URBAN TRANSFORMATION IN CAIRO

PROPOSALS FOR SUSTAINABLE DEVELOPMENT

HCU | HafenCity Universität Hamburg

M.SC. RESOURCE EFFICIENCY IN ARCHITECTURE AND PLANNING

WINTER SEMESTER 2018/2019

Impressum

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Print: Print Pool GmbH

ISBN: 978-3-941722-84-2 (print)

978-3-941722-85-9 (online)

Cover Image: View of Cairo. Source: S. Giraldo, 2018.

Figure 1: View of the Nile and Mohandessin. Source: S. Giraldo, 2018.

Cairo's Urban Transformation Towards Urban Development

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Higher Education Dialogue with the Muslim World

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Introduction

This brochure was developed by third-semester students of the Master of Science "Resource Efficiency in Architecture and Planning" (REAP) program, offered by HafenCity University Hamburg. The publication showcases the results of the students' Project III course which had a focus on sustainable urban development transformations in Cairo, within the districts of Mohandessin and Zamalek.

The authors are 9th generation REAP students; an international and multidisciplinary group with diverse professional competencies, cultural origins and academic backgrounds. The Project III endeavor was possible thanks to the cooperation between HafenCity University Hamburg, the Architectural Department of Cairo University and from the financial support of the German Academic Exchange Service (DAAD). The primary goal of the partnership between the two universities was to facilitate an exchange of insights and ideas between students about sustainable urban transitions in the Cairo context.

The student projects presented marks the completion of course work for the REAP program. As part of the task, students were grouped into five mixed teams as diverse as possible, so that members could learn from each other through sharing and applying the knowledge they have gained during the course to produce holistic design proposals.

As a Project III course kick-off activity, the topics of energy, waste, water, informal settlements, and governance were investigated by Hamburg students. This activity led the groups to visualize some of the many challenges experienced by Cairo, and which would need to be addressed in the development of proposals for its sustainable urban transformation.

REAP students visited Cairo in November 2018 for one week to undertake research about the study area. During the REAP students' stay in the Egyptian capital, each

project group was allocated a neighborhood scale study area, and participated in a five-day workshop comprising a series of lectures, field visits and research tasks together with local Cairo students. Following an initial immersion workshop and field visits to the Cairo case study areas, students were required to select their preferred topic to investigate so that they could refine their investigation and analysis of Cairo's current situation.

The result of the cultural and technical exchange during the field trip is five project proposals, all featured in this publication including: Zamalink: Mobility & Community; Regenerating Public Green; The Urban Bio-Loop; The Sun Over Zamalek; and (Re)Enchanting the Nile. All projects strive to develop innovative and contextually appropriate climate responsive and resource efficient concepts.

Cairo

According to Kondolf G.M., et al. (2011), Cairo has a population of over 11 million inhabitants which makes it one of the dense cities in the world. The cosmopolitan city is easily recognized for its ancient history of pyramids and the Nile River, although on closer inspection, Cairo is much more: the city's mix of history and effervescent modern lifestyle is unique and intriguing: a place that never sleeps and is in constant transformation.

However, like several other megacities, Cairo needs to manage many issues related to its rapid and unplanned urban growth, including air pollution, soil depletion, heavy traffic and inefficient public transport systems, water pollution, sewage, solid waste, noise pollution and the proliferation of informal settlements.

Zamalek and Mohandessin were the two urban districts that were the focus of the field trip study. Zamalek is located in the city's west, forming part of the northern part of Gezira Island surrounded by the Nile River. According to Kitunda (2018), Gezira Island used to be called "Jardin des Plantes" (Garden of Plants). Rafaat (1996) describes green areas during the twentieth century as experiencing rapid urban redevelopment to now at the current day, and how they feature many of Cairo's landmarks including the Gezira Sporting Club, Cairo Tower, as well as the Egyptian Opera House and Museum of Islamic Ceramics. Goldschmidt (2013) states that the earliest development in Zamalek was started by the British syndicate and continued more intensively after World War I, when numerous villas were built for British officials and wealthy Egyptians, and now function as embassies. Witnessing significant spatial changes and growth periods, Zamalek became one of the most attractive districts in Greater Cairo.

Keller and Polach (2010) note that Mohandessin was created in 1948 on the left bank of the Nile, and known as the city of engineers, as it was designed to accommodate the housing needs of engineers during industrialization efforts following the 1952 Egyptian Revolution. As further explained by Cairo Scene (2014), during the industrialization, the Giza district was established over agricultural lands with luxurious villas predominating the urban form in the 1970s - however in recent years there has been a significant change in the urban typology. As explained by Keller and Polach (2010), today, Mohandessin although remaining an upper middle-class neighborhood, is characterised by mixed uses including commerce, bars, cafes and restaurants featuring international franchises, offices, and residential units. According to their research, Mohandessin has been subject to a constant transformation, and even though it was founded only 55 years ago, the district has radically transitioned from low density villas surrounded by generous landscaping to crowded high rise development.

Acknowledgement

The authors would like to thank their instructors, M.Sc. REAP Maya Donelson, and M.Sc. REAP Gionatan Vignola, the course tutor M.Sc. Arch. Xhelona Haveriku, the project managers Prof. Dr.-Ing. Wolfgang Dickhaut and Prof. Dr. Sahar Attia, the project assistant Dipl.-Ing. Sonja Schlipf and all participants and instructors of the Cairo workshops, with a particular mention to Prof. Dr. Heba Allah E. Khalil, and Dr. Sherin Gammaz.

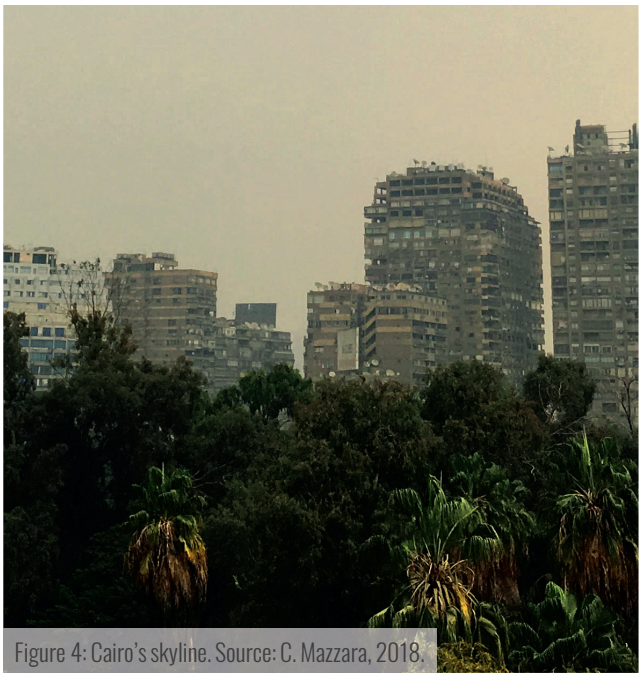

Figure 4: Cairo's skyline. Source: C. Mazzara, 2018.

Figure 5: Mobility Situation. Source: J. Ardila, 2018.

REAP Topics

The REAP program merges a variety of topics under the theme of sustainable planning on different scales. The course aims to enable students to promote sustainability and urban development in different geographical and cultural settings.

The REAP course is interdisciplinary and follows an integrative and multidimensional approach. During the program, students gain knowledge about energy demand and supply, energy flows in the urban context and renewable energies, water cycle management and technologies for water supply, wastewater, rainwater treatment, urban waste, and the material lifecycles. While the emphasis of the course lies on technologies for the provision of sustainable urban and building services, it also investigates the socio-economic context in which these services are provided and managed. Modules examining topics such as international and European environmental laws and policies, project management, methods of integrative urban planning, and research methods, consolidate the different facets of sustainable planning featured in the program.

The wide range of fields explored by REAP, enabled the students involved in Project III to have a holistic understanding of Cairo's urban scenario. The groups were encouraged to gain background knowledge about the historical and cultural contexts of the Cairene society, as well as investigate its regulations and the origins of problems experienced by the city.

Students were challenged in the Project III task to overcome Arabic translation difficulties, cultural differences and working under time pressure. Despite challenges, students were well prepared for dealing with highly demanding activities, time constraints, the divergence of ideas and other adversities. The Project III class has been a valuable training ground, by extending the student's competencies which has achieved an enriching and rewarding result.

Mobility

Mobility in the Greater Cairo Region (GCR) may be characterized by overburdened transport infrastructure that inhibits the movement of citizens from one point of the dense megacity to another. According to the World Bank Group (2014), GCR is home to over 19 million inhabitants and it is forecast to grow to around 24 million by 2027. This would inevitably place more pressure on the existing transport infrastructure, as demand for mobility options would increase.

The Urban & Transport Unit (2006) summarizes the critical challenges in GCR's urban transport system as follows: aggravated traffic congestion, poor public passenger transport system, high accident rate, air and noise pollution, institutional weaknesses and fragmentation, and inadequate financial arrangements. The typical response to mobility issues in Egypt has been to expand transportation infrastructure by constructing more roads, bridges, tunnels or flyovers, which in turn amplifies the problem (Tadamun, 2016).

Even though GCR has a diverse road network, traffic jams are routine, delaying motorists for hours before reaching their destinations. On-street parking also continues to cause congestion (Sims, 2014). In 2010, the cost of delays from traffic congestion alone amounted to approximately 7.14 billion Egyptian Pounds (2.4 billion US Dollars) (World Bank Group, 2014). Additionally, as recognized by DPTPC Study Experts (2009), the growing number of vehicles and the extended commute times from slow driving have increased the rate of emissions, contributing to poor air quality. DRTPC Study Experts (2009) also adds that petroleum products (petrol/gasoline and diesel) and compressed natural gas serve as fuel for road-based transport in the GCR, while the Cairo Metro and trams run on electricity.

Rowell (2018) argues that decades of car-oriented urban design in Egypt have underpinned the city's disjointed rhythms of movement. The private car represents more than 95% of on-street parking, and it contributed to 70% of traffic congestion in 2010 (Sims, 2014). El-Khateeb (2017) points out that the surge in private car traffic can be dated back to the 1970s, when the economic open-door policy made cars more affordable to the increasing middle-class population. This resulted in high car ownership, as seen in Figure 1. Moreover, during that period, urban planning in Cairo prioritized road-based transport while the Cairo Transport Authority's capacity to offer public transport services deteriorated (Tadamun, 2017).

Public transport is composed of formal and informal modes (DRTPC Study Experts, 2009); the formal modes include buses, minibuses, the metro, trams and ferries, while informal modes consist of microbuses, also known as shared taxis. The metro is the latest addition to the public transport modes which is currently undergoing expansion with its service line 3 (Grontmij & EcoConServ, 2012).

The high demand for public transport in the GCR is evident by observing the large number of passengers on buses or the metro, especially during peak hours (World Bank Group, 2014). Therefore, an effective response to the transport needs of the GCR population would be to introduce more alternatives for public transport with new and innovative transport modes, and to integrate them into a single network for enhanced mobility.

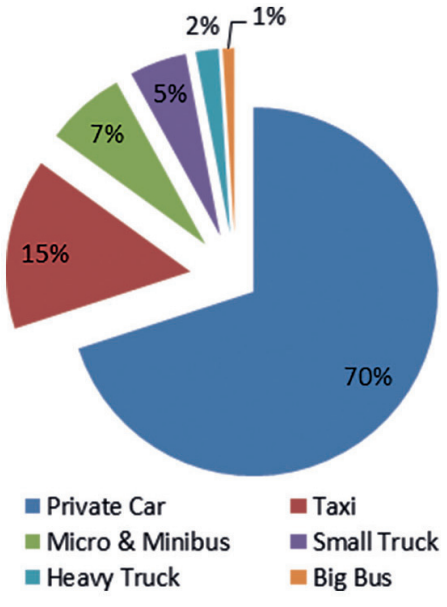

Figure 6: Average Modal Split 2010. Source: Authors, 2019; adapted from Sims, 2014.

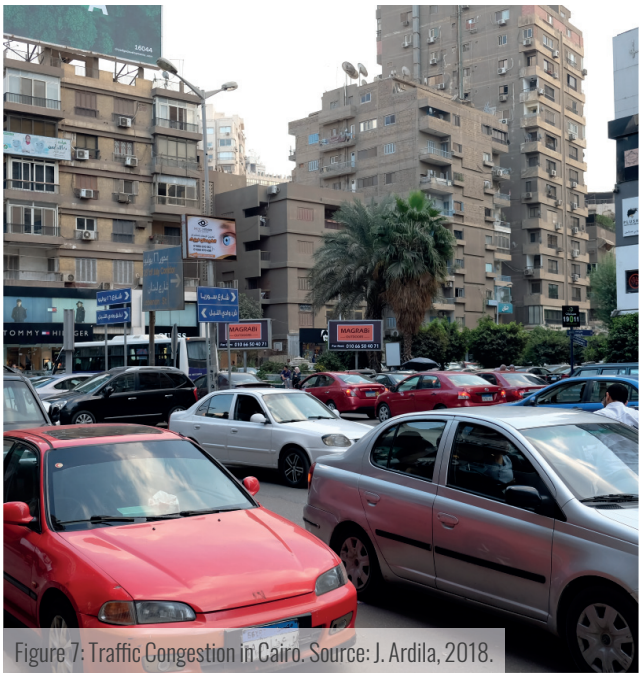

Figure 7: Traffic Congestion in Cairo. Source: J. Ardila, 2018.

