINE | SCAPES



Production scape

Dandora waterfalls

Community garden

Playground

5

9

6

10

Sportsfield

River Restoration

4

7

2

3

School

Art center

8

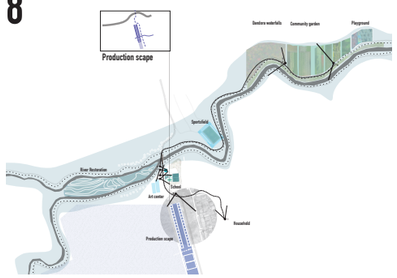
1

Household

Production scape

VI. STORYLINE | SCAPES

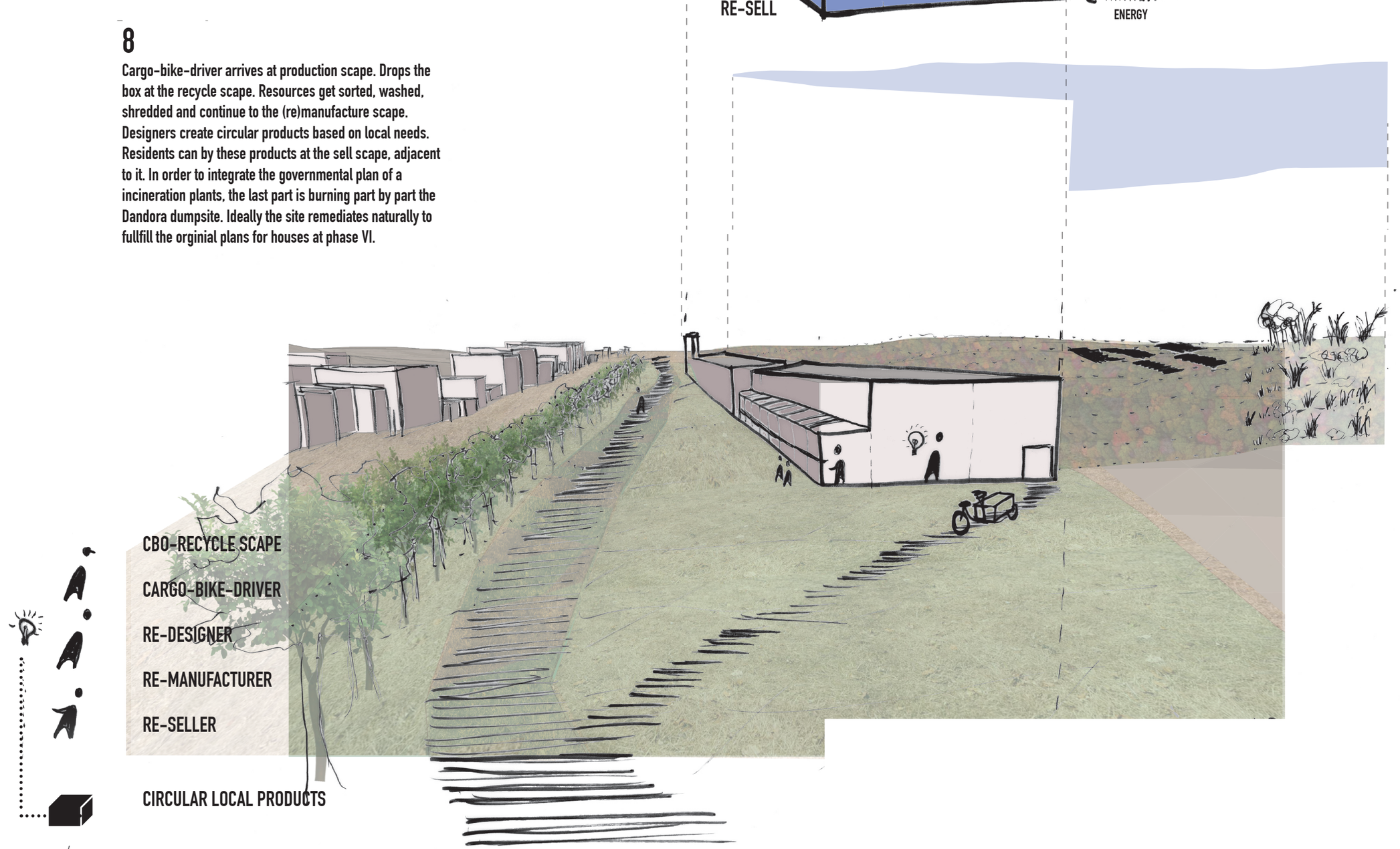
8



8

Cargo-bike-driver arrives at production scape. Drops the box at the recycle scape. Resources get sorted, washed, shredded and continue to the (re)manufacture scape. Designers create circular products based on local needs. Residents can by these products at the sell scape, adjacent to it. In order to integrate the governmental plan of a incineration plants, the last part is burning part by part the Dandora dumpsite. Ideally the site remediates naturally to fullfill the orginial plans for houses at phase VI.

SPATIAL



STAKEHOLDERS

CBO-RECYCLE SCAPE

CARGO-BIKE-DRIVER

RE-DESIGNER

RE-MANUFACTURER

RE-SELLER

RESOURCES

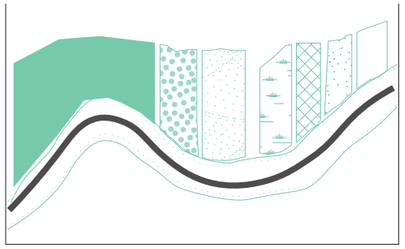


CIRCULAR LOCAL PRODUCTS

PLANTS (REED)

Figure 163: Storyline scene 8 - Authors' drawing

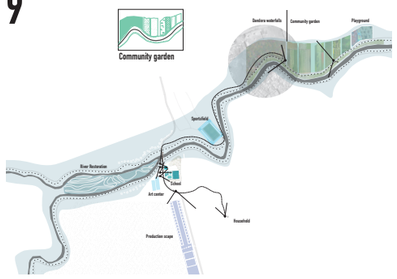
VI. STORYLINE | YEARS LATER



Community garden

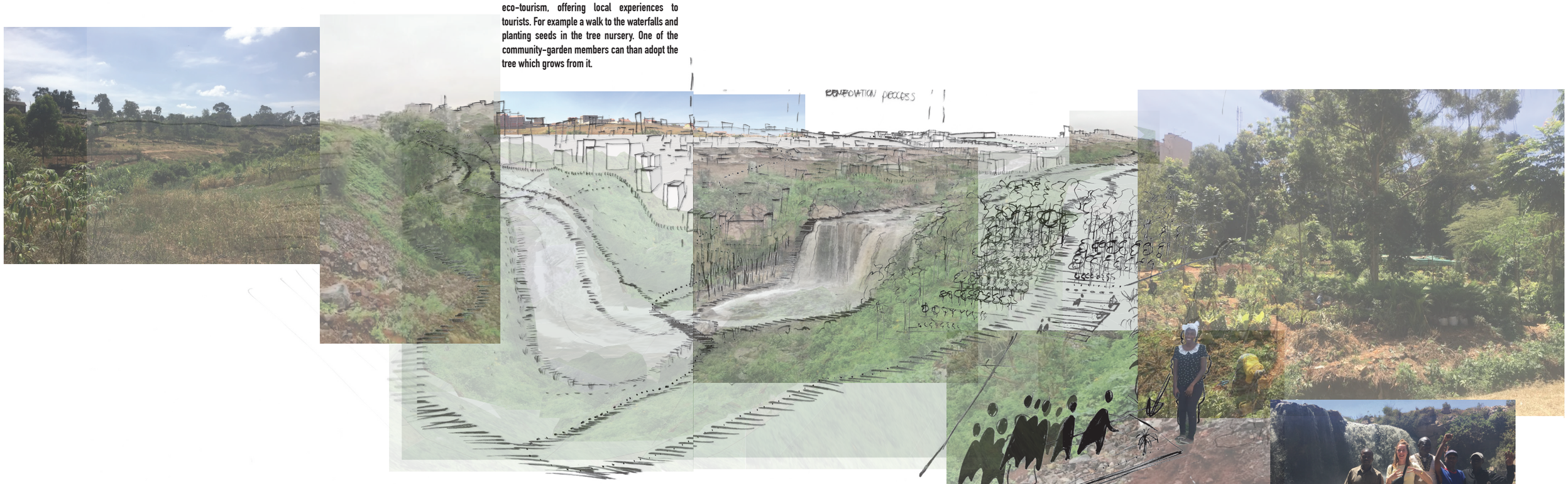
VI. STORYLINE | YEARS LATER

9



9

7 years later, Akinyi is part of a CBO on eco-tourism, offering local experiences to tourists. For example a walk to the waterfalls and planting seeds in the tree nursery. One of the community-garden members can than adopt the tree which grows from it.



STAKEHOLDERS

Tourists

RESOURCES

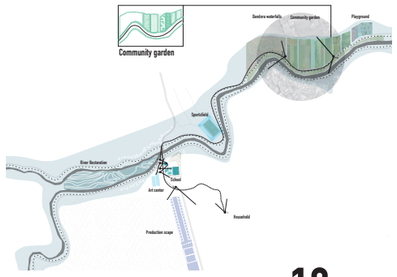
I-like-local-company

CBO-eco-tourism

Seeds

Figure 164: Storyline scene 9 - Authors' drawing

VI. STORYLINE | YEARS LATER



10

After school Akinyi as garden supervisor teaches her kids about gardening, harvesting and vegetables. The other way around she learns from the kids about the newest trends.

Figure 165: Storyline scene 10 - Authors' drawing

VI. STORYLINE

By summarizing the spatial and systemic interventions in from the perspective of a kid, into one story, this map highlights the route of this kid.

Playground

Dandora waterfalls

Community garden

5
9

8 10

Sportsfield

River Restoration

4
7
2
3

School

Art center

8

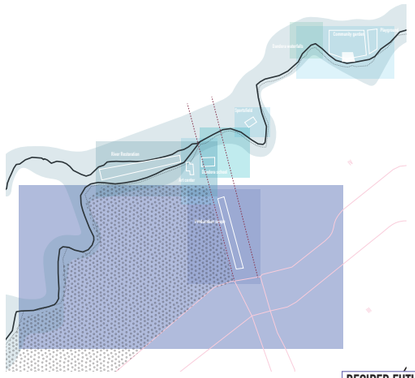
1

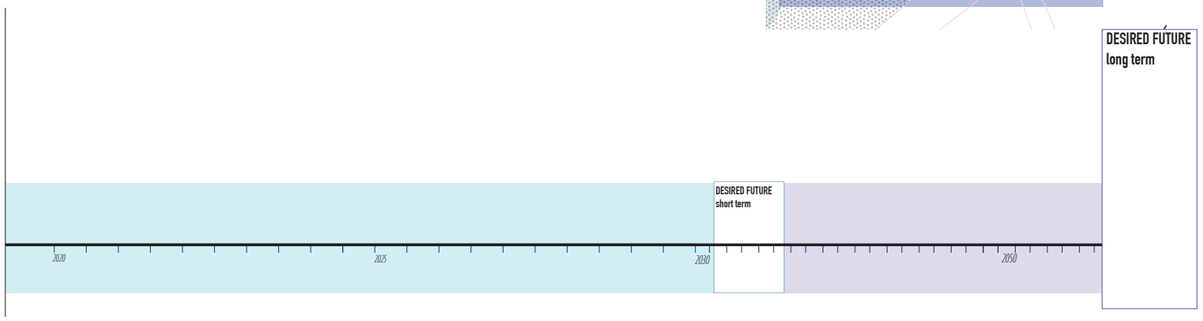
Production scape

Figure 154: Storyline spatial overview - Authors' map

VII. LONG TERM VISION

Elaborate more on the effects of the production scape and taking into account the investment in a incineration plants by the government, the long term vision focuses on spatial potential of the dumpsite and its surroundings.





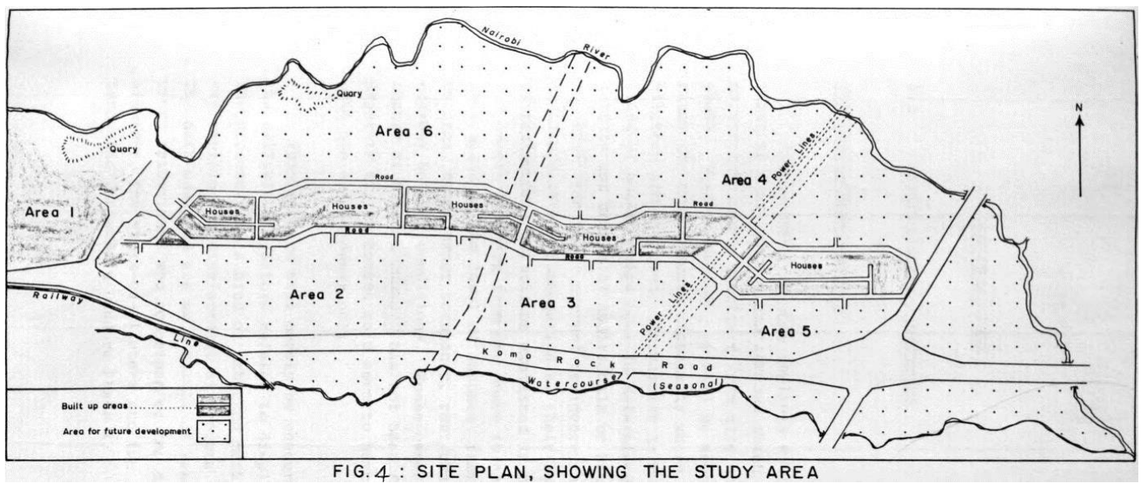


Figure 167: Site plan Dandora - Original plan of site and service scheme in 1972

original plan Dandora 1972

Site and Services scheme: a way of combining a planned construction of plots and **public facilities,** such as water, roads, sewage, and electricity and within that framework the construction of houses by **self-organization** through a 'progressive development'

..the more the government in involved, the less self-organization there will be and the more expensive the dwellings will become (Rots, 2019).

VII. LONG TERM PLAN | PHASE VI PLAN

The set of drawings showing plan and section are a proposal for the dumpsite. Taking into account the ecological dimension and by gaining advice of a landscape expert on natural remediation, the vision has been developed. The vision includes the dumpsite as regenerative park while being part by part burned by the incineration plant as well part by part re-mediated by the natural process of the plants. An characteristic example is the Fresh kills park in NYC. Freshkills Park is a public park being built atop a landfill reclamation project on Staten Island.

Starting the remediation process on the river side of the dumpsite, is a strategic choice in order to help the phyto-remediation process of the urban rivers.



phase 1: remediate soil production scape



Figure 168-a: Long term plan - phase 1

phase 2:
incineration plant burns parts of dumpsite
use other land of dumpsite for solar generation
natural remediation of dumpsite part near to the river

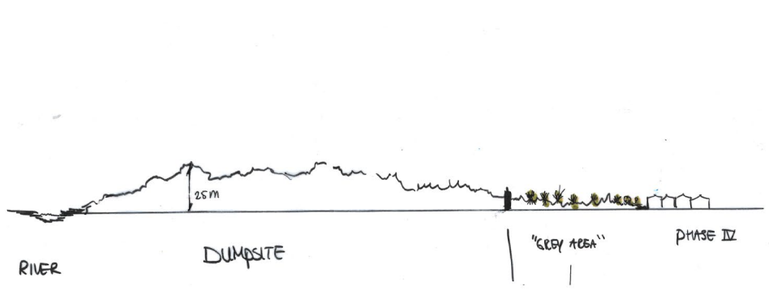


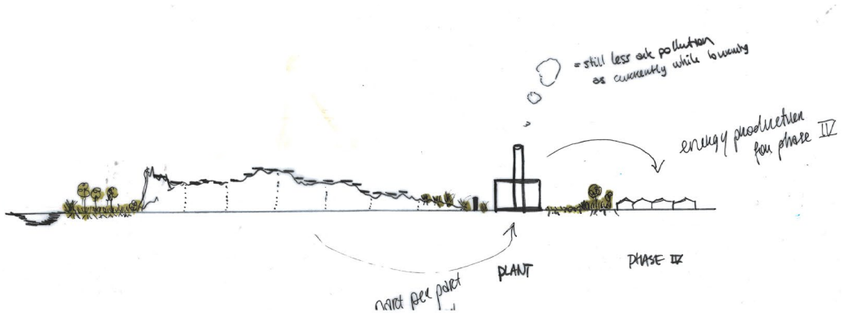
Figure 168-b: Long term plan - phase 2

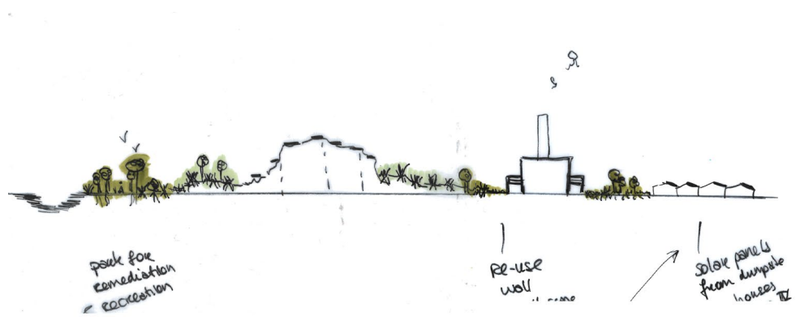
phase 3:
production scape reuses wall for extension sell scape
reuse solar panels for dwelling adjacent to production scape
riverfront into recreative functions and phyto-remediation of water



Figure 168-c: Long term plan - phase 3







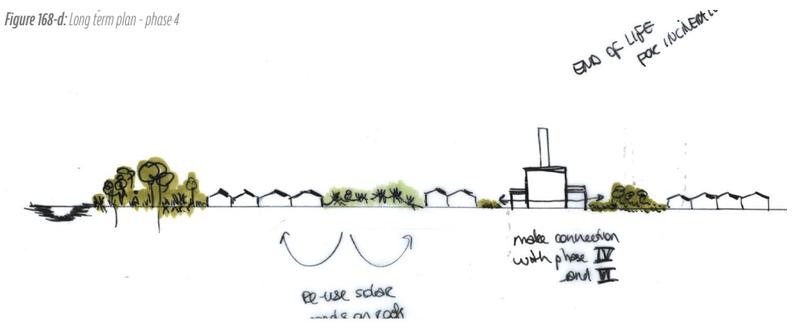
VII. LONG TERM PLAN | PHASE VI PLAN

As the result of the long term desired future, this proposal takes lessons learned from the site and service scheme strategy and develops built on this strategy of 1972. The original phase VI will be in place with an innovative character. The production scape is a new form of industry, while the regenerative public spaces by solar panels providing a new form of energy.

phase 4:
remediation of ground allows to build dwellings
dwellings according to site and service scheme strategy
generative core as public space and reuse of solar sells on houses



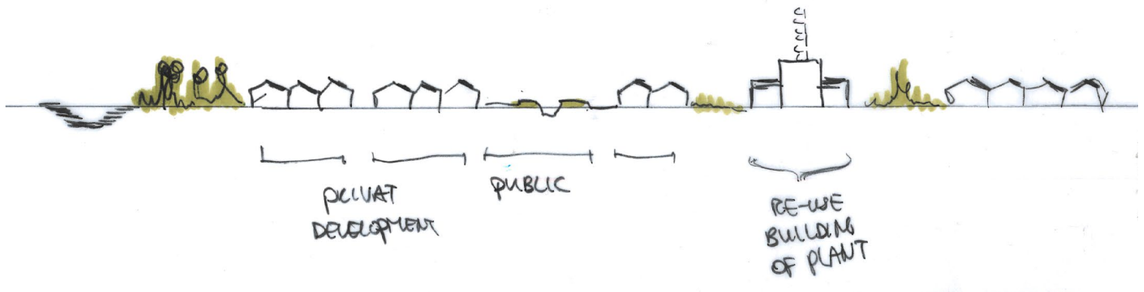
Figure 168-d: Long term plan - phase 4



phase 5: long term future vision
completion of high density dwellings
blue green infrastructure incorporated in design public functions
CBO network spread among different blocks to create network



Figure 168-e: Long term plan - phase 5



VI. LINKAGE PROBLEM TO SOLUTIONS

The design brief announced a variety of problems, of which some of them solution have been proposed in the design of the roadmap. This page gives an overview of the problems on systemic as well spatial level.

Problem overview



Figure 169-a: Overview problems - Authors' diagram

VI. LINKAGE PROBLEM TO SOLUTIONS

The overview highlights the suggested menu of solutions. In the reflection chapter, elaboration on the roadmap and its effectiveness will be provided.

Solution overview

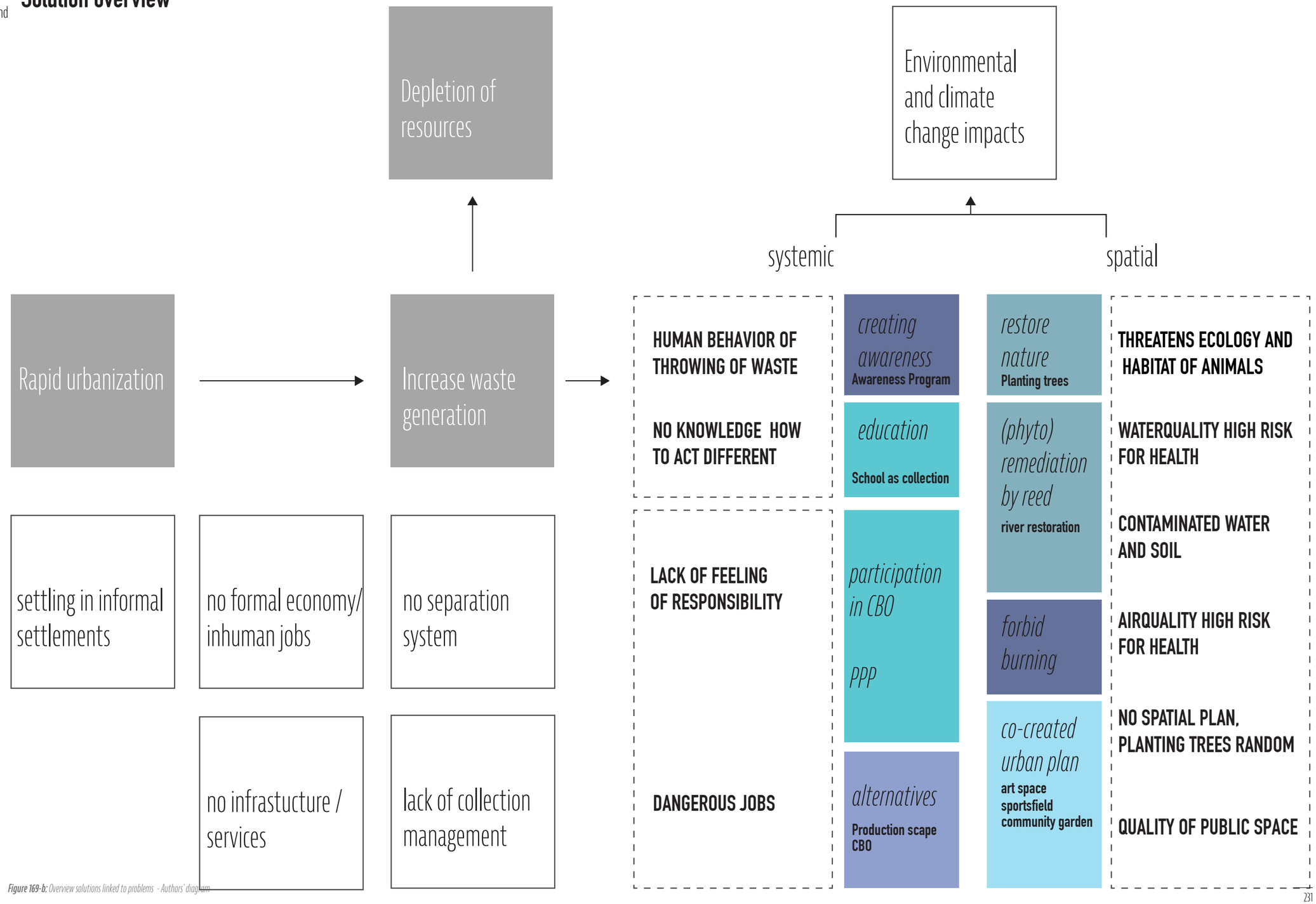


Figure 169-b: Overview solutions linked to problems - Authors' diagram

Picture : Ben White 2010 - creative cloud

VII.

CONCLUSION REFLECTION

CONCLUSION

i. Lessons learned in order to scale up and spread out

REFLECTION

ii. Reflection on design of roadmap and the process towards it
- outcomes on conceptual framework
- limitations and considerations
- future recommendations

iii. Reflection on personal development and linkage studio
- tools
- skills
- values

I. LESSONS LEARNED IN ORDER TO SCALE UP AND SPREAD OUT

Destillating from the spatial interventions, the systemic interventions which are general and working together in a network, are visible in the diagram on this page. These interventions are generic and possible applicable in other contexts and environments, giving the roadmap a broad impact. Together with the spatial dimension, the roadmap implies a deep impact in its' context.

