http://www.diva-portal.org

Preprint

This is the submitted version of a paper presented at *SBE16 Cairo: A proactive approach for sustainable built environment, Cairo, Egypt, November 29 - December 1, 2016.*

Citation for the original published paper:

Redeker, C., Nazer, H. (2016)
Designing Cycles – Solid Waste Management: Case Study Geziret El Dahab
In: *SBE 16 Cairo Conference: INTEGRATE People • Process • Technology: A proactive approach for sustainable built environment. Proceedings Book.* (pp. 392-404).

N.B. When citing this work, cite the original published paper.

Permanent link to this version:
http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-193576

Designing Cycles – Solid Waste Management

Case Study Geziret El Dahab

Cornelia Redeker[1], Hanaa Nazer,

[1] German University Cairo, Department of Architecture and Urban Design
New Cairo City, Main Entrance El Tagamoa El Khames, Egypt
e-mail: cornelia.redeker@guc.edu.eg

[2]Fayoum University, Department of Geography
Al Fayoum, Egypt
e-mail: hanaanazer@yahoo.com

Abstract: *With an estimated 8,000 inhabitants (see Nazer, 2006), the agricultural island of Geziret El Dahab as one of the protected Nile Islands is a green haven in the middle of the megapolis Cairo. Currently, there is no solid waste management system in place. While organic waste is mostly fed to the animals, an-organic waste is either thrown in the Nile, on its shores, or burnt. Apart from a missing sewage system, this poses the most pressing problem for the island's ecology.*

The action-based research outlined includes
- *A household survey to understand the willingness and preferences of the inhabitants*
- *Potential models of solid waste management on and off the island*
- *A test-run of waste collection in cooperation with Ihlam, a student's environmental group, the islanders and the Zabaleen of Manshet Nasr*
- *A SWOT analysis of four customized SWM models for the island*

The action-based research evaluates the spatial, legal and socio-economic parameters for the installation of a solid waste management system on the island and is part of the Nile islands Initiative (Nil).

Keywords: *action-research, Nile islands, participation, recycling, solid waste management*

1. INTRODUCTION

1.1. THE NILE ISLANDS INITIATIVE - DESIGNING CYCLES

The Nile Islands Initiative (Nil) is a multidisciplinary open platform initiated to map, protect and activate the spatial qualities of the Nile Islands in the context of increasing urbanization. There are an estimated 144 islands in the Nile of which many are threatened by encroachment and environmental degradation. At the same time their legal status is unclear. Dahab Island in the middle of Cairo is currently serving as a case study for Nil activities. Environmental protection and urban upgrading regarding informal building activities, water quality and supply, solid waste management, engagement of the local community and habitat protection are the strategic aim of the Nil series “Designing Cycles”.

1.2. SOLID WASTE MANAGEMENT IN CAIRO

As any megapolis, Cairo is struggling with the provision of solid waste management services and infrastructure. Many communities and neighbourhoods are either not served or not served adequately by the state collection service currently provided by multinationals. For Egypt, only an estimated sixty per cent of the waste produced is actually collected, of which less than twenty per cent is recycled or properly disposed of (see nswmp.net). According to the GIZ, “despite international support, the institutions responsible for waste collection and disposal are not yet able to perform their complex tasks. The legal framework is inadequate, there is no strategic planning, and the allocation of responsibilities and tasks remains unclear. The sector is significantly underfinanced and there is an enormous need for sustainable investments and services”. The majority of solid waste collection services in Cairo are currently provided by the Zabaleen, the mainly informal garbage collectors of Cairo. While the formal collection services dispose the waste to landfills, the Zabaleen manage to recycle 60% of Cairo’s overall waste by collecting, sorting and recycling privately. The informal solid waste management system of the Zabaleen has resulted in Manshet Nasr, a whole city district of predominantly coptic waste collectors (men) and sorters (women) also known as Garbage City and a number of other neighbourhoods of garbage collectors who have divided large parts of the city terrain among themselves to provide services (see Figure 1).