Sustainable Urbanism

To describe sustainable urbanism is to examine sustainability in relation to urban design. As defined by Wall & Waterman (2009), it is a creative collaborative process that involves shaping the form of cities, enhancing experience and improving function of human habitats. Farr (2008) adds that it includes walkability and transit-served urbanism integrated with high performance buildings and high-performance infrastructure which seeks to achieve compactness, meanwhile retaining people's access to nature.

According to Adhya, Plowright & Stevens (2010), sustainable urbanism combines the three main aspects of sustainability by ensuring that urban spaces are environmentally aware, socially inclusive and economically productive, which depends on both responsible politics and professional competences of key industry players. This concept, identified by Farr (2008) makes the best use of built and natural environments, while at the same time harnessing economic and social benefits of the community to conserve identity, strengthen neighborhoods and encourage cultural diversity and distinctiveness.

Momoh (2016) adds that sustainable urbanism brings together the many components of environmentally responsible place-making, social equity and economic viability into the creation of places of beauty and distinct identity, and suggests mixed-use development that brings about opportunities for people to interrelate easily within an urban space. Elkil, MacLaren & Hillman (1991) state that the main goal of sustainable urbanism is to develop a city that is 'user friendly' and resourceful in its design form, energy efficiency and function. These principles will be necessary to reverse current city trends, to mitigate severe environmental consequences.

Almayouf (2013) pointed out that creating sustainable strategies for urban development could be achieved if the built and natural environments are integrated rather than separated thereby serving the objective of increasing the beneficial use of environmental resources like green services and open spaces. An example as explained by Baxter (2010) draws upon the parks and open spaces in Dubai, which has witnessed considerably generous developments in terms of expansions and upgrades thereby attracting approximate 5.7 million visitors annually.

Dhanapal & Chaudhary (2012) affirms that open spaces play a critical role in creating urban sustainability and so promoting urban green services in cities should be a fundamental aim in making livable and ecologically sustainable places. Nevertheless, Collyer (2015) highlights that the world's population is becoming increasingly urban with more than half of the world's population now living in urban areas. Consequently, the retention and conservation of open green spaces presents a critical challenge and the principles of sustainable urbanism will be necessary to reverse the current trends or mitigate severe environmental consequences.

Goell, El-Lahham, Hussen, et al. (2009) identified that similar to cities in many other countries, Egyptian cities are increasingly overwhelmed by social, economic, ecological, and cultural problems including the lack of water supply, shortage of available housing, inadequate mobility and air pollution, insufficient service infrastructure. Shokry (2009) corroborates that Cairo also presents a complex result of different urban forms layered purposefully or indiscriminately throughout its history of successive Islamic empires, colonial influences and westernization. Attia, (2011) identified the lack of public green spaces or venues that accommodates the members of the Cairo community and this decline occurring at the riversides, residential communities, public gardens, and even public squares, is the result of a social segregation which affects the production of successful places in the city. As described by UN-Habitat (2015) the city's glorious past has become overshadowed by unregulated clusters of high-rise offices and residential blocks, while at the same time bold new structures are emerging alongside ambitious visions for future development. Sims (2012) added that since 1952, Metropolitan Cairo has been one of the most transformed places in the world, facing a huge alteration in its urban landscape. Some parts of the city's urban fabric is highly heterogeneous like most cities, however there are three destructive urban forms: the formal urban areas, the informal urban areas, and the newly planned 'desert cities'.

UN-Habitat (2010) projections have suggested that by 2025, Cairo will be one of the 13 most populous cities of the world. Subsequently, a long-term development of the new cities in the desert around Cairo are underway making it the most ambitious efforts of any city in the Middle East to transform itself into a sustainable Global City, while meeting the many challenges of its growing population. (UN-Habitat, 2011). This being the case, sustainable urban planning of these areas should be the rule, not the exception. Among city buildings, the network of spaces that will create and strengthen connections at different levels of influence should therefore be among top priorities.

Waste Management

According to the United Nations, by 2050 68% of the world's population will live in urban areas (United Nations, 2018), and so cities will grow to fulfill the needs of the residents. The population increase will result in the production of more waste, and so it will be important for urban areas to prepare efficient waste management systems for the future. Waste management is defined as the assessment, control, and manipulation of all solid residuals produced in a city (Leblanc, 2018). An efficient and well-planned waste management program would further mitigate the release of pollutants to the atmosphere assisting efforts to address climate change.

What is involved in Cairo's current waste management system? According to Simpson (2017), Cairo is already considered a "megacity" with nearly 20 million inhabitants., which presents a significant challenge to implement an efficient waste management system that also achieves sustainable outcomes.

Projects presented in this brochure are located within the Governorate of Giza, which according to the Egyptian Environmental Affairs Agency (2012) has around 3 million inhabitants, who generate approximately 4000 tons of waste a day including cardboard, plastic, metals and organic waste as depicted in Figure 8.

Cairo has an intriguing history regarding the collection, sorting, and recycling of waste. Since the 1940s, a group called Zabaleen originating from rural areas, have been a large part of waste management in Cairo (Simpson, 2017). As identified by Zafar (2018), the group now manage the collection of waste residuals from city inhabitants, recycle and repurpose these goods as other products for sale. Even compared to western country standards, the Zabaleen were recognized for creating one of the most efficient waste management systems in the world; where they collect up to 60% of city inhabitants' waste and 80% of the collected material was recycled (Zafar, 2018). However; the Zabaleen system changed around the 1990s when the municipal government decided to privatize waste collection with European companies (UN Habitat, 2011). Nevertheless, the foreign companies were not able to accomplish the same service the Zaballeen had, and the inhabitants complained about the increase of the presence of waste on the city's streets (Zafar, 2018). As outlined by UN Habitat (2011), due to the inefficient foreign waste management contractors in the city, the Zabaleen could again continue to service the city with their informal waste collection processes.

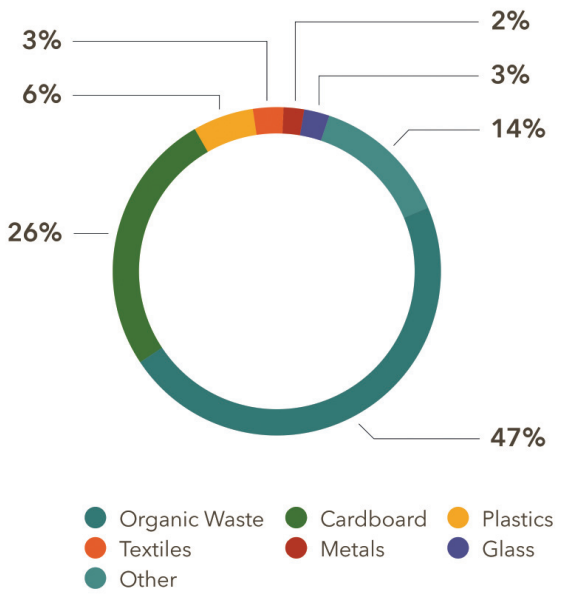

Figure 8: Types of waste in GIZA. Source: EEAA, 2012.

Regarding organic waste, Zabaleen used pigs to help the processing of organic waste, however in 2011 with an outbreak of the N1H1 virus amongst pig populations, the Zabaleen could no longer use this method and stopped organic waste collection altogether (UN Habitat, 2011). As the Zabaleen no longer collect organic waste, this residual is now the main concern for Cairo's waste management, as often the waste is dumped and pollutes water bodies or is openly incinerated further adding to the poor local air quality (Elfeki M, 2014). However, this situation also represents an opportunity for new projects in the city which addresses the issue and involves the inhabitants in a way that sustainably manages organic waste.

Cairo currently has a few different initiatives in place to manage organic waste including a modern landfill where waste is stored underground to generate methane gases for electricity production. (Ibrahim M, 2016). This type of waste management system illustrates the potential of waste to produce clean energy towards a sustainable future, while at the same time addressing the city's organic waste dilemma.

As depicted by the overview of Cairo's waste management system since the 1940s, it is fair to say that the city is capable of solving its waste management issues, in particular, an organic waste issue; through the Zabaleen's informal processes and also modern biogas electricity solutions. Therefore, it will be critical for future waste management proposals to follow and harness the existing waste management capabilities in the city. Specifically, they should align with the city's organization of recycling and repurposing, characteristic of the Zabaleen, so that future systems adapt to the current situation but can also address future waste challenges.

Energy

Egypt's first electrical power station, the Karmouz Power Station in Alexandria was inaugurated in 1895 (MOEE, n.d.). The electricity generated however was limited and exclusively used by trams, public facilities, main street lighting and lighting for villas, palaces, and businesses of foreigners and aristocrats (MOEE, n.d.).

The 1920s introduced modifications to gas fired stations to run on coal powder instead of gas, as it was determined that coal is a better suited turbine fuel for Cairo's warm climate (MOEE, n.d.). Then as a result of the Second World War between the years 1939 and 1940, Cairo experienced a significant shortage of coal supplies, which led to the replacement of coal with mazut – a derivative of petroleum - as fuel for turbines (MOEE, n.d.). Until today, coal, mazut and gas still dominate Egypt's energy sector, with a significant contribution (to electrical power generation) from natural gas, accounting for 78.8% of fuel use (EEHC, 2017).

It is presumed that within the next 15 to 20 years Egypt will experience another shortage of gas and oil (Egypt Oil & Gas, 2012), as the country reached its peak production in 2012. The cost for importing the necessary volumes of fuel for the country would place a large burden on the national budget. Therefore, an urgent situation persists to explore alternative fuel solutions to alleviate the shortage, but also critical in the context of climate change.

HPGC (n.d) accounts that in the 1960s, president Abd Al-Nasser, ambitiously initiated a hydro dam across the Nile River known as the Aswan High Dam project. In 1971 the hydro-dam was the country's only significant renewable energy power plant; supplying close to 60% of Egypt's electricity demand (HPGC, n.d). However as a result of Egypt's rapidly growing economy and population, hydro-power today only amounts to 6% of the country's electricity supply, and wind and solar power only contributes to 2% (HPGC, n.d).

Nevertheless, according to the International Renewable Energy Agency (2018) Egypt has the potential to generate up to 53% of its electricity from renewable sources by 2030, indicating that there is great potential for using large-scale solar power generation especially in the country's southern regions. According to the World Bank (2017), the implementation of rooftop solar energy is also an important step towards improving Egypt's energy efficiency in public and commercial buildings and decreasing dependency on fossil fuels.

As stated by NREA (2019), in 2008 Egypt's Supreme Energy Council set its first national renewable energy target for the country's total power production, which aimed at a 20% share of total energy supply by 2020, and in 2014, a feed-in tariff scheme was introduced. The tariff-scheme provided the right for private companies and individuals to own and operate and generate revenue from renewable energy plants, through selling produced energy to the national grid (Egyptian Official Gazette, 2014). Adjustments were made to the scheme in 2016 (NREA, 2019).

Simultaneously to introducing and adjusting feed-in tariffs, electricity subsidies for consumers were reduced and resulted in the increase of electricity tariff rates, to positively stimulate the widespread installation of renewable power plants as an alternative to fossil electricity generation (Mubasher, 2014).

The Egyptian Ministry of Electricity and Renewable Energy is the responsible body for developing and supporting the renewable energies for the country, and the promotion of renewable energy is undertaken by its subsidiary body: The New and Renewable Energy Authority (MOEE, 2017). Together with the Egyptian Electric Utility and Consumer Protection Regulatory Agency, the bodies regulate feed-in tariffs for renewable electricity (EEHC, 2015). In addition, the Egyptian Electricity Transmission Company is responsible for the transmission of power across the across the country and is therefore responsible for the purchase of plant generated renewable energy feeding into the grid. (EEHC, 2015).

Despite the availability of renewable energy in Egypt, and its spreading adoption through the tariff scheme, existing policies are marginal and more effective improvements are required. There is great potential for Egypt to capitalize on its renewable energy sector to secure future electricity supplies, in particular the contribution of solar power. Immediate actions to build the capacity of the renewable sector will be critical to address the country's declining supply of electricity challenged by a growing demand.

The Nile River is a prominent source of life in North-Eastern Africa, where freshwater in an arid climate is a limited resource (García, Cuttelod & Abdul Malak, 2010, p.1). Egypt is one of eleven African countries that obtain water supplies directly from the Nile River to provide fresh water for the population for irrigation and its sewer systems. (Smith, El-Kammash, & Hurst, 2019) Unfortunately, the city's high demand for fresh water, the dumping of untreated greywater into the river and additional anthropogenic impacts to the river have been highly damaging to the ecological balance of the Nile's surrounding ecosystem and to local consumers. (Abdel-Satar, Al & Goher, 2017, p.21)

As local species of flora and fauna are heavily dependent on the river's environmental well-being (Nile Basin Initiative Secretariat, 2012, p. 60-61), monitoring of the river system is necessary to determine the presence and health of local species to mitigate the impacts of harmful water pollutant levels.

The article "Indices of water quality and metal pollution of Nile River, Egypt" from the Egyptian Journal of Aquatic Research 2018 addresses the environmental analysis of the Nile River. The article was published online on February 7, 2017, by the National Institute of Oceanography and Fisheries and the Chemical Department of the University of Hail, Saudi Arabia. The principal purpose of this analysis was to monitor the potential anthropogenic impacts of current wastewater discharges into the Nile River from agricultural, urban and industrial areas (Abdel-Satar et al., 2017).