Resource flow

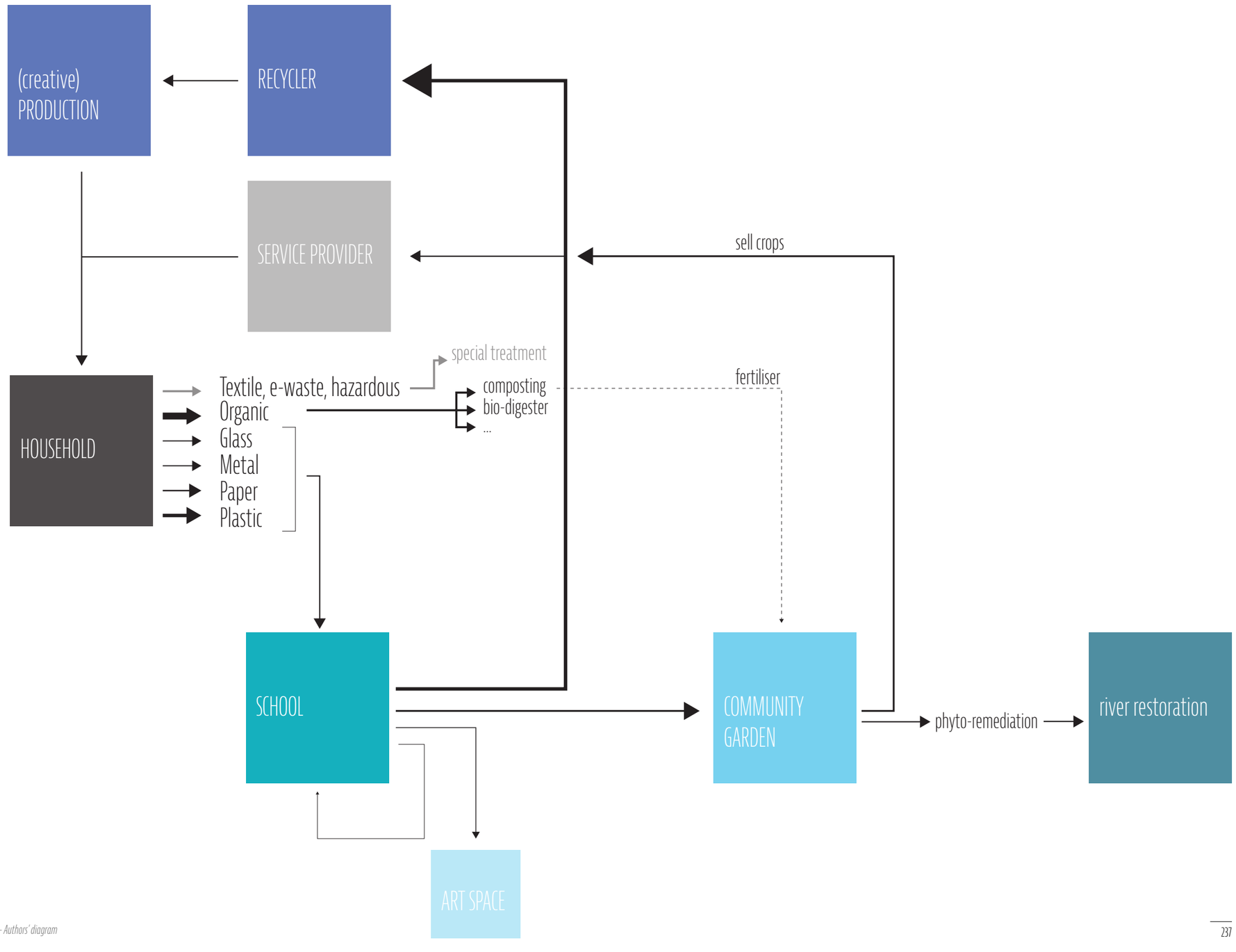


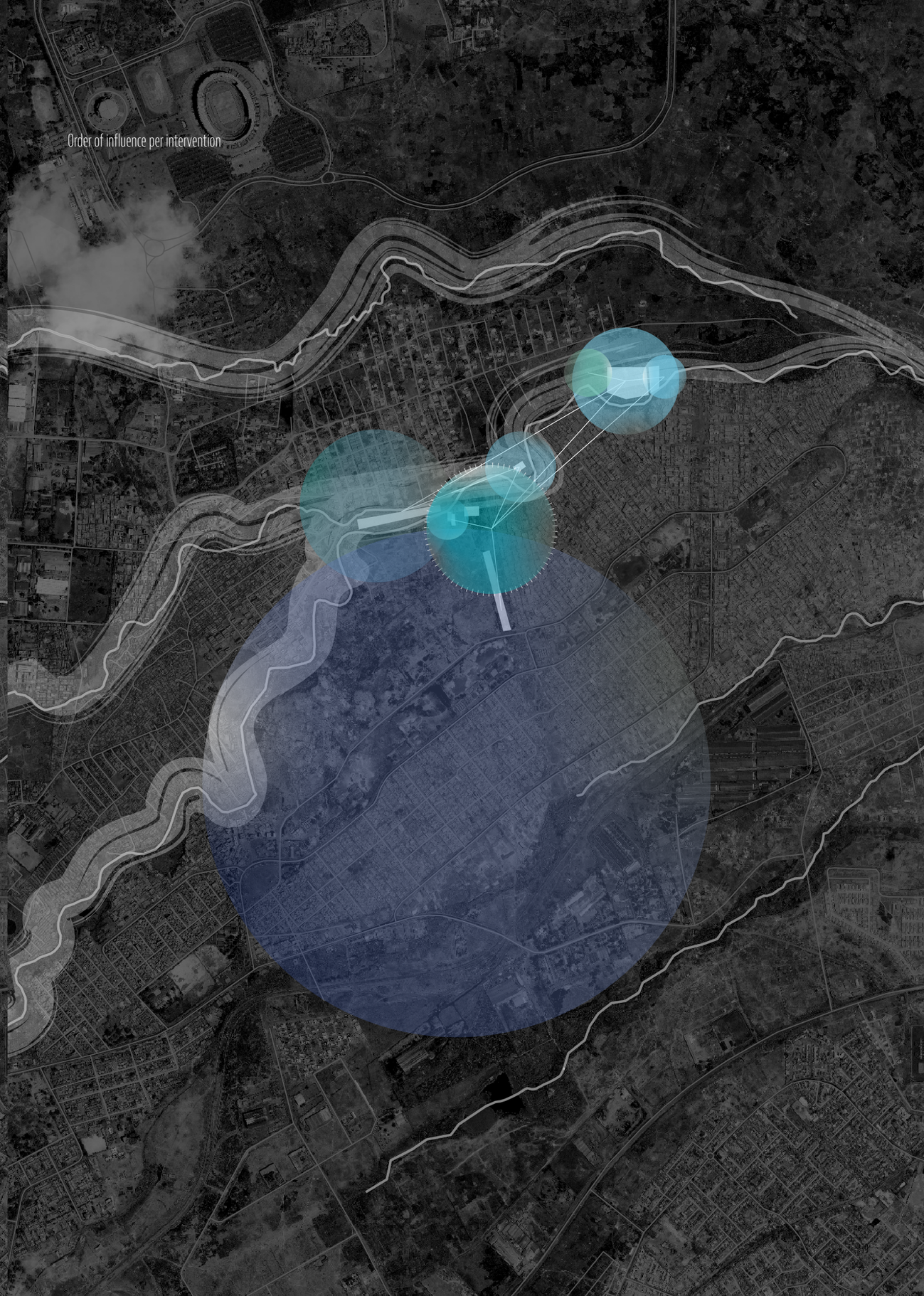
Figure 171: Overview resource flow including systemic solutions - Authors' diagram

I. LESSONS LEARNED IN ORDER TO SCALE UP AND SPREAD OUT

Connection between programmatic spatial interventions



Order of influence per intervention



I. LESSONS LEARNED IN ORDER TO SCALE UP AND SPREAD OUT

Taken into account the lessons learned from the site specific design of the roadmap in the Dandora School. The possibility to spread out to the neighborhood and to the neighboring estate is explored. Not only explored, it is recommended. Since the system works better as there is multiple CBOs participating in the decentralized network.

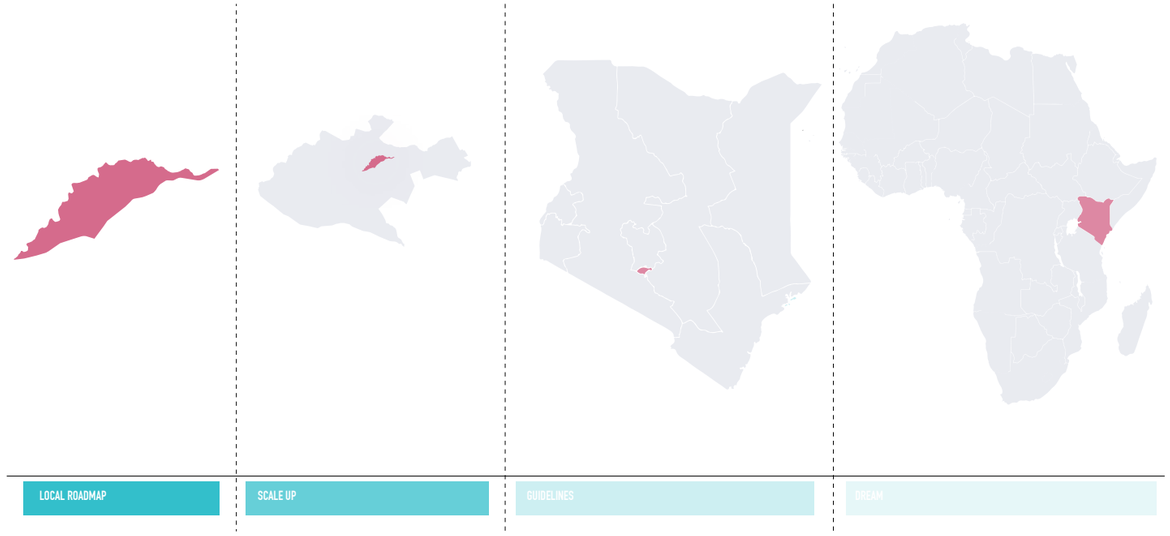
By doing so, according to the open data platform mapping schools in Mathare, it is possible to reach 129 schools, 1231 teachers and 98230 students. The schools are located along the Mathare river, which comes together just before the Dandora school, before the Dandora Waterfall.

The following maps and diagrams show the example of the MYTO school, which could be seen as the beginning of the pilot area. At MYTO junior academy, I organized a workshop to co-create on circular ideas with 26 teachers of 9 different schools. Together with them we made a plan of action to execute the resource requirements, the coordination of the idea and the

Dream big, aim high. The eventual vision is to extrapolate this idea of the pilot area and the pilot schools over the whole of Nairobi. If the systemic intervention is successful here, it could be in the rest of Kenya too. Considering the different rules and regulations, planning governance and culture, this idea could be elaborated on the whole of Africa.



Figure 170: Overview Kenya Open schools - zoomed in on Mathara and Dandora - retrieved online at open source Kenya open school data - April 2019



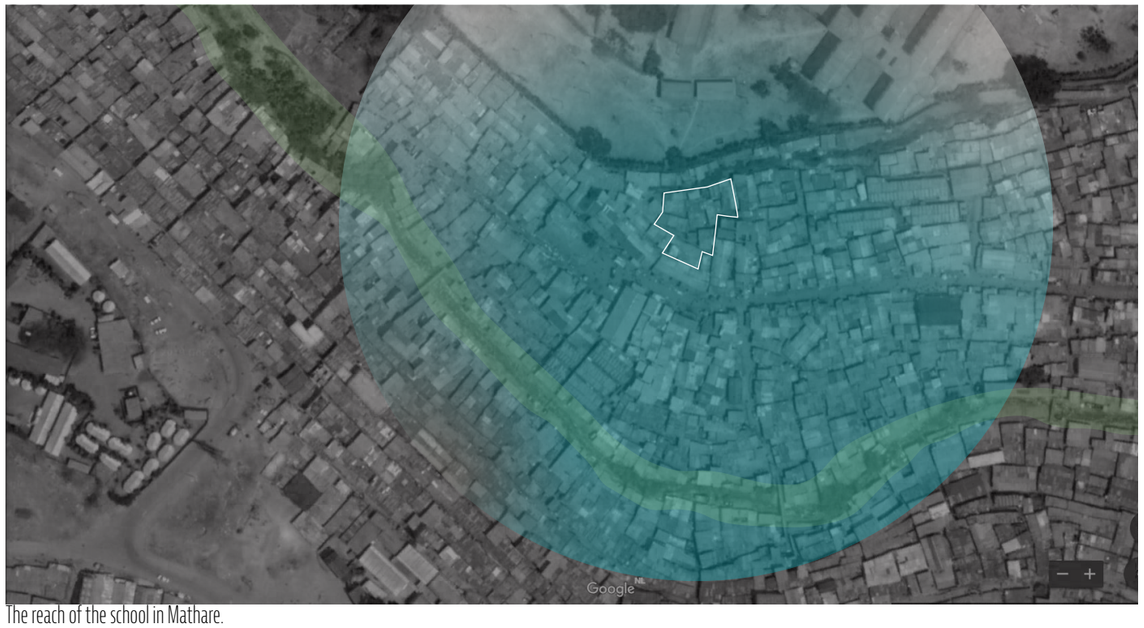
I. LESSONS LEARNED IN ORDER TO SCALE UP AND SPREAD OUT

Specific example in Mathare Valley

The map shows the pilot area. East is the MYTO school, at distance of the river. Right is the Dandora school, as the beginning of the Dandora Estate. The difference is that the MYTO school does not have a direct relation to river.



Pilot area Mathara and Dandora



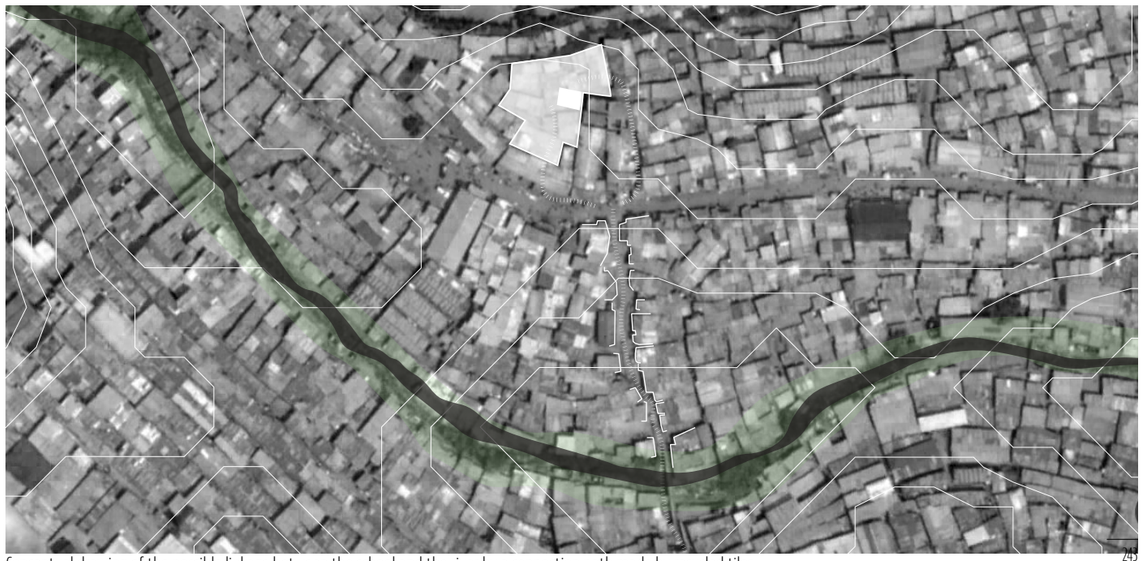
The reach of the school in Mathare.



MYTO school



Dandora school



Conceptual drawing of the possible linkage between the school and the river by a connection path made by recycled tiles.

I. SPREAD OUT AMONG MATHARE

Garden

Waterfalls

Dandora
school

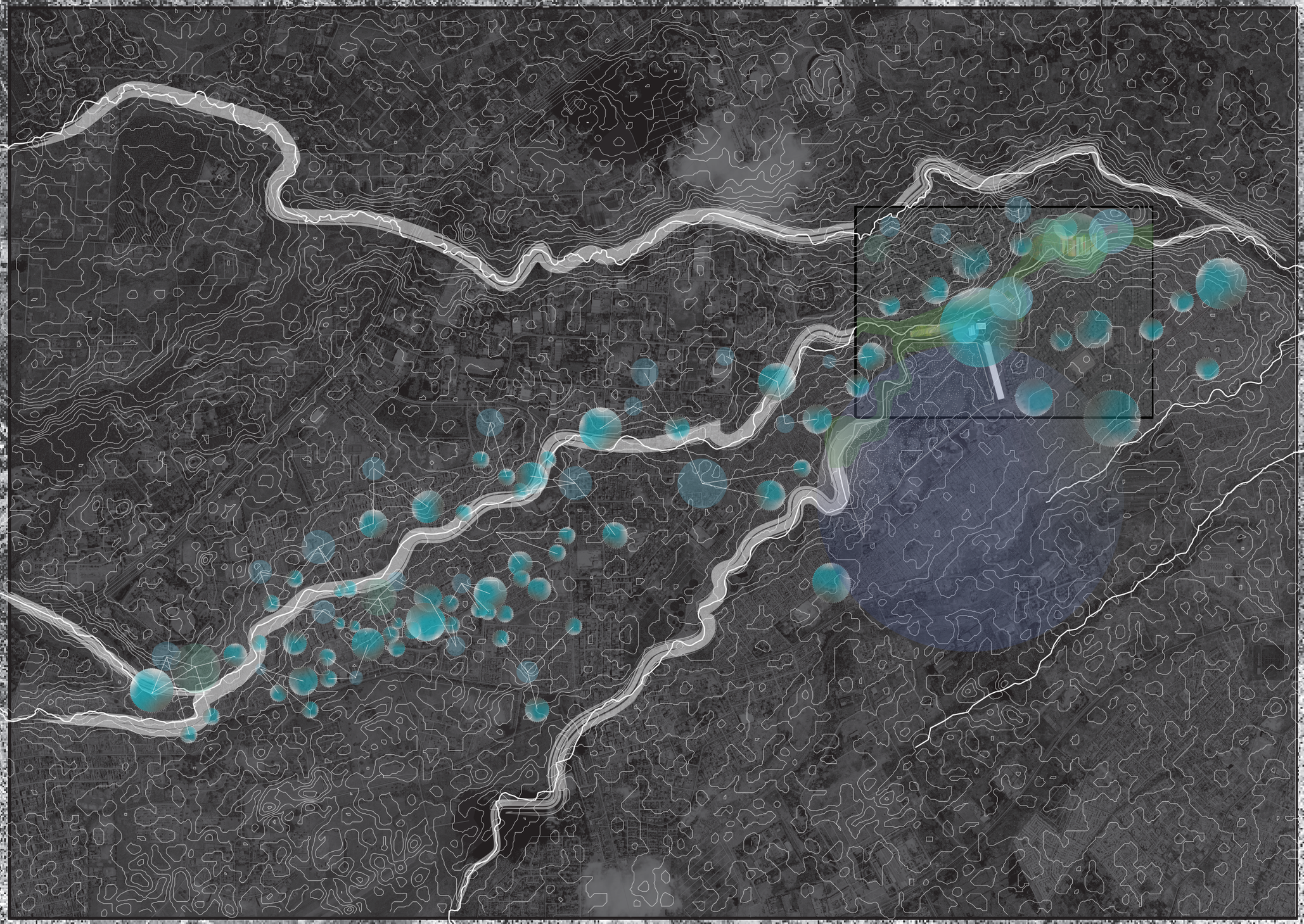
MYTO school

114 SCHOOLS
365 TEACHERS
9806 STUDENTS

VII. REFLECTION

I. SPREAD OUT AMONG MATHARE



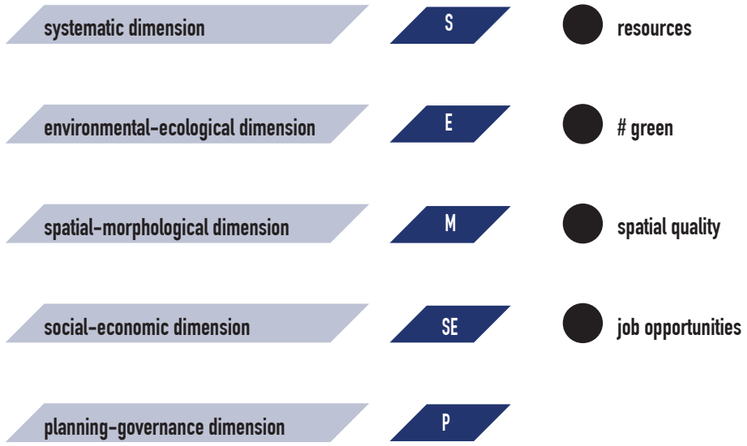


I. SPREAD OUT IN WHOLE NAIROBI



II. REFLECTION ON DESIGN OF ROADMAP

Outcomes

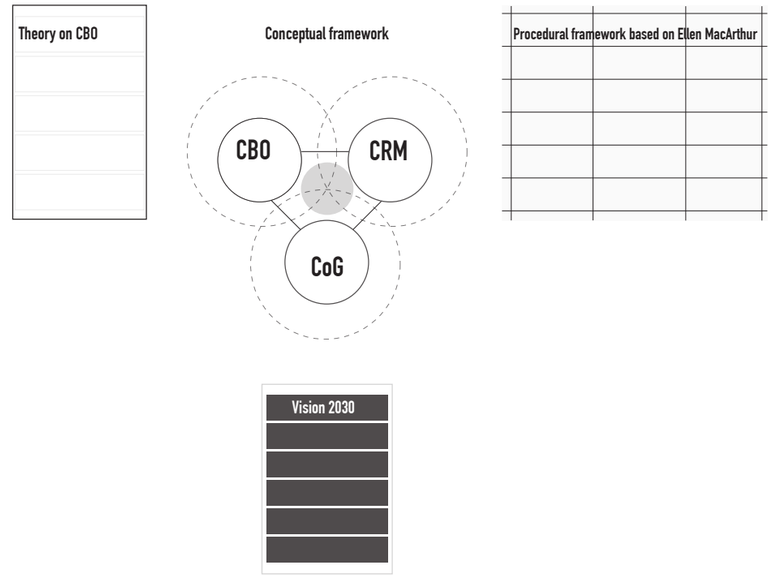


As deriving from the layered approach, the outcome of the design of the roadmap could also be tested on the formulated dimensions. Although the roadmap a strong systemic solution base has, it could have been more detailed on the resources and the amount of these resources. Giving the fact of no available data, acknowledged by multiple institution - among which UNEP and NEMA - the amounts are hard to make assumption on.

By the help of landscape advice, the environmental-ecological dimension is elaborated. Giving the background of our local guides in Nairobi, telling about the animals that are threatened by lack of natural habitat and the possible beauty of the land, this fascination is embedded in the eventual design resulting in the green buffer zone with its specific plants.

Reflecting on the spatial-morphological dimension, I would like to refer back to the history of Dandora - being a site and service scheme. Research has concluded that principles of this scheme could lead to opportunities of reimplementation of the combined philosophy behind this planning strategy. Since this is not the original focus of the roadmap, a plan to revive the old phase VI at the place of the dumpsite, has not been put into detail, but its an exploration.

The socio-economic dimension is more related to the school of thought of the circular economy and the related job possibilities. As the roadmap implies a production scape with jobs for local inhabitants, from production member to creative experts, this would contribute to the economic growth as well to circular economy.



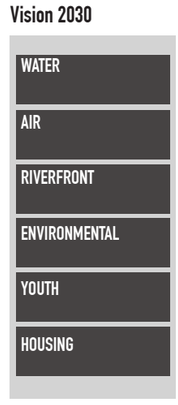
The conceptual framework implies three main bodies of importance. As the theoretical foundation on the CBOs concludes into requirements for CBOs to fulfill in order to be successful, this offers a clear evaluative framework. Moreover, the constellation of governance aspect is represented by the Vision 2030. This vision is leading and binding for the whole country. Reflection on their recommendations while comparing them to the outcomes of the roadmap, brings either reinforced conclusions as well recommendations to change. Third is the procedural framework based on the Ellen MacArthur foundation, which functions as a evaluative framework to reflect on circular economy aspects.

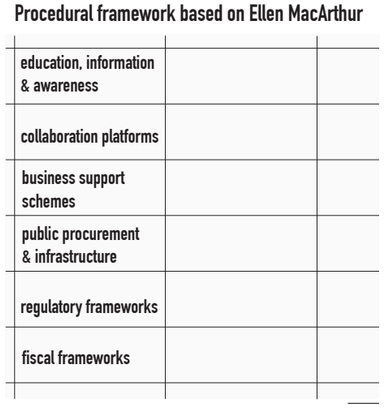
Willingness to participate - specially for the school intervention - as experienced during the co-creative workshop, during talks with locals and heads of CBOs, **is present**. However, one should be considerate of my position of a white woman in this context. People tend to show their willingness to work with you, since they expect you to bring in money. However, the main conclusion on the theoretical part is the necessity of sense of self-organization. Local initiatives will only work once community-members feel like they invented it and they own it.

Reflecting more in detail on vision 2030, on most aspects the intention of the Vision is right. Lacking is the implementation plan and leading examples. As role models play an important role in this country, it could be addressed more widely in the vision. **Since the roadmap tackles water, air-quality, environmental aspects, aims at youth and eventually makes space for houses, it mostly complements the indicators of the Vision 2030.**

As the procedural framework is based on a model of the Ellen MacArthur research group, this complements the circular economy aspect. Reflecting on this framework, some policy recommendations are ambitious. **Specially in a country where the government has a lack of financial tools. However, for the reason of self-reliance of the local - poor - inhabitants, the more local approach this framework is aiming at, could work.**







II. REFLECTION ON DESIGN OF ROADMAP

Relevance

SCIENTIFIC

The project contributes to the work field of planned cities and circular economy within the context of (Eastern) Africa. In essence, the elaboration of this work explores the potential of local knowledge of resource management, manifested in the complex service and site scheme system and its development derived from the New Town Movement, for possible re-implementation within the urban network and governance system in the context of Dandora, Nairobi. Relating this to the new town movement in East of Africa, it will gain new insights into both (theoretical) frameworks. Since there is not much written about either sustainable transformation and circular urban processes in the African context, this research will do an attempt to close this gap.

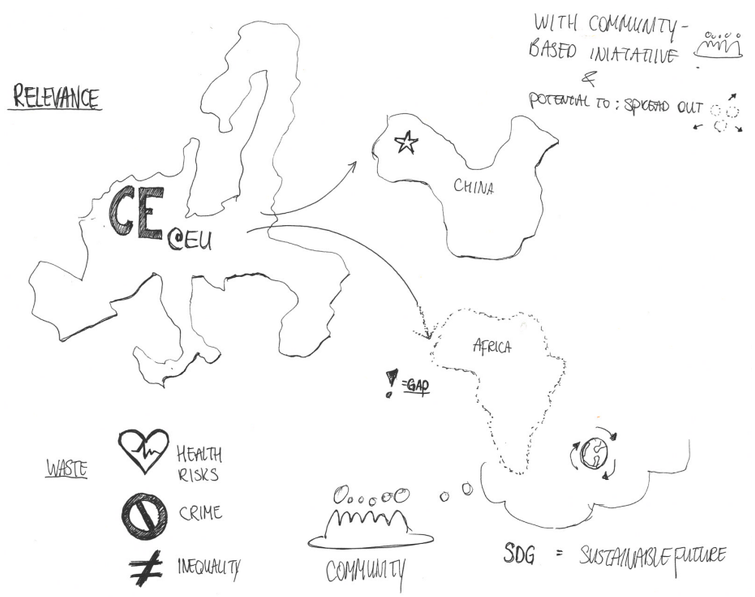
The project intended result of proposing a roadmap (design and planning), could be used as a guidance for the improvement of socio-economic, spatial and ecological systems in Dandora. Since the analysis is based upon this site-specific data, in-depth knowledge will be gained and could be useful source of knowledge for other similar character settlements. The methodology of research, based on history, socio-economic and systems, could be applied in other similar areas for which the potential of alternative development is researched.

Moreover, the analytical framework of the project could be of valuable addition to the provision of data from field work, linked with existing practice and theory, hopefully expanding the understanding regarding the shortcomings of current practices and the needs of the communities involved. The project's local focus is an attempt to contribute to a more anchored practice of urbanism, relevant to the post-colonial discourse.

SOCIETAL

Globally seen, the UN report of 2017 is showing that half of the global population lives in urban areas. This figure is projected to increase to 75% by 2050. This urbanization will take place for 95% in developing countries. Sub-Saharan Africa is regarded as world's fasted urbanizing region. Rapid urbanization caused by high population growth, climate changes a fast-economic growth (Keeton, R., The rising of the East). The population living in informal areas will increase, being the converge of poverty, health issues, crime, chronic inequality. Inclusivity and sustainability are widely adopted goals, but practice remains difficult. However, this almost uncontrollable urbanization leads to self-organized settlements without any formal structured basic services. As reaction to this movement, the planning of 'New Towns' arises. However, these new towns and mainly the informal settlements and economy developed during time are badly performing on sustainability, resilience and adaptability aspect. Regarding the Sustainable Development Goals, number 11 in particular, this research tries to do an attempt to guide this situation to a more sustainable future.

By using the social, economic and resource systems of Dandora as case study, this project seeks to result in an urban planning and design framework for re implementation of circular concepts. This is meant as a guide for change, that aims to be an alternative within the current system, since it seeks to explore alternative sources of knowledge, both for urban design as for planning. The guide aims to guard the local cultural and social values in the urban system, as a necessary consideration for any plan of change that aims to be a long term solution that works for the people. It could provide the community a practical bottom up action framework towards development.



II. REFLECTION ON DESIGN OF ROADMAP

Considerations and limitations

CONTENT WISE

Waste, in all its forms, is a product of human and urban development (Zapata Campos & Hall, 2013) and, as cultural performance, is what defines how society is seen and who we are (Hawkins, 2006). As such, it also embodies ethical obligations that have close relation with individual habits, including social and cultural memory, and are responsible to create social identity (Hawkins, 2006). According to Hawkins, ethics are indispensable to develop "cultivated sensibilities that establish the range of possibilities in perception, enactment, and responsiveness" regarding waste (Hawkins, 2006). This becomes even more relevant considering that the current environmental pressures over climate change have generated shifts in governmental rules and societal waste practices. As Gay Hawkins continues to explain, these changes alter the relation between individual and waste and can be triggered by "moral injunctions" (enforcement of moral code based on the feeling of guilt); compulsory acceptance, (change in the system without leaving options for the citizen); and genuine individual consciousness (also associated with less altruistic reasons, such as social status) (Hawkins, 2006). From the governmental perspective, effective waste policies are only possible with the engagement of the population and their social context, especially considering their obstructive power (Zapata Campos & Hall, 2013).

