Chapter 8: Heat-Stress-Related Climate-Change Adaptation in Informal Urban Communities

Reflections on Socially Inclusive Approaches in Cairo, Egypt

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INTRODUCTION

Climate change is affecting human settlements, worldwide, to different degrees of severity. The mutual relationship between climate change and urban forms and urban development are subject to scholarly and applied discourse. Heat stress, in particular, is understood to be aggravated by non-climatic stresses that are linked to urbanisation and those that make cities hotspots of risks and disaster (Wamsler 2008), thereby intensifying the existing vulnerabilities of urban populations. Hence, this chapter's main question: What are the connections between adapting to climate change and housing and community involvement, particularly in informal urban areas?

This chapter aims to shed some understanding on how knowledge adds up and becomes beneficial for co-beneficial interventions. To achieve this objective, the chapter focuses on a recent theoretical discourse on the type of heat stress that is linked to housing and informal settlements. The chapter[1] opens with a section dedicated to the impacts of climate change that are linked to housing,

1 This chapter draws its initial motivation and ideas from the author's master's thesis research from 2013, which is linked to the discourse on community-level climate-change adaptation in urban areas, particularly in informal settlements in arid regions (Laue 2013). The discussion builds on selected reflections from the author's dissertation and an additional literature review.

including some findings and conclusions of the Working Group II (WGII) of the IPCC's 5th Assessment Report (AR5) 2014, on risk and adaptation in urban areas.

Recent conclusions on an ongoing Egyptian discourse on climate adaptation and housing are referred to, followed by reflections on climate risks within the GCR. Here, the phenomenon of urban informality in Egypt is discussed alongside how an increase in knowledge has linked climate-change adaptation in the context of housing to the possibilities for dealing with heat as one climate-related stress. More precisely, a case study of the settlement of Ezzbet El-Nasr will illustrate efforts to introduce adaptation measures into an informal urban community, based on descriptions of a project undertaken by the German development agency GIZ's[2] participatory development programme (PDP 2017). Then the chapter will present complementary findings from the author's semi-structured interviews, mappings and observations in the community as part of the post-graduate findings from a 2013 case study of Ezzbet El-Nasr. The final section of this chapter will briefly look into the questions of participation and transferability.

CLIMATE-CHANGE ADAPTATION AND HOUSING

Climate adaptation is identified as one response to the impacts of climate change and is complementary to mitigation[3] (IPCC 2007; WBGU 2016). The International Panel on Climate Change (IPCC) defines climate adaptations as a 'process of adjustment to actual or expected climate and its effects' (IPCC 2014, p.1758). In order to pinpoint adaptive options and capacities, vulnerabilities are identified via three factors: exposure, sensitivity, and adaptive capacity to a climatic stress (Dreyfus 2015; IPCC 2014). The German Advisory Council on Global Change (WBGU) notes that adaptation to climate change is one of the five fields with the 'biggest potential leverage effects for urban transformation toward sustainability' (WBGU 2016, p.11).

Adaptation is achievable across scales and through varying strategies that can contribute to resilience. However, one strand of scholars regard adaptation as 'intensely local' (Huq *et al.* 2007, p.1), thus potentially playing a crucial role along with national and regional strategies. The scope and extent of climate-

2 GIZ refers to the German development cooperation entity, Deutsche Gesellschaft für Internationale Zusammenarbeit, which is active in Egypt.

3 Mitigation refers to reducing harmful anthropogenic emissions (IPCC 2014, p.1769).

adaptation measures depend on their size and focus. Moreover, the ability to adapt is highly dependent on financial and administrative capacities, which vary significantly (Moser and Satterthwaite 2008).

Intensive research on climate-change adaptation evolved between the 1980s and the 2000s. Before the Brundtland Report (1987) was released, adaptation was a secondary subject on the international climate-change agenda (Ayers and Forsyth 2009; Klein 2002; Smit et al. 2000), yet it gained "standing within the international climate change arena" (Ayers and Forsyth 2009, p.25) with each subsequent assessment report the IPCC released. The IPCC's 2007 Working Group II report (WGII) intensively reviewed the subject of adaptation and its interrelations with mitigation (IPCC 2007; Klein 2002). With regards to cities and urbanisation, strategic and scholarly discourse on adaptation has become increasingly relevant (Dreyfus 2018), yet the authors of WGII for the AR5 synthesis report on climate change stress the persistent lack of attention being paid to urban adaptation (in contrast to mitigation) by national governments (IPCC 2014). Moreover, for some cities, adaptation seemingly remains an unclear model and the knowledge gap between decision-makers and scientists is notable (IPCC 2014).

Housing and climate-change adaptation are increasingly relevant, crosscutting topics within academic (Dodman 2009; Hunt and Watkiss 2010; Huqet *et al*. 2007) and strategic discourse. Concerning the latter, the authors of WGII on 'Impacts, Adaptation and Vulnerability' within the IPCC's 5th Assessment Report (AR5), dedicated chapter eight in particular to urban areas (IPCC 2014, pp. 535-612). This chapter compiles analyses, case studies, and definitions of probabilities of benefitting from a more nuanced understanding of these linkages, based on the increased availability and diversity of the relevant literature (Dreyfus 2015; IPCC 2014). A large scientific community has validated the report's conclusions (e.g., Beattie and McGuire 2019). Chapter eight not only comprises subsections on urban risks associated with housing but it also mentions extreme heat as a particular challenge for housing (IPCC 2014, p. 569). Hence, housing is referred to as being 'often the major part of the infrastructure affected by disasters' (IPCC 2014, p. 559). Yet, simultaneously, housing is mentioned as a key sector for adaptation (IPCC 2014, p. 568).

When looking at case studies on adaptations to extreme heat, however, the report acknowledges that the literature and examples still predominantly refer to high-income nations and consequently calls for more discourse and practice in low- and middle-income nations (IPCC 2014). Furthermore, urban settlements in low- and middle-income countries, especially those facing a combination of rapid urbanisation and migration (Dreyfus 2015), are expected to face climate-

change impacts more immediately and severely (Moser and Satterthwaite 2008). Housing's exposure to climatic stresses, whether rapid or slow onset, creates sensitivities and vulnerabilities at the local level (Figure 1), yet differ across communities as the impact of climate change on housing is tendentially linked to socio-economic constraints (Bazrkar *et al.* 2015). Particularly neglected or contested are historical areas, informal settlements, and low-income communities, which may face higher vulnerabilities (Dreyfus 2015). Accordingly, more attention is given to evidence-based research, vulnerability studies and the identification of adaptation measures as the topic of discourse moves toward identifying adaptive capacities and adaptation measures (IPCC 2014) on social, physical and urban scales.