Abdel-Satar's article reveals three different water quality levels of the Nile. The first level was measured with the Water Quality Index (WQI), developed by the World Health Organization (WHO), which ranked the drinking water of the Nile at a level between fair to good. The second level was measured using the Egyptian standard (EWQS) which evaluated the water to be between marginal to good (Abdel-Satar et al., 2017, p. 24-27). The third level was measured using the Canadian Council of Ministers of the Environment (CCME), which graded the water quality as a critical scenario with a minimum value of 27.0: a very low value when compared to the best situation which has a maximum score of 54.70(Abdel-Satar et al., 2017, p. 27-28).

The section of the Nile River that transverses Cairo's Metropolitan Area has been measured to have suitable water quality to be utilized as potable water as determined by results from the Contamination Index (Cd) and Water Quality Index (WQI) (Abdel-Satar et al., 2017, p. 27-28). Nevertheless, heavy metal contaminants present within the water body are potential risks for human consumption and to the health of surrounding ecosystems supported by the Nile (Singh & Kalamdhad, 2011). The potential risk of heavy metals contamination for drinking water was ranked using the WHO value, which identifies the water body as having a close to but not yet achieved a critical value (Abdel-Satar et al., 2017, p. 27). According to ESWQS, the heavy metal concentration of Cairo's Nile River has already exceeded the critical values for drinking water and should not be used for human consumption (Abdel-Satar et al., 2017, p. 27).

Concerning water quality levels suitable for aquatic life in the Nile, the WQI states that the river scores a value of 45, which represents a marginal status based on the CCME standard (Abdel-Satar et al., 2017, p. 28). According to the Canadian Water Quality Guidelines for the Protection of Aquatic Life 2017 by CCME, the marginal status denotes: "Water quality is frequently threatened or impaired; conditions often depart from natural or desirable levels" (p.3). These values indicate threatening water quality conditions for aquatic life, due to contaminants including Cadmium (Cd), Lead (Pb), Copper (Cu), and Zinc (Zn) (Abdel-Satar et al., 2017, p. 26). The continuous discharge of untreated sewage from chemical industries, such as sugar producers, the agriculture sector, and urban areas along the river is the main source of contamination, and pollutant flows are likely to continue (Abdel-Satar et al., 2017, p. 26). So even though the Nile is able to support local flora and fauna at its current water quality levels, the ecosystem is at critical risk of further heavy metals contamination, which would be critically damaging to the existence of species within the river and its surrounds. The Egyptian Journal of Aquatic Biology and Fisheries shares the same conclusion within its article "Accumulation of some heavy metals and its effect on hematological indices of freshwater fish, Oreochromis niloticus" of 2015 (p.96).

In order to support riverside redevelopment in Cairo, it is necessary to continue monitoring the Nile's water quality levels with a focus on polluted trouble zones. The monitoring and evaluation of results will assist towards critical preventive and protective measures towards minimizing the harmful effects of heavy metals contamination, and its environmental consequences on delicate ecosystem balances. Further improvements to the current situation should also include improved regulation and practices for the collection and treatment of sewage, to reduce the currently uncontrolled wastewater discharges into the Nile River.

Project Proposals

Zamalink: Mobility Hub 1

Integrated Transportation and Urban Design

Regenerating Public Green 2

A Pilot Project for the Revitalization of Aswan Square

The Urban Bio-Loop 3

Towards a Sustainable and Social Use of Organic Waste

The Sun Over Zamalek 4

Energy Transition in the Neighborhood and Beyond

(Re) Enchanting the Nile 5

Reconnecting people and Wildlife with the Nile

Figure 9: Google Earth 7.1.8 (15.11.2018). Cairo. 30°03'19.78" N, 31°10'18.94"E, elevation 18m. Digital Globe. Viewed on 7.03.2019.

The Project Teams

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(Re) Enchanting the Nile

Figure 10: Proposal to Zamalek Metro Station. Source: Authors, 2019.

Zamalink: Mobility Hub

The first master plan for Zamalek was drawn between 1890 and 1905, which exhibited land plots that were originally planned to be occupied mostly by villas (residential buildings for the elite) (ElSerafi, 2017). The Island became completely urbanized and occupied by villas and palaces by 1936, but following the 1952 revolution, these structures were gradually demolished and replaced with multi-storey buildings in response to the demands of the growing middle-class population (ElSerafi, ElKerdany & Shalaby, 2017). Sims (2003) states that the subdivision of land accelerated during the oil boom period in the Gulf States during the 1970s, which brought about densification in all districts in Cairo. These events led to an increase in building-to-plot ratio, and the deterioration of public spaces (ElSarafi, 2017). ElKadi (2012) asserts that this intense densification of the urban fabric and the absence of parking spaces, caused the rise in traffic and parking congestion on the streets of Zamalek.

The urban transformation of Zamalek has not been totally negative, as it has introduced diversity in its built-up areas with mixed uses, and provides alternative points of interests to residents and visitors alike. In spite of this, adverse effects of urbanization over time have made some Zamalek residents (especially of the older generation) resistant to change, which inhibits sustainable urban development.

With the district's current state of mobility and public open spaces being our main concern, our research and proposed intervention seeks to tackle these issues while taking into consideration means of encouraging stakeholders' acceptance and support.

Analysis

We gained a first impression of the study area through direct observation of the state of Ismail Mohamed Street, Zamalek. Then, we conducted interviews with the residents of the neighborhood, photographic filming, and spatial, SWOT, and stakeholder analyses.

Our research group perceived Zamalek as a historic district that exhibited multiple uses, mostly composed of commercial and retail establishments, with a strong presence of tourists. Ismail Mohamed Street and its surroundings were particularly busy, where several activities taking place simultaneously on the street created a sense of chaos. Typical scenes involved the use of sidewalks as gathering spots for people to share drinks, or for the sale of goods by informal vendors. These sidewalks were in poor condition, as one could encounter potholes with accumulated garbage. The large number of cars coupled with traffic congestion at different times of the day was overwhelming. Double parking was common, while several cars were left parked at the same place for days. In the absence of urban furniture these parked cars served as resting spots for pedestrians, whereas informal vendors displayed their merchandise on them.

The reflections of the interviewees revealed: their memories of the study area, the transformation of the district over the past decades, associated problems, and potential areas for improvement. One of the most discussed topics during the interviews was the opening of the new Metro Line 3 station in Zamalek, to which residents (especially from the older generation) clearly expressed their opposition. These

residents saw the metro station as a means for people of lower social class to access the area, which would cause more insecurity and informality. On the contrary, other residents supported the opening of the station, arguing that it would reduce the need for private vehicles in the area.

From our spatial analyses, we could observe that the northern part of Ismail Mohamed Street is denser than the southern part, and generally, open spaces that are fully accessible to the public consist only of the streets or residual spaces between buildings. There are multiple privately-owned green spaces in the

area (owned by schools or embassies) which are fenced and do not permit access to the public. The existing public green spaces are deteriorated and occupied by informal parking spaces or vendors. Furthermore, more than half of the area is allocated for residential and commercial purposes, followed by diplomatic uses, cultural and educational services, religious activities, and recreation.

Ismail Mohammed Street is described as a main local street (Grontmij & EcoConServ, 2012). Presently, it is partially closed due to the construction of the Metro Line 3 station. Most of the streets intersecting it direct traffic northwards, trapping the cars inside the island as a result. Heavy traffic congestion points occur at the nodes of many streets, and along the main city roads of the island (26th of July, and 6th of October) due to high traffic flow from the bridges connecting Zamalek to the outer districts. In terms of the parking situation, it can be observed that parallel and perpendicular parking are common practices. Also, double parking persists as if law enforcement is neglected. Parking spaces are limited as there are only two official public parking spaces on the island (ElSerafi, ElKerdany & Shalaby, 2017). With regards to public transportation, the service is only authorized on the main city streets while the rest of the island remains unattended. There is no mass transportation system feeding the present Metro Line 2 station in the south of Zamalek, thus users of the metro have to depend on vehicles such as private cars or taxis to move around. In view of these, we concluded that the main issues in Zamalek are:

•Traffic and parking congestion, which is intensified by the lack of alternatives for public transportation.

•Low ratio of public to private open spaces, thus the public has limited access to leisure/recreation.

•The resistance of influential residents to change, which pose as a barrier to urban development.

We deduced that the resistance to change, by the conservative and influential residents, poses the largest threat to possible intervention. However, we identified certain opportunities that we can explore to address the current challenges of the island. First, is the possibility to improve mobility and public spaces with the upcoming Metro Line 3 station. Since the area around the station is currently closed off from Ismail Mohamed Street due to construction works, this presents the opportune time to implement changes. Secondly, the deteriorated open spaces in the area possess the potential to be converted to hotspots. Finally, cooperating with the embassies and educational institutions that are present in our study area will prove beneficial for subsequent interventions.

Mobility hub

Ismail Mohamed Street is located in the northern part of Zamalek, and will soon receive the Zamalek metro station – part of the Cairo Metro Line 3, currently under construction (Grontmij & EcoConServ, 2012). The new metro line will bring a better connection between Zamalek and the outer districts, however, that is as far as the plan goes. The lack of alternatives linking the other

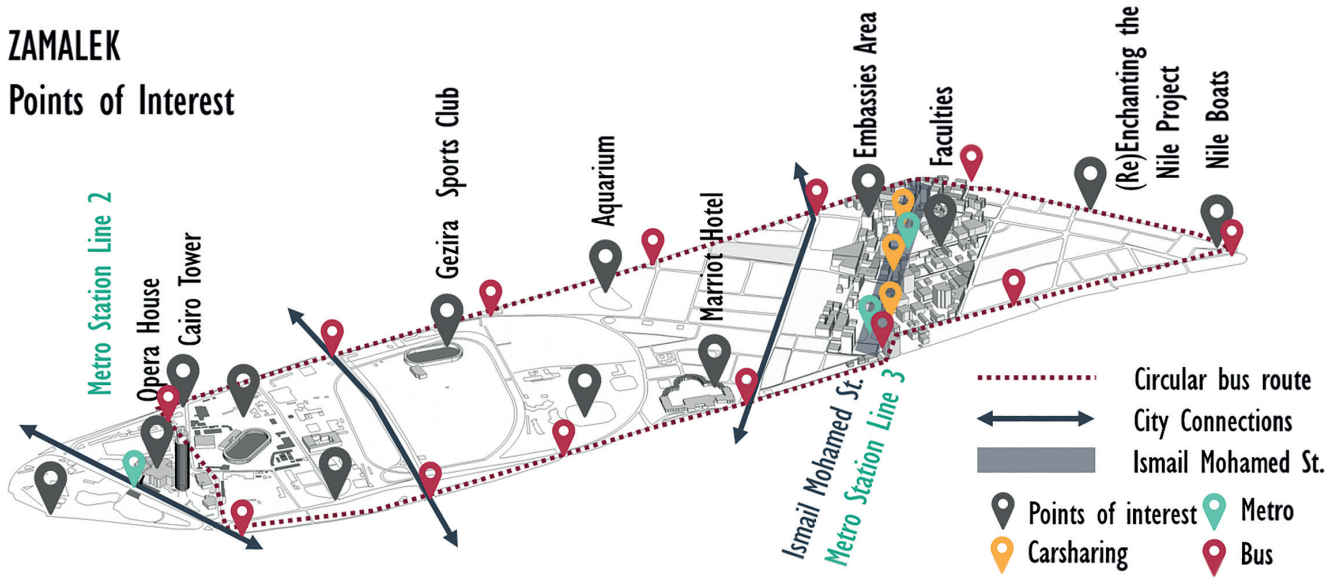

Figure 11: Circular bus route and points of interest of Zamalek. Source: Authors, 2019.

parts of Zamalek can become a disincentive to use the public transportation.

For that reason, the idea is to combine the metro with two additional transportation modes; a circular bus service around the island and a car sharing system for the residents of the area. The main objective of this project is to create a more sustainable balance between private and public transportation, thereby decreasing the traffic and the number of cars parked and abandoned on the streets. Moreover, we are also proposing changes that will transform Ismail Mohamed Street into a pedestrian friendly and shared boulevard, to promote better walkability in the whole area.

To integrate the new metro line, we are proposing a circular bus service in Zamalek to help improve connectivity between the north and south of the island, thus reducing the necessity of using private cars for short distances. This will help solve the issue of intense traffic and parking congestion in the area. The bus stations will be strategically located to connect people to different points of interests within the Island, such as traffic connection nodes, places of high concentration of people – e.g. Gezira Sport Club and Cairo Tower; and the existing metro line 2, located south of the island (Opera metro station).

The third mode of transportation proposed for the new Mobility Hub is the car sharing system. For a start, the pilot project for car sharing will feature 27 cars, distributed in three different stations along the Ismail Mohamed Street. The model of the project follows the stationary and neighborhood concepts, meaning that the cars will be exclusive to residents of the immediate surrounding area of the stations; and the users must pick-up and bring back the cars to the same station. To use the shared car, the resident must install the mobile application tool (App), on which cars can be reserved by locating the nearest unit available. The system also gives the user the opportunity

Figure 12: Carsharing APP. Source: Authors, 2019.

Figure 13: Zamalink Concept. Source: Authors, 2019.

of carpooling, where one can join or invite a neighbor to take part in a trip; this can be economically beneficial when more than one person is driving to the same area, at the same time.