As of yet, the informal segment that has evolved since the 1950s and the much younger state-run system do not cohere as one works via door-step collection while the other provides centralized roadside collection points that are often scavenged or otherwise torn apart by dogs and cats (see Figure 2). In addition, contractual penalties for international companies are very lax regarding pick-up delays. In a city as dense as Cairo with its hot climate, this leads to great health risks and unpleasant visual and olfactory street conditions. Beyond aspects of corruption, the general lack of awareness regarding solid waste, both as a resource and even more so as a health threat are challenging change.

Currently, a number of initiatives are underway to improve the situation. The National Solid Waste Management Initiative under the auspice of the Ministry of Environment is developing policy, legal and institutional framework and providing capacity building at the national and local levels with support by KfW, the EU and GIZ. However, this program is currently not focussing on Greater Cairo, but on the other Egyptian governorates. On a local sale, the Giza governorate has formed the Cleansing and Beautification Authority, however Geziret El Dahab is not declared a priority area.

In parallel, the informal sector, is developing mechanisms to formalize. As the current contracts of the formal sector for Greater Cairo are anticipated to end in 2017, the Spirit Of Youth Organization of Manshet Nasr is supporting informal collection practices to formalize by becoming microbusinesses. In cooperation with the informal sector, previous governments have provided system proposals on how to integrate a separation practice to differentiate between organic and anorganic waste, so far without execution.

The current situation underlines the need for self-initiative by inhabitants and the inclusion of the informal sector on a path to a more sustainable formal practice.

Figure 1: Informal and Formal Sectors – Zones served by Garbage Collectors and Landfills in Greater Cairo (source: Designing Cycles Waste and Water, Nil, GUC Architecture and Urban Design Program, students A. Faisal, M. Bargash edited by S. Sherif)