Climate change and urban informality

The intersection between climate change and informally developed urban areas over the past decade is becoming the subject of research, development cooperation and local initiatives. Moreover, two global agendas, the 2015 'Paris Climate Agreement' and the 2016 'New Urban Agenda' recently and explicitly intersected with regard to climate action. In its chapter entitled 'Urban Areas', the IPCC's AR5 WGII refers to informal settlements as being particularly vulnerable to amplified climate risks (IPCC 2014, p. 538; Moser and Satterthwaite 2009) and as having some or 'very little adaptive capacity or resilience/ "bounce back" capacity' (IPCC 2014, p. 546). Climate issues related to informal settlements are also mentioned within the key risk matrix for urban settlements, under 'livelihoods' and 'poverty and access to basic services' (IPCC 2014, p. 562).

The increased vulnerability that is linked to the causes and effects of rapid urbanisation (Bazrkar *et al*. 2015) is also correlated with the 'changing dimensions of migration' (IPCC 2014, p.552). For instance, increasing temperatures are discussed in relation to the changing availability of local resources and economic (agricultural) activities; i.e., in rural areas, temperature increases result in migration (Raleigh *et al*. 2008) toward more economically advantageous locations, typically toward cities (see also Mukaddim et al. in this book on climate-related migration). This forces individuals to permanently relocate, thereby gaining access to affordable housing mainly in underserviced and informal neighbourhoods and communities. This is communicated by the IPCC's AR5 as part of a discussion on 'spatiality and temporal dimensions' (IPCC 2014, p.551), creating a 'dynamic quality of risk' (IPCC 2014, p.552) for housing and urban informality. As recommended by the IPCC (2014) and Magali Dreyfus (2015), adaptation strategies will need to consider the impact of climate on migration

and the consequent stress on housing. Consequently, AR5 continues to refer to informal settlements being locations where adaptive strategies and measures can be linked to the above-mentioned key risks, with the help of community-based case studies (Pelling in IPCC 2014, p.566); the IPCC also suggests stakeholders in informal areas engage in risk assessment and in fostering adaptive action (IPCC 2014), as is briefly elaborated below.

Community-Based Adaptation

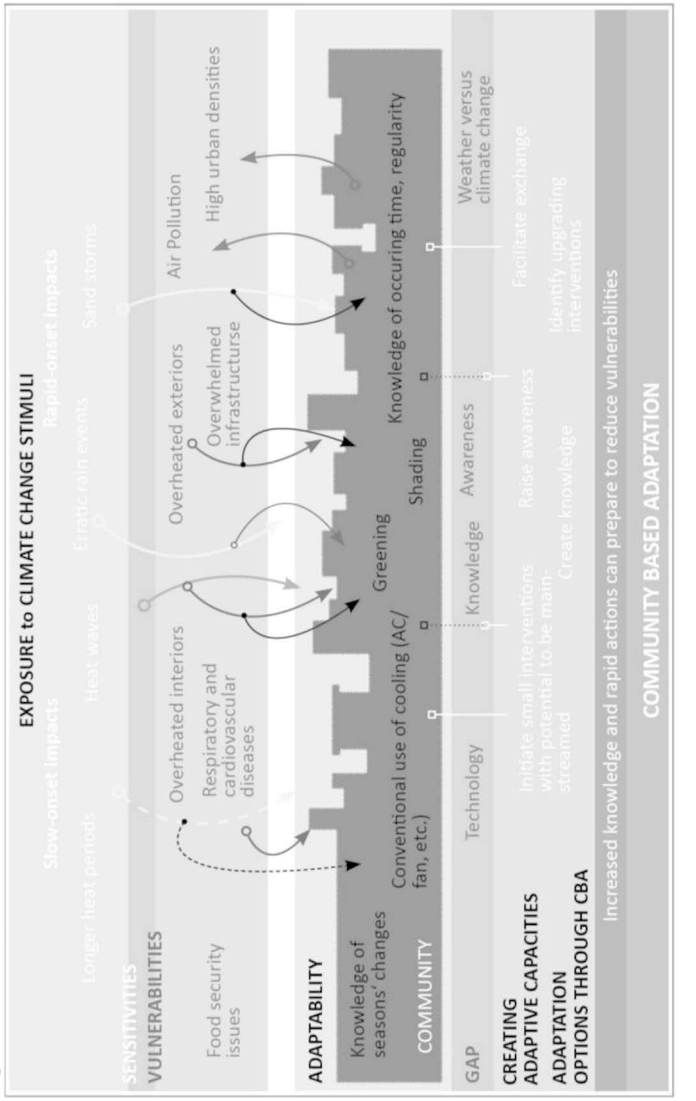
Community-based adaptation (CBA) refers to a localised and people-centred approaches to adaptation (Dreyfus 2015) in responses to climate risks that capitalise on local and social capital so as to build adaptive capacities (IPCC 2014). Moreover, the CBA approach is considered the 'only means of responding to risk' for a significant part of households living in informal urban areas (IPCC 2014, p.563). The IPCC AR5 WGII elaborates on CBA, recommending that a broad range of community actors and planners engage in the planning and implementation process for adaptation (IPCC 2014, p.580). Here, the IPCC is referring to experience gained in previous practice and also to scholarly work throughout the past decade, for instance by Satterthwaite, Dodman, Pelling, Mitlin, and Jabareen (IPCC 2014, p.581). References were made to successful CBA cases in Africa and Asia (see for example IPCC 2014, p.566). The case study in this chapter will illustrate the initiation and work of the CBA inside an informal urban community in the Greater Cairo Region.

CLIMATE-CHANGE ADAPTATION IN URBAN EGYPT AND THE GREATER CAIRO REGION

Egypt's decision-makers have acknowledged climate change on both national and regional levels (EEAA 2016) and within development cooperation agencies and local communities (PDP 2018). Climatic stresses and sensitivities affecting the country are complex and linked to the following particular geographical settings. Egypt's most fertile areas stretch along the Nile and its tributaries, which cover 45 (OECD 2004, p.14) to 56% of the total land mass, mainly Egypt's desert land area. Yet, this land provides about 95% of the country's entire water needs and most of its agricultural production (EEAA 2016, p.112). All of Egypt's major urban centres, with their industries and commercial activities, are located along a narrow strip of land that runs along the banks of the Nile, thus, putting stress on the country's water resources and its coastal zones

(Agravala *et al*. in OECD 2004, p.14; OECD 2010). The IPCC's AR5 states that Egypt will face further reductions in rainfall amounts (IPCC 2014, p.1210).