Moreover, the political pressure over waste management (including solid waste and wastewater) allowed the emergence of public, private and hybrid organizations that also have economic interests and are regulated by its own market rules (Zapata Campos & Hall, 2013). Therefore, when discussing waste flows, urban planners and governments have to bear in mind that urban interventions and policies have impacts in social habits and affect ethical relations. These relations can be reflected either in situations such as waste separation in every day life or in the creation of waste infrastructures such as sewage treatment plants. However, they can also blind the individual from waste itself, endorsing repudiation and exemption (Hawkins, 2006), and, therefore, should be taken in account when putting forward new solutions.

ETHICAL

After the description of the research question, the conceptual framework, the analytical framework and the methods on how to answer these research questions, one has to considerate the limitations of this project. Since the time constraint of this graduation research is just 9 months, the scope of the project has been adjusted to that. This time limit sorts out that not every topic has been deepened out extensively and that high ambitions must be realizable.

Even more important is the reliability of the data. According to the data available on Internet, or made available by fellow researchers, one can make assumptions and in-depth knowledge insights. However, this will not be able to translate one to one to real life situation. Data in sub-Saharan context should be checked with the triangle method, gaining knowledge from three different perspectives. Due to the gap of data available online and the different situation in real life, makes it extremely difficult to make right assumptions.

Another important matter, is the authors own perspective. Since this is an European one, with no experience in living in the area of study, this could influence that ability of imagination or understanding of the complex situation. I am aware of my undeniable position of representative of Western vision and knowledge. Imposing the risk of 'appropriation of the future instead of proliferation of the information about it' (Escobar, 1995). For this reason, my intention is an attempt to understand the local context, culture and behavior and not as an attempt to impose a change by me bringing certain knowledge. Since doing research includes certain steps of knowledge translation, I consider my awareness of my own bias as importance.

Concerning the European and neo-liberal school of thought the Circular Economy derives from, the reflection on African context has to be critically considered. In general, the approach of doing research from a non-authentic background can be critiqued. Being aware of this fact, continuously considering my own perspective is of high importance. Apart from being aware of my own bias and perspective and about my position as Western researcher trying to retrieve knowledge, one should also be aware of the willingness of local people to make data, knowledge or insights available.

Considering the field visit of this research, I would like to express the hope to not conduct research in an 'extractive' way only, but I hold the intention to give something back to the community according to their local needs and suggestions. Also, the gathering of visual materials poses ethical questions. For using material or photographs, this should be in consultation and approval with the local inhabitants. Moreover, by capturing my findings in this research, I do not suggest that it provides a complete picture or full depth understanding of the local context.

II. REFLECTION ON DESIGN OF ROADMAP

Future recommendations

The conclusion of this thesis is - in a way - in line with the statements by Murray et al (2017). He pleas that real sustainability can only be achieved when making changes within the three pillars of our society: social, economic and environmental. These pillars should be the core of every circular urban solution that aspires to create a society dedicated to sustainability. This thesis proposed - based on the three pillars of the regional vision (Kenya 2030), a new pillar: the environmental one.

THE VALUE OF LOCAL TREATMENT

Theoretical research has made clear that new circular treatment methods on waste have economic value. However, this value is most of the time expressed in money and related to larger scale treatment facilities. As conclusion from the developed roadmap is that monetary value is not the only way of creating value. To create a more sustainable and circular society, small scale and local treatment of waste has a high value in creating awareness an showing benefit on a societal and environmental level. Changing the behaviour of the inhabitants by interfering in their daily habits, will support the transition towards a more circular city and future.

INVESTMENT IN INFRASTRUCTURE AND AN INNOVATIVE SYSTEM

In order to successfully achieve an implemented system, there should be a public investment in infrastructure for cargo-bikes in order to collect resources from the collection points. At the same time an investment in this new innovative system with separation bins and (colorful) durable waste bags has to be done collectively by public procurement and private partners. The sensor element is an additional element in the system, but as the current use of Mpesa, it is not an unthinkable step for the local community. To accurate estimate the chance of implementation, elaborated research is recommended.

MOTIVATING MEMBERS BY REWARDING AND COMPETITION

A critical aspect of the system is the incentive of member to participate. As the DTL-approach - later reinforced by PSN - learned us that competition activates inhabitants to join. To reward kids by bringing waste to schools, they and their parents have an incentive to do so. Competition could rise between schools, on their resource-collection-ratio. This ratio is based on the percentage of kids who bring separated waste to school weekly.

In order to make the reward system possible, the polluter-pays-principle should be revised. As the schools as resource hubs should be able to achieve economic benefits out of this.

SUPPORTING LOCAL INITIATIVES

As the main case study shows, the design of the roadmap is much focused on local based context and the local existing initiatives. It completes these with showing possible linkage with new functions. To elaborate on their opportunities on community scale, this should be acknowledged and supported by governmental institutions. It plees for a more local based approached, but at the same time to reconnect collectives by a digital network.

As understanding the local context deeply, the implementation of plans such as the proposed roadmap of this thesis include various insecurities. Understanding the necessity of a role-model as well the financial benefit for those with (very) low income, I do admit that these are barriers that need to be solved in order to secure successful implementation. The dependency of cooperation with a lot of stakeholders, gives another source of insecurity.

CONCLUSION

These recommendations contribute to achieving the set goals and create more value on multiple scales. Some recommendations require large investments and probably long term planning. Nevertheless, some recommendations can already be applied on a short term. Small scale local initiatives and the promotion of these initiatives in Nairobi do not require high investments or long term planning. On a small scale, first steps towards a more circular city and society can already be made. The roadmap has hands on and site specific guidelines for the locals. Ready to come into action!

Apart from the described insecurities and barriers, I do believe - as a researchers and as a person- that the first lighting of fire has been set

III. REFLECTION ON PERSONAL DEVELOPMENT AND LINKAGE STUDIO

This part of the reflection consists of a personal reflection on the provided work and the process during the graduation project. It reflects on the relation to the chosen research group and how an extension has been given to the research of my first mentor. Moreover it explains the way I developed as a researcher and as a designer, exploring a context I was unfamiliar with. Since I have set some personal goals at the beginning of this year, it is time to reflect on these as last remark.

Studio Linkage

My initial interest in Circular Economy proposed as a sustainable development strategy and the socio-environmental problems around fast urbanizing African cities has led me to dig deeper into both the body of theory that concerns circular economy as well into site specific characteristics of a New Town in the African continent.

The approach provided by the Complex Cities research group includes the combination of spatial, theoretical, and policy analysis, and supports a holistic view as an attempt to unravel the complexity of informal urban systems that I would need in order to understand those different interactions between dimensions and scales.

My graduation project is part of the Inclusive Cities of the Global South, which has the aim to 'understand and to propose feasible and realistic planning and design solutions at the regional and local levels that are realistic, sustainable, inclusive and embedded in local contexts.'

The studio provided the students a lot of freedom to explore fields you as researcher are most interested in, however, this also contributed to more complexity and less guidelines. Moreover, as I found it very interesting and more enlightening to learn from the other students' works, in my eyes a more organized way to make knowledge cross-over among the other studio members would have been fruitful.

Skills

During the process of research and designing I have learned conscious and unconscious new skills. At the start of this year, I formulated a set of things I wanted to learn. One of them was learning a new context, a context I was not familiar with. To me, the African continent, its' fast growing cities and even entire New Towns made me eager to elaborate more on it.

A more soft skill I - unconsciously- learned while doing field research, is interpreting situations in order to observe and gain insights from local people. Having active contact with stakeholders, living in a slum for over 10 days and co-create on ideas with local inhabitants even learned me to coop with a very various set of situations. In order to communicate my ideas, I sharpened the communication medium in such a way that the receivers would understand. An example is the workshop I gave to 26 teachers to explain Circular Economy. Finally, to summarize this experience, I reinvented another skill to myself by making a movie of the field trip.

Organizational skills I derived from helping during an international and inter-cultural event, the African Perspectives Conference at the University here in Delft. Setting up a student version in advance, contributed to knowledge exchange and awareness under new graduate students.

Tools

By the absence of data, I have learned to be creative with sources and to make assumptions based on empirical knowledge.

To organize semi-structured interviews and immediate reflect on them was a way of deriving stakeholder analysis from a real life perspective.

Specifically using GIS as tool to extract data on heights for the spatial plan, is a tool I developed during the last part of my project.

While doing research, I became more effective in prioritizing which information was necessary and which was not. This was another skill I wanted to improve. By making deadlines for myself and setting an agenda for every meeting, I tried to increase conciseness for myself and my mentors. This would still be a point I need to work on.

Values

Progressing from the research towards the design part, I knew that I value 'social equality' high as a person but also as a designer. Remarkable for me was to notice my growing attention to ecological values. More and more the landscape and ecological aspect of the river became important to me. In order to keep alive the local flora and fauna, I have dug deeper into phyto-remediaton processes, the types of soil and types of plants growing during seasons in this context.

Moreover, as main lessons learned while imagining opportunities of solutions, I would consider the appreciation of local values, needs and cultural embedded habits. Applying theory and analysis respecting the local context, has a clearly high value for me. Understanding the societal, socio-economic but moreover the planning context of an area deserves serious attention. This became obvious to me while interviewing an authority in the National Treasury of Nairobi, who explaining to me that I should understand the planning system completely and than could come back.

That was not the only lesson learned by the above experience. Being a white European woman in that office and being treated like that, gave me - apart from the hardcore lessons on the streets of Nairobi - another insight in my value of equality.



Picture : Authors' own image

VIII.

APPENDIX

i. Historical analysis
    i. History of Nairobi
    ii. History of Dandora
    iii. History of Placemaking Lab 2015
ii. DTL social media update
iii. Governance elaboration
iv. spatial problems
v. river restoration plans
vi. best practices example
vii. field trip summary
ix. workshop teacher 18th february
x. procedural interventions extra
xi. Theory Chapter

< picture: creative cloud - Ben White 2016

I. HISTORY OF NAIROBI

The history of Nairobi has been drawn and described by former urbanism student Eva Labrujere as follow:

Nairobi was created as a direct result of colonisation by the British Empire. It was designated as a railway town for the KUR (Kenya Uganda Railway) in 1899. By 1900 the town had a population of 8000 and consisted of 18 square kilometers of land. (Nicholls, 2005)(Baliga, 2005). The new settlement was named 'Enkare Nairobi', Maasai for "a place of cold waters" (Obudho, 1997). The strategical location offered to act as collecting centre and distribution point, in between the coastal city of Mombasa and the highland regions of Kenya (Mathenge, 2008) and to the present day Kisumu part of what is now Uganda (Mitullah, 2003).

p.19
the British government believed in the British 'garden city' model; they had interest in keeping African wages low; wanted to segregate the African living areas from the European ones; and had the desire to ensure a standard of public health among African population to prevent outbreaks of infectious diseases...

p. 20
While the growth continues, the city deals with a lack of adequate urban planning. For many years Nairobi has not invested in developing a long term, integrative master plan and according policies for effective urban planning and improvement to guide the city's expansion (Mutisya and Yarime, 2011). The plan of 1973 was never really implemented (Obudho, 1997) and officially it expired in the year 2000 (Nairobi Metro 2030, p.7).

Anyamba (2011) argues that the inherited planning and housing policies were unable to cope with the scale and speed of the population boom which occurred after independence.

Currently the city shows many constraints on keeping up the supply of and improvement of housing and urban services, as the housing provision by the formal sector is inadequate.

The disrupted market also indicates how power imbalances between slum dwellers, landlords and public officials give way to illegal allocations of land as public officials use land as a political tool to reward their followers (Mwangangi, 2014).

p.21
Combined with the continuous increase of population, the conditions to proliferate informal settlements are set (Baliga, 2005). Which today have culminated in a continuous growth of number, size and density of informal settlements (Olima, 2001), in which currently more than half of the population of Nairobi lives.

p.22
The people living in the north-west and western suburbs are generally the more affluent (once occupied by the Europeans, now inhabited by the national elite and expatriates (Boniburini, 2015), where the spatial characteristics reflect and express capitalism and western culture.

(Labruejere, 2018)

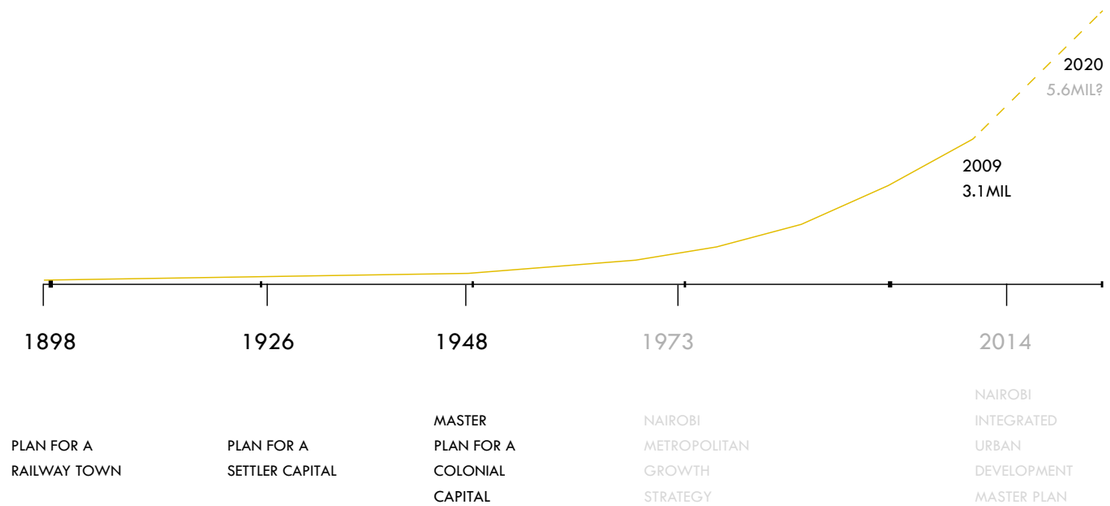


Figure 1: Graph by Eva Labrujere

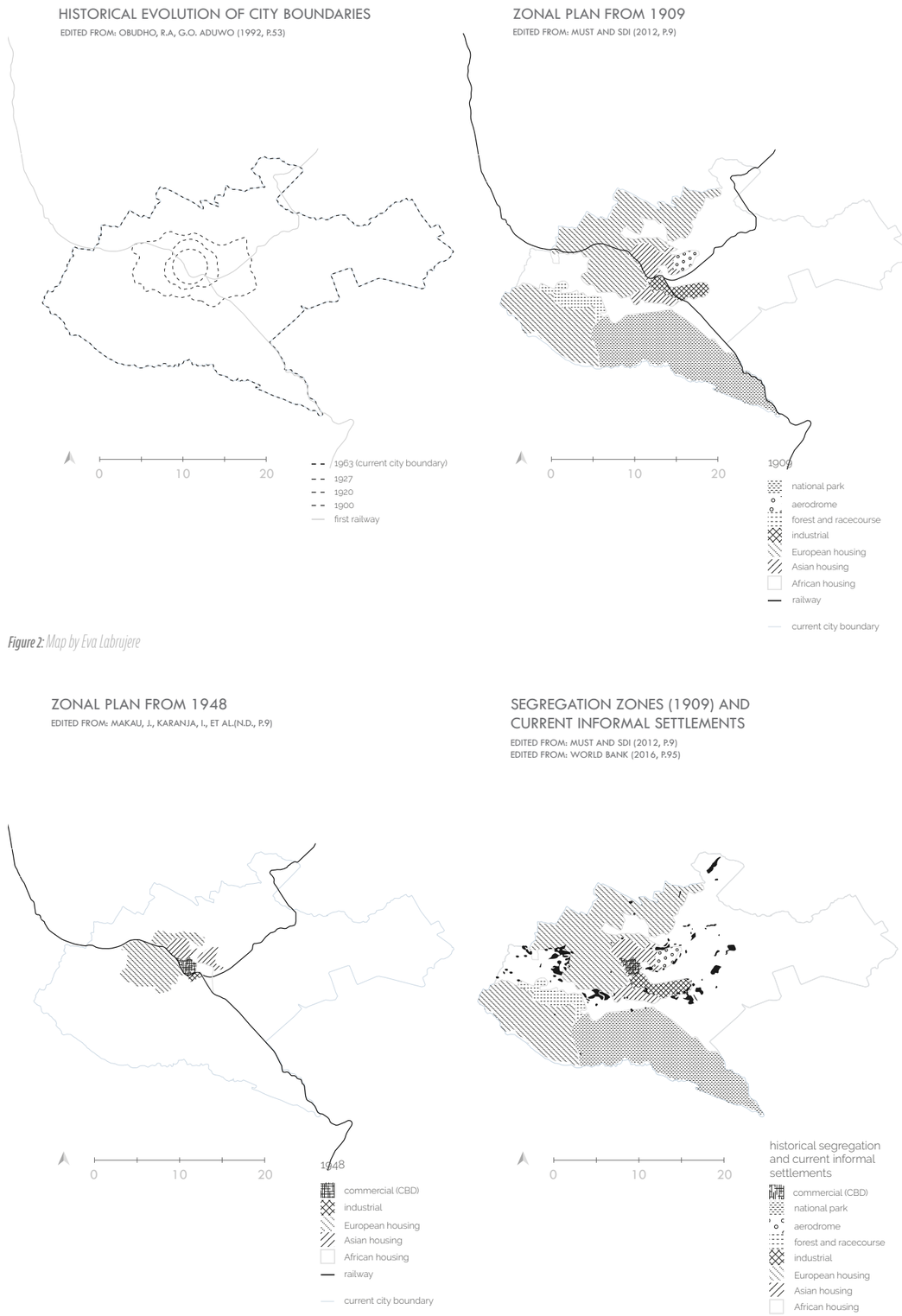


Figure 3: Map by Eva Labrujere

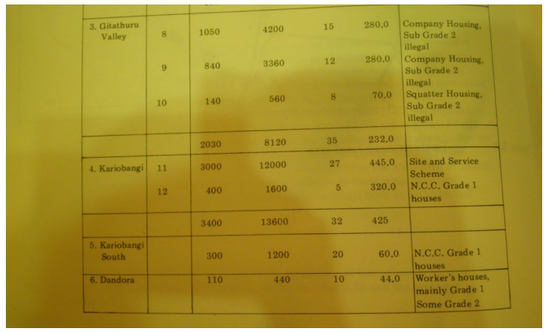
I. ELABORATED HISTORY OF DANDORA

The Metropolitan Growth Strategy has been researched by the Nairobi Urban Study Group, commissioned by the Town planning section of the NCC together with the UN. The original documents reveals a couple of remarkable facts about Dandora. For example in figure 13 shows the existing amount of houses in Dandora in 1977, which was 110 units for mainly workers. The document marks the area of Dandora as an excellent industrial location. It has large vacant areas of flat land with direct access to two main roads and a railway. Illustrating this by the original map of Dandora with its main roads, waterways, railway and electricity lines. However, already in this document some constraints are marked around the area, like unacceptable aircraft noise levels and the possible contamination of the river water by industry.

As follow up on the first strategy, the second MGS includes recommendation for urban expansion. In figure 14 one can see the recommended strategy in 1979, where Dandora is included.

In figure 16 the alternative strategy is mapped as the NCC sees Dandora as potential area for expansion for very low income inhabitants and 'nursery' industry. Their vision was to employ people here with a prediction between 16.000 and 18.000 for the area of Dandora.

Another study, so-called 'Dandora monitoring and evaluation study', explains about the existing dwelling situation, does policy implications and analyses the current state in 1977. It addresses the constraints and difficulties of specific plot types. For instance, Plot A has problems with the temporary shelters already in place. The documents explains three different scenario's to deal with this problem. As experimental component, dealing with innovative and environmentally effective approaches to community development for future human settlements in Nairobi and other urban centres in the country. The aims of this proposal was to explore possible formats for implementing the various sub-components. Remarkable is the fact that the component c. waste management, described as: methods of using human, animal and solid waste and water waste as productively through suitable processing e.g. for compost, energy, building material and irrigation, has been crossed with pencil. However, the document concludes in the summary that this experimental sub-component could be feasible in terms of economic development, managing and monitoring.



3. Gitathuru Valley	8	1050	4200	15	280,0	Company Housing, Sub Grade 2 illegal
	9	840	3360	12	280,0	Company Housing, Sub Grade 2 illegal
	10	140	560	8	70,0	Squatter Housing, Sub Grade 2 illegal
		2030	8120	35	232,0	
4. Kariobangi	11	3000	12000	27	445,0	Site and Service Scheme
	12	400	1600	5	320,0	N.C.C. Grade 1 houses
		3400	13600	32	425	
5. Kariobangi South		300	1200	20	60,0	N.C.C. Grade 1 houses
6. Dandora		110	440	10	44,0	Worker's houses, mainly Grade 1 Some Grade 2

Figure 5: Table 3.20 Ruaraka - Dandora housing and population in 1977 - original map photograph, retrieved from Pauline Bezemer.

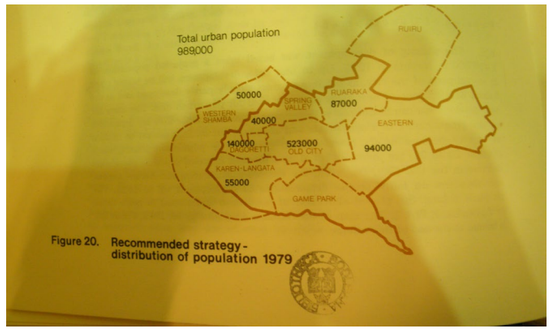


Figure 7: Map MGS, figure 20 is the Recommended strategy - distribution of population 1979 - original map photograph, retrieved from Pauline Bezemer.

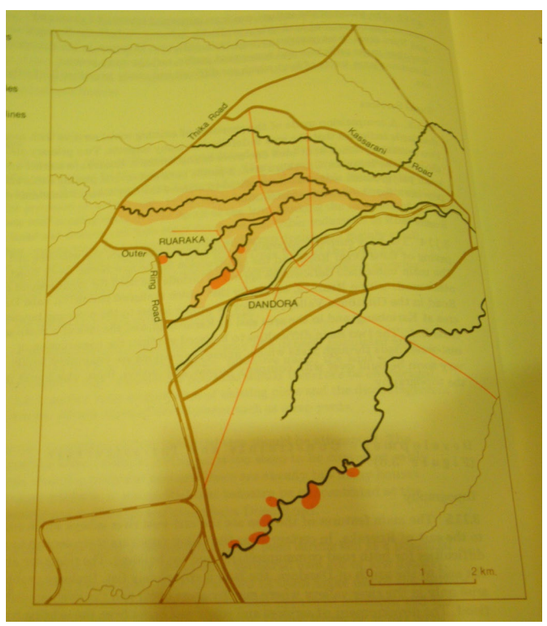


Figure 6: Map MGS, figure 20 is the Recommended strategy - distribution of population 1979 - original map photograph, retrieved from Pauline Bezemer.

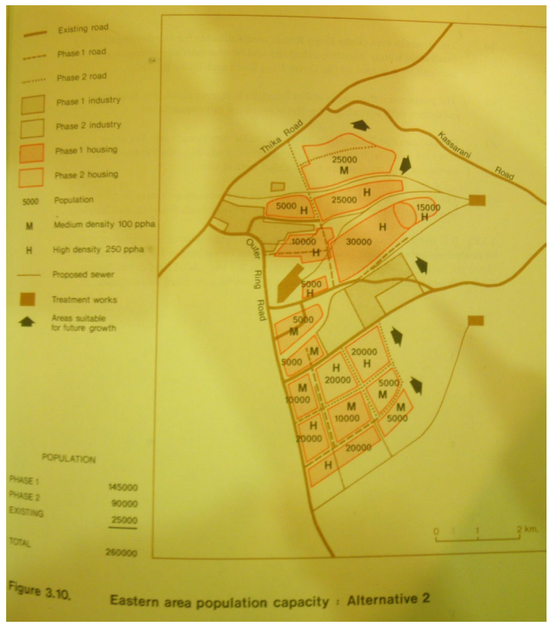
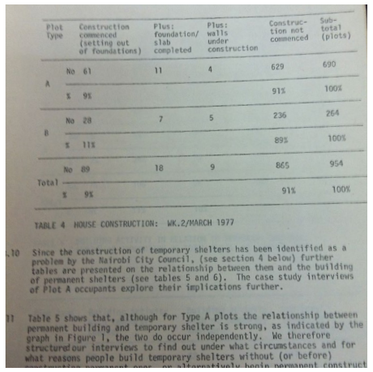


Figure 8: Eastern area population capacity; alternative 2. MSG 2 - orginal map photograph, retrieved from Pauline Bezemer.



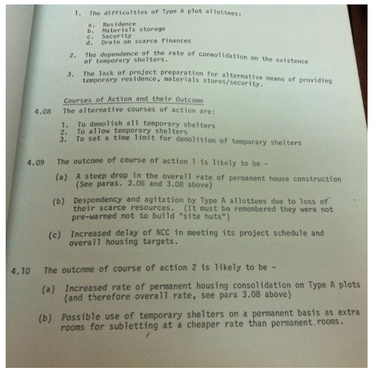
Plot Type	Construction commenced (setting out of foundations)	Plus: foundation/ slab completed	Plus: walls under construction	Construction not commenced	Sub-total (plots)
A	No 61	11	4	629	690
	% 9%			91%	100%
B	No 28	7	5	236	264
	% 11%			89%	100%
Total	No 89	18	9	865	954
	% 9%			91%	100%

TABLE 4 HOUSE CONSTRUCTION: WK.2/MARCH 1977

4.10 Since the construction of temporary shelters has been identified as a problem by the Nairobi City Council, (see section 4 below) further tables are presented on the relationship between them and the building of permanent shelters (see tables 5 and 6). The case study interviews of Plot A occupants explore their implications further.

Table 5 shows that, although for Type A plots the relationship between permanent building and temporary shelter is strong, as indicated by the graph in Figure 1, the two do occur independently. We therefore structured our interviews to find out under what circumstances and for what reasons people build temporary shelters without (or before)

Figure 9: Plot allocation and percentages of construction - Dandora Monitoring and evaluation study 1977.



1. The difficulties of Type A plot allottees:
   a. Residence
   b. Materials storage
   c. Security
   d. Drain on scarce finances
2. The dependence of the rate of consolidation on the existence of temporary shelters.
3. The lack of project preparation for alternative means of providing temporary residence, materials stores/security.

Courses of Action and their Outcome

4.08 The alternative courses of action are:

1. To demolish all temporary shelters
2. To allow temporary shelters
3. To set a time limit for demolition of temporary shelters

4.09 The outcome of course of action 1 is likely to be -

(a) A steep drop in the overall rate of permanent house construction (See paras. 3.06 and 3.08 above)

(b) Despondency and agitation by Type A allottees due to loss of their scarce resources. (It must be remembered they were not pre-warned not to build "site huts")

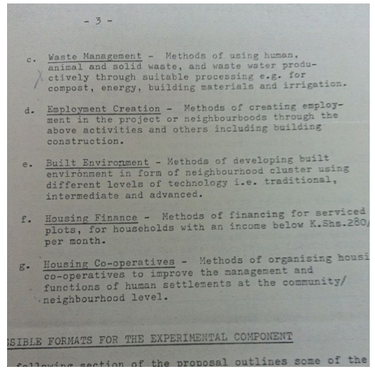
(c) Increased delay of NCC in meeting its project schedule and overall housing targets.

4.10 The outcome of course of action 2 is likely to be -

(a) Increased rate of permanent housing consolidation on Type A plots (and therefore overall rate, see para 3.08 above)

(b) Possible use of temporary shelters on a permanent basis as extra rooms for subletting at a cheaper rate than permanent rooms.

Figure 11: Explanation of difficulties and courses of action and outcome - Dandora Monitoring and evaluation study 1977.



- 3 -

c. Waste Management - Methods of using human, animal and solid waste, and waste water productively through suitable processing e.g. for compost, energy, building materials and irrigation.

d. Employment Creation - Methods of creating employment in the project or neighbourhoods through the above activities and others including building construction.