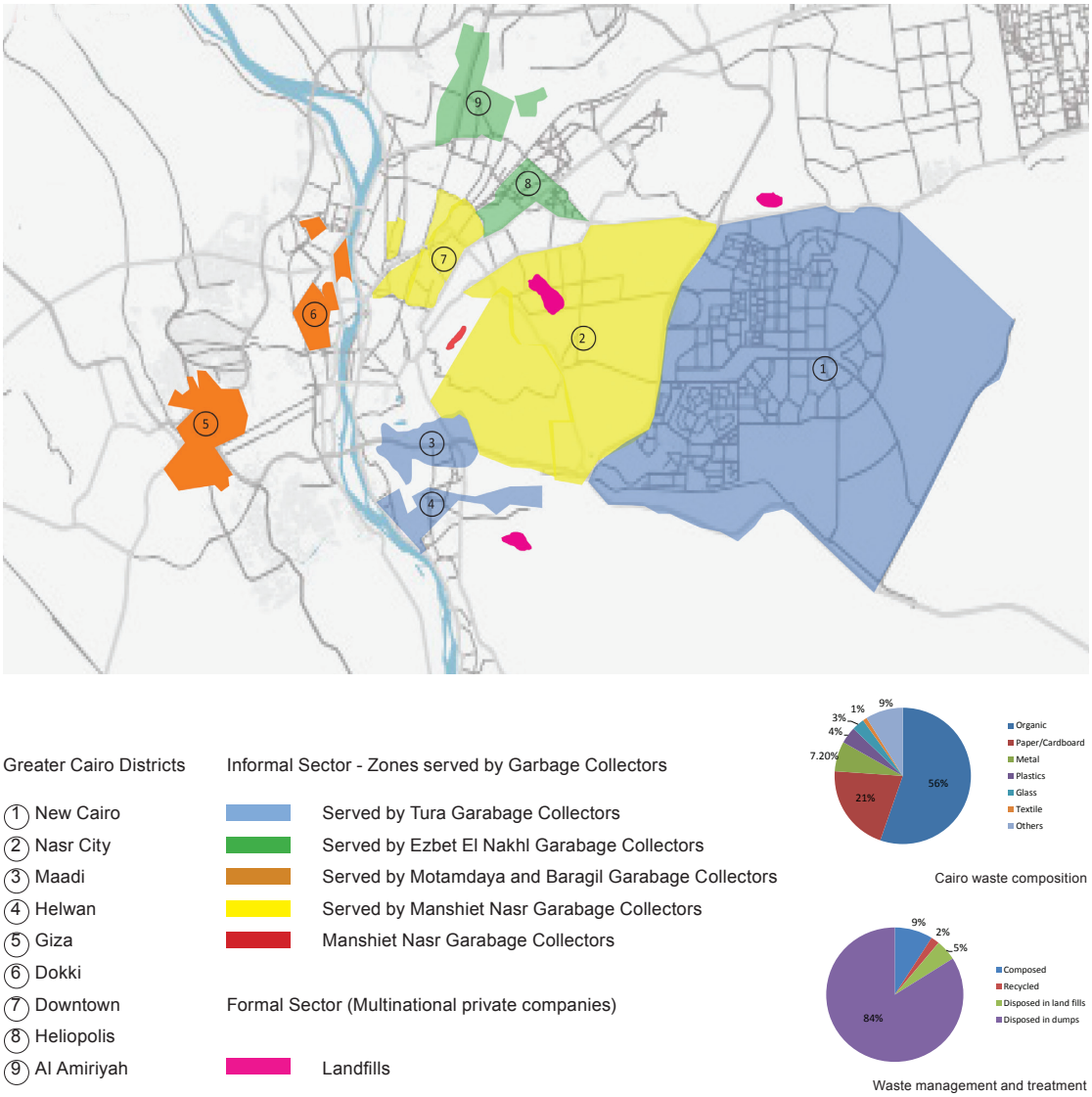
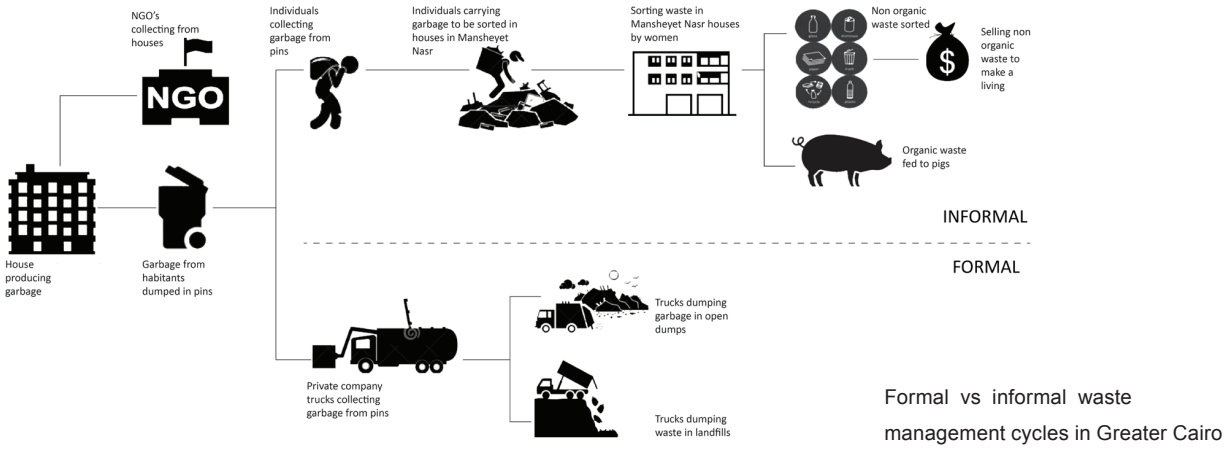
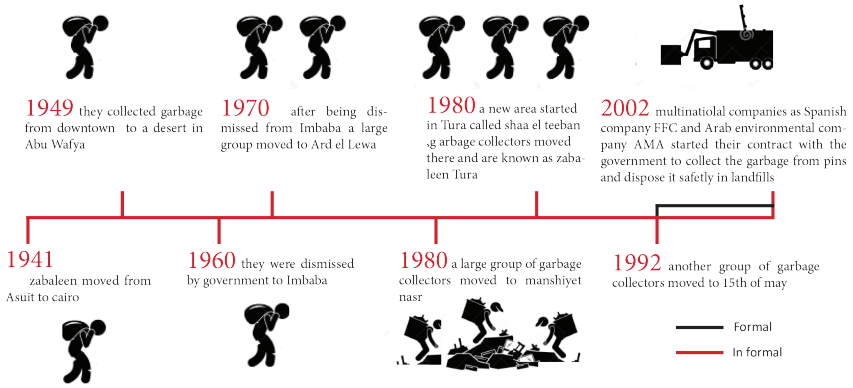


