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# The living conditions diamond: an analytical and theoretical framework for understanding slums

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**Sumila Gulyani**

The World Bank, 1818 H Street NW, Washington, DC, 20433, USA;  
e-mail: [sgulyani@worldbank.org](mailto:sgulyani@worldbank.org)

**Ellen M Bassett** ¶

School of Urban Studies and Planning, Portland State University, PO Box 751, Portland, OR 97207, USA; e-mail: [bassette@pdx.edu](mailto:bassette@pdx.edu)

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**Abstract.** What constitutes a ‘slum’ is much debated in the urban poverty and affordable housing literature. We argue that a focus on living conditions can help clarify this and present a framework, the living conditions diamond, for detailing living conditions and determining how the settlements we deem ‘slums’ compare with each other and with nonslum settlements. The diamond distils living conditions into four dimensions: (i) tenure, (ii) infrastructure, (iii) unit quality, and (iv) neighbourhood and location. This framework depicts conditions in graphic terms enabling comparison of conditions within and across cities. The diamond moves us beyond the notion that slums are homogeneously poor in quality, and facilitates analyses that can reveal why they differ. Settlements in Nairobi, Kenya and Dakar, Senegal are compared.

## 1 Introduction

In 2008 a significant threshold was reportedly passed: the planet became urban (UN DESA, 2008). That is, more people on Earth now live in urban areas than in the countryside. Those who think about our urban future warn that an urban Earth will be distinctively different. Urbanity’s future is not the charming burgs of Europe, nor is it the sprawling suburbs of North America. It will not even resemble the densely populated high rises of Hong Kong. Rather our global urban future is a “planet of slums” (Davis, 2006).

While this prediction grabs one’s attention and is by many accounts accurate, it does beg another question: just what is a slum? The term is strangely amorphous. It has been loosely deployed—used interchangeably with squatter settlements, self-help settlements, spontaneous settlements, and shantytowns. ‘Slum’ has also been rendered synonymous with local terms of different provenance—tagged as *majengo*, *ghetto*, *favela*, *kampung*, or *gecekundu* to name a few. The term is used to describe places as divergent as the abandoned, blighted neighbourhoods of shrinking industrial cities in the American Midwest and the intensely populated, poorly serviced settlements of booming Indian metropolises.

In this paper we argue that, while there is a lack of clarity of just what constitutes a ‘slum’ as well as legitimate concern as to whether the term even ought to be used (Gilbert, 2007), much of the confusion associated with the term could be avoided if we focused directly on the issue of living conditions—that is, the physical characteristics of settlement—and forge a shared methodology for comparing and understanding settlement quality within and across cities. By focusing on living conditions we can move away from the divisive issue of labels and instead focus on understanding relative levels of need and deprivation, identifying the aspects of living conditions

¶Corresponding author.

that are unacceptable, and formulating context-specific interventions by which living conditions can be improved or altered.

But just what indicators are best for understanding living conditions and differentiating human settlements? The literature has scores of indicators. We argue that these can be distilled to four dimensions: (i) tenure, (ii) infrastructure, (iii) unit quality, and (iv) neighbourhood and location. These four dimensions interact with each other and collectively determine the overall quality of living conditions in any given settlement, rich or poor, slum or not. We represent this graphically as a diamond with four vertices and call it the “living conditions diamond”.

The living conditions diamond, we suggest, is a framework that can enhance our understanding of settlement quality and assist in determining actions to ameliorate poor conditions. At its simplest, the diamond presents a cross-sectional snapshot of settlement conditions using data associated with the four dimensions identified above. The graphic presentation is powerful because it makes the data accessible and compelling to experts, laypeople, and leaders alike. The framework also emphasizes interactions between the four dimensions and helps us to understand how changes in one area might impact upon another. Because it has both static (snapshot) and dynamic (interactions) qualities, the diamond is a useful diagnostic and planning tool—it helps to identify potential context-specific points of intervention and evaluate the appropriateness and viability of interventions vis-à-vis other settlement factors.