Figure 1: Sensitivities and vulnerabilities on the city and community levels – the example of Cairo.



Source: Author, 2019, based on Author, 2013, p.46.

To deal with climatic stresses in Egypt, identifying the country's vulnerabilities to climate change and the need for adaptation has been part of the national policy agenda since the early 1990s. With its national communications that comprise both mitigation and adaptation (EEAA 2010a, 2016; IDSC 2011, Egypt acknowledges that the urban sector is among an increasing number of sectors[4] that are vulnerable to climate change (EEAA 2016).

On the topic of housing and human settlements, the Egyptian Information and Support Centre (IDSC) acknowledges that Egyptian cities are affected by extreme heat that is linked to climate change; moreover, this is intensified through hot air that is being emitted by buildings that use energy inefficiently (IDSC/UNDP 2011, p.92). In Egypt's Third National Communication, it was noted that heat in urban settings is associated with the phenomenon of urban heat island (UHI) effects or to a slow-onset heat threat. Particularly concerning is the projection of a temperature increase of an average of 3°C by the year 2100 (EEAA 2016, p.156). This will become a growing burden, particularly in dense neighbourhoods (CSC 2013; UNDP 2013); and these will contribute to increased energy demands and deteriorating air quality all of which can be exacerbated by environmental challenges (Dreyfus 2015).

This combination will continue to directly affect not only the functioning of urban areas but also their residents. Consequently, besides erratic winds and rain occurrences (EEAA 2016), (extreme) heat (IPCC 2007) that is linked to impacts on human health[5] (Chapman *et al*., in and Strengers 2011, p.493) requires adaptation. However, differing prioritisations may occur, based on a settlement's geographical location. For instance, while Egypt' surban coastline (including Alexandria, Port Said) is considered the most vulnerable to climate-change impacts (EEAA 2016; IPCC 2014),[6] climate exposure in the GCR, which is located along the Nile Delta, is considered to be 'less dramatic, but nonetheless serious' (Huq *et al*. 2007, p.1), with its equally complex combination of slow- and rapid-onset effects and direct and indirect risks, all of which are centred around heat (Figure 1). summarizes the various sensitivities (affectedness and responsiveness) to heat in the GCR, the specific vulnerabilities city-wide and in neighbourhoods and communities (susceptibility to harm), and some existing adaptive

4 Sectors include water resources, tourism, health, bio-diversity (EEAA 2016, p.150 et sqq.).

5 Hotter periods contribute to heat-related mortality (IPCC 2014; Maller and Strengers 2011; McMichael and Githeko 2001, in McCarthy et al 2001).

6 Climate change impacts refer to sea-level rise and flooding as a result of erratic weather events.

capacities (Laue 2013). Combined analyses of climatic and non-climatic stresses in cities like the GCR are essential to comprehending the burden on infrastructure, services, quality of life, and how to contain the potential for increased poverty.[7]

Housing and climate adaptation in urban Egypt and the Greater Cairo Region

In the context of Egypt, housing and climate change are closely interconnected. In contrast to previous National Communication Reports[8] of the United Nations Framework Convention on Climate Change (UNFCCC), the Egyptian Environmental Affairs Agency (EEAA), in its Third National Communication (2016), elaborated on housing and took a broader perspective, first, with housing being a basic human right (EEAA 2016) and, second, by acknowledging the gap between housing demand and delivery for low- and middle-income groups, which has resulted in an informal housing market. In the adaptation section of the EEAA's updated report,[9] housing is associated with both housing policies and formal and informal urban development (EEAA 2016, p.150). By adding the link between housing and climate-change-related exposures (ibid., p.171), it has become recognised that low-income and informal communities of the GCR are especially affected (CSC 2013).

URBAN INFORMALITY IN GREATER CAIRO: CATERING TO A MAJORITY

This section looks at informal housing in urban areas in Egypt, particularly in the GCR, which developed alongside policy shifts and transformation dynamics throughout the 20th century (Wodon *et al*. 2014). The GCR grapples with complex realities. Historically, it has been an attractive destination for both workers and residents, over decades (Madbouly 2009; Batran 1998). It has also experi-

7 Non-climatic pressures are administrative centralization, rural-urban migration, high natural population growth, changing housing policies, and particularly the liberalization of the housing market.

8 The Second National Communication Report (2010) links housing and climate change with increasing temperatures exacerbated by energy emissions, spatial orientation, and façade design (EEAA 2010, p.91).

9 Mitigation measures also refer to housing (EEAA, 2010, p.107 et sqq.).

enced natural population growth, declining mortality rates, and increasing pressure on the local housing market, land availability, and natural resources. With continuous migration toward urban centres (World Bank 2014), urban and rural settings have been dramatically transformed since the 1950s (UNDP 2004). Ever-growing urbanisation rates have materialised mostly in the formation of informal settlements (Madbouly 2009), such that the formal housing market has struggled to meet the demand for affordable housing.[10] Madbouly (2009) describes how housing in Egypt, in particular, has been a dichotomic topic for decades.

The gradual formation of Cairo's informal urban areas, predominantly termed as 'ashwa'iyat' in the Arabic language, can be traced back to at least the 1960s (UN-Habitat 2003, p.206). Their development is a result of complex and historic policy decisions, a dynamic housing market and population growth over decades, and economic and regional pressures. Whereas new cities were built within Cairo's greater metropolitan region, informal settlements significantly extended the existing urban fabric to accommodate the city's growing population and to contribute to an anticipated stable economic situation or to improve incomes. In 2000, informal urban settlements in and around Cairo covered over 94 square kilometres (UN-Habitat 2013, p.3) of the GCR's approximately 600-700 square kilometres (UN-Habitat 2011, p.xix ff.), or 13.4 % of the city's land mass.

These informal urban areas constitute a considerable and undeniable part of the GCR's[11] urban reality, both economically and spatially. The first recognition of informal communities and the initial reactive measures took place from 1974 to 1985 (UN-Habitat 2003), mainly through policies aimed to prevent encroachment on and the urbanisation of agricultural land. Since then, Egypt's informal settlements were the subject of various reports, action guides and international exposure (UN-Habitat 2003, 2015; PDP 2011; Davis 2006). The UN-Habitat report 'The Challenge of Slums' includes Cairo as a case study (UN-Habitat 2003). Furthermore, the Egyptian uprising of January 25, 2011, augmented inhabitants' call for improved quality of life "for deprived people who were suffer-

10 Egypt continuously suffers less from an overall undersupply of affordable housing but more from a mismatch between the demand and supply of affordable housing and locations, thereby resulting in inhabitants missing out on the security of property rights (EEAA 2016).