Figure 2: Evolution and Building Typology of Formal vs. Informal Waste Management Cycles in Greater Cairo (source: Designing Cycles Waste and Water, Nil, GUC Architecture and Urban Design Program, students A. Faisal, M. Bargash edited by S. Sherif)



Formal vs informal waste management cycles in Greater Cairo

Manshiet Nasr housing typology



Evolution of formal / informal waste management system in Greater Cairo

1.3. THE CASE OF GEZIRET EL DAHAB

Already today, Dahab Island has many qualities other cities are struggling to develop: it is car-free, contributes to local food production and composts its organic waste. At the same time its infrastructural and environmental shortcomings offer a fruitful ground for decentralized cyclic solutions. With an estimated 8,000 inhabitants (see Nazer, 2006), the agricultural, car-free island of Geziret El Dahab as one of the protected Nile Islands is a green haven in the middle of the megapolis Cairo. Currently, there is no solid waste management system in place. While organic waste is mostly fed to the animals, an-organic waste is either thrown in the Nile, on its shores, or burnt. Apart from a missing sewage system and agricultural pollution, this poses the most pressing problem for the island's ecology.

The island lies within the jurisdiction of the Giza governorate. Apart from the supply of drinking water and electricity, Dahab Island has been neglected in terms of infrastructural provision due to its informal state of urbanization and contesting interests regarding its future development. It is one of the three environmental protectorates of Greater Cairo (Ministry of Environment). A large section of the island is owned, but currently not cultivated by the Ministry of Agriculture while the Ministry of Water Resources is responsible for the Nile islands and any waterfront development along the river as a whole. The island is self-organized by a mixed Muslim and Coptic community defined by tribal structures. In terms of capacity building, the island is suffering from a lacking representative body both for the community as a whole as for the three villages. While rising costs are making it increasingly unviable to cultivate the fields, the island's agricultural land is decreasing due to two further developments: urban growth triggered by a growing local population and market-steered real-estate development as land prices are rising. Considering all of these factors: the blurry legal status, the contested land and the informal social structure vis-á-vis the obviously urgent environmental degradation suggest a low maintenance solution that could develop further upon success.

1.4. RESEARCH METHODOLOGY

The action-based research outlined is a collaborative project by the GUC Architecture and Urban Design Program and Fayoum University of Geography under the umbrella of the Nile islands Initiative and includes

- A household survey to understand the willingness and preferences of the inhabitants
- Potential models of solid waste management on and off the island
- A test-run of waste collection in cooperation with Ihlam, a student's environmental group, the islanders and the Zabaleen of Manshet Nasr
- A SWOT analysis of four customized SWM models for the island

It aims to evaluate the spatial, legal and socio-economic parameters for the installation of a solid waste management system on the island and is part of the Nil based on the hypothesis that a community-based participatory research approach provides multiple benefits in the public health sector (Minkler, 2005).

1.4.1. Case study Bahareya village

For this research, the village of Bahareya to the North of the ringroad with an estimated 200 households, serves as a case study. The village hosts one of the islands' main mosques and its only Coptic church. It is connected to the city by a falucca, or motorized ferry when there is no wind, mooring at Maadi Corniche around the clock.

1.4.2. Household survey

The household survey was conducted in the winter of 2015-16 by students of the geography department of Fayoum University covering 100 households.

1.4.3. Model development

The different models were developed by GUC architecture and urban design students under the supervison of Prof. Cornelia Redeker as part of the course Sustainable Urban Development in the winter term 2015-16. It involved a human-centered design approach including the formualtion of a joint framework and questionaire and resulted in different proposals that were

visualized in process diagrams and graphic representations pairing the inhabitant's feedback and the spatial survey on the island with expert consultations off the island. These models informed the four alternatives discussed in this paper: Model 1 Door-Step Pick-Up, Model 2 Central Collection Point, Model 3 Central Boat, Model 4 Garbage Sorting Plant on the Island

1.4.4. Test run

A 24-hour test run was conducted in cooperation with the villagers to

- challenge the general opinion that people do not mind the garbage and
- evaluate the willingness of the inhabitants to participate in solid waste management as a household
- estimate the level of awareness to differentiate between organic and anorganic waste

It further tested the the ferry operators' willingness to move the collected waste from the island to the mainland on the given ferry, as well as the Zabaleen's to collect it from the mainland ferry stop at a given time. The test run was carried out by the GUC architecture student environmental group Ihlam with a group of international students from AISEC. It involved

- preparing a flyer to inform inhabitants
- door-to-door briefings including bag sales
- collecting the bags at the doorstep the next day
- transporting it to the mainland by falucca by the ferry operators
- pick-up by the Zabaleen from the Corniche

The test run most adheres to Model 1.