The paper is organized as follows. In section 2 we define the components of the living conditions diamond. In the third section we draw upon the literature to flesh out the rationale for each quadrant of the diamond and explain how they *interact* with each other to collectively determine the overall quality of living conditions. In section 4 we use data from Nairobi and Dakar to depict and compare settlements; we also use the tool to suggest potential context-specific interventions to improve living conditions in these divergent settings. In the conclusions section we discuss the implications of the diamond.

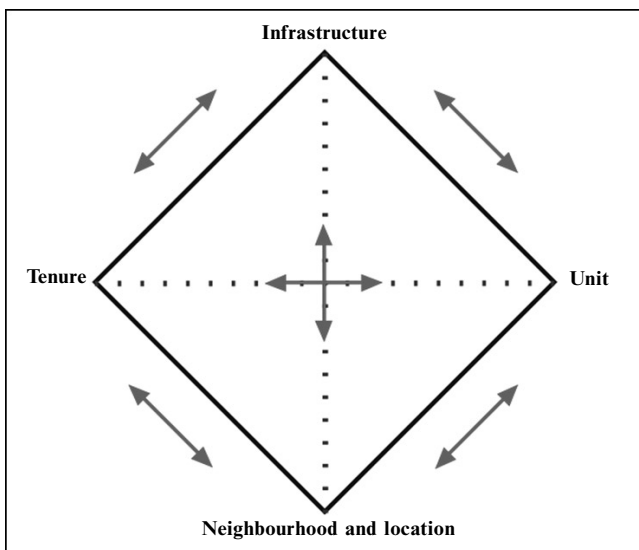
## 2 The living conditions diamond: components defined

As shown in figure 1, the living conditions diamond has four components arrayed on four vertices. These are: (i) tenure, (ii) infrastructure, (iii) housing unit quality, and (iv) neighbourhood and location. Here we define each of the four components of the diamond and explain why each is considered a fundamental aspect of living conditions. Each component is in itself a composite of several factors and requires use of multiple indicators. In the discussion below we discuss indicators related mostly to ‘minimum’ conditions for liveability, and especially relevant to low-income settlements in developing countries; these indicators can be modified to reflect and fit higher standards or thresholds that would be relevant in medium-income or high-income country settlements.

### 2.1 Tenure

The first vertex—tenure—can be defined simply as the right of an individual to hold something (land, a structure). In the literature on informal settlements, implicit or explicit recognition of tenure is often seen as a minimum condition for investments that will help improve the housing stock and the settlement in the medium to long term.

We have identified five characteristics of tenure that affect urban living conditions. The first aspect is the *type* of tenure held by settlement residents—in urban areas (where intervening layers of customary tenure are usually absent) this splits into two



**Figure 1.** The living conditions diamond.

categories: ownership and tenancy. Conventional wisdom is that ownership contributes positively to living conditions as owners have a financial stake in maintaining and improving both unit and neighbourhood quality. Experience suggests, however, that tenants can and have acted as strong neighbourhood advocates as well, particularly to protect their interests in and needs for affordable housing (Angotti, 2008.) Tenure can be further characterized by its *formality*, which refers to whether the tenure right is formally recorded and recognized by the state (as a rental lease or ownership deed). The concern with formality relates to the third characteristic, *security of tenure*, or the surety that owners or tenants have that they will not be displaced. The assumption is that formal tenures are more secure. Experience shows, however, that unwritten informal tenures can be secure and written formal tenures insecure—both are dependent upon the attitude and enforcement action of the state (eg to confiscate private land; to cease settlement demolition; to enforce leases). The fourth characteristic is *tenure mix*. What percentage of residents are owners? What percentage are tenants? High levels of tenancy are significant since tenants—particularly those in informal or unregulated markets—are often less empowered than owners to demand service provision from government or utilities. The influence of tenure mix, however, is significantly related to *duration of stay* or, conversely, the turnover rate. Transient populations are expected to have less interest in and identification with their settlement than longer term residents. While owners are generally more ‘stable’—studies show that they change residences less frequently than tenants (Gulyani et al, 2009)—long-term tenants can and do form strong links to their neighbourhoods and become effective neighbourhood activists (Angotti, 2008; Dieleman, 2001)<sup>(1)</sup>