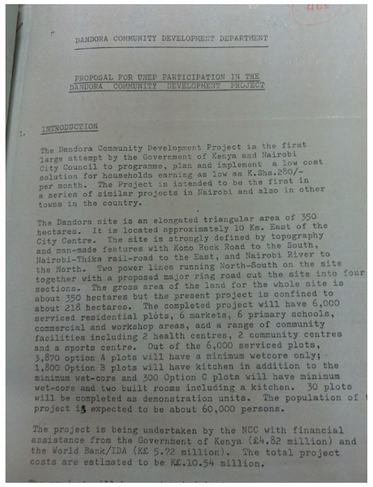
e. Built Environment - Methods of developing built environment in form of neighbourhood cluster using different levels of technology i.e. traditional, intermediate and advanced.

f. Housing Finance - Methods of financing for serviced plots, for households with an income below K.Shs.280/ per month.

g. Housing Co-operatives - Methods of organising housi co-operatives to improve the management and functions of human settlements at the community/ neighbourhood level.

ISIBLE FORMATS FOR THE EXPERIMENTAL COMPONENT

Figure 13: Subcomponents of the experimental component - Dandora Monitoring and evaluation study 1977.



DANDORA COMMUNITY DEVELOPMENT DEPARTMENT

PROPOSAL FOR UNEP PARTICIPATION IN THE DANDORA COMMUNITY DEVELOPMENT PROJECT

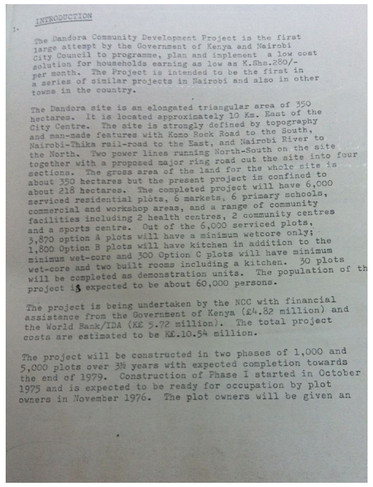
INTRODUCTION

The Dandora Community Development Project is the first large attempt by the Government of Kenya and Nairobi City Council to programme, plan and implement a low cost solution for households earning as low as K.Shs.280/- per month. The Project is intended to be the first in a series of similar projects in Nairobi and also in other towns in the country.

The Dandora site is an elongated triangular area of 350 hectares. It is located approximately 10 Km. East of the City Centre. The site is strongly defined by topography and man-made features with Komo Rock Road to the South, Nairobi-Thika rail-road to the East, and Nairobi River to the North. Two power lines running North-South on the site together with a proposed major ring road cut the site into four sections. The gross area of the land for the whole site is about 350 hectares but the present project is confined to about 218 hectares. The completed project will have 6,000 serviced residential plots, 6 markets, 6 primary schools, commercial and workshop areas, and a range of community facilities including 2 health centres, 2 community centres and a sports centre. Out of the 6,000 serviced plots, 3,870 option A plots will have a minimum wetcore only; 1,800 Option B plots will have kitchen in addition to the minimum wet-core and 300 Option C plots will have minimum wet-core and two built rooms including a kitchen. 30 plots will be completed as demonstration units. The population of the project is expected to be about 60,000 persons.

The project is being undertaken by the NCC with financial assistance from the Government of Kenya (£4.82 million) and the World Bank/IDA (KE 9.72 million). The total project costs are estimated to be KE.10.54 million.

Figure 10: Introduction - Dandora Monitoring and evaluation study 1977.



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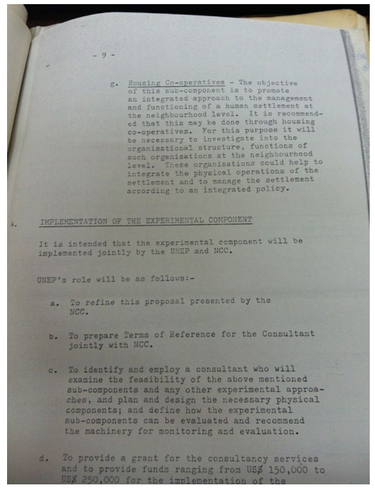
The project will be constructed in two phases of 1,000 and 5,000 plots over 3½ years with expected completion towards the end of 1979. Construction of Phase I started in October 1975 and is expected to be ready for occupation by plot owners in November 1976. The plot owners will be given an

Figure 12: Introduction part 2- Dandora Monitoring and evaluation study 1977.



- 9 -

g. Housing Co-operatives - The objective of this sub-component is to promote an integrated approach to the management and functioning of a human settlement at the neighbourhood level. It is recommended that this may be done through housing co-operatives. For this purpose it will be necessary to investigate into the organizational structure, functions of such organizations at the neighbourhood level. These organizations could help to integrate the physical operations of the settlement and to manage the settlement according to an integrated policy.

IMPLEMENTATION OF THE EXPERIMENTAL COMPONENT

It is intended that the experimental component will be implemented jointly by the UNEP and NCC.

UNEP's role will be as follows:-

a. To refine this proposal presented by the NCC.

b. To prepare Terms of Reference for the Consultant jointly with NCC.

c. To identify and employ a consultant who will exazine the feasibility of the above mentioned sub-components and any other experimental approaches, and plan and design the necessary physical components; and define how the experimental sub-cosponents can be evaluated and recommend the machinery for monitoring and evaluation.

d. To provide a grant for the consultancy services and to provide funds ranging from US$ 150,000 to US$ 250,000 for the implementation of the

Figure 14: Evaluation of subcomponents of the experimental component - Dandora Monitoring and evaluation study 1977.

I. ELABORATED HISTORY OF DANDORA

The official development plan for the community site and services scheme of 1973, written by the Nairobi City council, states the community facilities in Dandora as planned on page 34, as well the planned phasing on page 35. Both of these plans did not succeed entirely in reality. The same applies for the plans on page 50, describing the requirements for the facilities. It explicitly marks the extra fees for 'refuse collection' according to the city council. Remarkable is the strategy as described on page 67 of working with 'demonstration houses', to overcome unskilled labor to construct the more than 6,000 planned housing units.

II.9 Community Facilities

Land has been allocated for sufficient facilities (primary and secondary schools, day nurseries, health centres, social halls, commercial and industrial areas and recreational space) to accomodate the demands of up to 70,000 people (the maximum 60,000 on the site and service and possible additional 10,000 on plots reserved for middle-income housing).

The school sites are located in the central spine, and thus within easy walking distance of every plot . Space has been allocated for 100% of potential primary school children (requiring nine schools), and for about 40% of potential secondary school sites would be the responsibility of the City Council's Parks Department and maintained as open space.

Sites have also been allocated for day nurseries, some of which would be run by the City Council and the remainder would be developed by private individuals or companies, or by self-help (harambee) groups.

On the basis of the standards of the City Council's Medical Officer of Health, three health centres will be provided. One, with a maternity wing, will be locatad in the main commercial centre; and the other two will be in the central spine, providing a maternity and child welfare clinic and dispensary.

A single major community cnetre is planned, also including offices for social workers, community development staff and other officers working in the area. The plan, too, allows for three social halls.

The Dandora main commercial centre, containing shopping and office space, health and community centre, major markets, a bus station and administrative centre, would be laid out according to a Part Development Plan (sectional plans prepared by the responsible authorities) and private developers would then lease sites from the Commissioner of Lands and/or the City Council.

The employment opportunities will be provided chiefly on the planned areas in Dandora and Ruaraka Industrial Estates.

The greater part of the demand for playing fields will be met by the use of school fields outside school hours. In addition, there will be one playing field adjacent to the Community Centre, and one field of two pitches within the central spine.

Playgrounds with specialised equipment will be located at the social halls and community centres; and some within the residential areas adjacent to the nursery school sites. It is also suggested that the landscape treatment of the public walking areas within the site and service areas provide opportunities for imaginative play, small ball games and areas of rest and relaxation.

The land sloping down to the valley in the north presents difficulties for housing development. It is therefore suggested that the fertile parts of this land be developed as multi-shambas. People within the area could be allocated a small plot which they could cultivate. They would pay a small rent for this which would cover the costs of fencing. Like the other social commercial and industrial facilities, the use of the shambas will remain under the control of the existing departments of the City Council.

II.10 Phasing

The plans of Exhibit .... indicate the phasing of development, with 1,000 serviced plots being provided in the first year, 2,000 in the second year, and 3,000 in the third year of development.

The southern trunk sewer will serve Areas 2, 4 and 6; and must be completed not later than 1½ years after the allocation of the first plots in the project. The northern trunk sewer will serve Areas 3, 5 and 7; and must be completed not later than 2½ years after the first allocation. The Sewage Treatment Works must be completed at the same time as the southern trunk sewer.

- 50 -

Recurrent costs

Item	Total		N.C.C.		Government	
	High	Low	High	Low	High	Low
	£	£	£	£	£	£
A. Land	29,400	24,060	29,400	24,060	-	-
B. Infrastructure - Maintenance. etc.	70,000	47,450	14,650	16,450	-	-
Water, sewerage & refuse collection	69,600	69,600	-	-	-	-
D. Community Facilities	948,500	492,500	408,500	357,500	140,000	135,000
F. Management & Admin.	60,000	60,000	-	-	-	-
Annual Recurrent Costs	777,500	633,610	452,550	398,010	140,000	135,000

Of the component items which constitute the annual recurrent costs, those on land have been discussed previously (see pp .). The small sum charged to the City recurrent budget under the heading of maintenance represents the annual costs of upkeep of bus routes and secondary roads which, when they exceed certain standards, become the responsibility of the City Engineer. Also, the City has customarily borne a small excess charge for refuse collection over and above the fee collected.

The sum shown under water, sewerage and refuse collection is based on the assumption that the administration of the Project will be able to obtain a special low rate for bulk water supply from the Water and Sewerage Department. As things stand now, the minimum charge of about 21 shillings monthly per plot on which the figure in the table is based, presupposes a maximum consumption of water of 1,800 gallons per month and per plot. Inasmuch as this implies no more than 8 gallons per day, per person, it would seem to be an untenably low figure, even though the administration could control the overall flow of water and perhaps its pressure. It is for that reason that we have argued earlier that either the minimum rate would have to be lowered or the maximum water supply under the minimum rate increased. We estimate that if the minimum charge (8 shillings per month for water, 8.50/= for sewerage and 4.50/= for refuse collection) could be negotiated to cover a maximum supply of 3,000 gallons per month per plot, this would enable the Project administration to maintain an adequate flow of water to the plots at most times. By insertion of water charges into the structure of payments for the plots, we ensure not only that the collection is more efficient but also that adequate sanitary standards obtain throughout the site.

- 67 -

We propose, therefore, that the initial plans for the available house types be submitted for approval to the Building Inspector as soon as these plans are approved by the Director of the SSDU. Henceforth, the Unit's personnel will certify that the completed structures conform to the plan chosen and that they have been completed according to specifications. The Building Inspector will accept such certification as a matter of routine, but will reserve the right to make ad hoc and spot inspections with the adjoint right to impose fines on the SSDU in the event of non-compliance.

Demonstration Houses

It will be recalled that while we would expect that most structures will be erected by the plotholders themselves, with the aid, if need be, of friends and relatives, we also allow for the construction with the help of funds, or by groups set up for the purpose, (the existence of these alternatives will slightly complicate the control of the access to the site in the interim period but we do not expect great difficulties on that score).

In order to make possible the erection of houses by unskilled labour we make provision for technical assistance on the site, loan of materials and distribution of tools and other aids to construction. In addition, we also propose to build a number of complete houses for demonstration purposes, embodying various types and comprising varying number of rooms. This poses two distinct administrative problems. One, how to allocate the plots containing these demonstration houses and, two, how to charge for them?

We suggest that the demonstration houses (those which will not be used for administrative purposes and, perhaps, for certain community purposes) be set aside from the regular allocation process and reserved for disposal after the interim period is over. In the meantime, they could serve as temporary quarters of the technical assistance staff, as dormitories for those plotholders who choose to stay on the site overnight and for similar purposes. After most of the plots are built up, the demonstration houses will be offered to those who:

1. are willing to pay monthly charges substantially greater than those required of the regular plotholders. This implies that these houses and plots need not be confined to the target population households, hence priority should be given to those who in addition of conforming to (i), also

I. HISTORY OF DANDORA

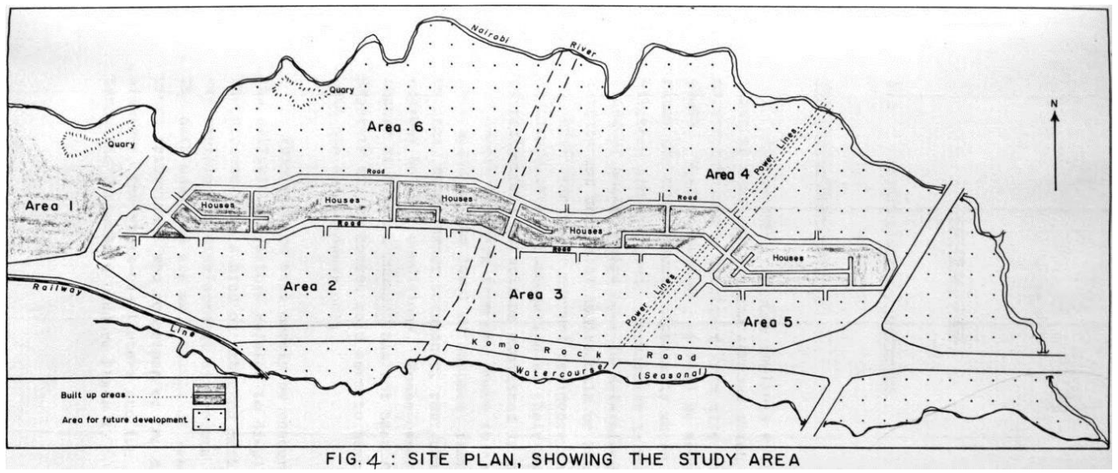


FIG. 4 : SITE PLAN, SHOWING THE STUDY AREA

BASED ON RESEARCH ANNA TEHLOVA

Dandora was planned for 6000 residential plots of 100 to 160 m2 each. Five phases of Dandora were planned to contain between 30 000 to 60 000 people. The allotees had to comply with number of criteria to be eligible for a plot: household's monthly income of the applicant had to be between KES 280 and 65021, the applicant had lived in Nairobi for at least two years and did not own any property in Nairobi. Over 25000 people applied for 6000 available plots, among them also people with higher incomes than the first criteria required (Wainaina, 1986). (Tehlova, p. 21)

Displacement of Initial Allottees

Nevertheless, the project failed to meet planned outcomes: within ten years after the commencement of the Dandora project, a half of original allottees sold their plots and moved away because they did not manage to repay the loan as repayment conditions were not adapted to their level of income (Wainaina, 1986; Owuor & Mbatia, 2012). New incoming residents were generally more educated with a slightly higher income: in 1980s, monthly income of most of Dandora residents was between KES 801 and 1501. Therefore, it appears that the project was more adapted for a lower middle class rather than for the urban poor who were initially targeted. Until nowadays, Dandora residents can qualify the best to what we call floating23 and lower middle class, living above the poverty line.

Initially, one plot was designed for one family however, very soon, the allottees started to sublet rooms within their plot to earn an income from their property. By 1983, 96% of Dandora residents were subletting a room (Wainaina, 1986). In one plot, instead of one expected family, now lived three families. Nevertheless, a such level of over-crowdedness had to be tolerable for allotees who, most of them, previously lived with two other families within one room in the rental housing or in informal settlements of Mathare, Kibera, Korogocho and others (Waweru, interview, 2017)

With the mushrooming of multi-story buildings offering housing for up to 100 families within one plot, population density in the neighborhood soon exceeded severalfold the set target of the initial project: nowadays, Dandora population is 141885 (Kenya Open Data, 2017).

Lack of social cohesion and deterioration of the site

Negative perception and the absence of the sense of ownership of the project by new residents led to further deterioration of the area. Infrastructure built at the beginning of the project was not maintained: street lighting, present in all streets at the beginning of the project, disappeared by 1985: the electric poles were stolen to be resold. To this date, street lighting is still missing and drainage disappeared under layers of rubbish: "There used to be a drainage everywhere in Dandora [...] then, it was abandoned and the drainage disappeared under the layers of dust and waste. But when you dig, you find the drainage system again" (Gachanga, discussion, 2017).

Reputation

No Nairobian from outside Dandora, and yet least a foreigner, would step in Dandora few years ago (Otieno, interview, 2017). Despite being a formally planned estate, it has often been referred to as a slum, as result of its streets and open spaces full of litter and poor drainage that has disappeared under layers of soil and waste after not being maintained for decades. Moreover, the presence of the dumpsite contributes to its reputation of a dirty space.

The Dumpsite

Covering an area of 30 acres, Dandora dumpsite is one of the largest unregulated landfills in the world (Barczak, 2015). Opened in 1975, it was supposed to be closed by 1990, according to international environmental laws. In 2001, Nairobi City Council declared the landfill to be full, however yet nowadays, 2000 tonnes of waste are being dumped each day to the site (Mills, 2016). Already in 1970s when the Dandora Site and Service Scheme was initiated, there were plans for relocations of the landfill (Waweru, interview, 2017).

However, this has never happened and the Dandora dumpsite has remained the only landfill in Nairobi where all the waste25 of the Nairobi county has been dumped. The relocation of the dumpsite is a highly political issue and violent conflicts involving gangs fighting for the control over the dumpsite and the income that it generates yet complexify the decision making in this regard. Furthermore, many people – apart from gangs - living around the dump site make their living as waste pickers26 and do not want dump site to move away. Other residents of the surrounding areas who do not work at the dump site would like the landfill to be relocated (Andersson, interview, 2017).

Risks of the dumpsite

Environmental risks are well present: burning, used to reduce the amount of waste, causes high rates of air pollution, releasing toxic substances in the air. Soil pollution is also critical: high levels of heavy metals27 were found in soil surrounding the landfill. Water pollution is equally serious: Nairobi river is contaminated as it runs alongside the dumpsite. Since Nairobi river flows into the Indian Ocean, the environmental impacts are likely to exceed the local scale (Barczak, 2015).

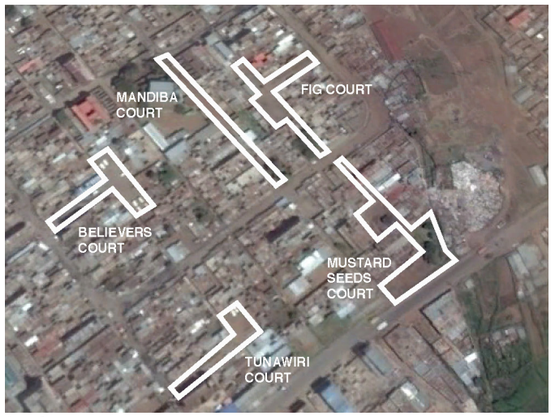
Environmental hazards cause number of serious health risks that have been demonstrated (UNEP, 2007, see annexe 14): about 50% of children living and schooling near the dumpsite, who were examined, had respiratory disorders and high presence of lead, equal to toxic levels, in blood. 30% of examined children had abnormalities of red blood cells as result of heavy metal poisoning. Other health hazards that are more prevalent among people living around the dumpsite include skin disorders, abdominal and intestinal problems, central nervous system disorders, chicken pox, lung cancer, septic wounds or genital abnormalities (Ogola & Moschetti, 2009).

I. HISTORY - PLACEMAKING LAB 2015

To understand the work done by the Placemaking design Lab in 2015, the original document retrieved by Simone Rots highlights the following figures:



Figure 74: Existing courts - Placemaking Lab 2015



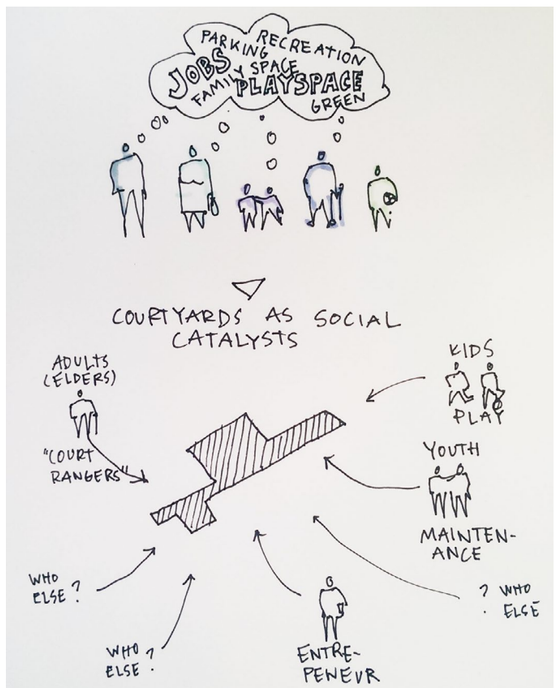
Source: Placemaking Lab 2015 - the rising courts

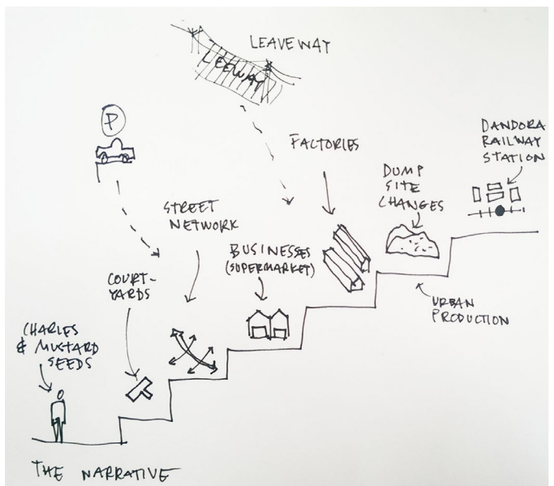


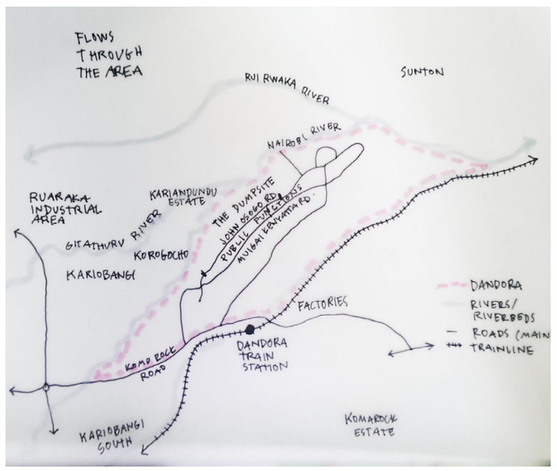
Source: Placemaking Lab 2015 - the potential courts



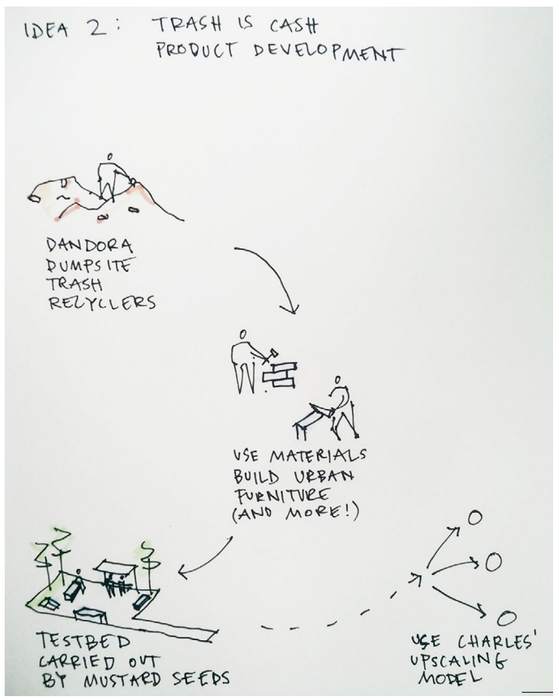
Source: Placemaking Lab 2015 - The Leaveway











II. SOCIAL MEDIA UPDATE DTL

Highlight of recent social media updates by Dandora Transformation League to illustrate the way the reach out to their youth and try to engage with their public at this moment.

Public Space Network
2 uur ·

#BadilishaNairobi
The first Nairobi-wide edition of Changing Faces Competition is in full swing! 136 teams have adopted small scale public open spaces all over Nairobi and started transforming them into clean and safe community places. They have until end of January to complete their transformations.

As the team Komb Green from Korogocho demonstrates, often the whole community from the smallest ones is involved in the transformation!

You can visit our online portal www.cfcnairobi.org to see who the teams are and what spaces they are working on! (Note that some of the 136 teams still need to finalize their online registrations to be visible to the public.)

UN-HABITAT The Aga Khan University East Africa Institute Kenya Green Building Society - KGBS Campus Radio Kenya Architectural Association of Kenya Nairobi Design Week PAWA 254 Mike Sonko. Kenya Association of Manufacturers Diamond Trust Bank Onestop Youth Centre - Nairobi Nairobi County Youth Network Nairobi County Government Dandora Transformation League Naipolitans: Urban Enthusiasts Getting Together



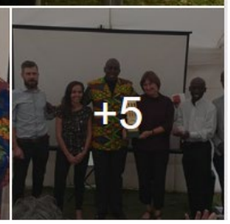
Dandora Transformation League is met Anna Těhlová en 5 anderen.
4 december om 07:29 ·

Yesterday we were honoured to host delegates from Block by Block and UN-HABITAT who were impressed with the work being done by youths from Dandora in transforming public spaces and making our neighbourhood habitable and inclusive to all.









Dandora Transformation League is met Anna Těhlová en 9 anderen.
4 december om 15:13 ·

It was not only presentation but evidence of what has been done on ground.

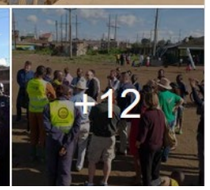
The delegates from Block by Block and UN-HABITAT got to visit some courts, the way leave and we all finished at the colorful floating zebra crossing-The first in Africa.

Our motto remains "If You Can Change Dandora, You Can Change Nairobi, Change Kenya and Change Africa at large"









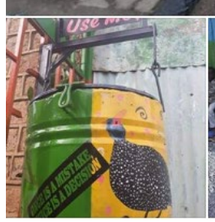
Dandora Transformation League
29 oktober om 16:58 ·

Litter and illegal dumping have environmental, social and economic effects to our society.

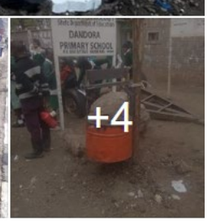
After the street clean up in phase 1 we put 8 litter bins to ensure there is right disposal pf waste and sustainability in terms of waste management in the street.

We will paint the litter bins,include environmental quotes and add color to make them attractive, the same way we did in phase 2 street.









Dandora Transformation League
6 uur ·

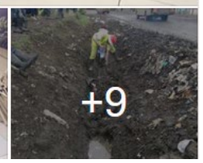
This week we took placemaking activities to another level. H. E Mike Sonko. took the initiative to support the youths from Dandora who have volunteered for long in doing clean ups and beautification in their immediate areas.
He provided the youths from Dandora with tools, Gumboots and reflectors for them to make Dandora cleaner, greener and safer.

The work began on Monday and within three days a lot has been done by the committed and passionate youths. We are creating the Dan...
Meer weergeven









Dandora Transformation League
26 oktober om 14:49 ·

We not only cleaned the street but put up litter bins to improve waste management along the street.
We will paint them to make them colourful .
As responsible citizens, we should put trash in its place.

Be a part of the solution not the pollution.

#badilishamtaa









Dandora Transformation League heeft een livevideo gedeeld.
30 november om 13:39 ·

Proud of the youths who have reformed and are now engaging in produc work in making our spaces clean, green and safe for all to live in.
Nairobi will indeed be the green city under the sun.
Kudos our teams for the efforts put today!!

#formnikureform
#safespacesforall



2.262 weergaven

Mike Sonko. was live.
30 november om 13:25 ·

Pagina leuk vinden

Ongoing clean-up of Nairobi River by youth groups from Dandora and Korogocho, were issued with cleaning materials yesterday by the Nairobi City County Gover...
Meer weergeven

Dandora Transformation League
30 september ·

The youth in Dandora have taken the initiative to clear up the #solidwaste dumped in our public spaces and converting them to clean and green spaces.

