Spatial, network and temporal dimensions of the determinants of adaptive capacity in poor urban areas

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ABSTRACT

Slums and informal settlements are home to rapidly growing populations in urban areas globally and face a range of significant shocks and stresses. The sustainability of these places is critically intertwined with the resilience of their populations. The nature of the capacity for populations to adapt to shocks, as an element of resilience, is related to the evolving knowledge and networks of those populations and is suggested here to have significant spatial and temporal variation. We analyse the key determinants of adaptive capacity and hypothesise that they are related to spatial dimensions of urban form, temporal dimensions of migration, place attachment, and to social differentiation. We investigate these dynamics of adaptive capacity across a transect of urbanisation from inner city to periphery in Kampala, Uganda using diverse methods including a sample survey of residents (n = 720) and ego-network analysis. Results show that the key determinants of individual-level adaptive capacity are attachment to place, social networks, and duration of residence. There are significant differences in adaptive capacity between slum areas, as well as strong social group and temporal dimensions. These findings suggest the importance of measuring adaptive capacities at appropriate spatial and temporal scales in order to identify specific interventions for slums that build the resilience of their populations.

1. Introduction

Slum areas in cities are characterised as being marginalised in terms of governance, service provision and infrastructure (Arimah, 2011). While there has been progress in improving slums worldwide, estimates of populations in these areas show that they are continuing to grow: there was a 28% increase from 670 million to 880 million people living in slums in 2014 compared to 1990 (UN-HABITAT, 2016). The prospect of continued growth in slums is in large part due to continued urban expansion in developing countries (Angel et al., 2011). Throughout the history of urban expansion, there is long documented evidence of how populations in these settlements face a range of shocks and stresses testing their own resilience and that of their communities.

There is a renewed focus on the resilience of people and populations in these informal settlements (i.e. *social* resilience) and on pathways of potential transformation in urban areas, both in the context of making cities sustainable and also disaster risk reduction (Ahern, 2011; Kernaghan and da Silva, 2014; Leichenko and Silva, 2014). Those bodies of knowledge show that resources and assets are important dimensions of social resilience, alongside social organisation to learn from and adapt to risks (Berrou and Combarnous, 2012). Studies on disaster resilience in particular show that the factors leading to resilience are different in pre-disaster and post-disaster circumstances (Baker, 2012).

Research has highlighted the tensions between, on the one hand, integrating slum areas into larger development trajectories, often at the expense of the urban poor, and alternatively simply making slum populations resilient to shocks (Tacoli et al., 2015). This paper focuses on the resilience of populations within slum areas, not as a long-term normative goal, but in order to understand the dynamics of the lived reality of shocks that slum-dwellers face, and the factors that can be leveraged to build resilience in these places. While disaster resilience is part of that landscape, we focus here on the factors that bring more general social resilience, in the sense of making populations able to cope with multiple shocks and stresses. These include disasters as well as more everyday shocks such as crime, threats of eviction, lack of access to services, and exposure to pollution (Banks et al., 2011). General resilience in this context therefore encompasses slum-dwellers' ability to progress, resist and develop roots in place (Brown, 2016).

At the most general level, system resilience is the ability to deal with shocks and stresses whilst maintaining structure and function; the autonomy to implement change; and the capacity to learn, adapt and even

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transform (Carpenter et al., 2004; Walker et al., 2004). Tyler and Moench (2012) identify systems, agents and institutions as the key components contributing to urban climate change resilience, while Arup (2016) identify four dimensions of city-scale resilience as leadership and strategy, health and wellbeing, infrastructure and ecosystems, and economy and society, with twelve goals within those (Arup, 2016). City-scale or system-based accounts of resilience are, inevitably, limited in their focus on agency, on how individuals are constrained within political systems, and on their individual capacities to act (Brown, 2014). Hence in this study we focus on the capacity of individuals within slum areas, examining which factors realise their opportunities to be resilient.

Adaptive capacity is a central element of resilience. It is the capacity of individuals to manage and influence their resources and risks (Walker et al., 2004). Adaptive capacity is not fixed: while it is well-established that the elements of adaptive capacity are unevenly distributed within populations, there is less focus on how adaptive capacity varies across space and time for individuals. Studies into adaptive capacity recognise that it is scale dependent: measures at one scale rarely are meaningful at other scales (Vincent, 2007). Moreover marginalised social groups are most often disproportionately vulnerable to a range of shocks through an absence of adaptive capacity (Hardoy and Pandiella, 2009; Revi, 2008). This social differentiation is often further manifest and accentuated in spatial heterogeneity in vulnerability (Cutter and Finch, 2008; Jankowska et al., 2011). It is also clear that relationships to place radically change over time (Lewicka, 2011) and elements of resilience differ significantly before and after significant events such as disasters (Rose, 2009). Variable capacity across space and time may well then affect overall system resilience and has been argued to make interventions ineffective given the dynamic changes in adaptive capacities (Cutter and Finch, 2008).