## 2.2 Infrastructure

The second vertex of the diamond refers to infrastructure stock and services—these are determinants of living conditions because they are required to make settlements and

<sup>(1)</sup> The majority of studies on residential mobility and its relationship to tenure status (among other variables) have been conducted in the developed world. A web search of literature review showed only a few studies focused on China, South Africa, and Latin America.

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housing functional. Our definition of infrastructure includes the physical stock or assets—such as roads, drains, water mains, and electrical lines—and the provision of public services such as potable water supply, electricity, solid waste collection, and public transportation.

To unpack the impact of infrastructure on living conditions we need to understand level of access which, in turn, depends on the following four aspects of a given service: coverage, level of service, service reliability, and affordability. Expanding *coverage* requires two complementary steps: building the trunk infrastructure required to connect and serve a settlement and the actual connection to and use of service by a household. For example, a water trunk line needs to be extended to a new settlement to deliver potable water, and resident households have to connect and use the service. A second aspect of infrastructure is the *level of service* provided to the consumer or resident. A higher level of service is essentially a more convenient level of service—having a private toilet is considered a higher quality service than having to utilize a communal toilet. But, as anyone who has ever listened to the rasp of an empty faucet can attest, convenience means little without the third characteristic: *reliability*. Good infrastructure is reliable infrastructure—water is there when the consumer needs it; the road is passable; and the stormwater drains function no matter what the season. Finally, the infrastructure or service has to be *affordable* to enable residents to actually use it. If the unit cost of water is too high, low-income residents will supplement or replace it with alternative (usually unsafe) sources such as water from unlined wells.

For tabulating the infrastructure vertex of the diamond we need to make two decisions—which services should be included and what aspects of these should be measured? We propose that the focus should be on access to health and economic infrastructure and these include the following ten services and facilities: water supply, electricity, toilets, sanitation (sewerage or septic tanks), stormwater drainage, access roads, urban transport, solid waste (garbage) collection, street lighting, and, finally, communication infrastructure and services (phones and, increasingly, broadband). We calculate the proportion of households with access to a given service or infrastructure asset—for this, we inquire about their ‘primary source’ for the service and whether the physical asset actually works. For example, only those who have an electricity connection and also use it as their primary source for lighting are reported to have access; by doing so we have attempted to capture affordability and reliability in addition to coverage (if the electricity was available less than 50% of the time and/or was used less than other inferior sources of lighting—such as kerosene—because of high costs, it would not be rated a ‘primary source’). Similarly, only households with a *working* stormwater drain outside *their* house are reported to have access to drainage facilities.

### 2.3 Unit

The third vertex of the diamond is the housing unit itself. Few would argue with the proposition that an appropriately designed, built, and adequately maintained housing unit is critical to living conditions and that adequate housing, most fundamentally, provides shelter. The most iconic image of a ‘slum’ is, of course, a poorly constructed or dilapidated housing unit. Using unit quality as a chief indicator for characterizing a slum is quite problematic since housing standards and materials vary greatly across climates and geographies. What is considered an appropriate building standard in one place may not be considered so in another. An additional problem with using unit quality as a primary indicator of slum status is that standards change as social preferences change and building technologies evolve. Gilbert (2007, page 706) observes that housing quality

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is a moving target, since “as general housing standards rise, areas that fail to reach the new standard will be newly categorized as slums.”