#WorldHabitatDay
#UrbanOctober
#Wastewisecities









III. PRELIMINARY RESULTS
WASTE FLOW DIAGRAM NAIROBI IN PHASES

2.1 What are the current waste management practices on household, court and town level?

SQ 2.1

Current processes + metabolism

This process shows the different stages from manufacturing to waste disposal in specifically Nairobi and related to the Dandora Dumpsite. Maps are made by retrieving data from GIS.



Figure 79: Manufacturing process at KAM in Nairobi - Authors' map - scale 1:300.000

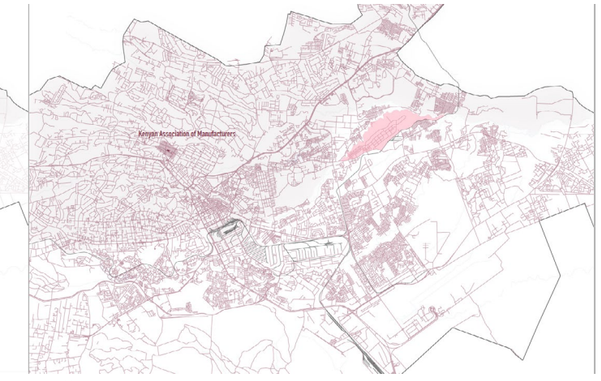


Figure 80: Distribution process around Nairobi - Authors' map - scale 1:300.000

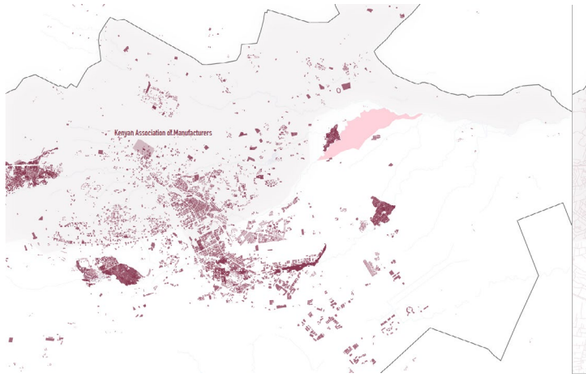


Figure 81: Consumer phase squatterend around Nairobi - Authors' map - scale 1:300.000

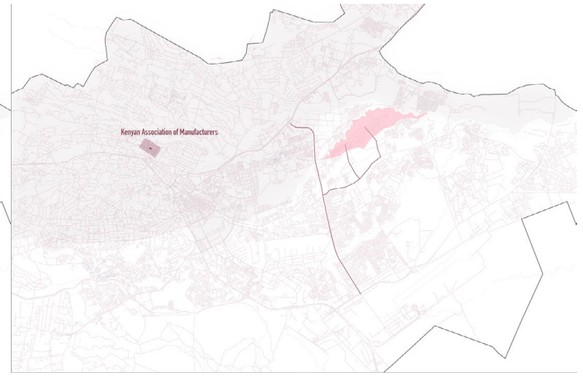
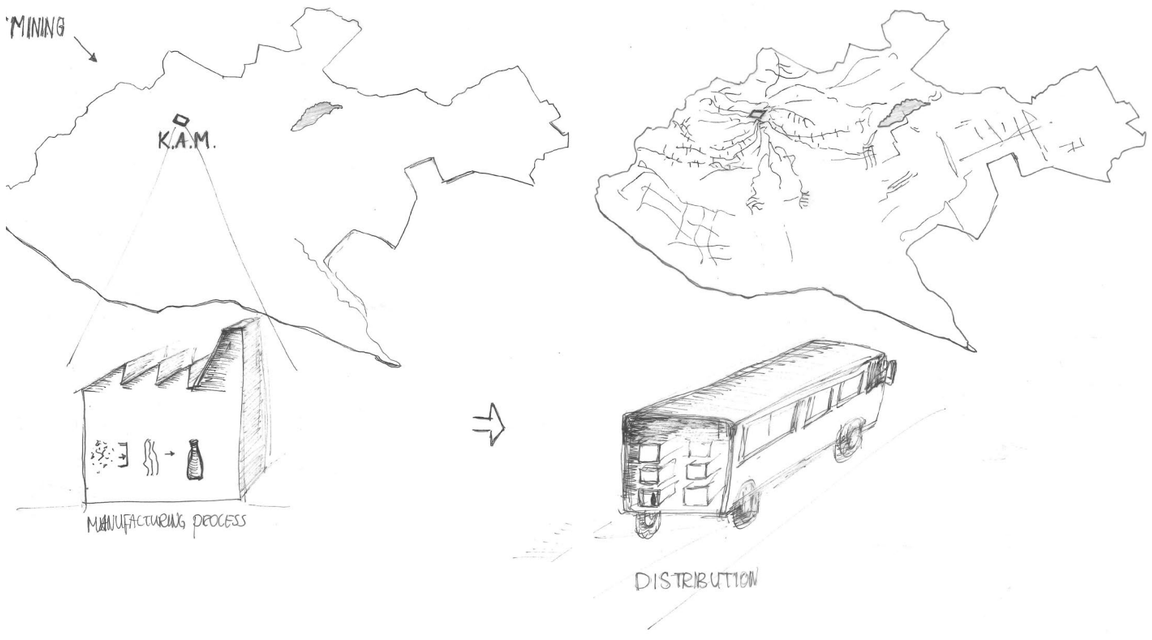
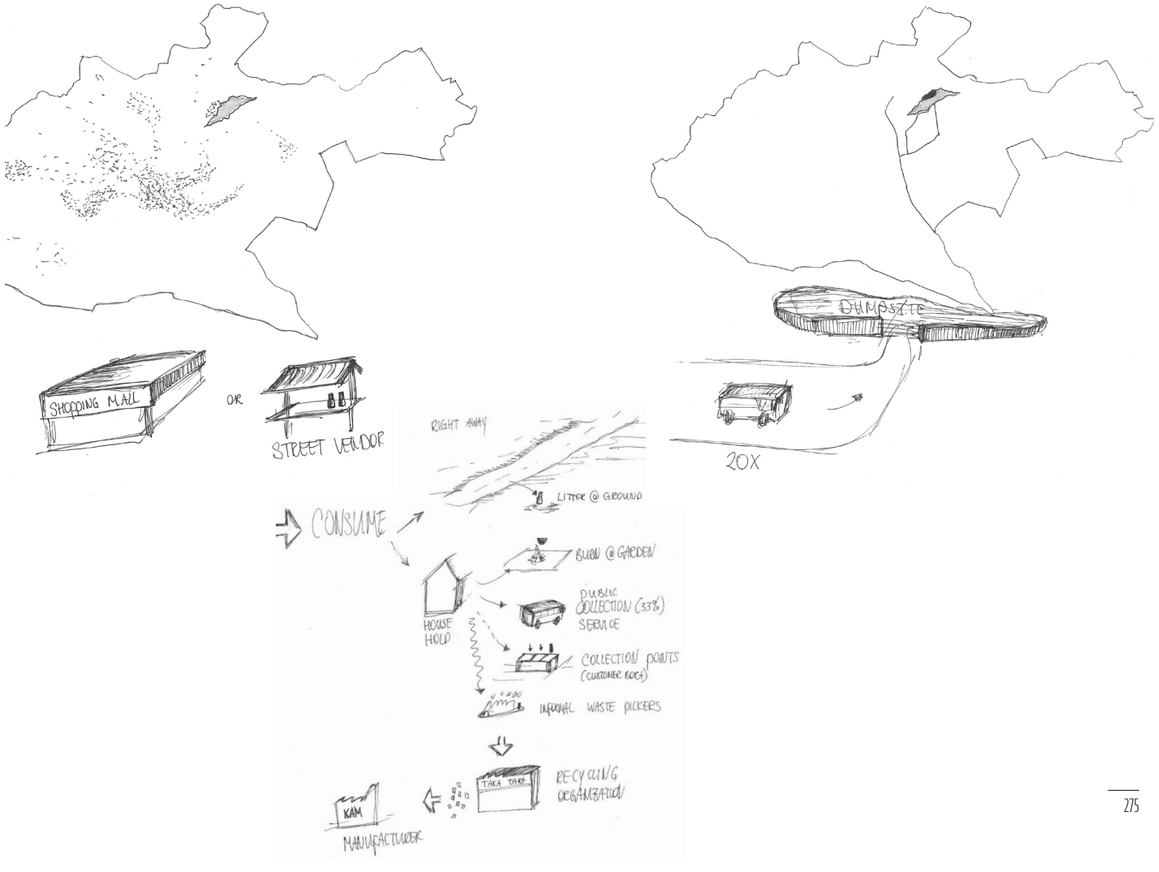
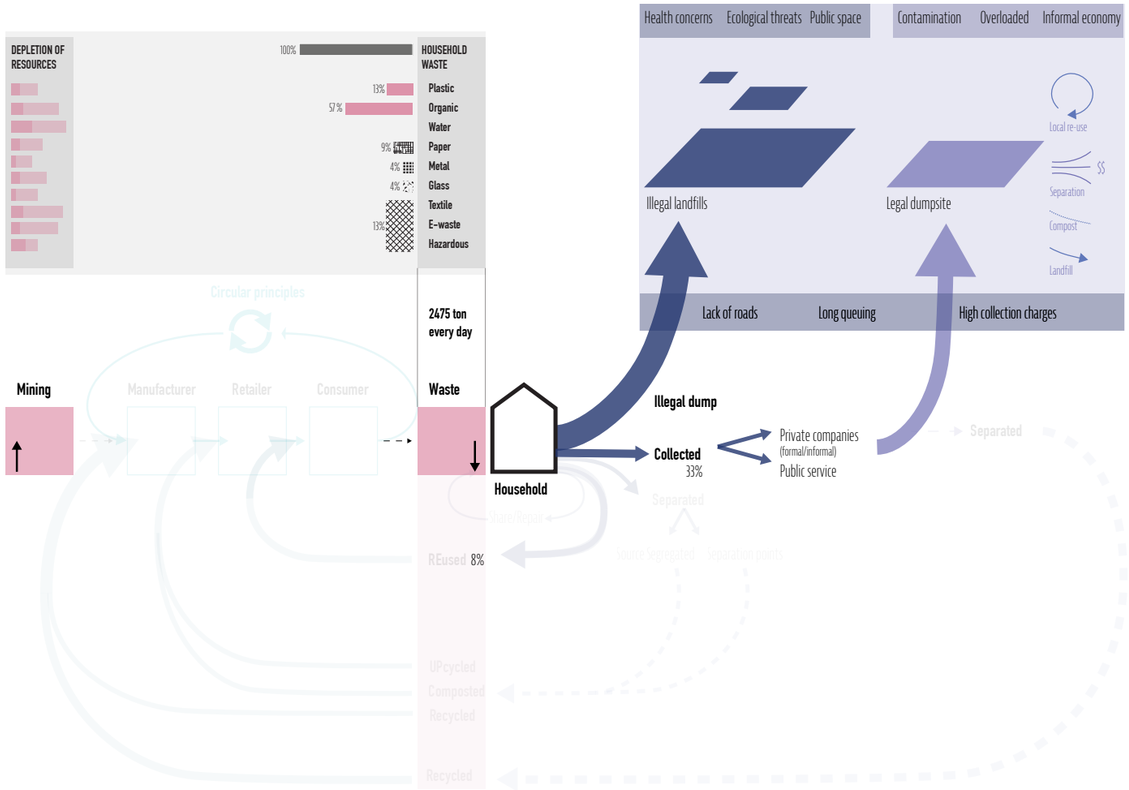


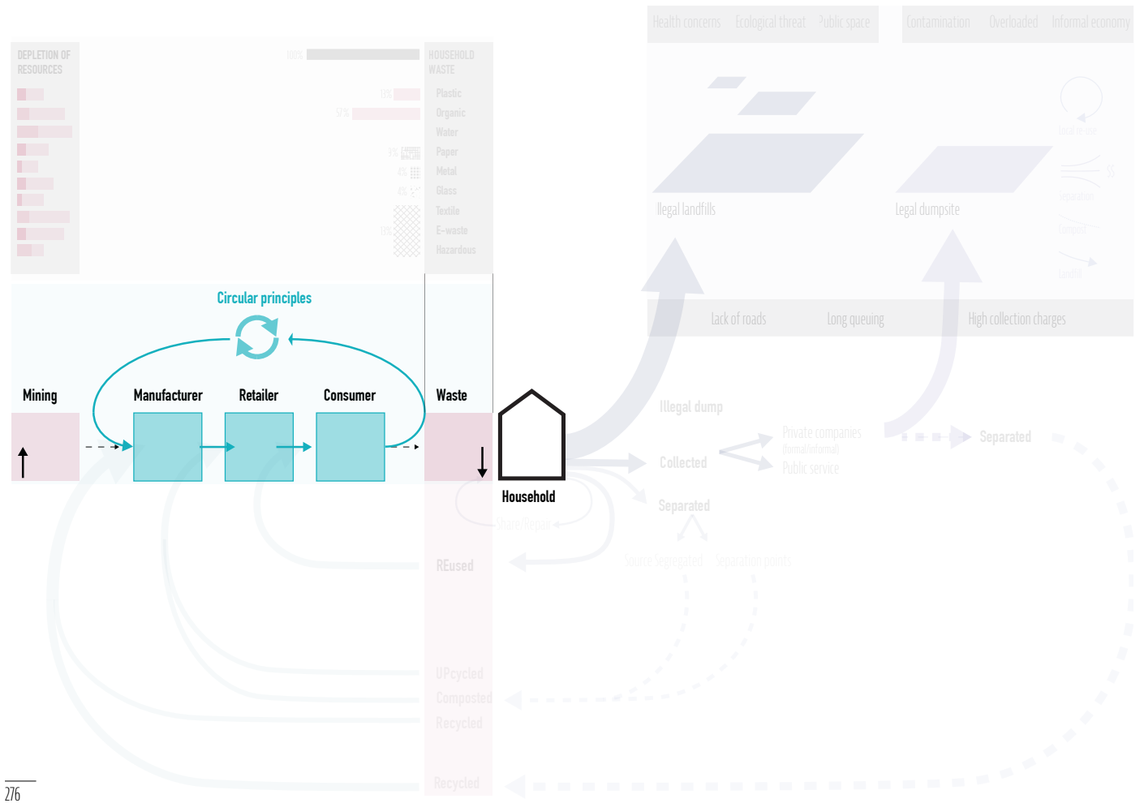
Figure 82: Distribution to Dandora Dumpsite - main roads Nairobi - Authors' map - scale 1:300.000

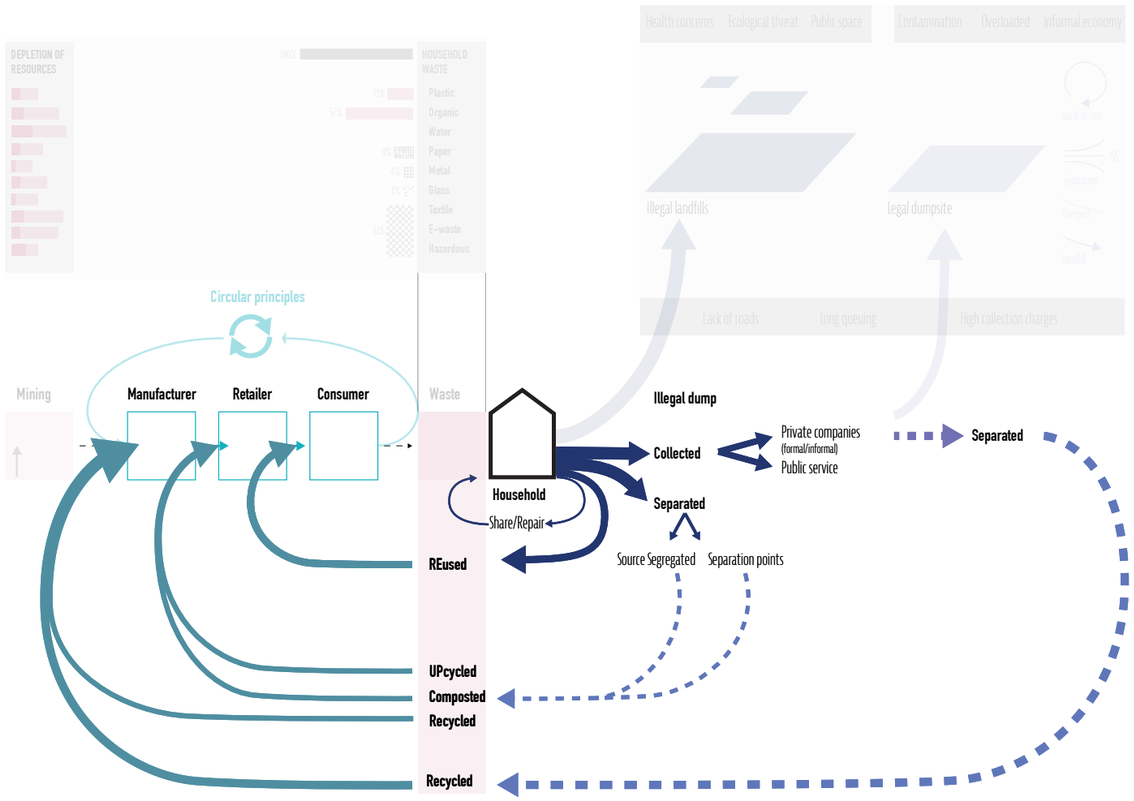


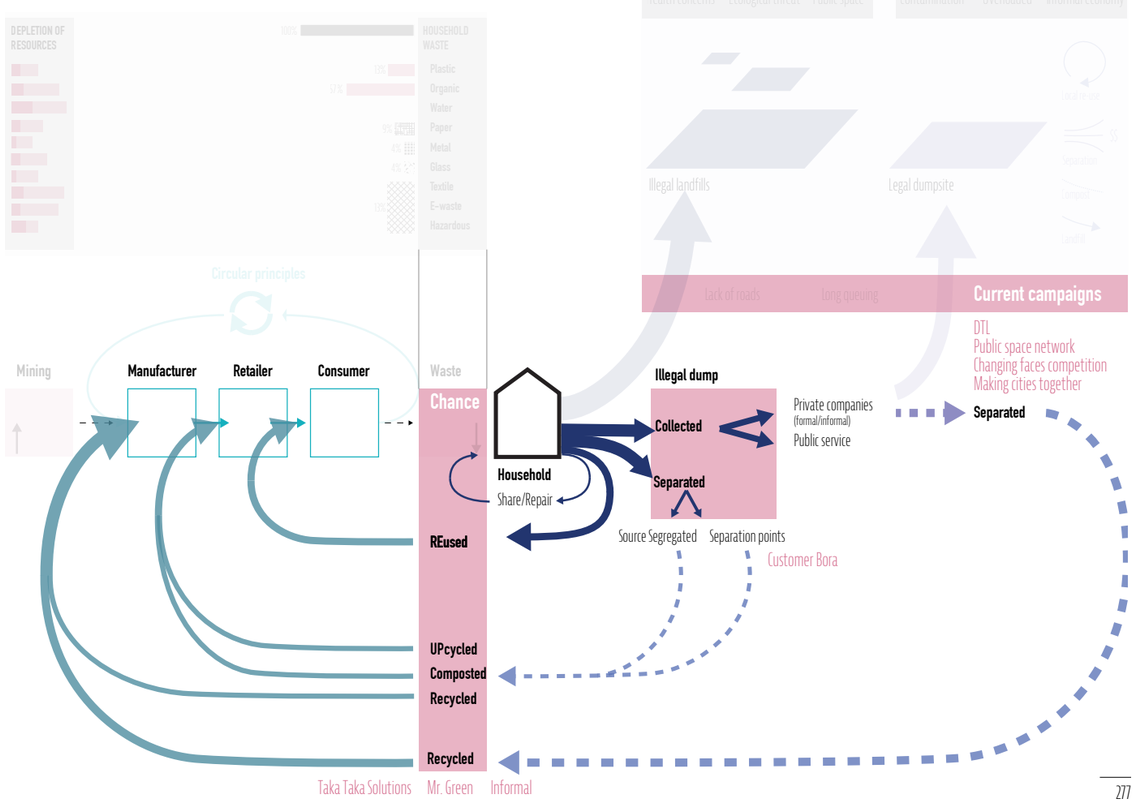


III. PRELIMINARY RESULTS



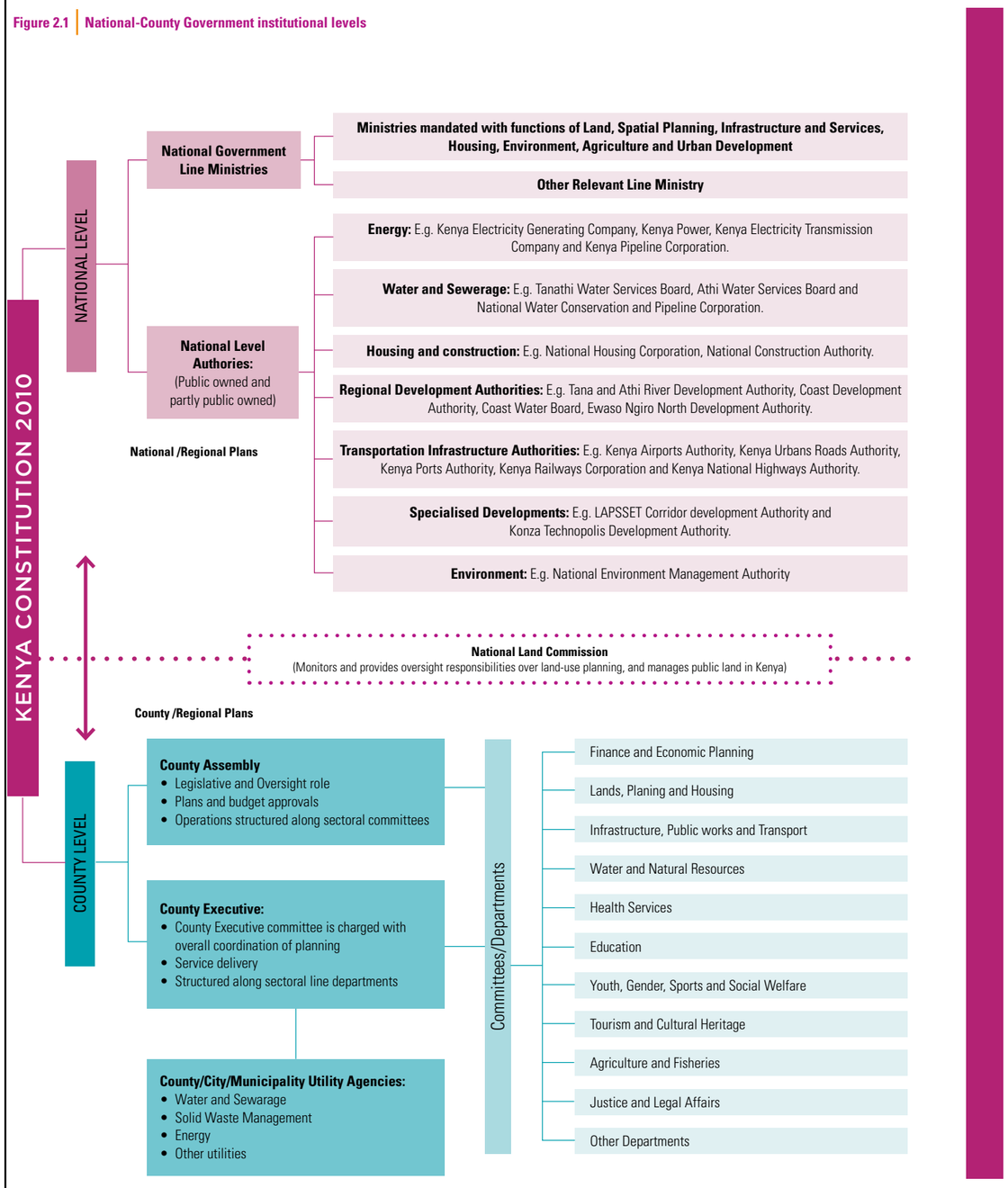






IV. GOVERNANCE ELABORATION

Figure 2.1 | **National-County Government institutional levels**



Box 2.1 **The Private Sector in Urban Planning and Development**

The role of the private sector in Kenya's urban planning and development is significant. Following the implementation of the Structural Adjustment Programmes of 1980s, there was a shift towards government deregulation and an enablement approach which also influenced major shifts in urban planning practice and urban governance. The role of private sector has since increased. In contemporary urban development, private sector actors have increased their stake in decision making on matters related to land use planning, and the provision of public goods such as infrastructure, services and amenities. This can take place in several contexts, from large complexes within a neighborhood, large-scale land sub-divisions or even town-scale developments (as with Tatu City in Kiambu County).

Land owners and residents' associations have increased their stake in urban planning decision making in major cities. Decisions made by developers and investors have significant bearing in planning decisions such as land use, infrastructure development, zoning and development control regulations.

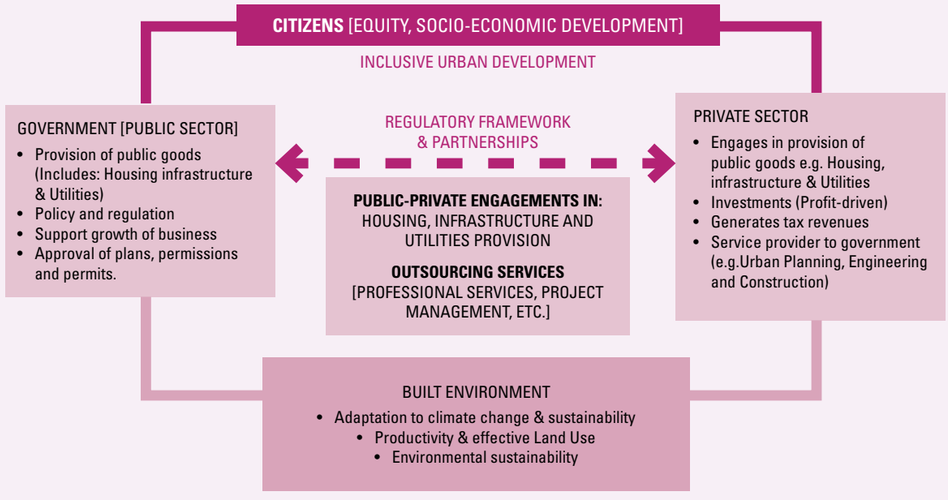
Private sector consultancy firms are increasingly undertaking planning tasks that were traditionally a preserve of public sector planners. Private firms are involved in formulating entire city or town development plans, through contractual agreements with governments. In many cases, private contractors are supposed to follow the procedures and standards stipulated in public policy and regulations. However, in Kenya such procedures and standards are inadequate, and at times a public authority can approve new standards introduced and proposed by private contractors through outsourced planning processes.

Urban planning activities of the private sector are still governed by public legislation and regulations. Only public planning authorities have the mandate to make legally binding planning approvals. But where public planning authorities are weak, the private sector defines the outcomes of delegated planning functions. Here, the main catalysts for action are contractual arrangements, profit interests and other specific incentives. Presented with this reality, policy makers and leaders should find leverage in the interplay between the public and private sector planning forms, to achieve sustainable urban development.

Both policy and political implications associated with increasing privatization of urban planning must be addressed by leaders. These include:

- The impact of privatization of public goods and reduced public assets;
- Outcomes of weakened public planning authorities, and shifting public finance from public planning authorities to private contractors;
- Implications of profit interests of the private sector on the need to promote social equity in urban development;
- Addressing planning barriers and creating value for positive private sector involvement in planning.