1.4.5. SWOT analysis

The SWOT analysis looks at the four proposed models based on the insight gained from the household survey and the test run to evaluate a short and possibly a long-term solution and the demanded commitment by all in terms of self-organization.

2. FIELD AND ACTION-BASED RESEARCH

2.1. HOUSEHOLD SURVEY

Field results showed that 75.8% of the sample are willing to participate in solid waste management of which:

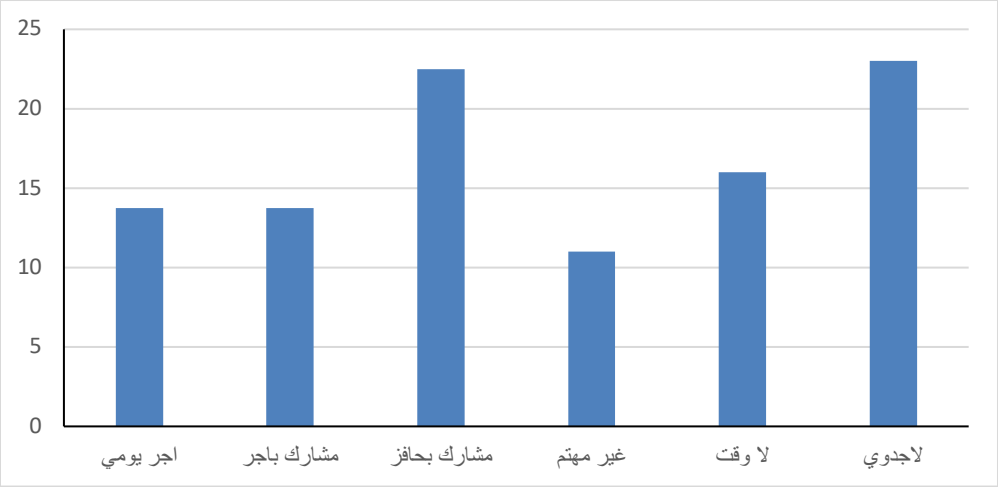
- 59.4% limit their participation to collecting their waste at home and leaving the rest of the process to someone else
- 27.4% are willing to collect and separate the waste
- 13% are willing to help throughout the process, from collecting, classifying to selling the waste
- Some other inhabitants showed no interest and unwillingness to participate in the whole process

58% of the sample are willing to participate for money in return, and this value varies:

- 45% wants ration goods in return (which may again be incorporated in a cyclic model)

- 27.5% wants to get more than 100 LE per month
- 27.5% wants to earn between 50 to 100 LE per month
- While one case only is satisfied with 50 LE per month

Figure 3: Participating to non-participating ratio of inhabitants in SWM measures (Nazer, H., 2016)



Paid daily / paid participation / participation with encouragement / not interested / no time / indifferent

2.2. TEST RUN

2.2.1. Process

The test run took place over a period of 24 hours and involved passing out 130 70l plastic bags to the individual households after prayers on Friday to be filled with anorganic solid waste by the inhabitants until the next day at 2 PM. This makes up about 65% of the village households. According to GIZ estimates in this context one can count 0.25 kg of anorganic waste per inhabitant amounting to 2.5-3 kg per household on average and 600 kg in total per trip. The test run further involved a door-to-door briefing supported by a flyer. Everyone who wanted to participate was asked to pay 1 pound upon receiving the bag as a symbolic price to signal that this service would not be for free in the future.

2.2.2. Outcome

All 130 bags that were handed out were found in front of the doors at 2 PM the next day as demanded. The transport from the island by the ferry operators was not previously announced, but worked smoothly without any extra fees. The Zabaleen were on time on the Corniche side to pick up the collected bags. Unfortunately, not all bags were exclusively filled with anorganic waste. The test run showed the willingness of the inhabitants and the need for awareness building regarding waste as a resource (not to mix anorganic and organic waste).