The shared car will be an option for people who do not use their cars every day and would like to have a car on demand, with good parking location guaranteed at all times. In a more meaningful approach, the car sharing can also change the peoples' mindset on car ownership, besides increasing the sense of communal living.

In our project, the Zamalek metro station will be the center of two different approaches: the intermodal mobility hub inside Zamalek and the transformation of Ismail Mohamed Street into a new hot spot, making the space surrounding the station a place to be, with new infrastructure and public activities.

Community Hub

Considering the deteriorated state of Ismail Mohammed Street, the absence of green public spaces in the area, and the residents' low acceptance of the metro station, the team decided to propose an ambitious approach – to convert Ismail Mohamed Street into a shared boulevard, where pedestrians are prioritized and vehicular movements are extremely restricted. The main objective is to deliver the street to the people, giving them a place and opportunity for social gathering and community building.

The entire street will be repaved, and in the new street design there will be a clear demarcation of the areas for cars and people, and along the shared street, there will be greenery in small pocket parks. As a special feature, we are proposing an open stage just in front of the Faculty of Music. Moreover, we are also proposing a new plaza at the Zamalek metro station, which will be a place for people

to gather and interact, and different activities to take place simultaneously (e.g. local markets, open-air art exhibitions).

The cultural profile of the institutions present in Zamalek can be favorable for implementing the project for the shared street. As stated by Village Well (2006), art and culture are key elements for engaging people to participate and interact in the street. Additionally, according to Mackenzie (2015), a street can become a cultural destination, other than just a regular path for our daily routines. Thus, the Embassies and the Faculties of Arts and Fine Arts are also expected to participate and help in shaping the area, creating a wider sense of identity for the local community. The Embassies can collaborate with periodic

cultural events and activities, while the art faculties can paint murals along the street and promote art exhibitions from the students.

By promoting a new program for Ismail Mohamed Street, we are not only proposing the enhancement of pavement and new urban furniture for aesthetics reasons. We believe that by redesigning the purpose of the street, we can also encourage better interaction between people, since the street will be a hotspot for cultural events and artistic exhibitions.

Zamalink

By adopting the principle that mobility and place making are interconnected, the Zamalink Community & Mobility Hub was created, through the combination of the proposed intermodal transportation and shared street for Zamalek. Both proposals of the project depend on one another.

The core of the concept of Zamalink is to embrace the metro station as a link between Zamalek and the outer districts, and connect people within the island. By introducing other mobility options, we want to achieve a more sustainable balance between public and private transportation. Furthermore, the new metro station can also be a new hotspot for the area, where the local community and institutions come together to reshape the Ismail Mohamed street into a mobility and cultural hub in Zamalek.

The use of art and culture is part of our strategy for bringing people together and to rebuild the community in Zamalek. By including the people in the creative processes of reshaping Ismail Mohamed Street, we are ensuring that we create a more humanized project, where the people can identify with the place. Once that sense of belonging is developed, it will encourage the maintenance of the spaces, as when people feel attached to a thing, they tend to take better care of it.

The benefits of Zamalink is mainly targeted towards the residents and visitors of Zamalek. We will seek sponsorship from the Zamalek Association, Municipality, Embassies, and business community. The target group, sponsors and other public and private entities, will constitute our key stakeholders. Effective communication of the project's progress through regular reporting, will be one of our preferred mechanisms for managing our stakeholders and ensuring their active participation. The duration of the project will be two years, from 2020 to 2022, and will be executed in two phases. A baseline survey will be conducted at the onset, enabling the project team to monitor and evaluate its progress and performance respectively. A control group will additionally be used as a basis for comparison during the evaluation process of the car sharing model.

To conclude, we believe that Zamalink presents the strategies required to realize our ultimate goals of reducing traffic and parking congestion, providing an engaging public space, and fostering social cohesion in Zamalek.

Figure 14: Proposal for Ismail Mohammed Shared Street. Source: Authors, 2019.

Figure 15: Aswan Square Fence Communication Panel. Source: Authors, 2019.

Regenerating Public Green

Cairo's Receding Green

Green open spaces have the potential to contribute to all three aspects of sustainability, including environmental benefits, economic values and social benefits. (Kafafy, 2010)

Did you know that Cairo has a tenuous history with green open spaces - with its earlier beginnings not intended to be used by the public?

The historic city of Cairo, as Rabbat (2004) explains, was originally founded around a Bustan (meaning park in Arabic). He identifies, however, that green spaces at that time were exclusively used and rare due to the City's arid climate (2004). He depicts Cairo's history as characterized by sprawling urbanization, removing green open spaces in its path. Kafafy (2010) perceives that luxurious gardens in the Cairo context were often the victims of their own success; they disappeared to more lucrative real estate in gardened locations.

Nassar (2011) in a paper about belonging in Cairo's public spaces, regrets that the opening of parks to the public led to their decay which she links to social stratification and disregard for spaces that are not considered 'exclusive'. She perceives that this mentality has a large influence on

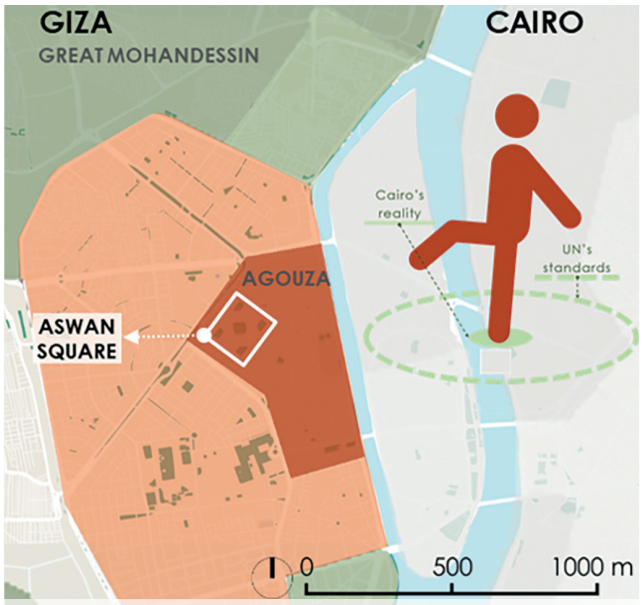

Figure 16: Aswan Square, Cairo context. Source: Authors, 2019; map adapted from Snazzy Maps, 2018.

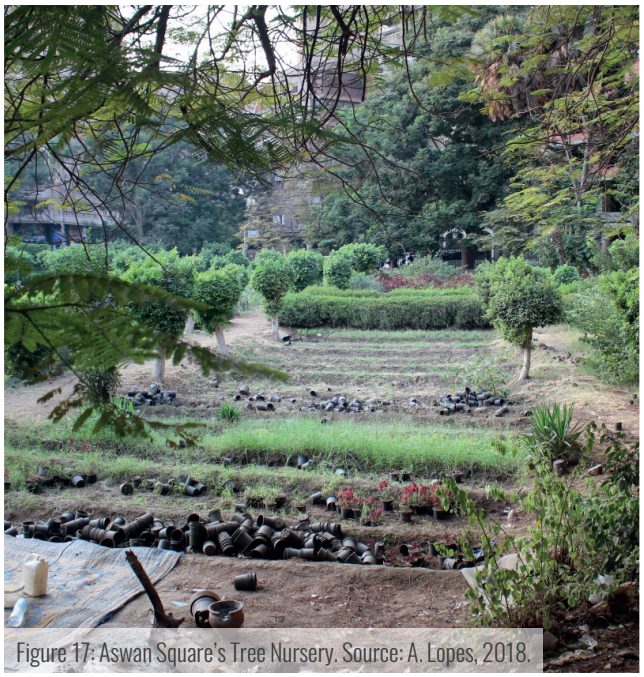
Figure 17: Aswan Square's Tree Nursery. Source: A. Lopes, 2018.

the gating and closing of Cairo's public spaces. Kafafy (2010) perceives that Cairo's declining green open spaces are also interrelated with weak governance over their maintenance. The regenSPACE group consider that the current situation of green open spaces highlights a collective disregard and culture of misuse of public green open space in the Cairo context. As shown in Figure 16, compared with international standards by the UN Habitat (2016) which recommends 9m2 green open space per capita, Cairo only provides 0.5m2 per capita, further illustrating the critical inadequacy of green space and the need for transformative measures to protect and enhance the remaining ones.

Aswan Square is an affluent Cairo neighborhood within the Giza Governorate, its location and scale is depicted in Figure 16. which is representative of a remaining green space in Cairo under threat of redevelopment. The Square is misused as a tree nursery, illustrated in Figure 17, which makes the space dormant for most of the day. Visitation is discouraged further from the discomfort of dumped rubbish and the absence of urban furniture to encourage social interaction. The Square once open to the public, was in later years closed, likely due to social mistrust and exclusion of a neighboring informal settlement. The Square's closure, as conluded by regenSPACE has further influenced a sense of anonymity among local residents, with limited opportunity to form social bonds within the space.

As a representative green open space experiencing the challenges of misuse, Aswan Square is an opportunistic case study to test interventions to address the inadequacy of green space in Cairo. Which raises the research question on **how to create a culture of using public open spaces, while promoting a sustainable transformation?**

A Pilot Approach by regenSPACE

The regenSPACE team is a multi-disciplinary international research group based at Cairo University, Egypt, born from an exchange partnership with HafenCity University Hamburg. The group seeks to address the research question by using Aswan Square as a pilot study, to create a robust and transferable project framework that can be used to transform other green spaces in the Cairo context. The framework recognizes that placemaking improvements can powerfully build resilient and thriving communities, and strengthen citizens' understanding and care of the natural environment.

The regenSPACE partnership model is structured with three influential participatory groups, referred to as anchors. The anchors are necessary to establish a robust project implementation process, and include the engagement of: citizens (local), relevant governance (authority) and external resources including local enterprise and charity involvement (NGO). This model's tri-anchor approach has equal weighting to show that each group should operate in balance with each other. The model forms the foundational building block of the project's structure, while at the same time providing flexibility for the addition of further cooperative partnerships and citizen engagement processes.

The role of the model's anchors:

Local: networking with local groups to provide opportunities for citizen engagement within the public open space.

Authority: cooperation with government entities to achieve necessary approvals to undertake the project within a locality's governance parameters.

NGO: Non-Government Organization (NGO)

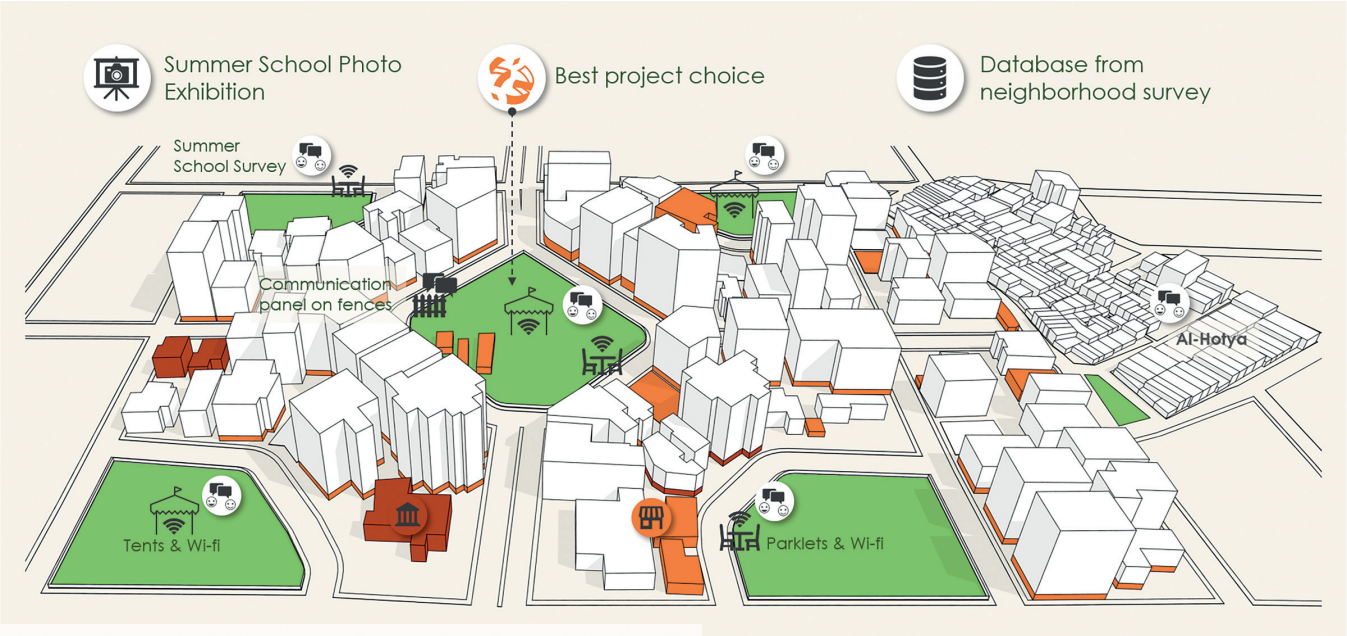

Figure 18: Project Phase 1 - Summer School Showcase Event. Source: Authors, 2019.

partnerships with renowned (national or international) organizations for promotion, resourcing and sponsorship of activities.

To realize the pilot project, regenSPACE will work within the structure and seek funding from the German development agency Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), within their Programme: Egyptian Participatory Development in Urban Areas. The project comprises two phases:

PHASE 1 - Transformative Research: In cooperation with GIZ, the first phase will work closely with the Egyptian National Government to secure funding and support for the Giza Governorate and Al Agouzah District governance levels. Cairo University will also be a major partner in this phase for the facilitation of a Summer School in affiliation with the German Academic Exchange Service (DAAD).