Figure 2.3 | **Public-Private Institutional Engagement in Urban Development**



Source: UN-Habitat/Baraka Mwau

IV. GOVERNANCE ELABORATION

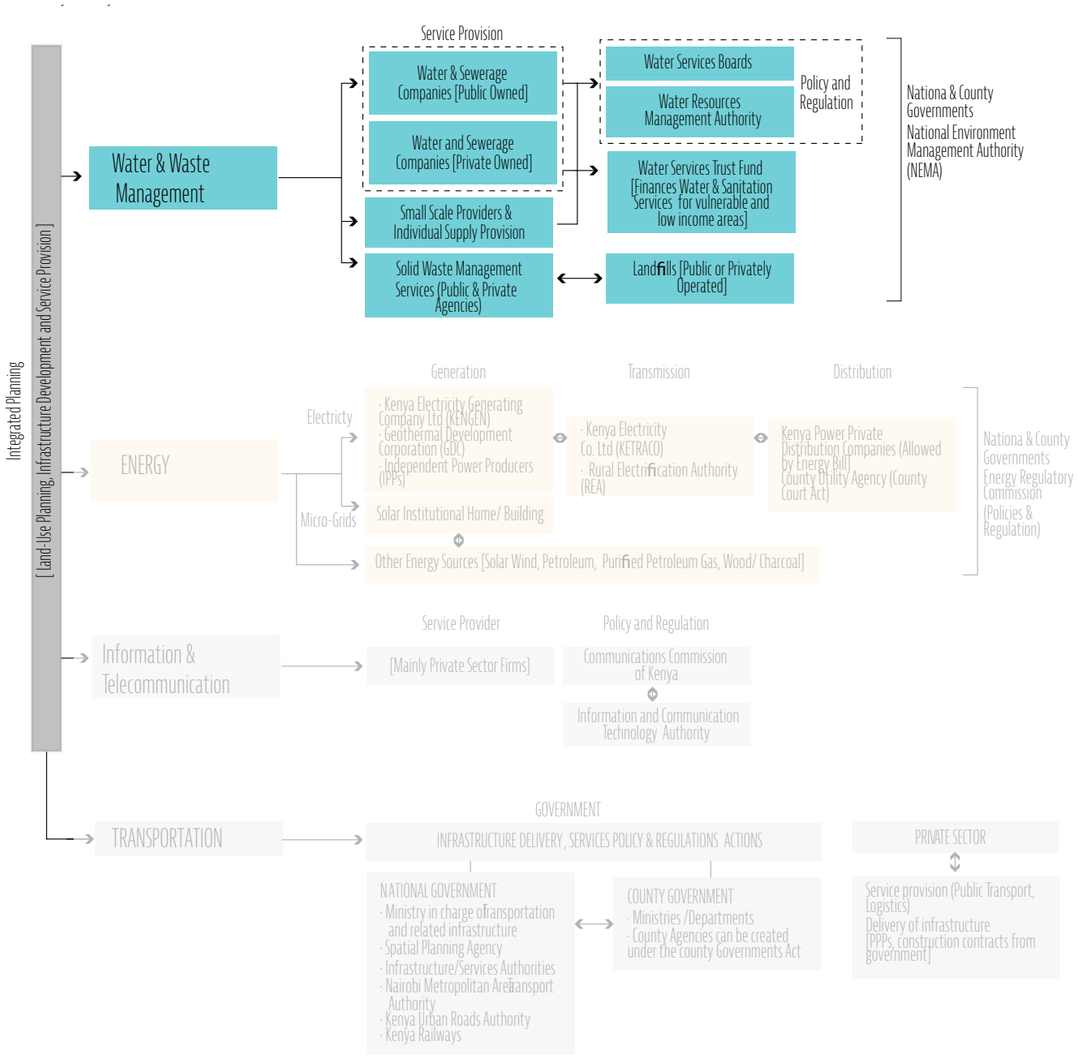
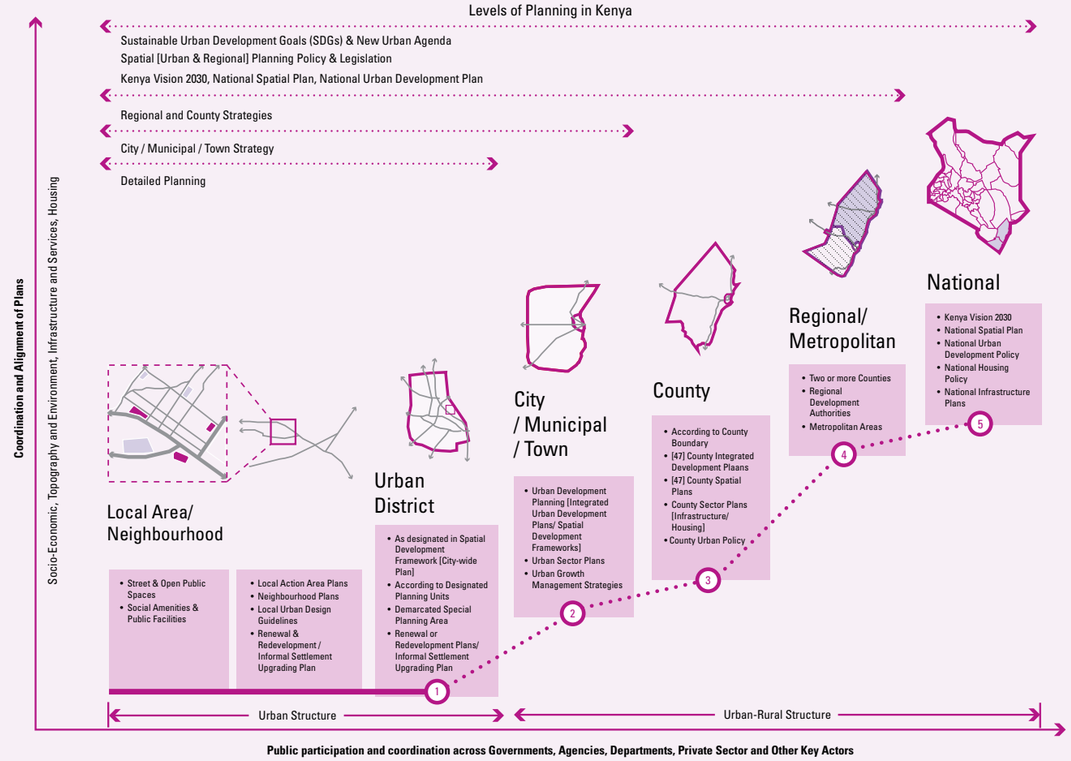


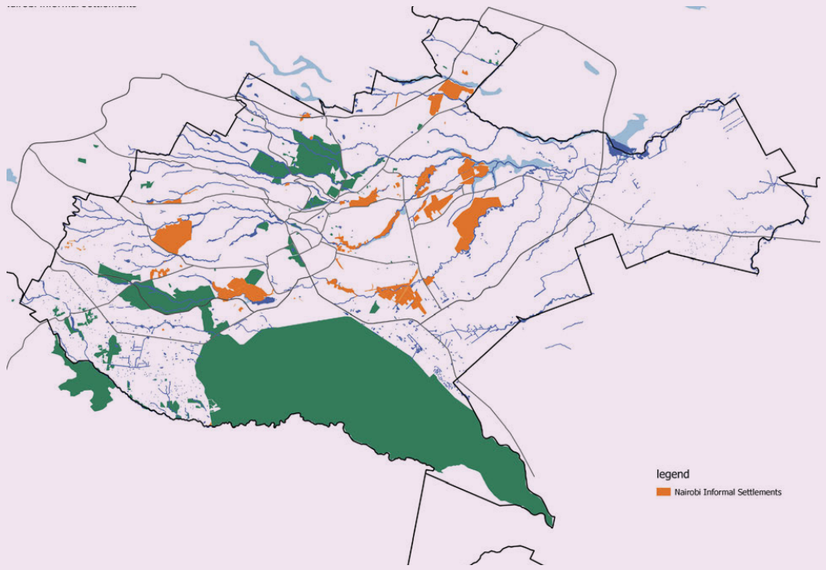
Figure 2.5 | **Illustration the different levels of spatial planning**



Source: UN-Habitat/BarakaMwau/Jiacong Ang

V. PROBLEM IN SPATIAL MATTER

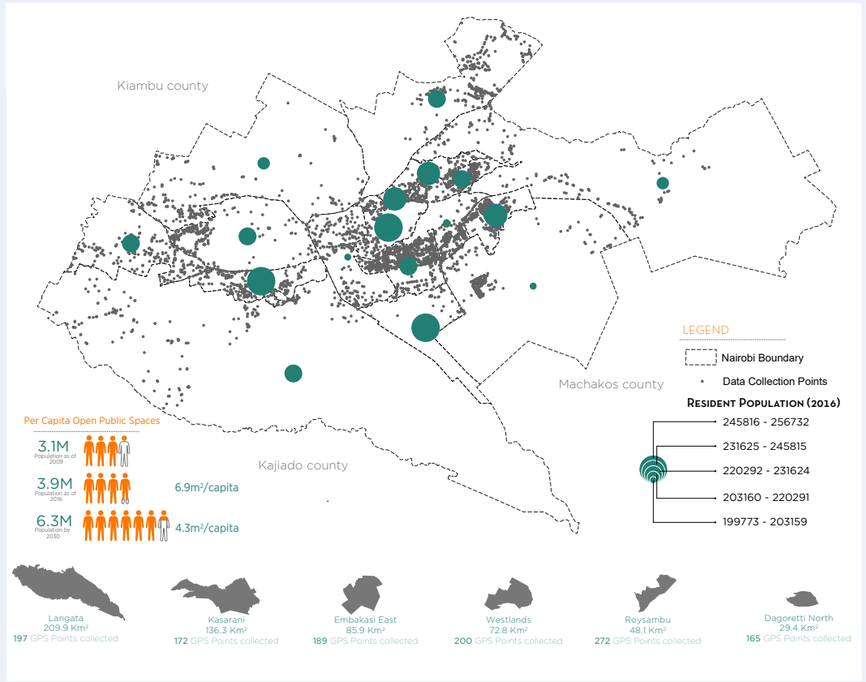
Figure 2.13 | City-wide map-informal settlements



Informal Settlements Mapping in Nairobi, Kenya © UN-Habitat Urban Planing and Design LAB

Box 7.1 Creating an Inventory of Public Spaces in Nairobi

A city-wide public space inventory provides an understanding of the supply, quality and distribution of public spaces, which are critical in formulating an appropriate city-wide strategy for public spaces. It may also be used as an input to the adaption and readjustment of policies for the protection, rehabilitation, maintenance and management of public spaces. The Nairobi City County and UN-Habitat collaborated to assess public spaces in the city with the aim of creating and inventory and a city-wide strategy for public spaces. The inventory revealed important issues such as land tenure, adequacy and distribution of public spaces, as well as estimates of catchment populations served by various public spaces.



Source: UN-Habitat (2017)

VI. RIVER RESTORATION PLAN

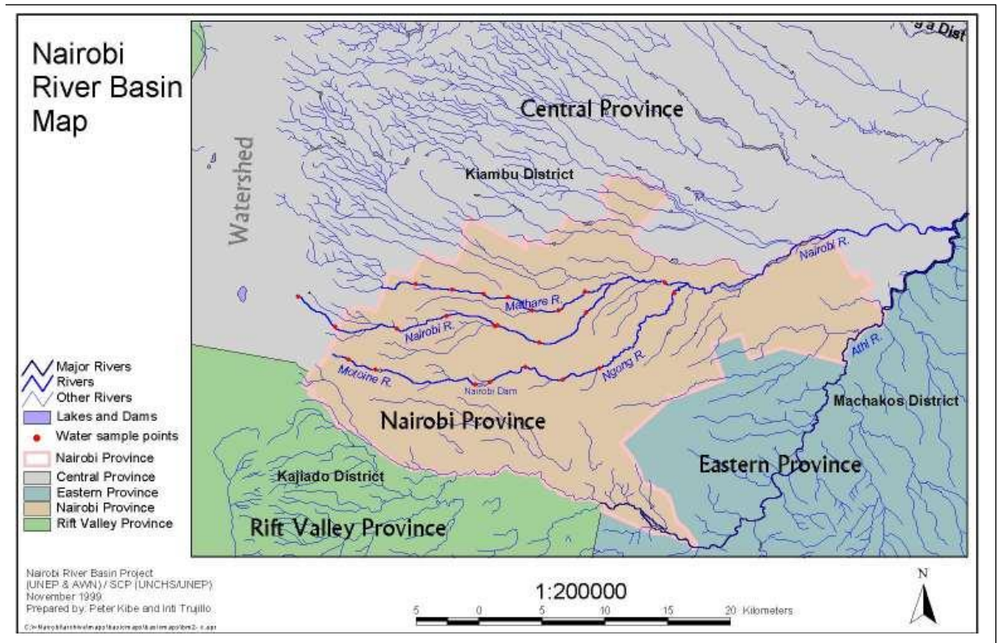
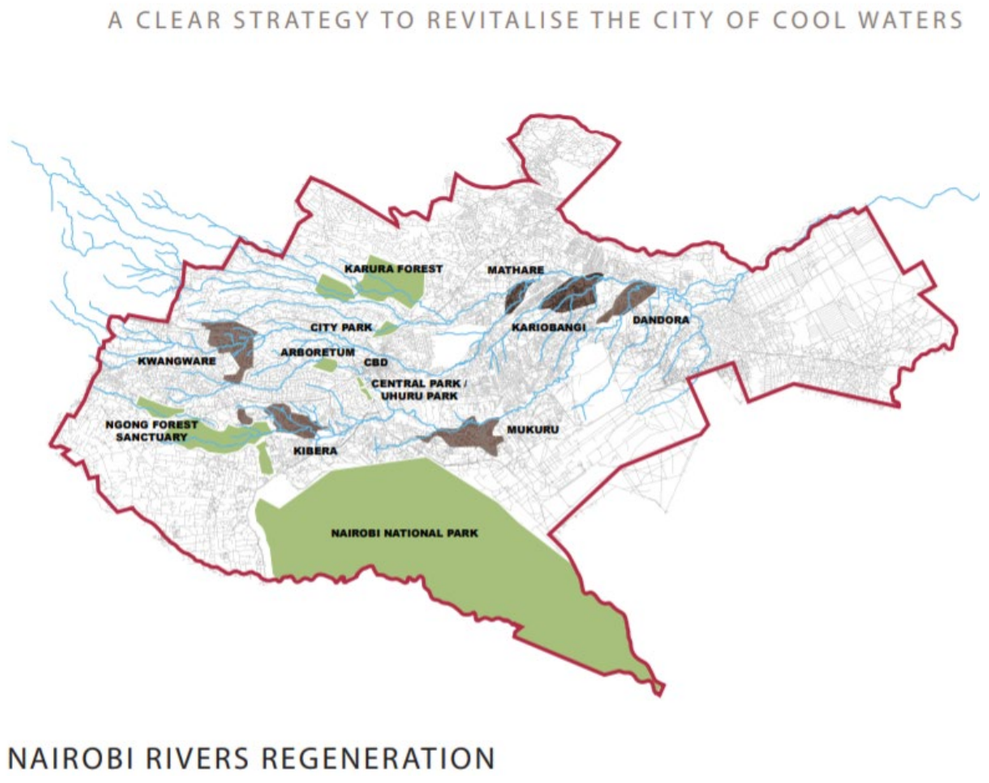


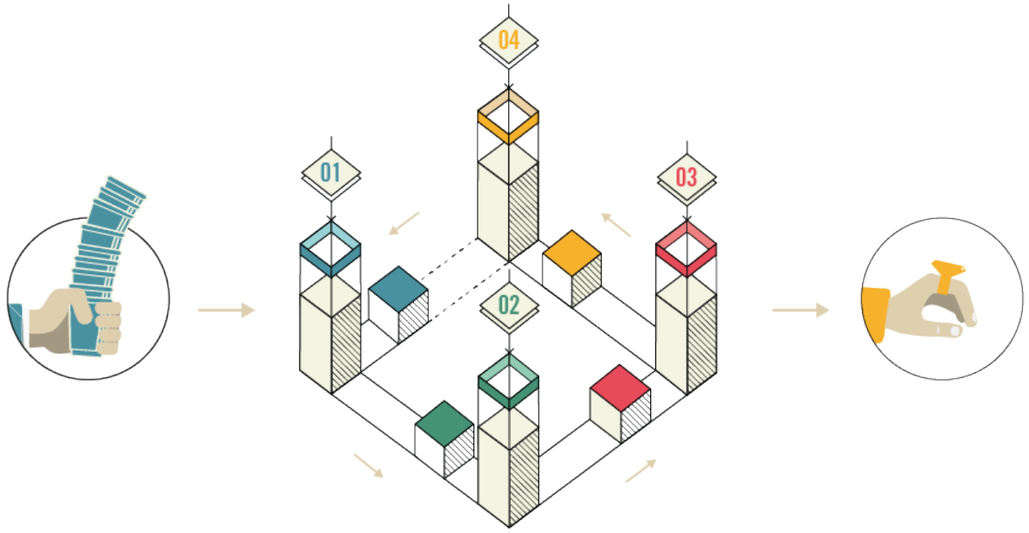
Figure 8: The Nairobi River Basin (UNEP, 2017)

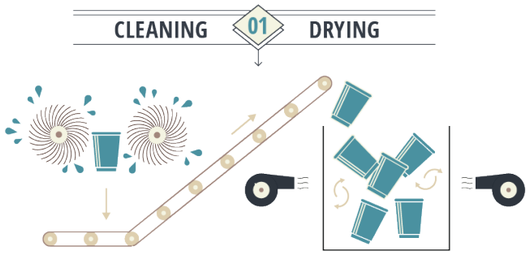


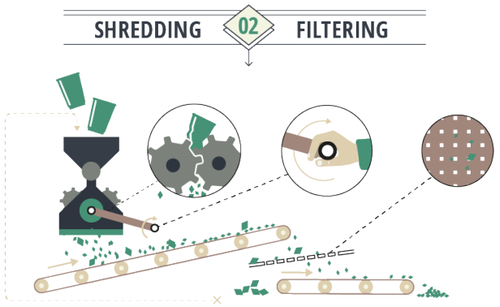
VII. BEST PRACTICES

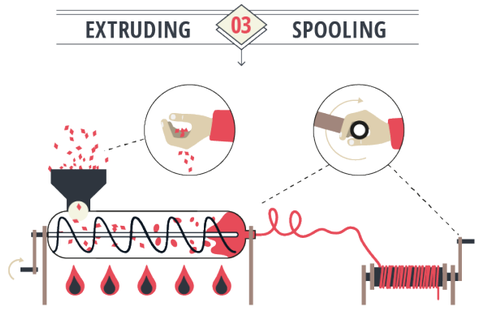
BETTER FUTURE FACTORY

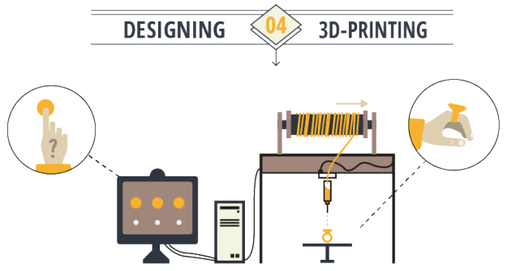
PERPETUAL PLASTICS











BETTER FUTURE FACTORY

CIRCULAR TILES

Local up-cycling tool
This project is about developing low tech recycling machines. These machines enable entrepreneurs in developing countries to make a living by upcycling local plastic waste sources. One of the examples is a low cost tile making machine, creating marble like tiles from old bottles. The first successful pilots were done in Angola. Currently Squarry is used in Angola, Cape Verde and many new locations are on the radar.

For more information about our adventure in Cape Verde, check out our blog. The possibilities for low tech recycling in Sierra Leone are also investigated. Details on our visit and research we'll be available soon.

Client

Heerema

What

Creating new circular entrepreneurs using low tech recycle tools

Why

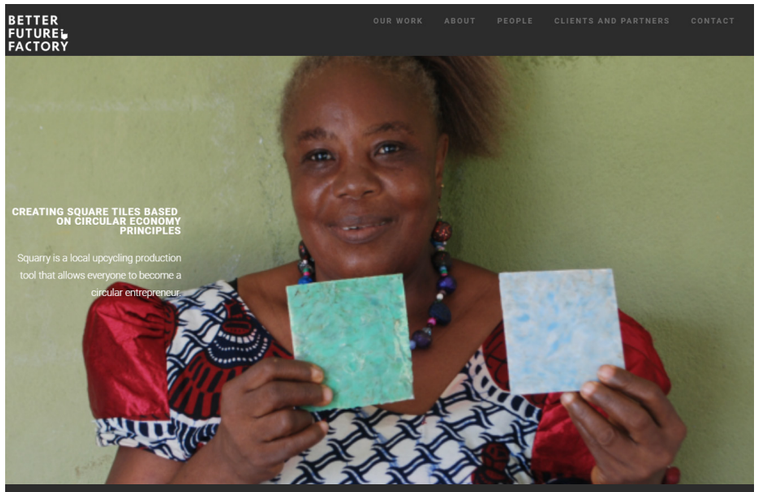
It enables people to make a living with plastic waste

Status

3 succesful pilots, currently baking tiles in Angola and Cape Verde

Year

Since 2015



VII. BEST PRACTICES

WASTE: Supporting waste pickers and workers in the PET supply chain in Indonesia

WASTE is involved in a project on Bali to improve working conditions and livelihoods of workers and waste pickers in the PET supply chain in Indonesia. Namasindo PLAS is a leading supplier of gallons, bottle preforms, and caps to the bottled water industry in Indonesia. The company sources its raw material PET from large established suppliers. The recycling arm of the business is exposed to an informally organized used plastic bottles supply chain consisting of a number of middle-men and about 15.000 individual waste pickers.

Aidenvironment and WASTE were contracted by the development finance institutions DEG from Germany and FMO from the Netherlands and Namasindo PLAS to design and implement a Supply Chain and CSR (corporate social responsibility) programme for the PET recycling branch of the business.

The programme aims to improve the working conditions and livelihoods of the workers in the collection centres and the waste pickers.



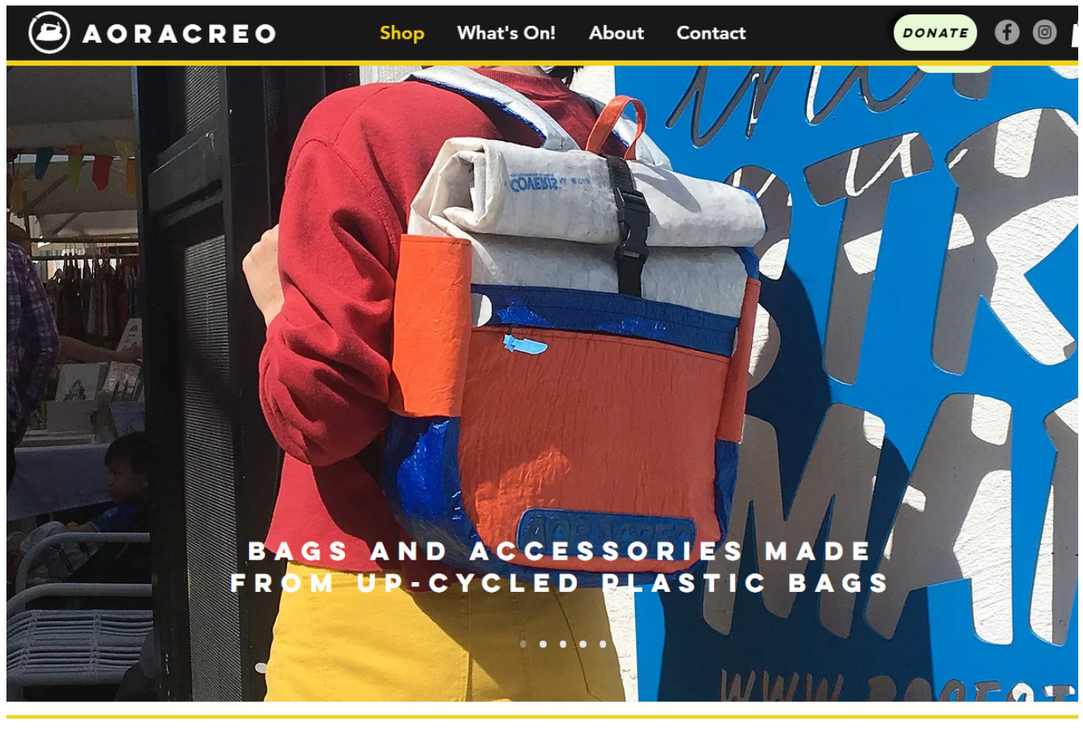
Cesar Marulanda: AoraCreo = make plastic bags of LDPE

In the world, about a trillion plastic bags are used every year around the world. here in Australia, the average person uses 170 plastic bags per year. Only an approximate 3% of plastic bag waste is recycled and about 200.000 are dumped in landfill every minute.

However recycling, is often called down-cycling because the process requires machines and large amounts of electricity to happen. Soft plastics, like plastic bags have technical attributes that can be utilised in many different applications other than just being a park bench. By Up-cycling, It is not required to melt down the materials completely but only partially, saving huge amounts of energy consumption and complex machinery.

MATERIAL
These plastics are chosen, because they are recyclable. However, due the lack of regulation, it means that most of the bags that are not labeled go to landfill every day, by the hundreds of tons, due to the fact that waste centres cannot easily determine the materials recyclability without a label, and most of the times it comes contaminated.

The process to turn plastic bags into useful material is very simple. It only requires a regular clothes iron and greaseproof paper. Several layers of plastic bags are trimmed and layered, then fused with the iron. The heat is transferred through the paper at a temperature of around 170 - 190 degrees, in which it is perfect to bond the plastics. These process requires very little energy consumption, yet it creates a material that has all the qualities that mass produced materials like, polyester, nylon, polypropylene have, at a fraction of the energy and resources needed to create such materials.

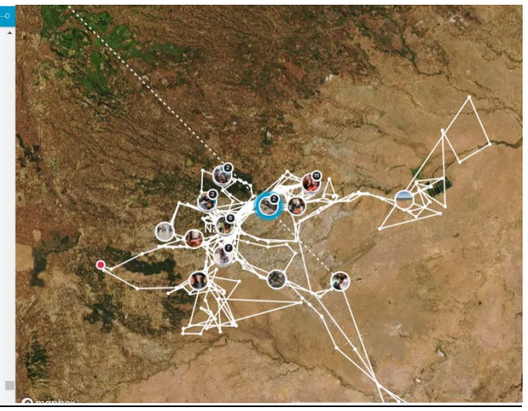


Short conclusions fieldtrip

- Observing **people's behaviour**: they are used to throw out their waste in public space, or actually anywhere. Since their direct surroundings are already polluted, its easy to keep polluting.
    - Clean up actions, they help to clean at the end of the waste chain, but not the core of the problem.
    - Burning waste day and night: influence peoples health. Kids grow up like this is normal.
    - There are no bins, and if there are (in people's household) they will just burn their waste in their garden or at the kerb side.
    - Repair and reuse is already happening.
- **Governmental institutions**: they don't feel responsible. Nor the national government nor the city council. Moreover, a lack of data on waste and a lack of implementation of plans are causing no action. NCC even admits that they failed in SWM. There is no authority specific for waste management. Also, they are obligated to have spatial plan, but there is none.
    - Forestry: only planting trees
    - WRA: only water, restoration program urban rivers
    - Education: willing to implement new program
    - NEMA: puts attention to local initiatives which is causing big innovation.
    - BUT! There is a big willingness to become Africa's first, leader of sustainable people do want to be leader and do want to win.
    - Lady of the president: wants to ban ALL plastics. Is that realistic?
    - Current policy: plastic bag ban. Just 1% of all waste.
- **Planning**: people don't understand the urge of planning. They live day by day. Besides, a lot of informal settlements deal with physical happenings on the ground, concepts of planning don't matter to them. Moreover, they don't pay tax.
- **Dumpsite**: this is whole world on itself. Big informal economy.
- **Waterfalls**: black river of polluted water
    - Human waste from the slums, no sewage system
    - Garage dump their waste
    - (Micro) plastics
    - Used to be natural habitat for birds
    - Space to grow for plants
    - Place to relax for humans + possible tourism
- **Private parties**: some see opportunity because waste returns into money
    - (Mr green Africa), their point of view is to not wait for policy or government. It's the private market that can drive innovative solutions.
    - Also, KAM is aware of their role as responsible producer.
    - PETco: kerb side collection, works together with council. Lack in capacity.
- **Civic society**: CBO, informal scavengers, youth groups.
    - Existing programs: customer Bora, responsible consumer program
    - Scavengers: very dangerous job, but make living from waste
    - Youth groups: get paid by council, but only do primary collection, no secondary.
    - Importance of role-model, a changemaker and a leader. People will follow.
    - Already happening: Greening Kenya Initiative

Fieldtrip Nairobi, Kenya- Vera van Maaren





<u>Sunday 27th of January:</u>

- Trash everywhere on the ground
- Burned trash just on the ground in many places
- Resell in markets along the road (reuse and recycling is very common)
    - Example of kiosk: kiosk-seller buys big pile of used clothes, and resells them for 50 shilling (50 euro cent) in his kiosk in town.
    - Example with bottle tops into toy cars, resells recycled toys on the ground (informally) in town
- Ben explains the importance of being a role model.
- Experience in the household: there is one bin, and they litter the bin just in the court.