2.3. POTENTIAL MODELS

The four alternatives compared were extracted from a number of models according to their potential for realization. A model previously discussed by the islanders and the Ministry of Environment that would lift the collected waste up to the Ringroad Bridge for pick-up was not considered as a truck stopping on the bridge would produce a severe bottleneck for the already stagnant Ringroad traffic. The following figures 4-7 elaborate the tasks of the different actors followed by Table 1 that summarizes the estimated demands in terms of infrastructure, manpower, initial costs and running costs, the potential business models and the expected fees for the inhabitants (not including initial costs) of Models 1-4.

2.3.1. Models 1-4 Responsibilities

FIg 4: MODELS 1 DOOR-STEP PICK-UP (Redeker, C., 2016)

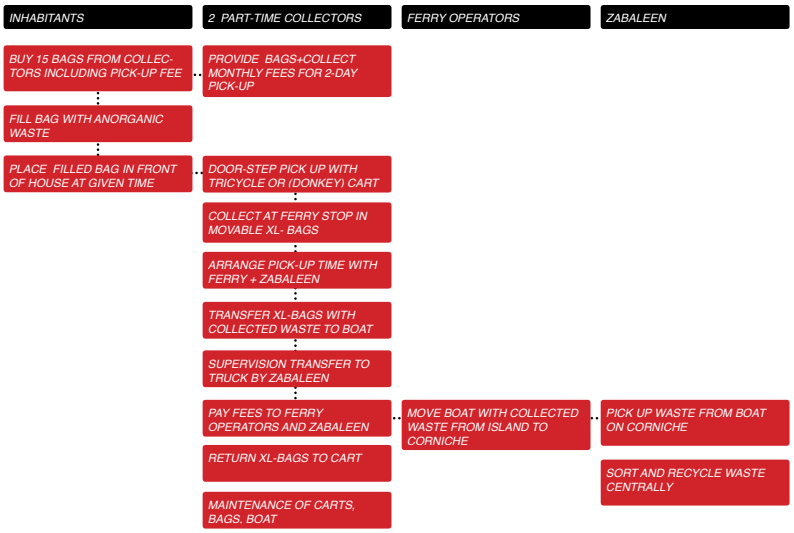


FIg 5: MODEL 2 CENTRAL COLLECTION POINT (Redeker, C., 2016)

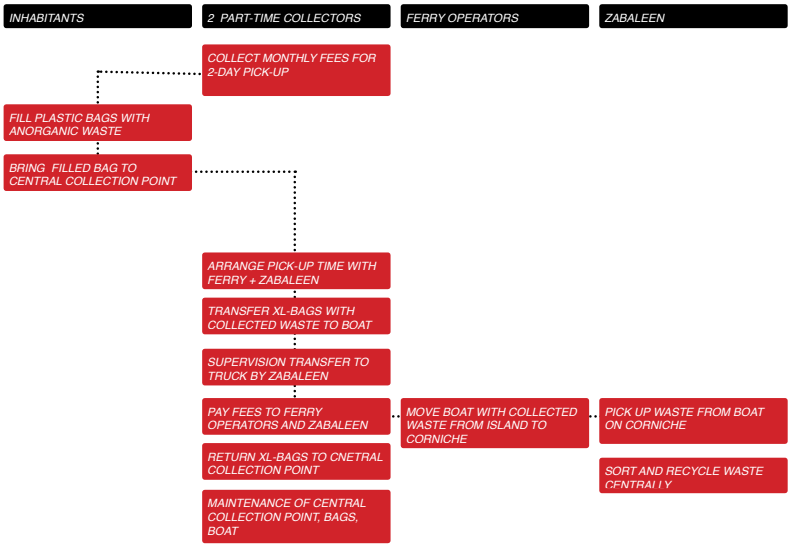


FIg 6: MODEL 3 CENTRAL BOAT (Redeker, C., 2016)