11 About 65% (Al-Gohari 2010, p.5; UN-Habitat 2011, p.xx] to 70% (GTZ 2009, p.15) or around 18 million (GIZ 2018) of Cairo's inhabitants lived in informal settlements in 2006.

ing from bad living conditions" (Hassan 2012, p.9). Some communities, such as Miit 'Uqba (2011), developed initiatives to improve their communities, based on self-mobilisation and creating networks to external non-governmental actors. Informal areas[12] progressively became subject to rights advocacy and support from urban activists and organisations, which contributed to adjusted responses in policy revisions and administration, resulting in the creation of urban upgrading units within the Cairo government and a shift from 'prevention' to 'upgrading' (Abouelmagd 2014). With their great socio-economic and morphological complexity, these informal areas continue to be the subjects of researching graduate and post-graduate work and in design projects across a number of disciplines (e.g. Khalifa 2011; Kipper and Fischer 2009; Shehayeb 2009). Consequently, these areas provide illustrations of increased knowledge, changing practices and ongoing, decades-long exchanges on topics related to housing and climate change (Cluster 2018a; Kipper and Fischer 2009; Singerman 2006). The related contemporary housing and planning discourse (Madbouly 2009) remains a topic of interest to scholars in the Global North and South, urban practitioners, advocates, and artists throughout the past decade.[13]

The research on environmental and climate action gained momentum during the 2000s and 2010s, becoming linked with informal urban settlements and, particularly, with community mobilisation (Miit 'Uqba, Tadamun – Cairo Urban Solidarity Initiative 2013) and cultural exchange (i.e., newly created art space like El-Lewa community). Around 2012, the particular connection between heat (including urban heat islands, UHI) and informal urban development became not only the subject to research (German Egyptian Research Fund / Science and Technology Development Fund – GERF/STDF)[14] but was also assessed to become subject to an innovative approach within development cooperation, with GIZ dedicating a strand of its local PDP programme in the GCR portfolio (PDP 2018; Verner 2012). After an extensive vulnerability study and participatory needs assessment, a number of affiliated consultants (Plan + Risk Consult) developed an initial catalogue of suggested interventions (Lückenkötter *et al*. 2016) – these are illustrated below. Subsequently, a number of projects were commis-

12 Along with deteriorated central urban areas.

13 This includes the continuous work throughout the decade by Manal Batran, Yehya Shawkat, Marwa Khalifa, and Nezar Al Sayyad.

14 In the context of dry urban areas, three to nine areas became the subjects of research (German Egyptian Research Fund / Science and Technology Development Fund – GERF/STDF) and the locations of projects for adaptation (UNDP, GIZ PDP).

sioned for up to six informal urban communities, some of which were implemented between 2016 and 2018.[15]

FROM ADAPTIVE CAPACITIES TO ADEQUATE MEASURES IN EZZBET EL-NASR, GREATER CAIRO REGION

This case study briefly illustrates efforts that were linked to identifying adaptive capacities and community adaptation measures in an informal community, namely Ezzbet El-Nasr, which is located in the GCR. GIZ and its partners from the EEAA, and the Ministry of Housing, Utilities and Urban Communities (GIZ 2017) selected this urban community to be one of the first to implement community-based adaptation measures under the PDP programme's sub-component 'Climate-Change Adaptation in Informal Settlements Physical Change (retrofitting) for Adaptation to Heat Stress' (PDP 2017).

Ezzbet El-Nasr evolved in 1977 and consolidated as a community with a population of approximately 60,000 inhabitants (UMP 2010, p.31) through people continuously squatting on state-owned land and the increasing influx of residents throughout the subsequent decades (Figure 2). Since then, the legal status of the land has been pending, leaving the area underserviced. Being located in no particular disaster-prone area, the community struggles particularly with heat stress and the UHI effect. Ezzbet El-Nasr faces non-climate-related pressures within its built environments as it lacks basic urban services and faces ecological challenges due to nearby tanneries and a waste disposal site. Along with economic and social challenges, these contribute to the lack of adaptive capacities and, hence, the community's potential overall vulnerability toward the impacts of climate change. During the initial assessment, in 2012, the community's limited awareness of any climate-change impacts was reported in the Participatory needs Assessment (PNA) by CDS, consultants commissioned by GIZ. In interviews with some of the inhabitants, no specific associations were made with the term "climate change", yet those interviewed[16] referred to the increasing heat

15 The Egyptian platform 'Cluster', commissioned by GIZ in partnership with RISE/AUC, implements urban interventions, including urban shading, façade painting, and green roofs in Saqiyat Mikki, MasakenJazirat al-Dahab and Giza (Cluster 2018b).

16 About 62% of respondents in the baseline study (2013: 146) and all interviewed households.

and the sun's intensity as the strongest overall weather-related pressures on the area (CDS 2013, p.48).