Goal: To identify potential stakeholders and to establish a trust network to assist citizen engagement, which will be facilitated through a coordinated Cairo-Hamburg Summer School.

Students will be engaged to interview local stakeholders in the Square to inform their concept development of low-cost and temporary intervention projects for the green spaces. To facilitate stakeholder interaction, temporary parklets with free wifi will be installed to invite passersby to use the furniture, encourage citizens to engage in conversations with students and promote the use of project social media channels as well as partnerships with adjoining businesses. A community event will invite stakeholders to review and vote on their preferred student solutions to be realized for the green space. A second community event at the close of the student's involvement will present an exposition of photos that best represent the Inhabitants' impressions of the area with their local narratives and treasured landmarks. These activities are depicted in Figure 18.

PHASE 2 – Green Regeneration: This phase maintains the cooperation with GIZ and a close working relationship with the Egyptian National Government, Giza Governorate and Al Agouzah District. A further key partner in this phase will be a newly established neighborhood association that would be formed as a result of the first 'Transformative Research' phase.

Goal: To achieve a vibrant and redesigned Aswan Square and adjacent plazas, serving their purposes in the community as places of sharing and inclusion.

The redesign of the green areas will be based on requirements defined by the neighborhood's community, supported by technical experts. The design of a definitive project and its execution will be decided based on a national competition for Egyptian Architectural Offices. Community participants will collaborate in the process by setting activity program requirements to be undertaken in the green spaces, and a technical team will define sustainability requirements, such as water and energy efficiency. The definition of technical requirements will also support the raising of local awareness to sustainability topics.

A staged approach will be used for the construction and implementation of activities within each of the green spaces, to minimize disruption to the neighborhood, but also to test the solutions with the community for each of the physical changes realized within each green space. For example, before construction works, the removal of the perimeter fencing can be tested to see how the community interacts with the space. With the completion of each solution a Little Celebration will be held. The process of this stage is illustrated by Figure 19.

Empowerment

During the project, emphasis will be placed on strengthening the bond and voice of a newly established neighborhood association. This is to maintain a strong working relationship with the municipality, and to assist the stewardship hand-over of the Square's green spaces, following the final inauguration of the new Aswan Square. The regenSPACE group will transfer full responsibility of the green spaces to the community slowly, by offering practical support in the initial hand-over phase.

Participatory Processes

The regenSPACE approach to the transformation of green open spaces has been designed with citizen engagement at its core. The participatory process will provide a general idea of future possibilities, but with enough freedom for citizens' to develop their own ideas and imagination to shape the green open spaces. Figure 15 illustrates the intended actions to take place within each Project Phase for the Aswan Square pilot project.

The first phase will include stages 'inform' and 'consult' with the community role to listen to ideas and contribute their own ideas through the engagement initiatives of a communication platform, the development of a trust work and the implementation of a summer school. Its goal is to promote and assist local understanding of the project and to generate interest and monitor participation.

The second phase will include the actions of 'involve' and 'collaborate + empower' with the community role to participate, partner and decide in decision-making for Aswan Square through the engagement initiatives of visioning workshops, design and construction. The goal of engagement is to work directly with stakeholders to ensure that their aspirations and concerns are understood and considered, and to identify barriers for

implementation.Furthermore, there will be a progression towards the partnering in decision-making and a transfer of responsibilities to a newly formed neighborhood association so that the Square can be self-managed in the long term.

Finally, for future projects there is a time for reflection on what went well and what can be further improved in the process, for the transfer of the model to other green spaces in Cairo. This part of feedback is essential towards refining all project processes.

Who are the stakeholders?

Participation of stakeholders is key to the success of this project. Once identified they will be categorized according to their contribution to funding, expertise and labor in the project. The level of influence of each stakeholder will also be considered.

A key communication tool for each open space transformation will be regular project status updates to promote active participation. Updates will enable the community to follow the progress of changes and schedule of workshops and events. In addition to a digital platform for news updates, a timeline panel would be mounted along the street-facing side of the central square's boundary fence to display undertaken activities and upcoming information. To maintain community interest throughout the project, achievements for each milestone will be recognized with a 'Little Celebration'. This is an inauguration to invite the community to experience the Square's spaces as they transform. The concept for the communication panel for Aswan Square's boundary fence is depicted in Figure 15.

Transferability

As regenSPACE will use the Aswan Square green open spaces as a pilot study, lessons learnt from the implementation of this project will be evaluated to consider its success and transferability to other open spaces in Cairo. This will be achieved through a follow-up survey and feedback process with participating stakeholders, in the eight months following the hand-over of the project to the newly established neighborhood association.

The survey will question the users' experiences and interaction with the redesigned space, and satisfaction of recent changes. Feedback channels will be provided through project social media channels and with a collection box positioned at the Square's central green space. The feedback is specifically targeted to understanding two key processes: how the engagement process can be improved to increase stakeholder engagement in open space transformation projects; and how to form a robust neighborhood association to sustain management of the space in the long term.

The transferable model will be refined and provide a general framework that can be adapted to spaces with similar issues. The regenSPACE group sees the potential in bridging the social disconnect between citizens, to realize a collective vision for a successful green open space. This approach starts at the individual level, but builds on cohesion and community collaboration to drive change, which is resonated by the words of Margaret Mead, the winner of the Planetary Citizen of the Year Award in 1979:

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it is the only thing that ever has.

(Mead, n.d.)

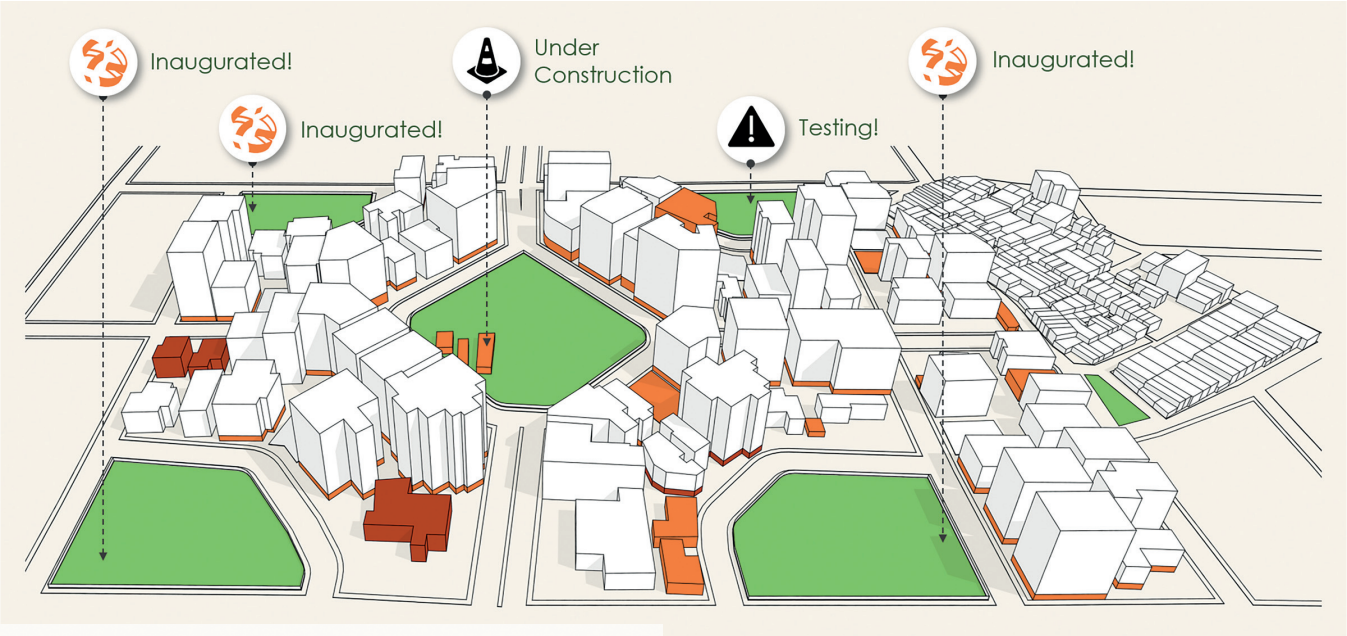

Figure 19: Project Phase 2 - Green Regeneration Stages. Source: Authors, 2019.

Figure 20: Visual of recycling and composting waste materials at community center. Source: Authors, 2019.

The Urban Bio-Loop

Introduction

Mohandessin is one of the affluent quarters located in the Giza governorate, Cairo. It neighbors Mit Akaba, historic settlement in Giza governorate dating back to the 14th Century (Tarek Waly Center Architecture & Heritage, 2015), and Ard al-Lewa, one of the largest informal settlements in Cairo. Mohandessin explicitly shows cases of the urban transformation in Cairo. Within about half a century, it transformed from a residential quarter predominantly occupied by villas, to a present commercial business district with emerging high rise buildings. Consequently, urban problems such as traffic, waste, and insufficient open spaces, which are also common in other areas of the city, are becoming more difficult to manage.

Our proposal focused on defining the potential contribution of composting in the management of organic waste, as an alternative to traditional landfilling of such waste. In this context, the project proposes on-site composting strategies using a combination of composting facilities, community composting centers and home composting, as well as waste separation, and place-making. The proposed composting scheme has the potential to help solve the unexploited open spaces and the social segregation in the neighborhood.

Problem analysis

Since 1948, at the time the Ministry of Waqfas advertised a land lease plan of today's area of Mohandessin (Keller & Polach, 2015), the neighborhood has encountered drastic urban transformation in response to changes in socio-spatial demands at different periods in time. Villas from the 1950s and 1960s were replaced by medium-rise apartment buildings from the 1970s to 1990s, due to higher density requirement (Keller & Polach, 2015). For the past two decades, the neighborhood has evolved into a commercial business district (Keller & Polach, 2015), of which we also witnessed the emergence of high rise commercial buildings. The change in land use and the ever-growing density seems to only intensify and complicate urban problems in the neighborhood.

We have investigated and analyzed three main urban issues: 1) Waste management, 2) open public spaces utilization, and 3) social cohesion.

The increasing urban density led to more waste generation in the neighborhood. Waste is currently collected by the Zabaleen; minorities specialized in waste collection and recycling. The Zabaleen people collect the waste from door to door, and use some pocket spaces in Mit Akaba as a reloading and primary separation point. They take the recyclable wastes and organic wastes to their homes on the outskirts of the city and the remaining waste to the landfill. They recycle the plastic and metal waste and use the organic waste to feed their pigs. With their rich experience, the Zabaleen people could easily adopt innovative technologies that potentially enhance waste management.

Open public spaces are insufficient, and the available open public spaces are not serving their function at full potential. The biggest open spaces in the area, Tersana

Figure 21: Problems Identification. Source: Authors, 2019.

and Zamalek sports clubs, are gated and privately owned, and can only be accessed by paying an entrance fee. Small pocket open spaces are misused; they are often used as waste reloading points in contrary to their intended purpose.

From our interviews on Lebanon Street, Mohandessin, we have learned of the social polarization between inhabitants of Mohandessin and the neighboring informal settlement. Some Mohandessin inhabitants claimed that the people from the informal areas bring a new and unwanted culture to the neighborhood.

Project concept

"Both recycling and composting seem to be promising practices, which can contribute to solving the complex urban problems we are facing in Cairo; and eventually, it would create a more productive and healthier urban environment." (Authors, 2019)

An extensive amount of waste generated in the Mohandessin district is one of the main issues due to its high urban density. Organic waste accounts for half of the waste composition and becomes a burden for the government who are responsible for providing waste management services. The concept of the project is to reduce the dependency on the dumpsite and to focus on opportunities for decreasing social segregation and increasing public space usage. The project proposal involves on-site composting strategies by using waste separation and home composting method. The mission is to separate organic waste from the rest of the waste, encourage composting at a community level, and produce fertilizer compost as a final product to be applied in green spaces.

Composting is a natural process to recycle organic matter which breaks down into rich fertilizer for planting by using decomposers; microorganisms or macroorganisms (University of Illinois Extension, n.d.). After in-depth research on different composting methods that focus on household composting, the Takakura composting method seems to be appropriate to implement within the Cairo context. The technique does not require much space and simple household materials can be used to cultivate microorganisms.

The main elements in the method consist of fermenting solutions, fermenting bed, and container as in figure 4. Microorganisms are cultivated in fermented local foods, vegetables, and leaves. They are then mixed with the fermenting bed to produce seed compost. The production of seed compost will be at the community center where experts would be present to control its humidity and temperature. When the seed is ready for composting organic waste, food waste should be chopped into small pieces and drain of liquid to accelerate the fermentation and avoid humidity inside the container. When the container is full, taken some of the seed compost out and dried it before used as a composer (JICA, n.d. & Maeda, 2009). The Composers will be used in households or sold to the community center for public use in green spaces.