This study therefore investigates the determinants and heterogeneities of individuals' adaptive capacity in slum areas. We hypothesise that differences are related to spatial dimensions of urban form, temporal dimensions of migration and length of residence, place attachment and social differentiation. The study tests these ideas using data collected in three slum areas in Kampala, Uganda's capital and largest city. The analysis is primarily based on data from a survey of 720 slum residents across three areas across the city, analysed for their spatial and social dimensions and using ego-network analysis to analyse the importance of social capital. We disaggregate the results according to social groups, and analyse how they change with residents' duration of residence. The results reveal specific determinants of adaptive capacity, pointing towards the importance of considering socio-cognitive factors, and different types of social support networks. Moreover, there are clear spatial, social group, and temporal dimensions to social resilience within the three slums. Wider implications include the case for assessing general resilience, and assessing adaptive capacity at the local level.

2. Resilience and adaptive capacity in poor urban areas

Resilient systems have various characteristics. They are, for example, those that can deal with, and respond to, a spectrum of shocks and perturbations whilst retaining the same structure and function. But systems have also been argued to be more resilient with greater autonomy and agency for action; and with greater capacity to learn, anticipate change and possibly respond to external perturbations (Nelson et al., 2007; Walker et al., 2004). This understanding of resilience is more than just bouncing back or persistence. It includes the capacity of individuals and communities to learn, anticipate change and possibly respond in the face of change to a different state (Folke, 2006; Matyas and Pelling, 2015).

For cities and their populations, then, what constitutes a resilient system? There are now well-established tools for assessing resilience that identify the critical components at a city scale (Arup, 2016; UN-

HABITAT, 2012). Studies have identified the characteristics of a safe and resilient community, including that it is knowledgeable and healthy, organised, connected, has infrastructure and services, economic opportunities and can manage its natural assets, although this is not specific to urban issues (Arup, 2011). While these frameworks contain measurements of levels of human vulnerability, economic opportunities and some measure of community cohesion, there is evidently a limited understanding of the dynamics of individual populations adaptability given the scale of study. Community-scale resilience assessments in urban areas so far focus on climate risks (Cities Alliance and WRI, 2017) or the impacts of urban development (Woolf et al., 2016).

This study focuses on slum residents as agents and the determinants and dimensions of their adaptive capacities to influence general resilience. General resilience in this context refers to how individuals respond to a range of shocks, rather than individual ones, hence general rather than specific resilience. Assessments of vulnerability and resilience are often focused on a specific type of shock (Meerow et al., 2016). We consider general resilience here given that it is likely to be difficult to pinpoint specific adaptive measures in the urban poor context where the shocks individuals face are multiple and synergistic (Nielsen and Vigh, 2012; Waters, 2013).

Adaptive capacity is not simply a set of resources or sets of capital assets. Core elements have been argued to encompass resources, structure, and agency (Cinner et al., 2015; Lemos et al., 2016). Resources generally refer to assets and hard and soft infrastructure. Structure includes factors such as social class, religion, gender, ethnicity, and customs, while agency refers to the 'ability to mobilise' resources and more subjective, socio-cognitive factors. All three areas have been shown to individually influence adaptive capacity (Amendah et al., 2014; Grothmann and Patt, 2005; Kuruppu and Liverman, 2011; Marshall et al., 2007; Moser et al., 2010; Opiyo et al., 2014). Eakin et al. (2014) distinguish between generic capacity and specific capacity in dealing with risks and that generic capacity is often limited at collective scales of governance. Marshall et al. (2012) and Cinner et al. (2012) have shown how adaptive capacity, at both individual and collective levels extends beyond resources to include dimensions of learning, skills in planning, and willingness to undertake adaptive actions (see also Berkes and Ross, 2013). These insights suggest that while adaptive capacity can be indicated more generally by resource or asset based measures, more fine-grained understanding requires insights on individual and psychological resources, and on social networks.

How does adaptive capacity vary in spatial, social, and temporal dimensions? There is evidence that across cities, poor urban areas are highly heterogeneous in their residents' adaptability (Chatterjee, 2010; Jankowska et al., 2011; Simon, 2011). Stark differences across social groups in cities include vulnerability of women, young and elderly populations to stresses such as heatwave risk and flooding (Gasper et al., 2011; Hardoy and Pandiella, 2009). Second, there is evidence from disaster risk situations that individuals' adaptability changes in pre- versus post-disaster situations based on their underlying resilience and networks (Masten, 2015). Third, place attachment is strongly predicted by residence duration (Lewicka, 2011). Hence, it appears adaptive capacity varies across standard measures of social differentiation, is context and place specific, and is mutable and likely to alter across the lifecourse.

Specific challenges and elements of adaptive capacity appear in low-income marginalised urban contexts. Slums and informal settlements are vulnerable to a range of natural and man-made shocks, often because they are located in marginal areas such as steep hillsides, floodplains or other high-risk areas (Baker, 2012; Chatterjee, 2010); and because the poor quality, densely packed housing with lack of infrastructure increases the risk of hazards further (Hardoy and Pandiella, 2009). In addition to high exposure, slum-dwellers often face other vulnerabilities such as exclusion from the formal economy, lack of voice or political representation (especially for migrants), and lack of tenure