<u>Monday 28th of January:</u>

- School Vincent: Lucky Summer MYTO junior academy: small school with 35 pupils from slum area. Teached them something with drawings.
- Came across a sewing lady in the street; repair of any goods.
- Walked down Mathare Valley. So much trash in the green fields, causing threat for local ecology and health.
    - Chickens and ducks just living in the illegal landfill, eating from trash.
    - Water is very polluted throughout the valley area into the river
    - Human waste is also dumped in the river
- Vincent's' vision: separated sewage system.
- Visited MYTO school of Ben and WHY NOT school of Dominic





- **Pitched the idea of bringing waste to school** (based on what we used to do in the Netherlands as a kid: bring every Wednesday the paper of the toilet rolls and glass to primary school. Either we made some art with it, or they reused it).
    - can make up a new system: points every day, more points if you bring separated waste, more points if you can make something out of it.
- Education as key to success – acknowledged by as well Dominic, Ben, Vincent.
    - As you learn a kid new behaviour: means a change as they will teach their parents.
    - Statistically: average age is increasing from 19 to 28 in the coming 15 years. So investment in youth and their education is strategically smart.
- **Sports**: way to bring people – especially kids – together.
- **Garden** as place to rest, harvest and farm. Dominic loves this piece of land, since its one of the only places to come and take a breath. Educational garden: teaches kids about different plants and how to harvest.
- **Water** is holy.
- **Role-model** is inspirational.





➢ They explain the tribalism, which is currently still happening in governmental layers of the society.

➢ Across the river, a scavenger is trying to detect metal by a magnet on a stick. Without wearing any protection.

Tuesday 29th of January:

- At the Matatu (local buss) the conductor bought a candy, as he eats it, he **throws the wrapping out** of the window. That although there is a bin allocated in the matatu.
- Meeting Zahra in town:
    - Talk about history of DTL, KUWA, Placemakers, Changing Faces Competition and Public Space Network. Verifying my history of the process (preliminary result).
    - Idea of making sports out of dustbins.
    - Acknowledging the school idea, give kids points to invest in planting in community gardens or in sport stuff.
    - Interesting of Dandora is that men can physically see the dumpsite.
- Lunch in the grass, next to community garden.
    - Local host tells about their fight for the public space to remain garden, with importance for the community (social) as well for the nature (ecological). Remarkable was his explanation about the **purifying the water with plants.** They use it there. Finally the court saw the importance, but they fear private investment is going to take over the space at some time.



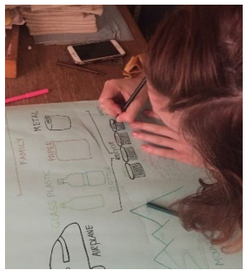
- UN meeting with Cecilia Andersson, Mark Ojal, Jose Chong.
- Cecilia
    - Around 3000 people make living from the dumpsite – be aware of that informal economy
    - Dumpsite could not move. Council has an urgent problem and lacks solutions.
    - 225 slums in Nairobi: plan for it. Korogocho is the poorest slum where people make living from the dumpsite.
    - High income area: producing more waste. Low income: less waste generation.
    - Example of making art: https://korogochostreetscapes.com/portfolio/nana/
- Nao Takeuchi – head of MSWM and currently researching and designing a strategy:
    - Advice: Make a strategy according to the waste phases (waste generation, collection & transport, treatment or recycle, disposal). Quantify waste flows.
    - Main barrier: financial aspect
    - Solutions
        - **Transfer station**. Have to check feasibility.
        - Online app
        - PPP
    - Lack of overall vision, difficult accurate data. 119 active CBO on waste, informal collection.
    - Acknowledged:
        - people do not know how to treat waste. Low awareness.
        - School/education is important, but is not directly affecting the enormous amount of waste right now.
        - Reduce: it's the first thing to do.
        - Disincentive: charging for waste generation (polluter pays principle)
        - Tax: cannot work in informal settlement where people do not have a physical address.
- Mark Ojal:
    - Design mindset: add value to trash (**urban furniture** for example)
    - Point system: **create currency** with for example supermarkets
    - Idea of **urban farming**: people need FOOD.
    - **Separation bins** = new opportunity





Wednesday 30st of January:

- Visit again Vincent school: first try out with drawing of waste categories, separation, collection and recycling
- Walk towards Dandora:
    - Woman cleaning with their barefoot
    - Piles of glass (two colours) and plastic
- Visit DHC: artist come together there, creative space, addressing societal issues.



- Talks about the dumpsite, the waste problem, the mindset change and the importance of education
- Walk along river
    - Women washing plastic bags, with polluted water, resell plastic bags. These bags will be wrapped around fruit/food, person who eat is, indirectly gets sick.
    - Scavengers burning metal to remove plastic, and to remain metal. 30 shillings per metal piece. Health risk is extremely high.
    - Reused plastic into fences, in informal settlements
    - **Waterfall full of trash**. Black water. Incredible. Big ecological treat!
        - Only 2 trees left as natural habitat for the birds to sleep. Soon will be gone.
        - Garden around feels like nature, relaxation for the inhabitants. But gets smaller and smaller, about to disappear. Only place to reconnected with nature. Locals tell me this is the only place to take a breath without the constant air pollution of trucks.
    - Special waste bins in Dandora, owned by informal waste pickers. Because of community social control, works.
    - Pilot project: **taka bank** (as part of customer bora project). Point of collection and separation
        - Idea of recycled waste into bin, bin that separates directly at the taka bank
    - Close to dumpsite. Just next to it: women reselling plastic waste into useful products, eg hats and bags.
    - DTL and Mustard Seed
        - Talk with Charles. Importance of competition, social control, community engagement and leadership. **Changemaker.**
        - Believers court: reuse material to turn into high quality public space.
    - Again close to the dumpsite: resell of electronic devices. Informal market.
    - Close to Korochogo: met the Komb Green solutions: turn space next to the river, which used to be a bridge with extreme high crime rate, into beautiful park. Work with the kids. See value of education
        - New item to put thought to: diapers as specific waste.
    - Walking back from korochogo, Dandora towards lucky summer. **Burned waste** causing a lot of air pollution. Could not even see the other end.
    - Talks during dinner: financial aid in forms of public private partnerships are key. School program, check ESD: Education for Sustainable Development. https://en.unesco.org/themes/education-sustainable-development











Thursday 31st of January:

- Visiting Pamoja – Polish-Kenyan cooperation. Designed school and art gallery.
    - Sewing workshop with lone mothers. Using recycled material.
- Visited Trust school, friend of Julius.
    - Spoke with head teacher, he was enthusiastic about the waste education program.
- Visited school in Obama – MYTO junior academy
    - Ben is proposing my idea at the school: '*my environment, my health*' = 'mazingira yangu, afya yangu'.
    - Zuza and me made drawings and explained the waste process and the importance of separating, collecting and recycling with visual tools and simple language.



Friday 1st of February:

- Education & plastic – event at Moi Avenue Primary School to launch the educational program. Called: '**sustainable management of PET bottles schools awareness programme**'. Cooperation with Mr Green Africa, Nairobi City council, CEO unilever, ministry of environment and forestry, Wildlife Clubs of Kenya, KAM.
    - Margaret Otieno: Raise awareness and in need of innovative solutions
    - Sammy: admitted that they (**NCC) have failed**, underlines the water problem in Dandora Waterfalls.
    - NEMA: **local little initiatives: causing big innovation**. Put this country back on the world map again in terms of environment. Admit the need of change of attitude.
    - KAM, murai Kunyiha: as long as we live, we create waste (I doubt that).
    - Meeting with Tinu, enthusiastic about the new ideas. Understands the importance of data and underlines that no one has real data.
        - Connects me with Faith Temba, doing research for Ypsus.
- Meeting at the office of National Treasury and planning – climate finance unit/GCF-NDA
    - Meeting with Peter Odiengo
        - *Identified challenges: schools lack of education, implementation of vision, concrete plans by NCC, mismanagement of financial budget, attitude regarding waste, no spatial plans, feasibility study required but no financial aid.*
        - *Identified solutions: education, transfer station, taka bank, supermarkets and point system, urban furniture, overall spatial strategy.*
        - Learned about the concept 'nala-hypotheses'.
- Meeting with Anna Tehlova, Public Space Network.
    - Acknowledged problem of SWM
    - Not much of upcycling here, since there is no technology
    - National government: county is **obligated to have spatial planning**, as part of CABD.





Saturday 2nd of February

- Art Tour around National Railway museum. Old train wagons transformed into art space. Met Joan, a lady who has a sewage workshop including only ladies to work with material from the dumpsite in Dandora.
- Michelle and Christine are both Architecture students. According to them is the gap between research being done at the university and the practical implementation and local needs huge.

Sunday 3rd of February

- Yoga in the park. Yoga teachers raising funds for the community initiatives.
    - Idea: use sports activity to raise money

Monday 4th of February

- Visiting Mr Green Africa at Sameer Business Park. After a talk with the CEO Keiran Smith, he gave me a tour around their recycle plant.
    - sees the importance of education. Focus more on social aspect instead of environmental aspect.
    - Importance of the **price of waste** and incorporating a full supply chain in order to make it circular and of the highest possible value.
    - Question: feasibility of transfer station? = only if there are different stations for different kinds of waste.
    - in his eyes: **private market can drive innovative solutions**, policy and government will follow once there is evidence.
        - Strategy: coming from private sector > you will be able to accelerate. Government will follow, but after 10 years.
    - Relevance is scale
    - Reuse is already happening
- Visiting the office of the National treasury and planning of climate finance unit GCF-NDA. Meeting Shakespeare again, who came up with an idea of funding waste initiatives by sports. For example for hockey classes.
- Meeting Danial Paffenholz, the founder of Taka Taka solutions. Intense talk.
    - Production of PET; not remarkable in terms of quantity. Households in Dandora are not going to make the difference. Look into data.
    - Why should people change? **If there is no incentive, people won't change.**
        - Disincentive might works in the Netherlands (like taxes, fines) but since there is no exclusive selection source in Kenya, it would not work.
    - Taka taka solutions:
        - Collection. From everywhere.
        - Sorting sites. Sorts waste in 40 different types.
            - 1 sorting site in Banana = 9 hectares
            - 1 sorting site in … = 1 hectares
        - Resells.







    - Pet & kazuku: people already doing it, because of pp/hd is thick and easier to recycle.
    - Low grades (for example yoghurt wrapping) is not yet being done. However specifically these are ending up at the river!!!!
    - Problem of data. JICA data 2010 is most reliable. The data of the government absolutely not. Taka Taka has a lot of operational data, but he does not want to publish it.
        - Question: if he believes that might makes a change at the government. Straight answer: NO.
            - In his eyes: lack of data is not the problem. Its lack of willingness to change, lack of care for the environment.
    - Plastic bag ban is working, **but only the 1% of the waste**. However, it works, because of 50% is going down. BUT! Could have been done without policy.
    - Role of the government in Daniels eyes:
        - Better focus on regulation (who is allowed to do what), not focus on operational role.
        - Stop companies who illegally dump and incentivize green companies
        - Law is there, it is about executing the law
        - Stuck on county level, too small to solve the problem.
    - His opinion: youth groups to collect waste are not the answer. They do **only primary collection, not secondary.** That's problematic. It is subsidized by the governance, but not effective.
        - Solution can be: either the whole process by youth group, or nothing.
        - Youth groups (between 18-35 years old) are not a scalable solution, they are not systematic and have no capacity. They should not be in the business (Daniels' words).
    - Taka taka solution: is having 50 tons per day, in comparison to 2500 tons of waste produced per day.
        - Question: what is his eyes can be the solution?
            - All waste to sorting centres. Fee should be as high as Dandora Dumpsite. (fee: official = 500 shilling, 1500 shilling for informal). Takes up to 6 hours.
            - No place in Nairobi. Option:
                - In industrial area
                - Outside Nairobi
        - Questioning: transfer station (is it a sorting system?)
            - Opinion Daniel: another UN people paid..
        - Solution: less waste generation.
        - Difference low and high income areas. In low income area.

Tuesday 05th of February

- Talks with Moraan and Laura (former teacher at BK city)
    - Question to me: what is an example of a **successful urban strategy**?
    - Disincentive: like in the Netherlands, we pay tax on top of existing tax
    - As designer: map the problems, how big is the problem, how big shall it become if we do nothing (nala-hypothesis).
        - Map the difference between east and waste, make a drawing of the differentiation
        - Where does the Nairobi river ends?

Wednesday 06th of February

- Visit Strathmore university and KCIC. Understanding the technology they use and are the way of funding regarding climate change at KCIC.
- Met with Pjotr Schade from Everest Energy.
- Asking myself, what is it what I am going to do? A strategy which bridges stakeholders (un, ncc, locals, private sector), waste water ecology behaviour change and education, low/high income and east/west.
    - What I think of at first?
        - Toolbox of spatial and systematic elements
        - Roadmap for urban planners and for locals
        - Strategy with 3 possible future visions
    - Now I think
        - Overall strategy with spatial element (river) with specific focus points, steps:
            - Map problems
            - Narrative from different perspectives
            - Identify existing initiatives
            - Identify gaps and possibilities
            - Focus on 3 gaps in detail
            - For different perspectives
            - Local: video to show problem
            - Government: Policy recommendations

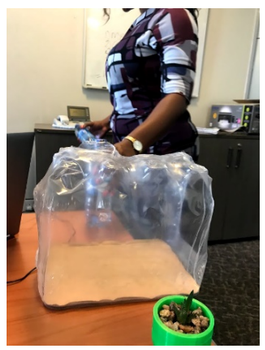




- Visit the Karura forest. Campaign in circular principles, there they are very aware of polluting the nature.

Thursday 07th February

- Meeting with Joyce Wanguri from PETco Kenya
    - Plastic bags, so useful specially for low income people
    - Also our agriculture and food industry are heavenly reliant on PET.
    - Government policies are driven by others.
    - Gap in the waste supply chain: **kerb side collection**.
    - No accurate data, JICA research should be updated.
    - SWM national government has no say. County has no idea & not in control.



    - Agrees on the problem of **low grade plastic as a big problem**. Packaging ends up in the river. As long as there is no business case, this problem will grow.
    - Waste to energy plant is ridiculous, makes no sense because of not making use of full capacity and returning it into low value.
    - Government does not do its role! NEMA is taking good leadership
    - PETco position, what is position?
        - Building network in 5 years, more structured and formalized jobs. The strategy is to also make scavengers be part of CBO.
        - What and how to target?
            - Segregation at source.
        - Pilot: collect and separate in specific neighbourhood
            - Pick up every week. Schedule different day per neighbourhood, already in line with NCC.
    - 2 ideas
        - **Bin out of recycled plastic** = DESIGN IT. Product to be proud of, brings in new jobs.
        - Stand for people to hide in the shadow, combine with **urban furniture.**
            - Question, can be combined? Since its hard to combine people and waste.
        - Question about the pilot: will it still work if people do not have an incentive?
- Meeting at the office with Shakespear
    - Green Climate Fund GCF. Green champion workshop. Design for implementation.
        - Has 17 rules.
            - Among number 4. Involve all learning institutes. CFA community forest association, WRUA, Water Resource Usage Association, CBO, WRA water resource authority.
        - Within UNDP, there is a **special fund to apply for:** Low Emission Climate Resilience Development LECRD. They are looking for ideas, they have to be innovative, transformative and bankable in order to apply for such a fund.
            - Shakespear sees opportunity: if make roadmap, incorporate real people, I can apply for this fund in order to really implement it.
        - Talk about Nairobi River. **There is a vision, but no plan for action.** This makes a gap and according to Shakespear, there is no urgency and in his eyes a spatial design is the best entry point.
            - Urban River Restoration program, they are a governmental institute with a budget to maintain the river. Basically, they are planting trees.
    - Video of leadership: how to create a momentum/movement.

Friday 8th of February

- Phone call with Els.
    - Spatial strategy can be an intervention that links something.
    - Role of an urban designer: bring structure
        - Step 1: gather information
        - Step 2: conclude (self)
        - Step 3: tool/design
    - Ultimate goal: a clean Dandora, a clean Nairobi.
    - Solutions so far:
        - Educational program: create awareness and behavioural change.
        - Collection point at public space
        - Taka bank: creating new currency
    - Map all the stakeholders and identify their constraints and desires



Saturday 9th of February

- Visiting the Waste Water Plant in Ruai.
- Meeting at the briquette factory in Ruai. Which makes out of waste materials a new product which can replace coal. This centre is an idea of the green champion program and part of green climate fund.
- Visting the waterfalls in Ruai, where the Nairobi, Ngong and Mathare river are joined and the water is so so so black. Huge amounts of waste are gathering here, contaminating and polluting the nature.
    - Asked the boda boda drivers of they see this as a problem in their home town:
        - **They did not see it as a problem. Cause they don't know better** (their age was 22 and 23).



Sunday 10th of February

- Free day at Nairobi National Park.

Monday 11th of February

- Meeting with Tinu from KAM.
    - Daniel Pafferholz: business perspective. His friend is selling bins, for 130.000 KSH plus a service fee, way to high for the most Kenyans.
    - Keirans' approach: cuts out the middle man.
    - Kerbside collection: problematic if there is **no service** provided for SWM and if waste is not segregated.
    - National government is talking about a huge incineration plant with different countries like China and Japan. They think this is the solution to get rid of the waste in Dandora Dumpsite. To burn it all. This is a **quick fix, without a tackling the real problem.**
    - SIB: Sustainable Inclusive Business by Karin Boomsma
    - Talk about PET bottles. It contains 4 different types of PET. The biggest share is type 1 PET. The top is mostly a mixture of PE and PP (type 7 and 5). However, ideally it is type 2, HDP. The seal and the etiquette are mostly type 3, PVC which is not recyclable. An opportunity, possible



these types are made from PET and 100% recyclable. However, the type cannot be distinguished by eye. This should come from the manufacturer.
        - PVC has a lower price. As **manufacturer you can make the change**. Change the design.
    - Better future factory, contact Casper the CEO.
    - Lady of the president today announced that she want to ban ALL plastic at the presidents website.
    - Biggest problem according to Tinu: lack of data and a lack of overview.
    - Question: what do you think of organic waste since it is the biggest share of the waste generated in Nairobi?
        - Answer: biodigester. Make bio-gas. Methane gas. Check Vegpro, in Naivasha, Longonat Horticultural Limited. Edward Karanu.
    - Another example: COREC in Nairobi. Rooftiles out of HDP and sand.
- Visiting the opening of the Pamoja Trust Art Gallery. Also meeting Benard Ochieng again to present my idea of the education program. He agreed and we discussed to have a workshop next Monday.

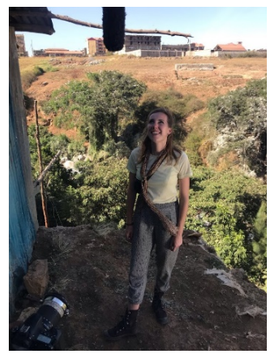


Tuesday the 12th of February.

- The day to visit the dump site in reality. It was incredible impressive, these amounts of waste. The moment we entered, we stepped on a black floating cover, an old lady shouted at us immediately. There was food underneath. They will resell it again. There is a whole business. We walked quite far on the road, where the pickup drivers were driving so hard that they left a trace of dust in order to not be recognizable to me, as mzungu. My guide told me because they are afraid of hidden cameras. I should not forget the dust in my eyes, the smell of my clothes and the burning feet in my shoes. That experience was so so so dirty, filthy and dusty, almost not possible to imagine. However, the people working there, were just normal people. Like the other people in the slum, who were shouting at me: hello how are you? Mzungo, mambo. In contrary to their job, which in my eyes feels inhuman.



- Meeting at DHC with Sanne, founder of I like local, and Charles co-founder of Global Platform Kenya together with Matias.
    - Idea: to gain attention for the waterfalls and the **local experience by tourism**. This is in a way for DHC also a sustainable way of funding. Since this will not depend on a donor, but a more continuous income.
- Another walk down to the waterfalls. This time it was even burning. All the waste on the ground was black, and we could not stand on it anymore. Some of the community-members, have never seen the waterfalls before. Coming back, at the jewellery hut, the new online platform and TV channel Dandora 360 degrees, interviewed me. I told them about my research and explained about the problems I observed.



Wednesday 13th of February:

- Meeting with Erik Akotsi, Ministry of Forestry. In his eyes the national government's role is to create policies. The county government is supposed to be in the county, which management is not adequate.
    - they do tree planting, but just on places where there is place. There is no structural plan.
    - Question: do you think the urban river can be restored? Yes, it can. But the issue is the domestic waste, there is necessity of sewer system. specially in the places, like informal settlements, where its not there. Although, even where there is sewage, in high rise buildings, there is too much pressure. The capacity is not enough, which is causing flooding. Problematic is the informal settlement areas, where people dump illegally.
        - On top of that, where there is no accessibility, there is no inspection possible.
    - River: domestic waste is main polluter. Organic waste is not a problem. The solid waste, although currently reducing mainly in CBD and with the plastic bag ban.
- Visit the Water Resource Authority. Asked for data. They will send it later.
- Visit the council to talk with Mr. Makori. Because he was too busy that day and because of the strike we did not talk. But we talked with his colleague, Sammy instead. He admitted that the implementation of plans are lacking.
    - Remarkable: he was questioning **why the government** is expected to be **responsible for waste** management problems.
        - As role: regulatory.
    - Explains about laws. There is isolated legislation and fragmented laws.
    - In history: JICA that ISWM-masterplan, but implementation went wrong because firstly they had to decommission the Dandora dumpsite and set up a sanitary landfill in Ruai. Result is that it never happened.
    - Polluter-pays-principle does not work. Have to come up with a new mechanism. Same with the water system.
    - Each county is independent, so in his eyes: **no cross-border collaboration possible**. For now, county has to solve the problem on his own. And for now, incineration is the best option. It is not the best, but is the fastest.
        - On long term: education is.







Monday 18th of February

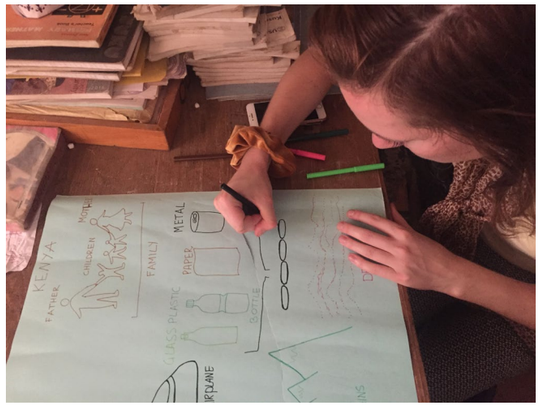


- Workshop at MYTO school with 25 teachers of 6 different primary schools around Dandora and Mathare. Presentation of the problems, the possible idea of education and the proposal for a new mechanism. Thereafter a collective brainstorm. The response was very positive. They understand their role as changemakers and developed the program. All together confirmed the way to go, divided tasks and different action groups with each a leader. My role as initiator and creator of the program, proceeds as developing a video and visualize of the educational program.

Summary of problems

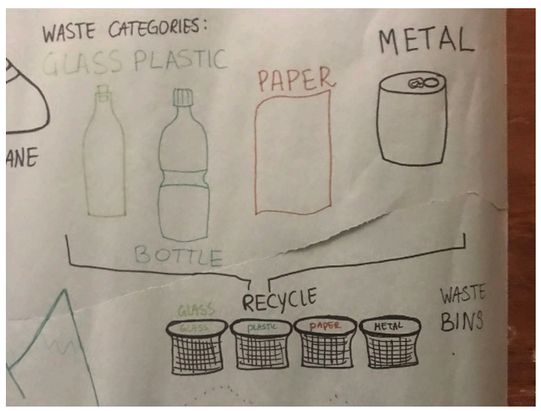
- Throwing of waste
    - change of behaviour
        - educational program
        - songs
        - sports
- Polluting of nature, threatens local ecology
    - spatial plan around river (incorporating slums)
        - planting trees for example
- No (public) collection
    - governmental system
        - collection per neighbourhood with separation bins
- Burning of waste
    - health risk due to air pollution
        - no waste to burn by circular economy
- Specific: light fiber plastic, ends up in river, should be forbidden by government and manufacturers only produce different.

IX. TEACHERS PROGRAM – WORKSHOP 18TH OF FEBRUARY











X. PROCEDURAL INTERVENTIONS

ReSOLVE framework: six action areas for businesses and countries wanting to move towards a circular economy based on Ellen MacArthur Toolkit for policymakers

principles		principles mapped on dimensions		explanation of principle within dimension
REGENERATE	Shift to renewable energy and materials Reclaim, retain, and restore health of ecosystems Return recovered biological resources to the biosphere	**OPTIMISE LOOP**	S	Leverage big data, automation, remote sensing and steering - e.g. sensors in collection bins Remanufacture products or components - e.g. plastic Recycle materials - e.g. HDEP
SHARE	Share assets (cars, rooms, appliances) Reuse/secondhand Prolong life through maintenance, design for durability, upgradability	**REGENERATE**	E	Shift to renewable building materials - e.g. bamboo Reclaim, retain, and restore health of ecosystems - e.g. urban riverfront buffer zone
OPTIMISE	Increase performance/efficiency of product Remove waste in production and supply chain Leverage big data, automation, remote sensing and steering	**SHARE**	M	Share assets as included in site&service schemes for new housing - e.g. cars, rooms, appliances
LOOP	Remanufacture products or components Recycle materials Digest anaerobically Extract biochemicals from organic waste	**EXCHANGE**	SE	Apply new technologies - e.g. 3D printing
VIRTUALISE	Dematerialise directly (e.g. books, CDs, DVDs, travel) Dematerialise indirectly (e.g. online shopping)	**VIRTUALISE**	P	
EXCHANGE	Replace old with advanced non-renewable materials Apply new technologies (e.g. 3D printing) Choose new product/service (e.g. multimodal transport)			

Potential of community-based-organizations in Sub-Saharan urban areas

An exploration of the potential of community-based-organizations regarding waste management in Sub-Saharan-Africa

AR3U022 Theory of Urbanism

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Abstract – Due to the rapid urbanization in Sub-Saharan countries, especially in Kenya and the lack of sufficient urban implementation by the government (UN, 2017), urbanity issues are resulting in unhealthy circumstances for local inhabitants. The current inadequate waste management throughout Nairobi remains a spatial challenge as it contributes to health concerns, threatens local ecologies, and degrades public space. As current top-down approaches are lacking local implementation, possible solutions can be found in community-based-organizations (CBOs). In this paper the focus lies in the current meaning of CBOs and their potential to contribute to sufficient solid waste management (SWM). By reviewing literature on CBOs, referring to recent newspaper articles and by analyzing a selected amount of case studies in least-developed countries, this paper aims to explore the opportunities and challenges of CBOs regarding circular waste management. This aim contributes to the translation of the CBO currently in Dandora, the Dandora Transformation League (DTL), which has a major role in the graduation project.