With those caveats, we have identified two characteristics that can be used to depict and differentiate unit quality: building materials/structural integrity and density of occupancy/overcrowding. The first characteristic, *building materials and structural status and integrity*, has been heavily relied upon by governments of all stripes to determine whether a building should be considered substandard. In regards to building materials and living conditions, three aspects of the building should be measured—roofing materials, foundations, and exterior walls—and categorized as to whether they are constructed of permanent or temporary materials. Walls and foundations, at minimum, should be evaluated as to whether they are adequately strong—that is, able to hold up the roof or additional floors. Roofing materials such as plastic, cardboard, and palm fronds are temporary materials inappropriate for urban settings since they are vulnerable to degradation and fire. Likewise, buildings without permanent (eg concrete, brick, or stone) foundations and walls are less durable and less likely to withstand the elements. Structural status and integrity—whether the unit’s structural frame is vulnerable to collapse and whether there are holes in the walls, roof, or windows—should also be evaluated in determining unit quality. In all cases, local conditions or threats—like the possibility of seismic events—should influence the metrics used for the evaluation. The second characteristic of unit quality relates to *occupancy level and overcrowding*. While different societies have different tolerances or preferences regarding the number of people who can comfortably share a single unit or room, overcrowding detracts from living conditions in many ways, and not least because it facilitates disease transmission. The latter is especially true when overcrowded housing is located in a settlement that is underserved by health infrastructure. A difficulty arises because there is no hard and fast rule for determining at what point overcrowding at the unit level—and housing density at the settlement level—becomes dangerous to health (Churchman, 1999). While this is problematic, it is not entirely paralyzing since one of the objectives of the diamond is depicting conditions relative to other settlements and illustrating the diversity of conditions. In section 4 we use two measures of unit-level overcrowding, rooms per household and persons per room, as part of the assessment of quality of living conditions in the informal settlements of Nairobi and Dakar.

#### **2.4 Neighbourhood and location**

The final vertex of the diamond is the neighbourhood—a settlement’s location, quality, and amenities crucially influence the overall quality of living conditions. When consumers look for housing, they generally choose their neighbourhood before they choose their house. Consumers evaluate neighbourhoods relative to jobs and commutes, the quality and location of schools, the provision of public open space and facilities, as well as crime and vehicular traffic (see Kim et al, 2005). Neighbourhood quality, not surprisingly, is a primary factor in the cost of housing—identical housing units will fetch dramatically different prices if located in neighbourhoods of substantially different quality.

The following three characteristics of a neighbourhood directly influence living conditions: spatial location; density, physical layout, and circulation; and amenities. The first aspect, *spatial location*, has two key parts: centrality/connectedness and physical or environmental vulnerability. *Centrality/connectedness* refers to where the settlement is situated relative to economic and social activities and facilities—jobs, markets, schools, health facilities—and transportation corridors and services. Centrally located or ‘well-located’ settlements are those that offer easy or inexpensive access

to economic and social activities; such locations are considered advantageous to low-income residents because they allow them to minimize transportation expenditures and use that money for other crucial elements of the household budget (eg school fees, health care).<sup>(2)</sup> The connectedness of a settlement, however, needs to be considered in conjunction with the second component of spatial location which is its *physical or environmental vulnerability*. Globally, poor people—be they residents of the landslide-prone *favelas* of Rio de Janeiro or the displaced populace of New Orleans' Ninth Ward—often live in physically vulnerable and/or environmentally undesirable locations. In settlements characterized by physical or environmental vulnerability, residents directly bear the costs of the bad location—such as infection from contaminated water supplies or the economic costs of recurrent investment to clean up after flood damage. These costs can detract from or even negate the presumed advantages of a well-connected location. The second aspect of neighbourhood condition relates to the settlement's key physical planning indicators: that is, *density, physical layout, and circulation*. Physical planning provides two benefits that impact upon living conditions. First, physical planning helps manage population density and overcrowding by controlling lot sizes and housing units per acre or hectare.<sup>(3)</sup> Second, physical planning can provide for a layout that facilitates delivery of services and ensures basic circulation. The layout and circulation are especially important to ensure access during emergencies: for example, by ambulances and fire trucks. The third feature of a neighbourhood is the *amenities* that it offers, such as schools, open spaces, and community facilities (community halls, sports centres, etc). These characteristics of the neighbourhood, as will be further discussed below, are often interrelated: a settlement located in a peripheral *and* precarious location such as a riverbank, for instance, is unlikely to have benefited from physical planning.