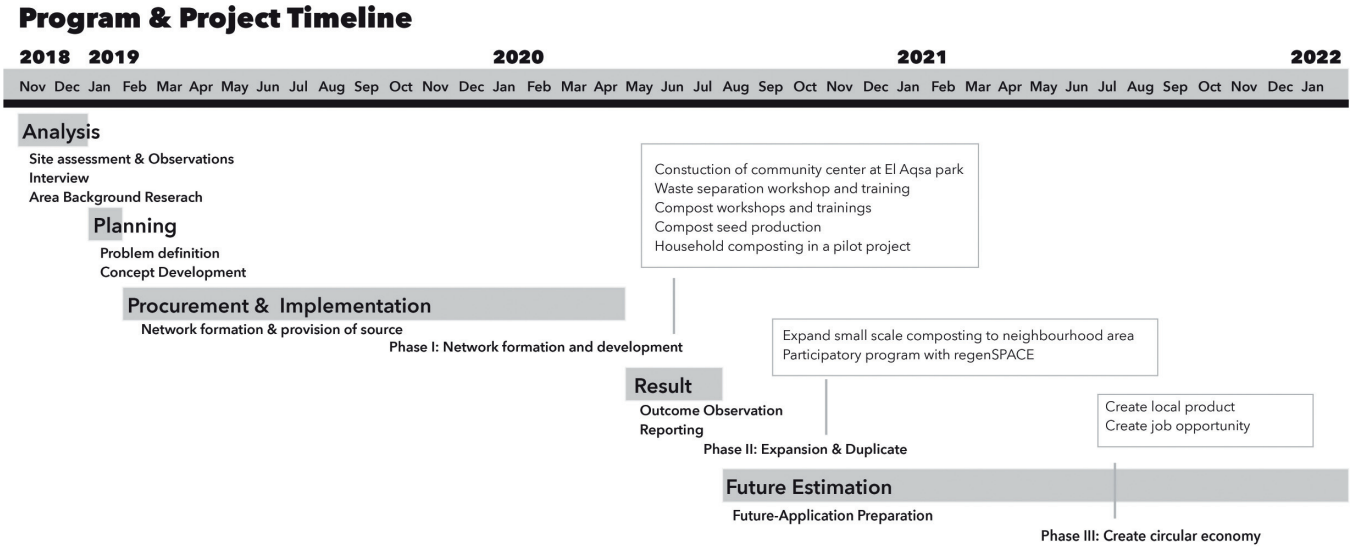

Figure 22: Program & Project Timeline. Source: Authors, 2019.

Project plan

The Project consists of analysis, planning, procurement and implementation, results and future estimations phases. The timeframe of the project for the first phase will be 21 months (figure 3). In phase I, it aims to build a network among the community with waste management actors, Zabaleen group and GCCB, as well as to form a collaboration with educational experts and source financial support from external agencies. The pilot project will start with the construction of the community center in El Aqsa Park, where most of the training and workshop activities will be held for interested inhabitants and participants who live nearby. The waste separation will be the main method to collect organic waste. Afterwards, education on the composting process and the composting itself will take place at the community center (El Aqsa Garden).

Phase II consists of the extension and replication of the practices in the neighborhood district. For stronger commitment, researchers and community groups in the neighborhood district will be included. A strong connection with the research group regenSPACE (as being part of the regenSPACE Participatory Program) will start in this phase (regenSPACE, 2019). The plan is to create a market flow for compost products and storage area. Aside from that, local compost can be used in public open spaces and agriculture sectors.

Future estimations would include creating a local economy. Hopefully, products from urban gardening facilities will start being sold on the local markets. Creation of job opportunities involving composting and recycling (also for different types of materials) is the main aim to support a circular economy.

Project outcomes

With the composting method, a significant quantity of organic waste will be collected for composting to produce rich compost. We believe that public spaces in the Mohandessin district will appear cleaner and more green. We estimated that organic waste generated per household is about 2.4 kilograms/day. Therefore, 3.6t of organic waste could be composted per month, from all of the participants (500 households) (EEAA, 2013 & Mohamed & Tkadlec, 2015). Aside from reducing the amount of waste produced, at the community center, we will strive to get all the different social and cultural groups involved in the workshops and training, and the local market as well.

Stakeholder and financial overview

All the project activities will need full support from the inhabitants and actors from the waste management sector. To develop a strong commitment within a community, the community center will be the main factor creating a network for all of stakeholders and inhabitants. Knowledge and experience will be shared at this venue. Moreover, regular promotion, training and workshops will raise awareness and empower people to address the issue. The project will be presented to the internal agency; GCCB (Giza Cleaning and Beautification) Authority and external agencies such as GIZ (the Deutsch Gesellschaft für Internationale Zusammenarbeit GmbH) which already has several projects related to the topic (GIZ, 2018). Furthermore, sponsorship from private sectors like local supermarkets could provide support by supplying materials for compost seed production. To sustain the project, the sale of composers to green areas and agriculture sectors will be the main goal in a long-term plan.

To extend Urban Bio Loop project, several workshops, and training programs will be held at the community center, provoking inhabitants' interests and practices. To measure the progress of the project, primary indicators will be applied in the project plan for monitoring and evaluation in figure 5.

"From burying the waste to utilizing waste as a resource…" (Authors, 2019)

Conclusion

The main aim of the project is to reduce the excessive amount of organic waste littered on the streets and that taken to dumpsites. Compost production and ultimately mitigation of environmental degradation are our environmental intentions. Another purpose of the proposal is to foster a knowledge-based society and to

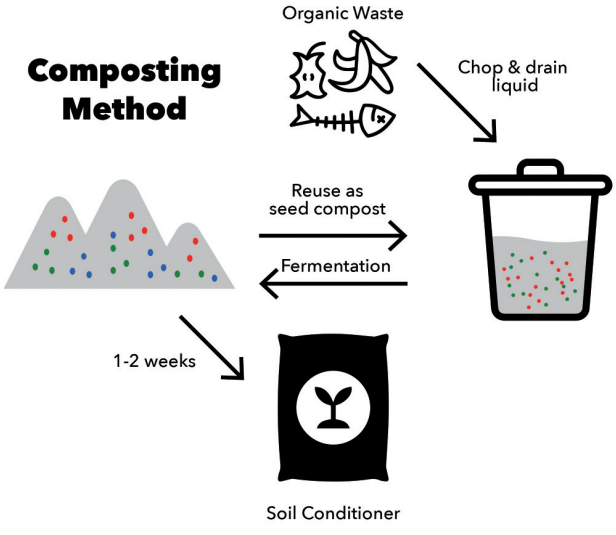

Figure 23: Takakura Composting elements and operational flow. Source: Authors, 2019; adapted from Toshizo Maeda, 2009.

Maintenance

Objective	Activity / Action	Responsible Actors	Benefited Actors
Organic Waste	Teaching program regarding waste separation in the households and the city	JELMS GIZ Egyptian Minister of Environment	Zabaleens Inhabitants
	Separation of the different types of waste	Households: Inhabitants City:Zabaleens	Zabaleens Inhabitants
Local Compost	Fermented solution making in the Training & Composting center in El Aqsa Park	JELMS GIZ Egyptian Minister of Environment	JELMS Zabaleens Inhabitants
	Takakura technique teaching for the compost production	JELMS	Zabaleens Inhabitants
	Composts storage inside and outside households	JELMS Zabaleens Inhabitants	Zabaleens Inhabitants

Evaluation

Indicator	Measurement	Possible Barriers	Attack Plan
Inhabitants assistance to the teaching program	Number of people attending compared to total number of people in the neighborhood	Lack of interest from inhabitants Insufficient publicity of the project	Sufficient promotion of the project emphasizing on the benefits of the Urban Bio Loop
Decrease in waste sprawl on the street	Tons of waste sprawl in the neighborhood before/after the project implementation	Lack of interest from inhabitants	Reinforce the interest through workshops in the Training & Composting center
Increase of separate waste inside/outside households	Tons of separate and not separate waste for comparison	Oblivion by the inhabitants	Encourage the people to fulfill the activity with workshops and entertaining activities
Increase of compost quantity in the storage places	Tons of compost produced	Insufficient space for storage Inappropriate storage of the compost	Expansion for suitable site for storage will be in considered beforehand

Figure 24: Maintenance & Evaluation. Source: Authors, 2019.

promote community cooperation. The project begins with a small quarter in Mohandessin, extending to the whole neighborhood and later spreading to all of Cairo.

A novel aspect of this project is blending a variety of stakeholders from governmental and institutional level to other relevant non-governmental organizations, from international associations to local groups, especially inhabitants and the Zabaleen. In this proposal, we include a group of people who are already working with garbage collection, sorting, as well as having experience with organic waste materials. Moreover, different socio-economic groups are incorporated into the process, aiming to create social harmony and feeling of belonging for all.

Although composting and processing organic waste is often undesirable and burdensome to surroundings, the development of an organic material processing technology is essential through the lens of sustainable urban planning. Waste management prevails at the core of many urbanization-caused challenges, having developed from its most basic form (i.e., cleaning the city) to an increasingly forward-looking service idea (the waste management chain), and notably to its dominant position at the heart of the circular economy concept.

Figure 25: Visual of utilizing composers in green area. Source: Authors, 2019.

Figure 26: Sun over Cairo. Source: H. Sengen, 2018.

The Sun Over Zamalek

Introduction

Egypt is blessed with renewable sources for electricity production, including hydropower, wind power, and especially solar power. According to the International Renewable Energy Agency (2018), it has the potential to generate up to 53 % of its electricity from renewable sources by 2030 but more than 90% of its demand is generated from fossil sources in centralized large-scale power plants. As stated by EEHC (2017), Cairo's energy demand is covered by 10 gas power plants, with no renewable sources and a fuel mix comprising natural gas, mazut, and diesel, with natural gas accruing 78.8% of the total fuel consumption.

Egypt is running out of gas and oil, presumably within the next 15 to 20 years (Egypt Oil & Gas, 2012). By this, the cost of importing the necessary fuel will put huge pressure on the national budget. CCT (n.d.a) opined that reducing the electricity demand by increasing the efficiency of usage and switching towards renewable energies will be a key challenge in the coming decade since the energy sector is a high contributor to greenhouse gas emissions. According to the World Bank (2017), the implementation of rooftop solar energy is an important step in improving Egypt's Energy Efficiency in public and commercial buildings.

Shere (2009) describes Egypt's history of using renewable sources for electricity generation as striking, since the advent of the first solar power plant. It was built in 1913 for irrigation purposes using parabolic troughs to reflect the radiation on pipes with running water, which eventually changes into steam that runs a turbine and a generator (Silcox, 2009). This technology again has become aware of in the past decades, the so-called concentrated solar power.

In addition, in the 1960s a hydro power plant at the Aswan High Dam was built and at that time provided more than 60% of the demanded electricity of Egypt (HPGC, n.d.). With the economic growth and the increasing population this number dropped to 6% today (EEHC, 2017). Considering Egypt's growth and the extreme temperatures, the electricity demand especially for space cooling is very likely to rise over the next decades. This outlook calls for sustainable and renewable concepts for space cooling to first, lower the demand, and secondly meet the remaining demand with renewable energy generation.

The study area for this project is the center of Zamalek, the wealthy island district in the Nile of Cairo. It is placed North and South of the 26th of July corridor, bordered by the streets Ismail Mohammed in the North, Salah El-Deen in the South, Shagaret Al Dor in the East and Hassan Sabry Street / Brazil Street in the West. The research and proposal focus on the energy production and consumption in this area. When analyzing the neighborhood, the authors realized that Zamalek, with its affluent inhabitants and its variety of local, national and international institutions has the potential to become first movers in the process of transforming the energy sector. Not only due to the prosperity of the quarter, which indirectly causes a high energy demand, especially electricity, but also due to a possibly higher awareness, financial abilities and political influence of the people living there. Together this makes an ideal setting for the implementation of a pilot project in supporting urban renewable electricity production. Bearing in mind the missing expertise of

decentralized renewable electricity generation among the inhabitants and the maintenance demand of the plants, it was decided to focus on institutions for the initiation of pilot projects. Another benefit of implementing a pilot project at institutional level is the reach of such a project and the utilization of it as publicity for the institution. It therefore comprises additional gains, apart from financial benefits and occurring barriers that might be less fatal to the project's success than for private households, due to a more professional character.

The guiding research question was consequently: How to increase the energy efficiency and implement renewable energies at an institution in the center of Zamalek?

For understanding the status quo, the existing barriers for the implementation of decentral renewable plants in Egypt were analyzed. The findings focused on three main problems in the implementation process: A lack of awareness in the population, complicated and opaque bureaucracy for the installation of privately owned and operated plants, and low profitability of the operations due to low feed-in tariffs in contrast to the high initial investment.

The approach therefore was to provide a toolbox for possible improvements of the current situation. As an exemplary pilot object, the Dar El Tarbiah School was identified. The selection was based on the available information and the suitability of the building, its owners, and its usage. Located on 24 Ismail Mohammed, it is a private school from the Dar El Tarbiah group, owner of 7 educational institutions along the city of Cairo (Dar el Tarbiah, n.d.). On the one hand, this ensures a high replicability of the project also outside Zamalek, and especially in the case of an educational institution, the capacity building within the school can be used and easily extended to renewable energy generation.

Increase awareness

The Cairo Climate Talks initiative from the German embassy in Cairo has held different events since 2011 to provide a platform for discussion and exchange between Germany and Egypt about the topics of energy and environment. Within this framework, a public panel with expert lectures took place in February 2016 in Zamalek about Egypt's potential to improve energy efficiency in different sectors (CCT, n.d.a). Events like this can increase the recognition of important matters but might get more attention from professionals, than from the broad population, even though it is open for the public.