Key words: Sub-Saharan Africa, circular principles, community-based organizations, solid waste management

1. Introduction

The world population is projected to increase by more than one billion people within the next 15 years, reaching 8.5 billion in 2030, to increase further to 9.7 billion in 2050 and 11.2 billion by 2100. (UN 2015)

'Africa: fastest growing continent' – UN 2017

More than half of global population growth between now and 2050 is expected to occur in Africa, with the highest rate of population growth by 2.55 per cent annually in 2010-2015 (UN 2017). According to the predictions Africa should prepare for a total population increase of about 60 per cent between 2010 and 2050, with the urban population tripling to 1.23 billion during this period.

A more detailed data set in figure 2, shows the continuous growth of the African continent, whereas this will decrease in the region of Asia after 2040. The urban growth has led to a rapid increase in poverty. It is estimated that 46 per cent of the urban population in Kenya live below the poverty line, often in informal settlements which are deemed to be 'illegal' (Ishani & Lamba, 2018). More than half of Nairobi's 3.5 million inhabitants live in slums. (Ministry of Environment and Natural Resources, 2016). Hand in hand with this development, cities produce an ever-growing amount of solid waste. (Ministry of Environment and Natural Resources, 2016). Lack of formal employment opportunities and the fast-growing informal sector (8.1%), however, offers alternatives in the waste management sector (Ishani & Lamba, 2018).

Waste management is an essential and urgent problem, in the words of Director of the World Bank: "*Solid waste management is everyone's business. Ensuring effective and proper solid waste management is critical to the achievement of the Sustainable Development Goals.*" (Ijjasz-Vasquez - Senior Director World Bank) (Kaza, Yao, Bhada-Tata, & Van Woerden, 2018).

Sub-Saharan Africa, identified as least developed country (LDC), has a low waste collection rate and due to irregular or no waste collection (Bundhoo, 2018). Currently, 69 percent of waste in the Sub-Saharan Africa region is openly dumped, and often burned (figure 3.36). Around 24 percent of waste is disposed in some form of a landfill and about 7 percent of waste is recycled or recovered. Identified as increasing problem is that many people in LDCs are resorted to illegal practices such as illegal dumping or open burning of wastes.

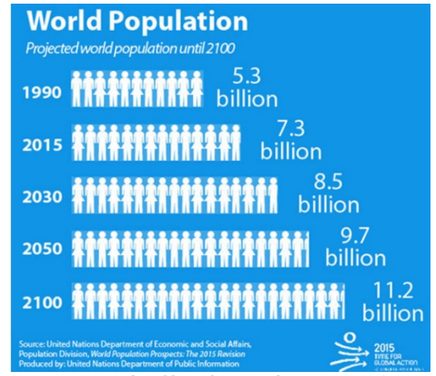

Figure 1 - *projected world population until 2100 – UN 2015*

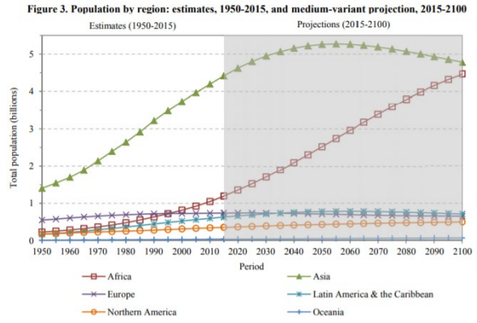

Figure 2 - *United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision. New York: United Nations.*

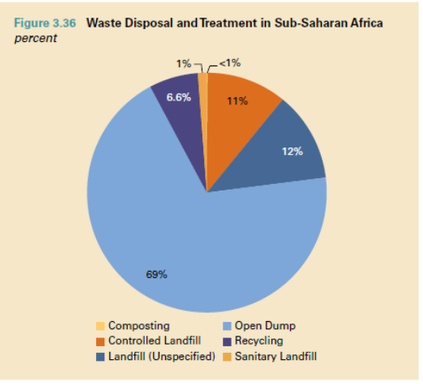

Figure 3 - *Waste disposal and Treatment in Sub-Saharan Africa – p. 82*

Burning releases toxic gases which may have irreversible health effects (Bundhoo, 2018).
In this paper is put an eventual focus on Kenya and its capital Nairobi. Nairobi produces around 2,400 tons of waste per day. While 93 per cent of Nairobi's waste is potentially reusable, only 5 per cent is recycled and composted. Moreover, only 33 per cent of waste produced is collected for disposal at Nairobi's single official dumpsite, Dandora (JICA, 2010). This dumpsite, of 43 hectares, contaminates the groundwater which results in poisoned blood

levels in half of the 328 children being examined by UNEP in 2007 (Ministry of Environment and Natural Resources, 2016).

Circular economy (CE) is currently gaining momentum both in academic world as in business. It includes concepts of solutions regarding waste management, as it is a regenerative system in which resource input and waste, emission and energy leakage are minimized by slowing, closing and narrowing energy and material loops (Kirchherr, Reike, & Hekkert, 2017). This can achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, recycling, and upcycling (Geissdoerfer, Savaget, Bocken, & Hultink, 2017). This is in contrast to a linear economy which is a 'take, make, dispose' model of production (Ellen Macarthur Foundation, 2013).
Apart from the multiple notions that reduce and reuse is preferred to recycling waste, various researchers moreover express the required radical alternative solutions needed in order to achieve a complete system innovation towards the CE (Ness & Xing, 2017). Recognizing the complexity and interconnections of the system, numerous research ply for the combined top-down and bottom up approach (Pomponi & Moncaster, 2017).

Problem statement

Waste management regulated by top-down-systems in sub-Saharan African urban areas is insufficient. Nairobi exemplifies the problems of a dysfunctional waste management system, as in contributes to polluted air, water and soil causing health concerns, threatens local ecology and illegal landfills, eventually resulting in degraded public space (Ministry of Environment and Natural Resources, 2016).

Currently, existing private sector companies in Nairobi collect waste only in middle to higher income areas, while not engaging in any activities in relation to recycling of organic waste. This leaves two thirds of residents without any proper waste management services (Ministry of Environment and Natural Resources, 2016). Since Kenya envisage the '*polluter pay principle'*, where every polluter must meet the cost of disposing the waste in question, this is not possible for the low-income inhabitants in Nairobi, which is more than 50%. (Wangatia, 2013)
However, research has proven that the majority of the population participating in SWM practices, were motivated by the income generated from this practice. This could be seen as opportunity to invest in for long-term and sustainable investments (Wangatia, 2013).

Identified by local authorities are the challenges for LDC regarding waste management, highlighting mainly scarcity of funding and lack of legislation. Shortcoming of funding also means that municipal councils do not have enough workforce or equipment to properly manage the increasing amount of waste. Besides, the lack of legislations means that segregation practices cannot be enforced at source while absence of charges or taxes also implies that a considerable source of revenue is not collected (ICLEI & UCLG Africa, 2014).

Kenyan authorities published a SWM strategy in 2014 in response to citizen complaints of poor waste management, outlining collective action mechanisms to systematically improve waste management (National Environment Management Authority, Kenya (NEMA), 2014). This kind of top-down visions are lacking results on local scale, confirmed by local urban planner at Placemakers and working for UN-Habitat Nairobi Mark Ojal.

In addition, in the What the Waste 2.0 report is formulated as main reason for Sub-Saharan Africa waste problem that the governments are facing difficulties in coordination services and investment at the intermunicipal level. However, they state that capital financing alone is not the only sufficient solution for Sub-Saharan Africa's solid waste sector. Remarkable is the conclusion on challenging partnerships with the private sector. They state that although international companies are interested in larger public-private partnership opportunities, there only have been few successes. Financial, institutional, and political complications can make it difficult to attract international companies for waste activities. Municipalities are looking for ways to expand local capacity (Kaza et al., 2018).

Hypothesis

The hypothesis is based on two main themes. First, CE paradigm is aiming at using waste streams as a resource of secondary resources and to recover waste for reuse and recycling. This approach is expected to achieve efficient economic growth while minimizing environmental impacts (Kaza et al., 2018).
Secondly, the strong feeling of community in low income areas, which enables locally grown community-based-organizations. These initiatives are also gaining momentum currently, as top-down management lack in implementation towards urgent matters as waste management. My educated guess as urban researcher is that community-based-organizations (CBO) could help solving the waste management problem with their locally imbedded implementation.

As an example of a CBO, the Dandora Transformation League in Nairobi is a locally initiated organization, leading different workshops and campaigns to improve public space with the help of the local residents. By competition between courts, their strategy is to continue these improvements and to aim for more. ("Dandora Transformation | History, Mission and Vision," n.d.)

To underpin this hypothesis, the argument that participation of communities in their own development choices is increasingly attractive option for those seeking to bring about more active political constituencies in urban Africa (("Waste is wealth," 2018). Moreover, as stated in the '*State of African cities 2014'*, all too often, however, participation is weakly employed as a coercive mechanism to consolidate political power. Politicians make promises they fail to keep, thereby risking urban political disengagement and potentially inviting community power exercised in alternative ways, including public disobedience, social unrest or violent conflict (ICLEI & UCLG Africa, 2014).

Research question

To understand the problem statement and hypothesis, it is first important to understand what community-based-organizations are. Secondly what their impact could be in solid waste management. This leads to the main research question: *What are challenges and opportunities for CBOs to be a suitable solution for the waste management system?*

Regarding the urgent matter of rapid urbanization in the African continent, the waste management problem and it's lacking implementation of the system and the possible chance of community-based-organization and circular economy principles, this paper is of current importance. The objective for this paper is to explore existing literature on community-based-organization and to argue this as an alternative to the current paradigm for a sufficient system for waste management in Sub-Saharan-Africa. The final aim is to seek challenges and opportunities to learn from the CBOs regarding efficient SWM to implement them in the case study of my graduation project in Dandora, Nairobi.

To research thorough in order to answer the research question, this paper gathers in-depth insights by using different analytical methods. By reviewing shortly existing literature on the concept of circular economy and more elaborated on community-based-organizations, by analyzing academic papers on waste management in sub-Saharan African areas and the opportunities to solve this problem as well comparing these with case studies on ongoing examples of existing community-based-initiatives by secondary data like newspapers, blogposts and interviews, this paper is an attempt to reach to a conclusion. Most of the collected data are qualitative. Given the complex nature of urban development due to its multiple stakeholders and economic, political and societal impacts, case study research was found to be a suitable methodology for this research. Qualitative case study research is a commonly used research approach in urban studies to understand "complex social phenomena", as it is a useful strategy to gather contemporary insights within a real-life situation (Yin, 2009).

However, regarding the defined amount of words, the limited perspectives by academic sources and the tight time this paper is not able to give a complete and multi-perspective review, but it does an attempt. As urban researcher I suppose there is an opportunity for this growing momentum regarding local initiatives to solve the urgent waste problem. For the future is would be fruitful to undertake more research regarding lessons learned from best practice circular examples in developed and developing countries.

2. Literature review

Community-Based-Organization

To understand what is meant by community-based-organization, firstly this paper addresses the question: *What is a Community-Based-Organization?'*
In the book 'Community-based-interventions', Murphy (2014) explains what CBOs are in the following words: Community-based organizations are predicated on participation and enable communities to deal with their problems, as every facet of their planning and executing is a collective effort. Not only participation, but also the emphasis on widespread inclusion and the accompanying proliferation of ideas are characteristics of CBOs. Community-based projects, additionally, are bound together by moral convictions, ideals, and particular commitments (Murphy, Chen, & Powell, 2014).
As Murphy precisely points out, various authors (Chaskin and Greenberg 2015; Logan and Rabrenovic 1990; Yates 1973) elaborate on the fact that CBOs working closely with communities to promote neighborhood democracy by taking on some executive functions of informal governance and strengthening the sustainability of the community (Chaskin 2003; Chen and Webster 2005). Since CBOs are frequently formed from everyday conversations among friends, they are often informal in nature.

Moreover, community-based organizations are not simply characterized as informal due to their absence of hierarchy, they gain legitimacy by confirming the reality constructed by a community and operating within these confines (Murphy, 2014). As key issue is identified that community-based organizations should have traits that foster participation, as Murphy states that these organizations should be a vital part of communities. He also stresses that since these organizations are loosely-coupled and based on interaction, their stability is achieved through ongoing dialogue.

Since in the definition organization is included, it is important to understand the management of these kind of organizations. As Rothschield and Whitt believe is that as the emphasis of employee participation in the design of tasks and the overall operation of the organization, it is referred to 'self-management' or 'self-governance'. As a result, persons at all levels can participate meaningfully in designing their jobs and giving direction to an organization. As Murphy follows up on his colleagues Manz and Sims (1980), hierarchy begins to dissolve, the control of the organization is no longer centralized (Murphy, 2014).

As Rauws understands self-governance as self-organization and sees this kind of organizations applied in many studies on civic initiatives in urban development, he continues to explain 'self' in a complexity-inspired understanding, where the 'self' is referring to the 'unplanned' emergence of organization 'by itself' or 'spontaneously'. He cogently argues that 'self' foremost is referred as 'do-it-yourself': a network of citizens, interest groups or entrepreneurs taking action more or less independently from governments (e.g. Van Dam et al., 2009). 'Do-it-yourself' initiatives sometimes have a rebellious character, working their way around established governance networks (Rauws, 2016).

As conclusion, the usual claim that loosely-coupled organizations like CBOs will be chaotic and inefficient is contradicted by Murphy. His statement is that a decentered and porous organization, instead, is illustrated to be responsive to a community and an effective provider of social services. To use a phrase adopted by Onyett (2003, p. 166), these organizations rest on "authority from below," and thus have a purpose and direction that are socially relevant. The claim of 'authority from below', could be an answer to the expressed necessity of new innovative systems towards the CE paradigm.

Reflecting on the above-mentioned CBO called DTL in Dandora and the theoretical review on CBOs, this organization is indeed formed by everyday conversations on their dissatisfaction on the degraded public space by waste. Their initial set up was informal, based on interaction and ongoing dialogue. As it grows organically, their network of citizens taking action was increasing and established a self-governance way of working. As Rauws reveals 'self' in two different ways, in the case of DTL self is as well referring to the unplanned emergence of the organizations as well to the independently from governments acting group of entrepreneurs.

3. Analysis

In this part of the paper, firstly will be elaborated on the necessity of revising governance structures towards an alternative for waste management paradigm in Sub-Saharan-Africa. Secondly, some examples regarding Solid Waste Management (SWM) and the performance of CBOs are cited. Resulting out of these example case studies, thirdly the requirements, challenges and opportunities towards CBOs will become clear. This, in order to take lessons learned from best practice, and later on apply for the specific case of the Dandora CBO.

As Wunsch concluded, in contrast to the many disappointments of central government-designed and central government-led decentralization reforms, there have been many locally initiated, self-organized, and largely informal governance successes. Africans at the grassroots have frequently come together to manage their shared, public affairs: to engage in governance through collective action, in for example waste issues. (Wunsch, 2013)

The importance of a revision of the top-down system regarding achieving an environmental agenda including mainly waste management in Eastern African cities, is highlighted by the ICLEI report (2014). As requirement to realize this, radical decentralization of powers at local, municipal levels enable community level self-organization of these processes. As it underpins the importance to reconsider how bottom-up systems of governance might be implemented in short terms, it is remarkable the multiple times partnerships with communities and engagement at the city level regarding waste management are recommended. It outlines that linking top-down driven initiatives to bottom-up priorities requires additional concerted attention, so that regional scale interventions link to local initiatives more cohesively. In a sense, the need for top-down formal institutions that can act intelligently on governance, planning and resource management strategies is obvious (ICLEI & UCLG Africa, 2014).

Specifically in Eastern African cities, urban waste provide many circular opportunities and they are key for area development. Informal waste recycling already exists but jobs are often unsafe, poorly paid and taken up by the most marginalized among the urban poor. Waste removal and processing policies and other supportive instruments (e.g. regulations and strategies) for moving waste recycling towards safer, more profitable and socially valued occupations are needed. (ICLEI & UCLG Africa, 2014). Diversifying to local, medium scale waste markets can help migration towards circular resource management if solid waste is reused in the CE school of thought.

To explore the best practices on solid waste management SWM, community-based-waste management (CBWM) in CBOs this paper analysis some example case studies in different least-developed-countries. Cases are varying from Kenya, Zimbabwe, Tanzania to India.

The first example case study analyzes over 70 community groups that took part in waste management activities enabled by CBOs. When the concept started, in the early 2000s, volunteers came together to do clean-up activities and awareness campaigns. With the realization that there is '*money in waste*', most groups are now earning a living from such projects. This investigation explicitly mentioned the identified opportunity in CBOs for SWM (The Herald, 2015).

The second case study is situated in Dar el Salaam, where through partnership with CBOs many residents in settlement of Kinondoni Municipality have access to solid waste management services. However, policy gaps (absence of SWM policy, little attention from ministry and poor enforcement of regulations) contribute largely to informal waste management practices in Kinondoni. This weak policy strategy creates implementation barriers that give opportunity to the rise of illegal waste management practices. Another remarkable aspect is the attitude towards SWM, depending on awareness-campaigns and education. In this example, in low income areas and in slums the perception dominates that the waste collection is duty of the municipality. Moreover, this research pointed out the problem of non-participation from some people in the community which is an obstacle for CBOs revenue recovery.
There is a need to upgrade of the waste management system into waste reduction, separation, recycling and composting as it is identified to be a practical solution for SWM in Tanzania. As conclusion of this investigation, CBOs are seen as capable and reliable to provide waste management services and local employment. In this specific example, it has employed 24 people from local community in Tanzania. Public awareness campaigns are needed to motivate community participation and to enhance locals to adopt circular principles when it comes to waste management, summarizes the recommendation of this exploration. (Simon, 2008)

Thirdly, an in-depth research by Habitat International Coalition (HIC) into Kenya, Angola and South-Africa has been done regarding SWM in communities and their lessons learned. Noteworthy is the case in Kenya, based on multiple groups of low-income women involved in composting of organic waste. Three local NGOs have provided support and training to CBOs regarding education on composting. Since the Nairobi City Council can only manage to collect half the waste generated and lack on policy of waste reduction, for the unemployed residents using waste as a resource is a way of reducing the environmental problems as well as a means of obtaining an income. As result, there was a notable physical improvement in the environment. However, the analysis concludes that without participatory development, it becomes almost impossible for the governments to deal with waste issues. Waste reduction and composting in the Kenyan case would not have been possible if the women had not received training from the NGOs (Ishani & Lamba, 2018).

The fourth case study is a research on the efforts by CBOs to promote a sustainable SWM in Indian mega cities. The initiator, an NGO called EXNORA, based their effort on a 'zero waste management scheme', set up, run and financed by the residents themselves. The study learns that both case studies indeed succeeded in mobilizing enough motivation, funds and energy to start with an ambitions SWM scheme from scratch. However, despite their initial motivation, the communities face difficulties like lack of technical and institutional support and missing cooperation with the private sector. Moreover, since the NGO identified SWM as medium to promote a new model of society based on participative democracy, it places SWM at the core of society. It stresses the need for local bodies to be more aware of people's concerns and for citizens to be more involved in civic affairs. (Colon & Fawcett, 2006).

An investigation explicitly on the effects of Community Based Waste Management (CBWM) systems on people's attitude toward waste management has been done in Semarang City, Indonesia. It reveals the waste flow in areas with CBWM, which has positive effects on waste discharge behavior. There were no residents disposing their waste on the side of the road, into river streams or burning their waste illegally

where CBWM was already implemented. Consequently, it can be concluded that CBWM reduces inappropriate waste disposal behavior and in turn contributes to environmental improvement.
Moreover, from the waste flow analysis, it was estimated that 33% of MSW could be recycled and avoid landfill by implementing CBWM (Sekito, Prayogo, Dote, Yoshitake, & Bagus, 2013). The composting of organic waste and recovery of materials such as plastics certainly contribute toward reducing landfill waste and are a way to enhance the circular economy paradigm.

The sixth example is based in Yala, southern Thailand where residents were encouraged to bring recyclable material to exchange for eggs at exchanges in local communities. The project aimed not only at garbage reduction, but also at community empowerment through self-reliance, establishing new relationships of more equality and less dependence, between poor communities and the municipal administration. As conclusion this analysis reveals that the municipal policy makers become convinced of the advantages of community participation and empowerment (Mongkolnchaiarunya, 2005).

The last example includes a case in Kitale, Kenya based on participatory-based development planning that employs peer-to-peer learning and exchange as vehicle for replication and scaling up. A strategy also used by organizations such as Slum/Shack Dwellers International. They engage directly with the urban poor in establishing skills and management capacity within communities, and facilitating partnerships between poor communities and municipalities wherein community-led development agendas take precedence. In Kitale (Kenya), the "Building in Partnership: Participatory Urban Planning" project worked with government agencies, civil society and the private sector, demonstrating that neighbourhood level participatory processes can be scaled up to municipal levels (Chege, P, 2006).

3. Requirements:
Subsequently these example case studies, general rules for a well-functioning CBO could be set up. The following resulted from as well reviewed literature, the case studies as analysis of newspaper articles:

- Important in a CBO is the willingness of members to participate, since members often join a project because of their ideals and desire to change their surroundings (Murphy, 2014). Almost all the case studies emphasize the significance of a participatory process (Chege, P, 2006; Mongkolnchaiarunya, 2005; Colon & Fawcett, 2006; Ishani & Lamba, 2018; Simon, 2008). Many case studies address the lack of participation as crucial factor (Simon, 2008).

- Members in CBOs, do not feel necessarily rewarded by climbing an administrative ladder. Therefore a requirement for members can be found in enriching experiences and relationships, combined with feelings that they have improved the quality of life in a community (Murphy, 2014). This is expressed in the contribution of the residents in Yala, improving their direct physical surrounding (Mongkolnchaiarunya, 2005).

- Education fosters independence and dignity of community members. In Murphy's book this process of disseminating knowledge throughout a community without monopolizing the learning process, identified as key principle (Murphy, 2014). This requirement is illustrated by the conclusion of the case study in Nairobi, which claims that without education their aim would not be reached (Ishani & Lamba, 2018). In addition, as the implementation of CBWM was successful, it identified education as key factor (Sekito et al., 2013).

- Involvement of stakeholders from the level of tokenism to the level of citizen power. Shifting from 'informing' stakeholders, to 'delegated power and citizen control'. Professionals including architects and urban designers should be involved in the planning process, to create shared goals and to improve legitimacy of decision-making (Vogel, n.d.).

- Planning, as Portugali suggests that planning should be 'just-in-time' rather than 'just-in-case'. The just-in-time planning should however consist of actual plans, albeit short-range and micro in scale, rather than letting the postmodern milieu take over (Portugali, 2012). In extension, the importance of creating a planning together with all involved stakeholders has been mentioned multiple times (Chege, P, 2006; Colon & Fawcett, 2006).

- Sense of self organization as defined by Wunsch in urban development as example for citizen involvement initiatives for spatial interventions that originate in civil society itself, via autonomous community-based networks of citizens, outside government control. (Wunsch, 2013) As addition, Rauws describes self-organization either as emphasizes the spontaneous and emergent character of some civic-led urban development, as well as 'do-it-yourself ': a network of citizens, interest groups or entrepreneurs taking action more or less independently from governments (Rauws, 2016).

Opportunities

As emerging CBOs gain momentum for specific reasons, this analysis results in the following opportunities for CBOs:

- Public private partnerships involved in waste management are likely to be successful if decisions are made at the very beginning of project or processes. Partners should comprise different sectors including public, private, individuals and business institutions (Simon, 2008). The research by EXNORA also implies to promote public-private partnerships in this field (Colon & Fawcett, 2006).
- In a community-based organization, everyone is expected to be a leader and share their skills, so that various persons can emerge at different times to give advice or direct a particular task. A single leader would be a liability by dominating an organization and inhibiting the necessary adjustment (Murphy, 2014).
- The youth of Eastern Africa are the key to establish positively reinforcing values and norms since they are mobile and self-organized within peer and other groups to a large degree. To engage with them, crucial is to understand the way the youth is integrated in formal and informal systems of governance, and their right to participate in constructing their own future (ICLEI & UCLG Africa, 2014).
- In succession of the former opportunity, ICT and media platforms can play a key role in spreading awareness, holding formal institutions responsible and in creating accountability. They provide an alternative regulatory framework to formal institutions of governance and can create transparency in new ways. (ICLEI & UCLG Africa, 2014).
- Evolving in self-sustainable CBO without depending on donor funding, is by operating as a commercial entity. In different waste management activities, it employs various employment opportunities (The Herald, 2015; Ishani & Lamba, 2018).

Challenges
Learning from best practices of CBOs in these LDC, the following challenges can be found:

- When an CBO get no financial aid or funding by NGO, an external partner or by the government, it has difficulties to sustain. To illustrate by an example of Mathare: when the Clean-up-Nairobi (CUN) campaign started, the NCC helped by providing equipment and financial support but now the coalition has collapsed as the NCC is no longer giving its support (Ishani & Lamba, 2018).

- When locals do not have an incentive in order to participate in the CBO, they are likely to not cooperate in projects. As the case study of Chennai reveals, local community was willing to participate in waste related activities, due to the financial opportunity included (Simon, 2008).

- Single leadership would be liability by dominating an organization and inhibiting the necessary adjustments (Murphy, Chen, & Powell, p. 54, 2014). Moreover, in the case of EXNORA leaders have been unable to delegate responsibility; nor to develop representation (Simon, 2008).

- Top-down strategies for urban change require grounding in grassroots realities, which is the primary role of participatory processes. A secondary, but equally beneficial, role is the engenderment of political constituency at the grassroots level (ICLEI & UCLG Africa, 2014). This results in innovative system, where a linkage and overall supervision between different actors are both crucial and often lacking (Simon, 2008).

- By fostering collective action, a CBO should be porous and contingent, without losing their identity. In this way, these organizations can merge with communities and reinforce solidarity (Murphy, Chen, & Powell, 2014).

- Lack of feeling of responsibility, formulated as the phenome of NIMBY (Not In My Back Yard) has been a treat explained in the case of the two south Indian cities by the NGO called Exnora (Simon, 2008).

- Finally, but no less significantly, the communities have a limited business orientation. Therefore, strategies are not based on a good understanding of cost-recovery, leading to financial non-viability of the projects (Simon, 2008).

4. Conclusion

Starting with the emerging waste issue in the world and the current top-down approach, especially in Sub-Saharan Africa, the introduction concludes with seeing opportunities in circular principles to change the current waste management paradigm.

Setting a hypothesis based on as well CE paradigm, but moreover on community-based-organizations, the literature review and results are revealing characteristics of CBOs and their impact on waste management. After reviewing the definition of CBOs and analyzing different case studies in LDC, this resulted in an overview of requirements, challenges and opportunities for CBOs and their impact. To answer the research question: *What are challenges and opportunities for CBOs to be a suitable solution for the waste management system?* lessons can be learned to improve the working of the CBO in Dandora, DTL. As key requirements a CBO can work sufficient if there is willingness to participate by locals, as there is education to foster independence of members, involvement of stakeholders in creating a shared planning and vision and at last a sense of self-organization. As main opportunities public-private-partnerships are mentioned by various sources, as well the chance to cooperate with the youth. Moreover, over-time changing leadership is identified as major success factor. The treats as discovered by the analysis, mainly include financial restrictions to sustain CBO or waste management activities, lack of local incentives to participate and the missing management to supervise the linkage between different actors and scales.

To apply this on the Dandora case, DTL could improve on educational tools to foster different community members towards more independently oriented actions. In case of scaling up and spreading out their concept, as the DTL vision formulates, the sense of self-organization should be not forgotten. Currently DTL is working on reaching out to the youth, already by (social) media, but since this is identified as key opportunity, this could be enhanced even more. Considering the fact that DTL initially started off as competition between courts, different members could become winner and leader for a period of time. However, to make sure there will be no single leadership dominating, supervision to be changing from time to time is key. At last, current collaborations with various stakeholder could be complemented by public-private-partnerships specific on circular resource management.

Future research into the role of circular economy is recommended, since there is a lack of available data or case studies regarding this specific topic. However, this paper aims to connect the possibility of community-based-organizations with circular waste management. Considering the fact of the narrow amount of case studies, the limited scope and the defined time to research, this paper is not a complete overview.

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Picture : Ben White 2010 - creative cloud

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