### 3 Interactions across the vertices

We asserted at the beginning of the paper that these four elements interact and cumulatively determine living conditions. In this section we illustrate *how* the components interact with each other and dynamically alter quality within a settlement. For this discussion we draw on existing literature and attempt to show how the diamond framework contributes to it—particularly to theory and literature relating to settlement improvement. We argue, first, that the four components of the diamond strongly influence each other and, therefore, none should be considered in isolation. Second, to better understand the dynamics of living conditions, we need to focus on the interactions between the four components. Third, we argue that any one of the four components can serve as an entry point for interventions aimed at improving living

<sup>(2)</sup>To assess 'centrality or connectedness', a number of metrics could be used. Most simply, the distance of the settlement from the central business district, the nearest market, and other amenities such as a hospital and school could be tabulated. At the same time, household surveys can also record distance travelled by each member to their primary activity, their mode of travel, and time and cash expenditure entailed. Likewise, for the second set of variables environmental aspects should be assessed relative to safety—with safe locations (eg good soils, no known geological faults) scoring high, and unsafe locations (eg on side of seasonal rivers, unstable soils) scoring low.

<sup>(3)</sup>Although density is a crucial planning variable and a major determinant of the nature of a neighbourhood, there is no universally agreed threshold above which settlements are deemed 'too dense'. In using the diamond framework, we believe it is important to document density and compare it across settlements to improve our understanding of its relationship to other indicators and to living conditions more broadly. Common metrics of 'connectivity' (eg density of intersections, block lengths) as well as parcel-level descriptors (eg regularity of parcel dimensions, average lot sizes) could be utilized as measures of intrasettlement physical planning.

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conditions in a settlement and the ‘right’ entry point(s) will vary by context. The last point stands in contrast to the literature—much of which argues over the relative salience and efficacy of one component over the others in influencing living conditions (eg Field, 2005; Gulyani and Bassett, 2007; Wegelin and Borgman, 1995).

### 3.1 Tenure

Tenure has an acknowledged relationship with each of the other three components of the diamond: unit quality; infrastructure availability at the unit and neighbourhood level; and the neighbourhood’s condition and location. The relationship between tenure and the unit is much studied and theorized. Many have argued that residents of slums, despite their apparent poverty, will invest to improve their housing, but to do so they need to have some security of tenure (eg Durand-Lasserve and Selod, 2009). There continues to be disagreement, however, over how tenure security can/should be enhanced, including whether it can ‘follow’ rather than ‘lead’ investment (Payne et al, 2009). For de Soto (2000) land titling is the right approach to conferring tenure security and unleashing ‘dead capital’; in this view legal tenure is a precursor to housing investment and also leads to broader welfare gains for residents. By contrast, other analysts have documented cases where the sequence was reversed—in Amman, Jordan, and Voi, Kenya, residents invested in making their homes more permanent as a strategy for securing their tenure (Bassett, 2007; Razzaz, 1993). The latter cases lend support to a different argument: that perceived tenure security—even an implicit understanding that a built structure will not be demolished by government—may be sufficient to encourage residents of slums to invest in their housing (Calderon, 2004). In our framework this discussion is summarized as follows: tenure and unit quality are related and a change in either one can lead to a change in the other.

Tenure is also related to infrastructure access at the unit and neighbourhood level. When settlements are considered illegal, resident activism to demand the provision of key infrastructure is less likely (or even dangerous). Similarly, when government agencies and civil servants see slums as temporary or illegal (or even, as recent experience has shown as enemies of the state or ruling party), they are reluctant or even opposed to extending public services like water supply, sewerage, and street lighting. In such cases a necessary precursor to improving services and living conditions is a political decision to officially recognize the settlements and (potentially) begin legalization processes.