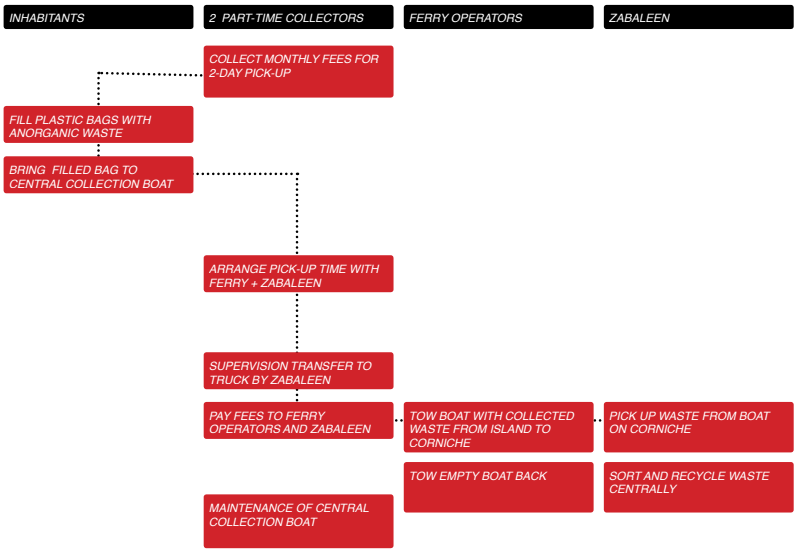
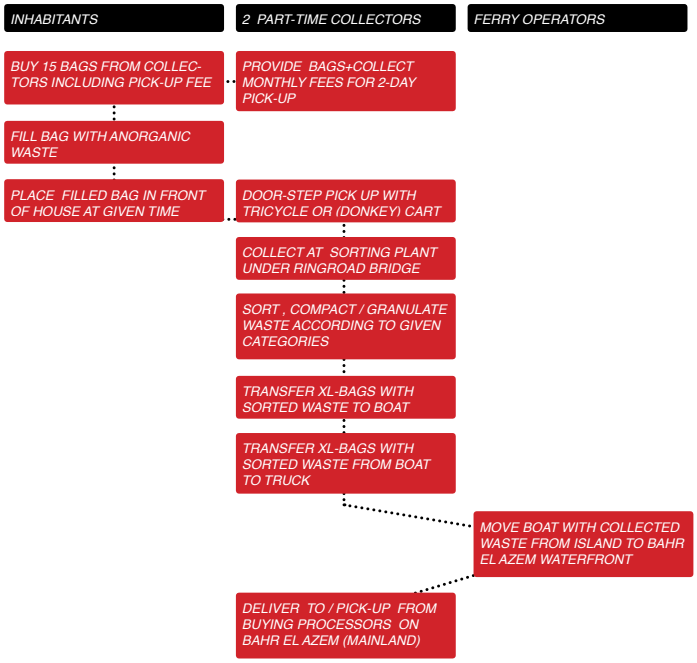


FIg 7: MODEL 4 GARBAGE SORTING PLANT (Redeker, C., 2016)



2.3.2. Model 1-4 Needed resources

MODEL	Infrastructure	Manpower	Initial investment	Fees inhabitants/ household/month	Organization	Permission
MODEL 1 DOORSTEP PICK-UP	donkey cart or tricycle XL-bags existing ferry use	2 part-time collectors and movers	donkey cart or tricycle 2000 egp	20 EGP / household / month	microbusiness	no permission
MODEL 2 CENTRAL COLLECTION POINT AT FERRY	central collection unit XL bags existing ferry use	2 part-time movers	initial investment 800-1000 egp	15 EGP / household / month	microbusiness	no permission
MODEL 3 CENTRAL BOAT	falucca with collection units XL bags existing ferry for towing	2 part-time maintenance worker	9000 egp	15 EGP / household / month	microbusiness	Ministry of Water Resources and Irrigation

MODEL 4 GARBAGE SORTING PLANT ON THE ISLAND	donkey cart or tricycle XL-bags sorting station existing ferry use	min. 10 full-time collectors and sorters	200,000 egp	20 EGP / household / month	Small-scale enterprise	Ministry of Water Resources and Irrigation Ministry of Environment Ministry of Transportation Giza Governorate

3. SWOT ANALYSIS

3.1. Based on the current conditions in Cairo, and the specific situation of Dahab Island, the survey results and the test run and model development, we can conclude the following parameters for the SWOT analysis:

- self-initiative friendly involving inhabitants and informal sector
- low maintenance solution
- job creation
- low demand on resources
- potential to develop further upon success

Table 1: SWOT Analysis SWM models Bahareya, Geziret El Dahab, Cairo‘(Redeker, 2016)

MODEL	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
MODEL 1 DOORSTEP PICK-UP	no land needed more service for inhabitants cores-ponding to survey results no permission	costs for inhabitants higher than M2, M3 garbage bags in the street attracting vermin	microbusiness model could be applied to Ringroad bridge site to serve other two villages	animals tearing bags apart reliance on households to place bags in time
MODEL 2 CENTRAL COLLECTION POINT AT FERRY	less costs for inhabitants than M1+M4	land needed potential smells, etc.	microbusiness model could be applied to Ringroad bridge site to serve other two villages	negative impacts on central location (Smells, etc.) but also hindrance to manoeuvre other goods
MODEL 3 CENTRAL BOAT	1 step less in moving waste no land needed away from land to avoid conflicts	initial investment higher central mooring site needed	microbusiness model could be applied to Ringroad bridge site to serve other two villages	Nile Authorities may respond negatively as this model is unprecedented

MODEL 4 GARBAGE SORTING PLANT ON THE ISLAND	larger scale job and income generation more independence costs for inhabitants if not participating in initial investment same as M1	initial investment highest long-term development complex permission process (Ministry of Water Resources and Irrigation, Ministry of Environment, Ministry of Transportation, Giza Governorate)	small-size enterprise expandable: use of derelict land under Ringroad could host further programs for example to produce biogas	lacking value of island waste to ensure economic viability

The SWOT analysis shows that M1 provides the biggest service to the inhabitants and avoids the potential conflict of installations in the limited public space (M2). M2 and M3 provide more economical solutions with a lesser job creation. M4 may be a long-term solution that is most adherent to become an expansion of M1. Legally speaking, M1-3 could probably be brought to practice without any permissions as long as the Nile Authorities accept the boat use. For M4 the permission procedure is complex due to the number of authorities involved, the unclear legal framework and the unprecedented situation. It would need further evaluation, maybe as one of M1-3 has been installed, to estimate cost-benefits of the islands produced waste. As it may provide a number of jobs on the island and serve all three villages centrally, M4 should be taken into account as a further solution. With the current governmental focus on business development, the formats of Community Development Association, NGO or PVO (private voluntary organization) registered with the Ministry of Social Affairs (Iskander, 1994) may not be the right format, therefore the focus lies on microbusiness and small-size enterprises.

4. CONCLUSIONS

The research carried out looked at a limited number of parameters to evaluate ad-hoc solutions to solve the current waste management problem on Geziret El Dahab. An action-based research approach was chosen to challenge a number of preconceptions. Many endeavours in the informal context fail due to unexpected banalities based on human shortcomings and lacking frameworks to ensure reliant services. Although not included in this research, all solutions would need an awareness-building and communication initiative to educate and brief the inhabitants on their benefits and role in order to function. As a next step, the religious institutions would be asked to get involved in order to present the proposed models and to ask for funding of the needed initial investment.

5. REFERENCES AND IN-TEXT CITATION/ REFERENCING

Behary, H., Wehenpohl, G. (2014). Integrated Community Based Solid Waste Management in Qalyubeya. GIZ PDP

Iskander, L. R. (1994). Mokattam Garbage Village. Stallion Graphics

Nazer, H. (2006). Bulletin de L'Institut D'Egypte

Minkler, Meredith (2005). Community-Based Research Partnerships: Challenges and Opportunities. Journal of Urban Health: Bulletin of the New York Academy of Medicine, Vol. 82, No. 2, Supplement 2. Oxford University Press

Interviews

Ezzat Naem Gendy, Founding Director, Spirit of Youth Association for Environmental Service, lecture GUC, October 5, 2015

Joachim Stetz, GIZ, head consultant to the Egyptian National Solid Waste Management program, August 1, 2016 https://www.giz.de/en/worldwide/22230.html

Websites

http://nswmp.net

http://soyzabaleen.blogspot.com.eg/