As a means of addressing the improvement of energy efficiency, Mahmoud, (2016) pointed out that the Egyptian government developed the National Strategy for the Egyptian Power Sector and included the Energy Efficiency Improvement and Greenhouse Gas Reduction Project in this framework. Within this project, a labelling system for energy efficient appliances was developed for commonly used devices like refrigerators, freezers, washing machines, air conditioners and electric water heaters, as well as efficient lighting equipment which has been showcased in various fora thereby calling attention to energy efficiency in the building (Mahmoud, 2016).

Based on this, as part of the concept development for the Dar El Tarbiah School, potential measures to further increase the awareness were developed and analyzed. For informing about renewable technologies and especially the opportunities and importance of saving energy, the approach of a social media campaign is chosen. The social media campaign has a local and supra-regional target group and can inform in depth. When updated frequently it can also promote participation events such as energy workshops at the Dar El Darbiah School or elsewhere.

A participatory approach at the school will focus on workshops and will be addressing, besides renewable energy sources, the user's behavior and its influence on energy efficiency. By raising awareness in this field and providing simple measures, the energy consumption can be reduced. For institutions in general, the responsibility of saving energy can be transferred to the employees in the fashion of a weekly assigned energy manager. This individual is responsible for e.g. checking the lights or other energy consuming appliances if being turned off when not needed. By rotating the responsibility, this will involve all employees and raise awareness by everyone. In combination with renewable electricity generation, this can establish a credible institutional strategy for increasing its sustainability.

Still, the main target group for the pilot project at Dar El Tarbiah School are the students. In view of this, energy-related topics will be taught at all grades during each academic year making energy an integral topic in school. The knowledge and awareness gained through this inclusion in their everyday school life, will spread to their friends, families, and other people they relate to and the broader population via the social media campaign.

Increasing awareness of the topic of renewable energy and energy efficiency is essential for a successful strategy of implementation. It can reduce opposition on the side of the citizens and enable them to decide maturely. Involving and informing the population can result in a claim for governmental action in this field and speed up the process of moving towards a more sustainable energy management.

Reduce Bureaucracy

One of the administratively essential but reportedly problematic aspects of Egypt's feed-in tariff scheme is the obligation for the end-user to issue a permit, allowing them to legally buy, install, own, and operate their renewable energy plant.

When issuing a permit, there are barriers in place, which impede the positive development of private solar plants. The process of application is time consuming and complicated. During the permission process, the end-user is obligated to deal with five to six involved administrative bodies, going through eight to nine steps. It starts with the application of an operation permit at the Ministry of Electricity and Renewable Energy and ends with the permit, which allows the installer of the plant to set up the plant and the metering devices, with the obligation of connecting the plant directly to the grid. This results in a complete grid feed-in of the produced electricity. The ministerial bodies in many cases are not prepared for the issuing of these requests. It results in negligence, dis-coordination, and lack of motivation to care for the end user's interests. Additionally, there are too many steps and associated or involved bodies in the process. To reduce or simplify these processes for the end user, the authors developed three possible solutions: The One-Window Scheme, the Third-Party Approach, and a Simplified Bureaucracy.

Ramadan (2014) highlighted the One Window Scheme as a brief and non-binding suggestion by the Egyptian Minister of Electricity and Renewable Energy, without detailed information on how this process could look like. It was still used by the authors to develop their own concepts about this scheme. The idea is premised on the creation of a new official governmental entity that would act as the front of the permit issuance for the end-users, while the same procedures still take place behind the scenes.

The Third-Party Approach is very similar to the One Window Scheme, but the central front-acting entity is the supplier and installer of the solar plants, a stakeholder already involved in the process and with the capacity to include the permission process into the standard procedure of issuing the purchase of photovoltaic plants. Since the process is the same in most cases, the company can perform more efficiently than the private operator can. This approach was adopted from a case study of Tanzania where this works very efficiently. The critical point of this is the possible dependency of the costumer on the private company. Nevertheless, this third-party approach is a small and simple adjustment to the current situation with a possibly large simplification for the private operator and can help to improve the current situation until the bureaucratic process is simplified.

The third option is The Simplified Bureaucracy. It is more profound and holistic, but also a complex approach. It entails reducing the overall steps and consequently limiting the Ministries involvement to the most essential. The idea of restricting most of the paperwork within the authority of one ministry will result in a clearer definition of responsibilities and better control. This approach has therefore the potential to create a sense of trust in the government's willingness to follow through on its obligations towards the solar-power and the renewable energy sector. However, cutting out several ministries will raise opposition, and if possible at all, increase the time of implementation of the restructuring. It is therefore considered as a long-term aim, in contrary to the first two solutions.

Eliminate Financial Constraints

The first and most definite obstacle to operating a photovoltaic (PV) plant is the initial investment. As shown in a project by Off-Grid Electric (n.d.), there are financing models in place for off-grid solutions with PV generation that involve a leasing concept where after a defined time span the ownership of the PV devices passes on to the person leasing the equipment. The investment is hereby split up into several rates, which then can be at least partly paid by the earnings and savings of the PVs operation. In an ideal case, this would mean that the initial investment is lapsed completely. The leasing rate is equivalent to a monthly electricity fee, and after a few years, the ownership of the devices is gained, and money can be saved and earned by the new owner. This model can be easily adjusted to the urban context in Cairo and remove some financial barriers.

However, for the financing model to work, the PV plant is required to run profitable. There are two ways of profiting from producing renewable energy as an owner of a generating device. The first one is to sell the whole amount of produced energy to the Electricity Transmission & Distribution Companies (Ramadan, 2014). This company is obliged by the Government to buy all produced electricity at a defined price, the so-called feed-in tariff. In 2016, this price was set at EGP 1.03 for households and EGP 1.09 for commercial plants up to 500 kWp. For larger plants, the feed-in tariff is even higher, at EGP 1.41 for plants up to 20 MWp and EGP 1.5 for plants up to 50 MWp ((Egyptian Official Gazette, 2016)

The other option is by consuming it within the building thereby reducing the electricity consumption from the grid. A necessity is that the government accepts the necessary bi-directional meters at the grid connection point and does not require a complete grid feed-in. Another prerequisite is that the plant is dimensioned to roughly match the electricity demand of the building. It is also much easier if the plant owner is also the electricity consumer. In the case of the Dar El Tarbiah, this should be given. According to Ramadan (2014) the first precondition however, does not exist in the current legal framework.

The conducted analysis showed that there would be a need to raise feed-in tariffs by 100% in order to achieve attractive business cases for a variety of applications. This is still a very expensive measure and mainly supports large-scale plants, since these have lower specific cost due to scaling effects. The second and more favored option is integrating the right of self-consumption, of on-site

produced electricity, in the legal framework. With electricity prices of up to EGP 1.5/kWh compared to feed-in tariffs EGP 1.09/kWh saving electricity in the building is already more economic than feeding into the grid (Egyptian Official Gazette, 2016; Al-Waqai Al-Masriyya, 2018). In combination with a reduction of electricity subsidies, this creates an attractive business case without the need for government investment. It would not only involve many small local investors, but also take pressure away from the electricity grid, since grid consumption and grid feed-in is reduced.

A holistic strategy in shifting towards renewable energies soon, then both instruments, feed-in tariffs and the promotion of self-consumption are necessary. The profit by the government from increasing electricity prices for high consumption can be reinvested into feed-in tariffs for large-scale solar farms using concentrated solar power with large heat storages. In contrary to the photovoltaic technology, this enables a renewable base-load electricity production, which is indispensable for high shares of renewable electricity in the grid.

Discussion & Conclusion

The pilot project serves as a base for evaluating the feasibility of the proposed concept. As the term "pilot project" suggests, the concept is not limited to a single building, but is useful for a wide range of cases. The fundamental idea is to create a setting in which distributed renewable energy grows within the urban context.

The focus on institutions eases some factors that are likely to be more complex for the implementation in other sectors e.g. the housing sector. For instance, maintenance can be covered by the existing staff and does not represent an insuperable barrier. For apartment buildings or single-family houses, this can be an additional financial factor to be considered, since especially in Cairo, regular cleaning of the panels is vital for an efficient system. Awad, (2003) and Khoder, (2007) agree that the hot air, containing high shares of particulate matter especially PM 2.5 and 10 such as dust from the desert, vehicle engines or factories, presents an unfriendly environment for capturing solar radiation.

Moreover, for self-consumption, it is favorable that the role of being the operator and consumer is held by the same party. In an area like Zamalek, where the majority is multi-story and high-rise buildings with many tenants or flat owners, it is therefore more complex and expensive to differentiate consumption and balance the savings.

The advantage of institutions representing the renewable harvesting of energy is ideal for a pilot project and can help to spread the news of a profitable business opportunity of great regional and global importance. The financial analysis, however, can only be an estimation. More accurate calculations require the cooperation of institutions to make their consumption patterns and financial conditions in the energy sector as transparent as possible. In addition, the replicability of the concept for other institutions is comparably high. The proposal includes a set of organizational, financial and communicational tools, which differ between the implementations and need to be adopted individually.

Furthermore, the proposal strongly relies on governmental strategic actions. What makes it more realistic to execute is the predictability of fuel resources in Egypt. The running out of these resources suggests a high economic burden for Egypt when continuing with fossil fuels in the near future and creates a critical dependency on international imports. The gas industry as a loser of this development will suffer in any case. Now, Egypt still has the chance of gaining knowledge and capacity building in the renewable sector and profit itself from the inevitable trend.

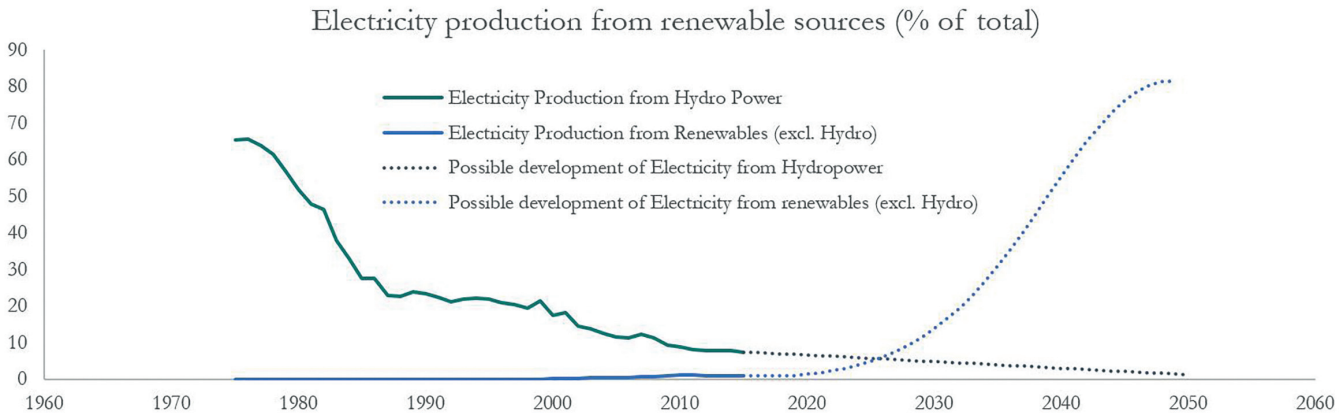

Figure 27: Renewable Electricity Production in Egypt. Source: Authors, 2019; adapted from Worldbank (2017).

Figure 28: Onshore and offshore landscape concept for current abandoned areas with demolition waste. Source: Authors, 2019; with elements from the Recycled Island Foundation, 2018a.

(Re) Enchanting the Nile

Introduction

The Nile River has been the source of life for Cairo since the beginning of the Egyptian civilization and the river embankment has played a fundamental role in urban development and transportation (Kondolf et. al., 2011). Today, Cairo's riverside is occupied by avenues with intense traffic, old industrial facilities, commercial and residential buildings, informal housing settlements and deteriorated pedestrian promenades with ferry stops.

Without a coherent urban design, Cairo does not avail the Nile river's power and capability of providing quality public open spaces by connecting different neighborhoods (Kondolf et. al., 2011). Private restaurants, commercial establishments, informal settlements, and private clubs are the current occupants of Zamalek's riverbanks (Kondolf et. al., 2011). Our study area, the Abou El Feda street in North-Western Zamalek, is a clear example of such a scenario.

As part of the research performed during the workshop held in Cairo in November 2018, the project team interviewed residents and visitors on the streets of Zamalek. This exercise revealed a feeling of nostalgia for an open and democratic riverbank pathway as the river is not visually or physically accessible.

Analysis

The research area features abandoned areas with construction waste (Figure 29), a private Engineers Syndicate club, restaurants and few open green spaces. Publicly accessible zones on the riverside account for approximately 1%, sidewalks occupy 12%, while abandoned zones with demolition waste and open green spaces represent 4% of the total each. Within the focus area, the spaces with potentials for interventions are the semi-public green areas, the sidewalks, and the abandoned areas, summing up to 20%. On the river bank, the Engineers Syndicate club built above the street level and its high walls block the pedestrian's view to the Nile River. On the other side of the street, high-rise buildings create a dense built-up environment. However, there are abandoned spaces on the riverside currently available for future redevelopment with access to the Nile River.

Based on the group's observations and on information gathered with locals, Zamalek's inhabitants and visitors consist of a diverse range of socio-economic groups, but the quest for an opportunity to enjoy the view of the river does not prevail on any specific profile. Along the whole Abou El Feda Street, groups gather on the sidewalks and any space where they find a little gap for peeking at the Nile; couples sit on fences and families are going for walks on abandoned pathways surrounded by waste and construction debris. It is possible to observe people's attraction to the landscape wherever high walls are not blocking the view of the Nile.