This logic resonates with de Soto’s and supports his ‘title-first’ approach; titles can, theoretically, encourage private investment in units and public investment in infrastructure. In contrast, infrastructure proponents argue the infrastructure can lead or even replace efforts to formalize tenure in slums (Gulyani and Bassett, 2007). Specifically, they suggest that infrastructure investment signals ‘acceptance’ or implicit recognition of informal settlements by government—it reduces the perceived threat of demolition and offers de facto tenure security which, in turn, encourages residents to invest in their units. In our framework, tenure and infrastructure interact and, in contrast to debates in the literature, we posit that either one can lead to improvements in the other. In this framework, the ‘right’ answer regarding sequencing of interventions and the relative superiority of one entry point over the other depends on and varies with the context.

Finally, tenure impacts upon and also reflects a neighbourhood’s condition and its location. Settlements characterized by insecure tenure generally have little political leverage to demand better services (eg drainage for a flood-prone settlement) that could improve neighbourhood quality. Settlements with high levels of tenancy and a rapid turnover of residents are expected to be less likely to see neighbourhood conditions addressed (or infrastructure provided.) The reverse can also be true: that is, tenure may be a reflection (rather than cause) of neighbourhood conditions. The proposition here

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is that neighbourhoods with better conditions—public amenities (eg parks, schools), safety, layouts that permit access—are likely to be associated with greater tenure security and longer tenure duration or lower resident turnover. The location matters as well—for instance, slums on hazardous sites (and those in prime downtown locations) are most likely to be tenure-insecure and more likely to be slated for demolition, even by governments that might otherwise support settlement improvement.

### 3.2 Infrastructure

Technically, infrastructure should ‘lead’ development of settlements and housing, because it is expensive to construct infrastructure in areas that have already been built up. However, settlements do originate and grow without public infrastructure investment. Retrofitting settlements with appropriate infrastructure takes place in both the developing and the developed world—in the latter, failing septic systems, for instance, are replaced by sewers at great cost; in the former, providing critical infrastructure such as water and drains is a very common component of settlement upgrading.

The existence or absence of infrastructure intimately affects unit quality, and can be considered an incentive or disincentive to investment in unit improvements. Lack of drainage and stormwater infrastructure, for instance, presents a direct threat to the structural integrity of a building—there may be little point in improving a house with high-grade building materials if the foundation can be swept away in a landslide. Likewise, the existence of infrastructure, level of service (eg in-house water connections), and quality of service (eg hours water actually flows) contribute to the value of unit as owned asset and as a source of rental income, hence affecting structure owners’ willingness to invest.

Infrastructure both affects and reflects neighbourhood conditions. The absence of infrastructure like stormwater drains can exacerbate the vulnerability of an already precarious settlement. But existing neighbourhood conditions—such as a poorly articulated physical layout or site plan—may preclude higher levels of infrastructure investment or require significantly higher expenditure (Mukhija, 2001). And, as noted in the discussion on tenure, the location of the settlement can be a determinative factor in whether the state is willing to invest. A peripheral (and particularly a noncontiguous) location is likely to increase the cost of infrastructure provision; higher costs may preclude government action. A central location should place a settlement at an advantage for infrastructure investment because trunk lines are likely to already exist. Ironically, however, a central location may make its residents more vulnerable for displacement—this is usually high-value land and by providing infrastructure the state is signalling acceptance of a settlement and conferring *de facto* security of tenure. As is illustrated in the debate over the fate of the massive Dharavi settlement in Mumbai, a state may desire to invest in infrastructure in slums in high-value locations, but there is no guarantee that it will be done to benefit existing residents.

### 3.3 Unit

The housing unit is, perhaps, the most rapidly changing—and visibly dynamic—component of the diamond. Individual action is all that is required to alter the quality of a unit, not least because it is largely (but not entirely) a ‘private’ good. Nevertheless, the quality of the unit is influenced by the other three vertices. The interactions between the unit, tenure, and infrastructure have already been discussed above. In the discussion below we examine what the literature suggests regarding the drivers of changes in unit quality over time—strikingly, the perspectives are different in the literature focusing on developing countries versus that from advanced industrialized countries.