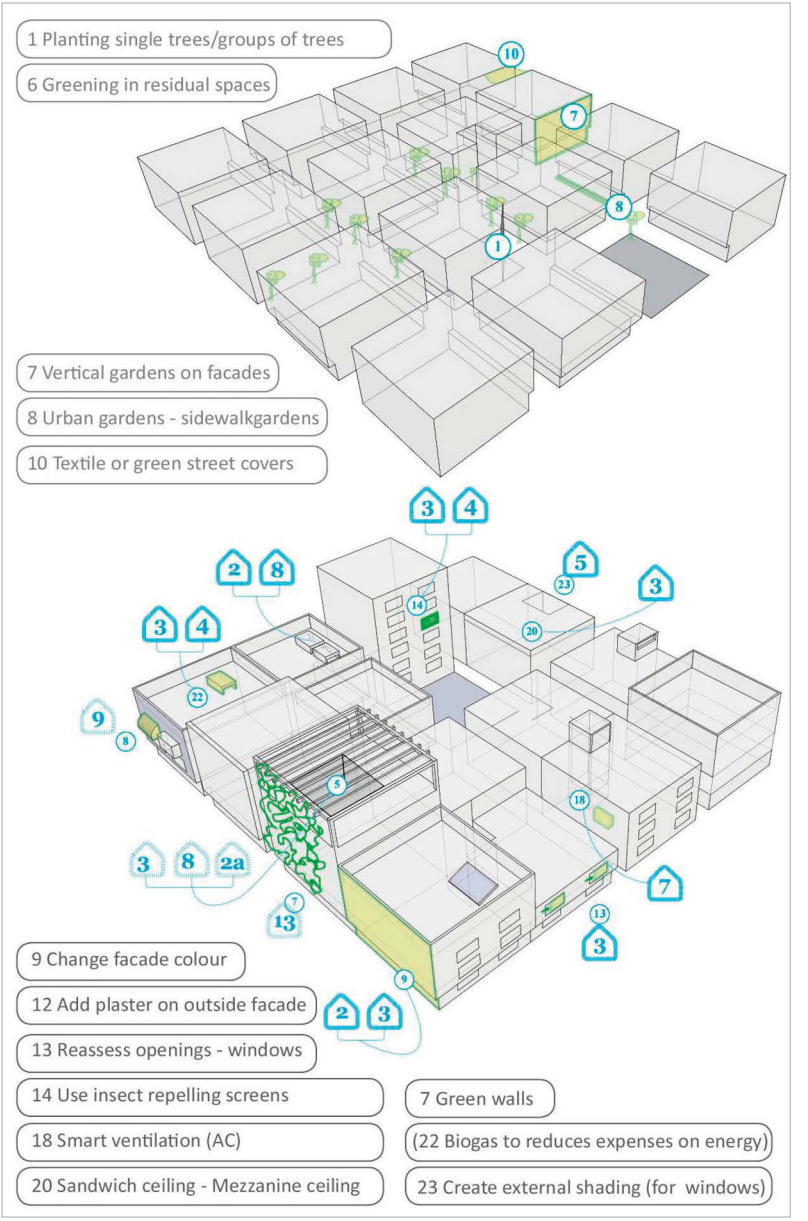
An initial assessment of Ezzbet El-Nasr identified the community's susceptibilities and adaptive capacities. Following this, vulnerability studies, (on-site and desktop) baseline studies, and a participatory needs assessment were conducted so as to formulate community-based interventions.

In 2013, the author of this chapter complemented these findings with semi-structured interviews, visits to the interviewees' dwellings and conversations with household members about the level of thermal comfort inside different rooms of their homes. Accordingly, household members had previously altered parts of their houses to improve the microclimate (see Figure 3), taking various forms of pragmatic action on a smaller scale.

Figure 2: Location of Ezzbet El-Nasr inside the Greater Cairo Region.

Source: Author, 2013.

Figure 3: Pre-project coping and adaptation measures in Ezzbet El-Nasr inside the Greater Cairo Region.



Source: Author, 2013.

For example, to relieve households from heat, the majority of those interviewed mentioned wearing lighter coloured clothing and using fans (CDS 2013), which can be described as autonomous coping measures. Other households adjusted the size and locations of windows (CDS 2013), which could be described as low level 'autonomous adaptation' as coined by Malik et al. (2010). Yet, financial constraints were common challenges for most households, and this prevented investments in physical and spatial adjustments to deal with heat (CDS 2013). Subsequent to this, the author developed a catalogue of adaptation measures (Figure 4) that could potentially support the community' spatial, physical and social organisation. The catalogue lists ten 'soft' (behavioural and organisational) and 32 'hard' (urban and physical) measures (Laue 2013). Most of these measures correspond to recommendations compiled in the IPCC's AR5 section of the WGII, including architectural and urban options for passive cooling, creating thermal mass, shading, green and white roofs, and green infrastructures, (IPCC 2014, pp.566-575).

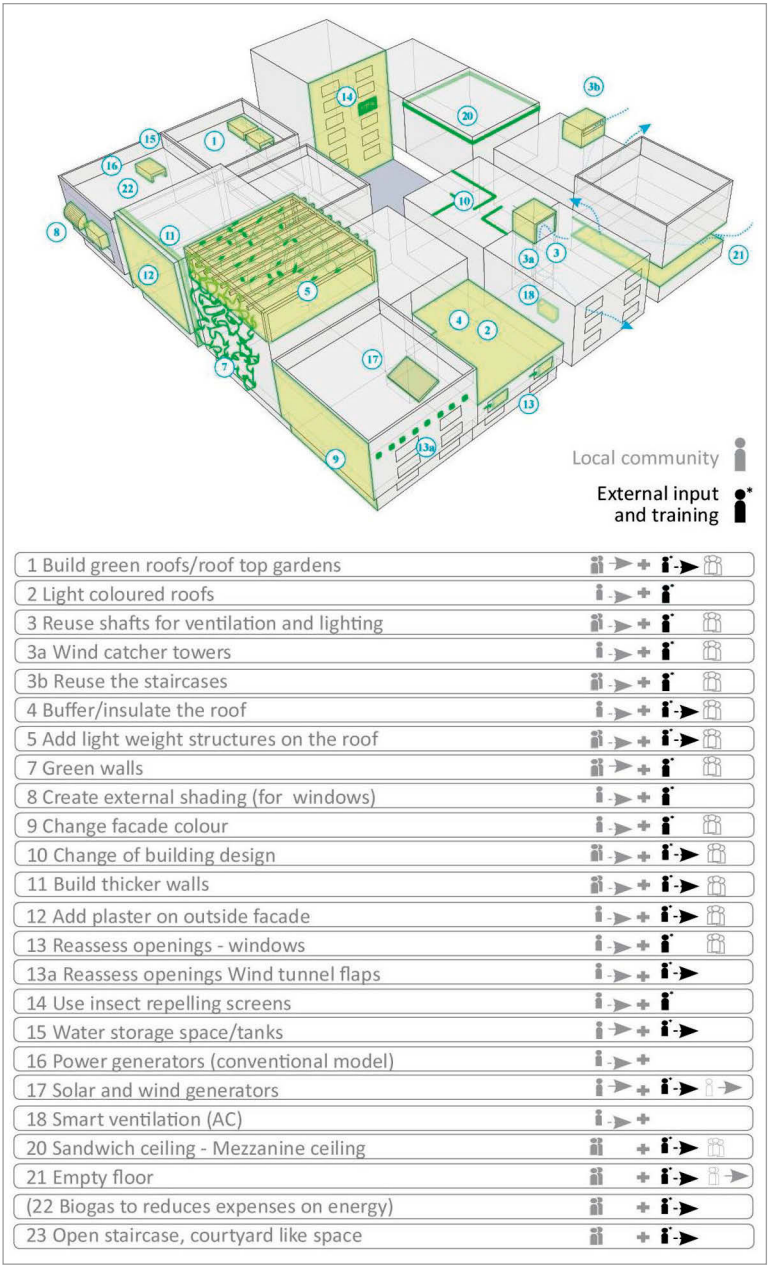
From the above-mentioned catalogue, the PDP project consultants (Plan+Risk Consult) selected 15 measures to consider in a further feasibility study, with each measure being assessed for its co-beneficial qualities (Lückenkötter *et al*. 2016)[17] and the potential prevention of an overall maladaptation (IPCC 2014). This corresponds to the IPCC's WGII, within its AR5 recommendations on creating co-benefits in urban adaptation, particularly when selecting options that foster incremental change and sustainable transformation (IPCC 2014). With regards to prioritising and implementing co-beneficial measures, the PDP project in Ezzbet El-Nasr illustrates that process. Since then, the PDP project has grown and continues to conduct its activities on-site and other communities.[18]