On the environmental spectrum, the high demand for fresh water, the dumping of untreated greywater and the anthropogenic inputs have been highly damaging to the ecological balance of the Nile River, harming not only the human consumers but also all the surrounding ecosystems (Abdel-Satar et al., 2017, p.21). According to the analysis published in the Egyptian Journal of Aquatic

Research, the Nile's water conditions in Cairo could be a threat for promoting aquatic life (Abdel-Satar et al., 2017, p. 26), although it is still under the limits that allow the development of flora and fauna. Nevertheless, the area is in continuous risk of potential heavy metal contamination, putting in danger the current aquatic species that inhabit Cairo's Nile River and its surroundings. To support the riverside redevelopment in North-West Zamalek, it would be important to continue evaluating the water quality through the Nile River, focusing mainly on the already identified polluted areas. This evaluation would be necessary to create preventive and protective measures that could minimize the potentially harmful effects of heavy metal contamination, altering the environmental balance of ecosystems in Zamalek and the rest of Cairo.

Concept

This project aims to propose a new design for the North-Western riverbank of Zamalek´s neighborhood by opening democratic access to the Nile waterfront. The proposal focuses on creating attractive public open spaces and promoting environmental improvements on water quality, restoring native fauna and flora.

For abandoned areas with construction waste, the proposal includes the construction of a sidewalk to allow people to walk beside the water, also establishing green areas where visitors can stop by and enjoy the view and access floating parks that will extend the green areas beyond the land (Figure 28). The redeveloped landscape would also feature playgrounds and places for periodic street markets. Existing boat stops would stay and new ones would be added to the new green areas to support and promote the local transport network. Construction waste collected from abandoned areas would be reused for paving and for the river bank reinforcement where needed. Old urban furniture and children's playground elements currently placed in this area would be restored and replaced, to preserve the renowned identity created by Zamalek's inhabitants and visitors.

Considering the scarcely available area for on-land landscaping and the costs involved in softening hard riversides, we propose advancing on the water with floating parks. The solution was developed by the Recycled Island Foundation (2018a) in Rotterdam and transferring it to North-West Zamalek would be beneficial to the neighborhood. The floating park would consist of adjacent floating hexagonal modules that either support soil or urban furniture, increasing the area of attractive open spaces without interfering with the private properties along the margins (Figure 32).

The modules containing soil would be designed in different heights to support the growth of native flora and fauna. Some modules would let plants and animals find their habitat on dry soil; others would be slightly below water level, allowing aquatic plants to flourish and giving small fish and birds a place to grow before entering deeper waters. Under the water, plants' roots would serve as shelter, food, and breeding areas for fish. Furthermore, the modules containing urban furniture would offer benches for people to sit, pathways for people to enjoy a walk by the water, and informative signs about the project and the wildlife it supports.

The floating modules would be made of recycled plastic coming from the Nile River, which naturally accumulates floating plastic waste close to the margins at the Northern part of Zamalek. At this place, the project proposes the installation of a litter trap to collect the plastic, based on the system developed the Recycled Island Foundation (2018b) in the Bay of Ambon, Indonesia. The structure would be made of reused local materials and built using voluntarily engaged members of the community, which would reduce the costs of production and increase the sense of identity

Figure 29: Current situation of the riverbank on Abou El Feda Street. Source: Authors, 2018.

Figure 30: Collage of the litter trap installed where the plastic waste accumulates on the river. Source: Authors, 2019; with elements of the Recycled Island Foundation, 2018a.

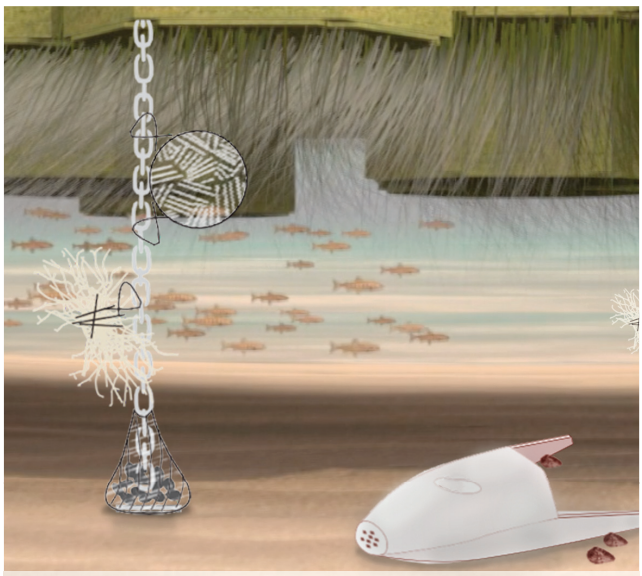

Figure 31: Anchoring system and stream cocoon for the floating parks attracting native fauna. Source: Authors, 2019; adapted from Lebendige Alster, 2018; and Recycled Island Foundation, 2018a.

and ownership (Figure 30).

The floating parks' anchoring system would be based on the concept of Lebendige Alster (2018) in Hamburg, Germany. Settable Replacement Structures, formed by vertical chains with deadwood nets and rocks at the bottom, would hold the floating parks at their position while creating underwater habitats for algae (e.g., phytobenthos) and invertebrates. The project would also use Lebendige Alster's stream cocoons to create shelters around the anchoring systems, providing resting places and extra habitats for invertebrates and fishes. We expect the whole structure to accumulate more algae and invertebrates to attract and feed local fish (Figure 31).

Figure 32 shows on the map of the focus area, how the proposed solutions would change the land use, especially creating more open green areas on the land and on the water.

Stakeholder Involvement

Even though all the stakeholders involved in the project are considered important and relevant to the success of the proposal implementation, four of them require special attention. The impact of their nonacceptance could represent a significant risk for the project. They are the Ministry of Irrigation, the Engineers Club, the residents of Zamalek and the Boat Transport Company.

The Ministry of Irrigation is the owner of the lands on which the project would be implemented. The Ministry collects rent from clubs, bars, and restaurants installed by the riverside. Finding solutions that would still grant revenues to the Ministry were considered during the proposal development process. Moreover, the proposals are based on removable structures, meaning that the portion of land occupied by the project could be easily adapted if needed, respecting the strategic aspect of the area.

The proposal intends to take advantage of the structural changes planned by the Engineers Club. These changes contemplate tearing down the high walls facing the street, enhancing pedestrian walkability and granting visual access to the river (Handassia, 2016). Additionally, the clubs´ modifications would serve as a connection between the intervention points that this project proposes along the Abou El Feda Street. After these changes, the club would maintain its private and exclusive character, while its surroundings would be substantially improved, thus revaluing its location.

Zamalek residents' acceptance is also decisive for the project's success. The proposals are ultimately meant to affect people's lives positively. Therefore, their engagement would not only represent the achievement of the project's goals but also serve as an indicator of success.

Finally, as a relevant player, the Boat Transport Company could jeopardize the implementation of the floating modules if they do not support it. In case the company does not authorize the partial use of the navigable space on the water, the number of intervention points would have to be reduced, harming the effectiveness of the project. The solution would be, showing the boat company the opportunity of boosting the frequency of the travels and the number of passengers. By gathering efforts, all parts would be favored; the company, the project, and users.

Action Strategy

The project would start with the legal approval for the use of the land. The Ministry of Irrigation should issue this authorization. After this first step, all the stakeholders identified would be brought to the project development phase.

The executive project would consist of designing in detail the landscape, the floating park units, and the litter trap to the dimensions of the area. After the approval of the executive project, the site should be prepared for the execution by having the construction debris removed, granting free access to the points of implementation.

Meanwhile, the litter trap would be installed on the water and start its operation. The plastic materials would then be sorted and sent to the recycling facility. The on-land landscaping would then take place and the area would be prepared for receiving the floating units, made with the resultant material of the plastic recycling process. Native plants would then be planted and the underwater structures installed, so the natural process of attracting fish and other aquatic organisms would begin. The construction is expected to finish within five years after starting the project and the monitoring within ten years. A maintenance plan, added by monitoring and evaluating processes would be implemented, being performed by governmental agencies and by members of the local community.

Figure 32: Land-use maps of before and after the project implementation with the indication of the places with the new landscape. Source: Authors, 2019.

Conclusion

The study identified that people not being able to access the Nile River visually and physically is a core problem of the area around Abou El Feda Street. To give people access to the river, the proposed project has focused on the revitalization and connection of potential public open spaces in North-Western Zamalek. At the same time, increasing public access to the riverbank is one of the most effective ways to improve river water conditions. By bringing people close to the water and exposing them to informative signs, the project expects to raise their awareness about supporting nature conservancy and quality of life.

To grant people access to the river, the (Re)Enchanting the Nile project has focused on revitalizing and linking together potential public open spaces in North-Western Zamalek as well as going beyond on-land landscaping with an innovative floating park. We believe the recovery of the Nile riverside can significantly contribute to the sustainable urban transformation of Cairo, enhancing at the same time its economic, social and environmental vitality. Building accessible public spaces on the riverbank does not imply the extinction of private spaces, rather the assurance of the coexistence of both.

The feasibility of the project depends on stakeholders' involvement and a more profound study for providing a circular economy where plastic waste would be transformed into an asset to Zamalek. If implemented, the project is expected to create attractive and democratic public open spaces while restoring the native fauna and flora. People and biodiversity would reconnect to the Nile River.

Figure 33: Collage illustrating possible native species on site. Source: Authors, 2019; adapted from the Recycled Island Foundation, 2018a.

Figure 34: Back Facades in Zamalek. Source: S. Giraldo, 2018.

Conclusion

The cooperation between Cairo University and HafenCity University Hamburg, combined with the financial support of DAAD, made the Project III course field trip to Cairo possible, and provided a fulfilling adventure for all involved - in particular, an inspiring cultural exchange between Hamburg and Egyptian students. The observations and experience of Cairo as well as the knowledge obtained through the valuable lectures held by local experts, brought the students closer to understanding Cairo's reality. During the five-day workshop, all project groups were able to investigate the transformations Cairenes have witnessed in their city and their perspectives on what the future holds.

Each project proposal in this brochure identifies that any actions for Cairo's urban transformation should address climate responsive and sustainable development concepts. The five teams developed design solutions with different focuses but all considering the same core value of sustainability, which is long understood as a powerful concept that recognizes the balance between economic, social and environmental aspects.

As presented in this brochure, "Zamalink: Mobility & Community" does not only propose a mobility hub that integrates the controversial metro station, a new bus line and a car sharing system, but also offers a community hub that responds to the lack of open green spaces and the neighbor's resistance to the metro development. "Regenerating Public Green" uses the Aswan Square as a pilot study to exemplify sustainable urbanism. The first phase includes transformative research, aiming to inform and consult the community, while the green regeneration stage involves, collaborates with and empowers the locals. "The Urban Bio-Loop" focused on the management of organic waste, proposes on-site composting strategies and waste separation, together with a strong integration of the community and place-making. "The Sun Over Zamalek" is conceived as a toolbox for accelerating a

shift into renewable energies. It focuses on how to increase the awareness on energy-related topics, reduce bureaucratic processes and mitigate financial constraints for photovoltaic installations. "(Re)Enchanting the Nile" propose a new design for the North-Western riverbank of Zamalek, by creating attractive public open spaces and promoting environmental improvements for water quality including the restoration of native fauna and flora.

Experiencing Cairo in all of its complexity to deliver as a group, both innovative and contextually relevant results was an enriching challenge - which pushed every 9th generation student outside their comfort zone.

Individuals with substantially different backgrounds, personal experiences, expectations, and aspirations embarked on the REAP journey to expand their professional horizons while at the same time to contribute ideas to society's environmental dilemma, such as the pressing needs experienced in the city of Cairo.

The students worked to address complex issues as part of their design solutions, taking into consideration several constraints, but also with the knowledge that the proposals are hypothetical and will not be executed. The proposals assume the best-case scenario for achieving the intended results, and so some obstacles were not considered an altogether barrier for implementation. A deep knowledge of Egyptian cultural and legal settings in a few months to create context appropriate solutions, is unquestionably impossible. Although brief, students' fresh perspective is still valuable, as it can lead to impulses of new ideas, of simple but effective solutions to bring improvements to people's lives and to the city.

Even though the projects were designed specifically for Zamalek and Mohandessin neighborhoods, during the Cairo workshop week, students learned that other parts of the city suffer from similar problems, thus, if adapted, the proposals could also address issues within the broader Cairo Metropolitan area. Some of the challenges experienced by Cairo are also shared with other cities around the world. With that in mind, students have created solutions that could further be adapted to different geographic contexts and cultural realities.

The concept proposals presented in this publication are the result of research performed within the time constraints of a semester, and they should be seen as a starting point for further steps towards Cairo's sustainable urban transformation. Nonetheless, the authors hope their proposals contribute to a growing body of knowledge that might benefit society and the environment in the near future. The overall experience gained by the students throughout this process is invaluable, so is the knowledge obtained from the very challenging task of developing assertive proposals in such a complex environment. The openness required from each student to the different perspectives and beliefs from their colleagues has contributed positively to personal development; a legacy taken for each student in life after REAP.

Figure 35: Mosque in Citadel. Source: C. Pascoli , 2018.

Figure 36: Back Facades in Zamalek. Source: S. Giraldo, 2018.

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Figure 37: Highway View. Source: E. Esmen, 2018.