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For the developing world, the assumption has been that units in informal settlements will improve over time—becoming more and more like units constructed by the formal sector. Settlement consolidation occurs as self-builders gain access to finance, hire labour to complete structures, and obtain tenure security (Datta and Jones, 1999). While this trajectory appears to be valid for many of the informal settlements in Latin America—particularly those settled through land invasions by the landless—housing consolidation has not proceeded as predicted in other parts of the developing world (Gough and Kellet, 2001; Smart, 2003). While tenure security remains important, the ability and willingness of unit owners to consolidate their housing are also significantly affected by two other aspects of tenure: tenure mix and duration of stay. In particular, settlements in which the tenure mix is characterized by a high proportion of renters and absentee owners appear less likely to consolidate as absentee owners have little or no incentive for improvement (Gulyani et al, 2009; World Bank, 2006). The mobility of tenants can also reduce the pace of consolidation—those seeking better unit quality may find it easier to move than to press landlords for improvements in the housing in which they currently reside.

In contrast to the assumed upward trajectory in unit quality over time in the developing world, theoretical perspectives on housing in some Western market economies predict housing quality decline over time as the structure itself deteriorates (eg Bear and Williamson, 1988; Bier, 2001). Dilapidation of housing stock, however, is not considered a bad outcome for the housing market as the provision of affordable housing is premised on the ‘filtering down’ of housing stock from higher to lower income households. The threat of slum formation occurs when disinvestment begins and structural declines reach a critical threshold whereby the entire neighbourhood is seen as deteriorating and tagged as an undesirable place to live. Disinvestment, of course, can result for a variety of reasons from an economic shock like a deep recession, racial in-migration and white flight, or even changing housing preferences. Widespread disinvestment in housing stock can become an accelerant of decline—creating a sense of irreversibility that leads to more disinvestment, greater levels of crime and disorderly behaviour, and finally abandonment of the community by its more mobile, better resourced inhabitants (Wilson, 1987). In short, the quality of the unit and neighbourhood are closely intertwined—deterioration in one can trigger a downward spiral and vice-versa.

### **3.4 Neighbourhood and location**

Interactions between the final vertex of the diamond—neighbourhood—and the other vertices have been touched upon in the previous discussion, but one element that merits additional attention is location. Settlements that are deemed slums are often found on the most precarious land or most undesirable locations in a city—on the edge of rivers, on steep slopes, adjacent to or even in the midst of polluted sites or municipal dumps, and on the edge of industrial areas. There are varying explanations as to just why this is the case. For economic theoreticians, the cost of land and differing household economies are critical components to consider. Polluted or vulnerable lands are the least desirable in the marketplace and lower demand for the land translates to lower cost—thus making the land available to lower income dwellers. Similarly, constrained household economies necessitate trade-offs between housing, transportation, and food expenditure—living near industry, for instance, reduces transportation costs, so squatting or residing in such an area is a rational economic decision. In contrast, an environmental justice perspective would explain the disamenities and poor locations associated with slum settlements not as the result of market exchange and rational economic calculation but as the outcome of conscious decisions to site undesirable land uses near or in the midst of vulnerable, unempowered groups.