As of 2017, nine small-scale development measures (pilot-measures) have been selected for implementation. In 2018, four architectural measures were realised in partnership with NGOs and private local businesses (PDP 2017). Three physical measures included street shading, wall greening and rooftop farming; others included capacity development and awareness-raising programmes on both the community and local administrative levels (PDP 2017).

17 Measures can be affiliated to four adaptation options or policies. These include 'no-regret options', 'low-regret-options', 'win-win options' and 'flexible management options', as coined by UKCIP (2007, p. 15).

18 This includes Masaken Geziret El-Dahab.

Figure 4: Suggested measures listed in the catalogue for Ezzbet El-Nasr.



Source: Author, 2013.

Community-based solutions – The role of participation

As described above, in the initial phase of the PDP project extensive studies and interviews were conducted inside the community. It was thought that this programme could build on the previous experience of other community initiatives[19] that were already active in Ezzbet El-Nasr yet were not explicitly linked to climate-change adaptation. Hence, the community already knew about the external actors' involvement. In this case, intermediate and external local actors or champions helped to build a bridge between the community, the external partners and the assistance.

To initiate and, more importantly, maintain successful community-based soft and hard measures, the process, scope and success of the PDP seemed to be highly dependent on involving the local community in all of its segments. This included building trust and involving individuals who could potentially act as champions or drivers to mobilise various groups to join in on the inclusive participatory processes.

From within – The aspect of community

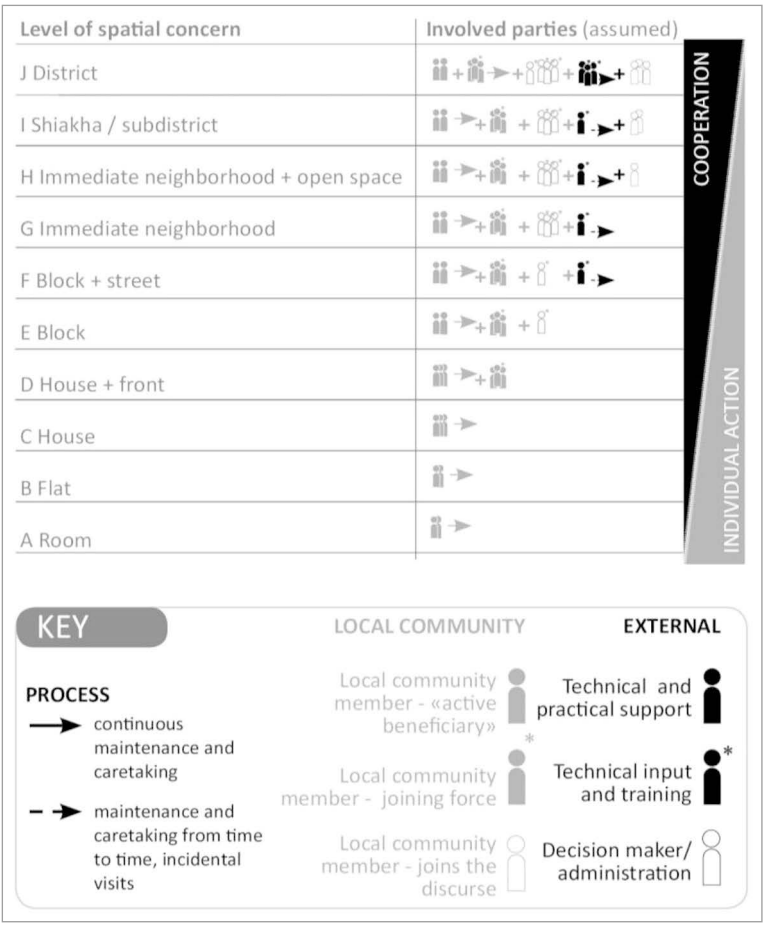
As was suggested above, when speaking of interventions on the local level, community involvement plays a crucial role. The success of these types of initiatives inherently requires active contributions from community members, particularly when identifying actors (internally or with input from outside), discussing issues, ideas and processes, and making decisions on needed measures.

The term 'participation' carries with it various interpretations and types (Arnstein 1969; Piffero 2009), yet commonalities include the indisputable aim (from within or without a community) to create knowledge, engage and empower community members, and ensure their commitment (Piffero in GTZ 2009) to influencing processes that are designed for their benefit (Piffero 1995). Referring to Arnstein's 'ladder of participation' concept (1969), community participation is preferably beyond technocratic measures and administrative dominance. Arnstein (1969) also argues for involving the local community in a genuine process of improvement, thereby creating a sense of ownership, in a process that emphasises the ladder's upper rungs (avoiding the lower rungs, such as manipulation) and creating a gradual process from developing 'partnerships' to 'delegated powers' and 'citizen control'. Hence, linking Arnstein's reflections on the process of community involvement to identifying co-beneficial adaptation measures and capacities in Ezzbet El-Nasr, it is evident that the early and close involve-

19 For instance, NGOs like 'Plan International' and local initiatives.

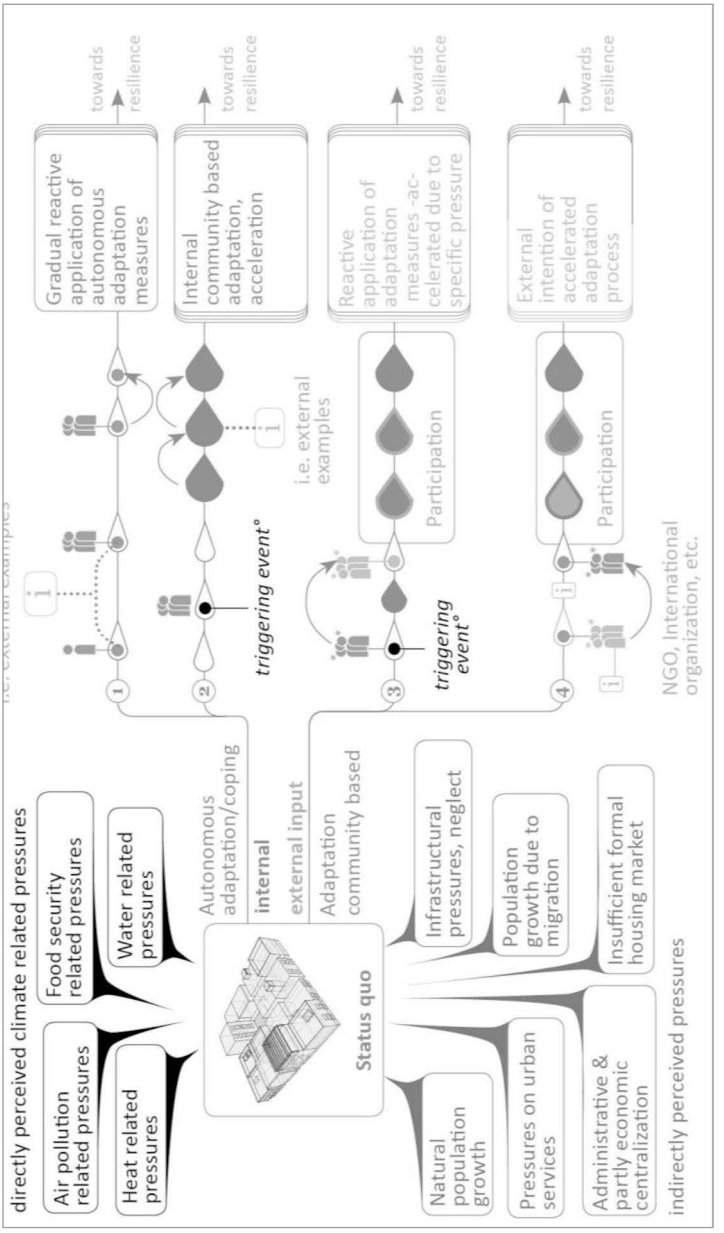
ment of various representatives in the process seems essential. Figure 5 illustrates a theoretical reflection on community-driven involvement within a spectrum that ranges from a household scale to a district scale, based on the author's observations in Ezzbet El-Nasr.

Figure 5: Levels and degrees of community involvement in Ezzbet El-Nasr.



Source: Author, 2013.

Figure 6: Scenarios for internal and external involvement of the community. level. The example of Ezzbet El-Nasr.



Source: Auhtor, 2019, adjusted from Author, 2013.

Community-based efforts to deal with climate change should pay special attention to involving vulnerable or marginalised community members, as this is heavily linked to health-related vulnerabilities. Hence, Verner (2013) and the UNFCCC (2018) suggest considering gender-specific and value-based approaches. In the surveys and interviews conducted in Ezzbet El-Nasr (2013), female 'agents' in particular were identified for becoming active participants in the community's social networks (Laue 2013); that is, to other female community members of different ages. Furthermore, children and youth were identified to play a crucial role in disseminating practices and awareness into families and households.

This is relevant as each adaptation measure and strategy might require a range of actors, depending on how and with whom and in which scope the actor is introduced. For example, planting a tree or making interventions at the building level can be both an individual or collective effort, varying according to whom benefits and in what context (see Figure 5 – levels D-J). However, other measures, including shared open spaces or soft measures, such as organising patrols, require a more complex set of actors. In some regards, this requires input and mobilisation from non-community members (i.e., NGOs, academia, value-based social movements).

In Between – Benefitting from local societal engagement and movements

In addition to increased research interest, there has been a continuous interaction and mobilisation between community members' housing realities, in informal urban areas and on community actors, that have resulted in interventions or social movements. Vincenti (2016, p.135) examined the role of new social forces in so-called 'value-based social movements' (VSMs) as playing an active role in the sustainable transition of post-revolutionary Egypt. Accordingly, these VSMs can and do result in collective action in social, political and spatial fields and represent the people's "readiness to individually and collectively construct lived alternatives in order to improve their respective communities" (Vincenti 2016, p. 136); hence, improved livelihoods and housing. In the context of the GCR, actors that have fostered such movements, so far, have been advocates like the 'Shadow Ministry of Housing' (n.d.), community architects and proponents of urban initiatives platforms, such as Urbanics since 2010 (Urbanics 2018), Tadamun (Froehlich 2017), and 'Takween Integrated Community Development'. Cooperation and collaboration among non-governmental actors have continued, to the date of this publication, and is documented on platforms such as the Cairo Urban Initiatives Platform (Cluster 2018a).

Moreover, academia also began offering channels for empowering, mobilising and encouraging local citizens in informal settlements to become involved in small- and medium-scale interventions that aim to improve livelihoods and living conditions in and around their immediate residential units. One example is the 'Ezbet Project', which was initiated by an academic staff member at the University of Stuttgart[20] and mobilises local students and community members.

From without – The role of external support

With a view to the above-mentioned reflections, interventions linked to housing on the community level seem to require significant overlaps not only with the real concerns of the residents within the respective community but also with the concerns of the city as a whole and, if needed, with impulses from outside.

Local knowledge about weather conditions and vulnerabilities that are thoroughly and jointly reflected by all involved actors is as essential as any statistical, meteorological and simulated data on a local urban community. Climate-change adaptation, on the city or community level, aims to ensure the prevention of any further damage and then to achieve resilience through growing knowledge. Hence, along with ensuring an awareness of climatic and non-climatic stressors, the recognition of interconnections may help identify and mobilise adequate responses. This could take place on different tiers; i.e., top-down adaptations through developing policies, regulations and investments for the benefit of the GCR in its entirety. This, however, as the WGII of IPCC'S AR 5 noted, may exacerbate inequalities among communities (IPCC 2014) due to differing amounts of social and financial capital on the local level. Therefore, bottom-up adaptation (community-based) efforts need to complement this and may require coordination and communication with authorities at the city level. Consequently, the IPCC sees a role for international partners in providing support (IPCC 2014) and in extending inclusive planning efforts (UNFCCC 2018) to (urban) communities with low capacities.

Referring back to the PDP programme in the GCR, as of the component's start in 2012, this has been undergoing current-practice testing for adaptation in informal settlements, adjusting to communities' actual conditions. As Figure 6 illustrates, there are several scenarios and corresponding degrees of external stakeholder involvement in the process of identifying and strengthening adaptive capacities at the community level. In all scenarios, social capital is being created,

20 Dr. Manal El Shahat, senior researcher at the University of Stuttgart, initiated the 'Ezbet Project' as a design competition in 2011, which evolved a project comprising interdisciplinary teamwork and projects.

yet with differing degrees of community involvement; hence, indicating different degrees of sustainable adaptation. The PDP project of GIZ and its local partners corresponds to the scenario at the bottom (illustrating a large share of mobilisation from external actors), which represents a donor-driven model that aims to support the local community to 'bounce forward' (IPCC 2014, p.549) within a limited time frame, whereas the scenarios that take place at the upper levels describe a stronger initiation that comes from the community side. Moreover, international philanthropic networks, foundations, and academia can play a role in facilitating and providing cross-references at both grassroots and community levels, focussing on vulnerable and marginalised segments of (urban) society (IPCC 2014).

Transferability OR Mutual exchange

Based on the above descriptions, one part of the initial question remains open: whether applying adaptive measures at the community level is transferable to other contexts that come with differing local and climatic specifics. A World Bank report entitled 'Clean Energy and Development: Towards an Investment Framework' (2006) states that, despite the global agreement that 'all countries are vulnerable to climate change' (World Bank 2006, p.9), the actual vulnerability levels and adaptive capacities may differ significantly among nations. Historically, low- and middle-income countries have remained unaccountable for climate impacts (Stern 2006, p.28), yet they incur the largest burdens from anthropogenic CO2 emissions. Being among the most vulnerable (IPCC 2007, 2014; Satterthwaite *et al*. 2007; Stern 2006; World Bank 2006) these countries "can even less afford not to adapt" (Stern 2006, p. 443). This calls for cooperation among local and international stakeholders, while also acknowledging local circumstances.[21] Consequently, before and after the Paris Agreement, in 2015, the spectrum of official and non-governmental stakeholders, in particular, has been increasing knowledge transfer and experience across tiers, scales, and actors (IPCC 2014). For instance, the 2018 UNFCCC report on adaptation in human settlements mentions 'city-to-city partnerships on adaptation' as one aspect of peer learning to increase knowledge and the pace of applying adequate adaptive measures (UNFCCC 2018).

On the local level, with increasing knowledge and lessons learned in practice, strategies that include community-based efforts (i.e., the PDP project in the

21 Lessons learnt from previous community-based projects within arid urban contexts may be important references for strategic concepts.

GCR) feed into the transfer of knowledge. For instance, initially implemented in the context of rural communities, community-based adaptation principles were transferred to urban communities. This new knowledge can now serve as a reference to foster regional and international dialogues. Moreover, knowledge exchange and discourse can support the application of non-climatic developmental interventions and strategic considerations to create co-benefits in the context of housing in low-income communities. For instance, exchange in knowledge on urban upgrading measures and retrofitting for improved local microclimates can feed into a catalogue of climate responses and adaptation measures. As the IPCC recommends, civil-society partnerships on an eye-to-eye level, such as 'Shack/Slum Dwellers International' can contribute to sustainable community-based exchanges and monitoring (IPCC 2014, p.584).

Whereas, in the future Greater Cairo can share its experiences and lessons learned in the field of climate adaptation on the local level, it may well find constructive input from other cities within the region and worldwide that have struggled with similar issues of scale, socio-economic realities, or the interconnection of non-climatic and climatic factors. There is, however, still limited practice-oriented reference to climate-change adaptation to extreme heat in urban areas and in comparable socio-economic settings worldwide. Nevertheless, several African cities such as Johannesburg, eThekwini, and Cape Town (ICLEI 2019) have begun applying community-based approaches in their urban settings. For instance, in Soweto (Phalatse 2008, 2011), an intensive dialogue with and within local communities identified constraints and capacities and, hence, built the requisite community trust (Phalatse 2008) that allowed initiatives to become embedded in community-based processes for adaptation. Such promising stories (along with experiences that failed) will help adjust and develop community-based processes for adaptation in the case of Cairo and elsewhere. This mutual (constructive) exchange between cities and actors on lessons learned will be of essence when further developing approaches to foster the resilience of human settlements and communities.

CONCLUSION

This chapter looked into how the connection between climate-change adaptation and community involvement was reinforced through increasing knowledge and information exchange, particularly those linked to housing in informal urban areas. It illustrated how the Greater Cairo Region deals with the impacts and stresses of extreme heat and erratic weather events whose combination reduces

the capacities of low-income households and communities to adapt, consequently resulting in the increased vulnerability of the region's population (Plan+Risk Consult 2013). A vast urban metropolitan region like the GCR requires holistic, long-term, comprehensive strategies that include adaptation on all levels for the sake of providing a 'collective good' (Pelling 2011, p.48) that does not exclude the most vulnerable segments of society. Currently, urban heat stress in the GCR and, in particular, in its informal areas seems to be subject to limited projects such as the PDP, a few bottom-up initiatives (Miit 'Uqba), and some research projects (GERF 2014). Nevertheless, knowledge is accumulating and interventions that tackle the environmental and heat-related aspects of climate change on an urban and built scale are beginning to be incorporated into mainstream development and community interventions. One example is the case of Ezzbet El-Nasr in the GCR, which is subject to development cooperation.

In respect to Ezzbet El-Nasr, one conclusion is that recognition of the connection between climate, the built environment, and housing is growing as the result of exemplary value-based community engagement (i.e., VMEs), and pilot projects are being introduced that are related to development cooperation and to diversifying the local and international academic discourse. Moreover, increased exposure to and growing knowledge on this topic can significantly contribute to developing a discourse on climate change across sectors and academic disciplines and the consequent complex aspects of adaptive housing. Information exchange and cooperation among the different actors across tiers are relevant to identifying and implementing co-beneficial measures and in fostering resilience.

Another conclusion is that measures on the community level can be physical or spatial but they need to be linked to communities' dynamics and diverse compositions, with personal and collective values playing a crucial role. Hence, adaptation in this context will require a particular balance between individual and collective awareness and community interaction and support, while (potentially) facing continuous neglect in the provision of services these communities need and also in formal governance. Here, the community and its people need to be in continuous communication and negotiation. The link to actual change (i.e., perceived or real improvements in livelihoods), however, will need to be subject to further monitoring and research. Moreover, the potential involvement of external actors (and champions) who act as catalysts needs to be sensitively built on lessons learned from previous experiences. Finally, looking at the question of transfer, a mutual (constructive) exchange between cities and actors on lessons learned will be of essence.

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