### 3.5 Upgrading, revitalization, and other interventions: a diamond perspective

Advocates concerned with the housing needs of the urban poor are often sceptical about neighbourhood revitalization and settlement upgrading. If we use the diamond as an interpretive tool, we can see that implicit in their concerns regarding upgrading or revitalization is recognition of the close interaction between the quality of the neighbourhood and the unit, and their combined effect on prices and affordability. Specifically, critics of early settlement upgrading activities observed that, in the first wave of such projects, the improvement of infrastructure and housing quality led to a situation in which housing ‘filtered up’ to higher income groups who had unmet demand for better housing as well as a higher ability to pay for the obligations of homeownership, such as taxes and the specific cost-recovery fees associated with settlement upgrading (eg Peattie, 1982; Sanyal, 1996). In the developed world the concern is similar but the term is different: gentrification. Conventional wisdom has been that the improvement of housing units and the cumulative positive impact upon neighbourhoods will result in higher prices—affordable neighbourhoods become less affordable for lower income populations and they get displaced. There are dissenting views—there is disagreement about whether this is really bad and whether other causes of displacement are more powerful; there is documentation of various strategies deployed by residents to mitigate displacement pressures and maintain their place in the city (eg Atkinson, 2000; Newman and Wyly, 2006). On balance, however, researchers examining urban redevelopment in the West remain wary of gentrification impacts on the poor and vulnerable populations (Freeman and Braconi, 2004; Smith, 2002).

Apart from facilitating analyses of issues such as upgrading and revitalization, the diamond also helps make the discussion regarding ‘entry points’ and interventions both more explicit and structured. For instance, in the United States efforts to improve conditions in selected blocks of public housing often focus on two components of the diamond: the unit and the neighbourhood—money is spent on improving the appearance and structure of the building, the quality and amenities in the units, and on street furniture, lighting, and public spaces. Rarely do these programmes worry about altering the tenure mix *within* the blocks of public housing that are targeted for improvements.<sup>(4)</sup> In developing countries, by contrast, efforts to improve slums focus on the two other components of the diamond: tenure and infrastructure. Upgrading projects have offered tenure security on a continuum—ranging from de facto recognition through mechanisms such as *addressage* (street addressing) in urban Senegal, to providing community-based tenure, to issuing individual titles (Bassett, 2005; Bassett and Jacobs, 1997; Farvacque and Godin, 1998). Another approach is to focus on infrastructure improvements—investment in basic infrastructure such as water supply and drainage; the aim is to not only deliver crucial services that have ‘public good’ characteristics, but also provide de facto security of tenure.

<sup>(4)</sup> Certain low-income housing programmes do utilize tenure institutions that effectively shield the occupant of the home from market pressures—for instance, by providing social housing as is done in Europe or creating equity-capped tenure forms such as limited equity cooperatives and community land trusts in the United States. Housing projects aimed at increasing affordable housing and deconcentrating poverty have been more interested in mixing incomes than in mixing or otherwise addressing tenure.

#### 4 Applying the framework: Nairobi and Dakar

To illustrate the strength of the framework, we present here data on slum settlements in Nairobi, Kenya, and Dakar, Senegal.<sup>(5)</sup> Our intention is not to provide a fully fledged analysis of slums in these two cities; a fuller analysis of these settlements can be found in Gulyani and Talukdar (2008), Gulyani et al (2010), Iskander and Gulyani (2010), and Salon and Gulyani (2010). The data presented here are drawn from a set of household surveys implemented in February–March 2004 in Nairobi and Dakar by a World-Bank-led research team.<sup>(6)</sup> The questionnaires utilized in the cities were virtually identical—small changes were made for language and terminology, and some context specific questions were inserted. In both cities the sampling strategy produced a population-weighted stratified random sample of slums. In Nairobi the study collected data from 1755 households in 88 Enumeration Areas (EAs). In Dakar 1960 households participated in the study; these were drawn from 99 enumeration areas.

The living conditions diamond illustrates some of the findings of the survey graphically and simply: data are plotted on an axis which ranges from 0 at the centre to 100 at the apex of each corner of the diamond. In figures 2 and 3 below, we have plotted only four data points to create a simple illustration. An alternative would be to plot an aggregated score for each of the four dimensions—along the infrastructure dimension, for instance, instead of plotting proportion of households with access to electricity, we could plot an infrastructure access index (eg by averaging the access rates for all ten of the infrastructure services). Within an index different services might be given different weights with critical health infrastructure (water, sewerage) having higher weight than, say, access to mobile phones. Similarly, it is possible to devise a summary index of living conditions by aggregating scores along all four dimensions. The diamond graphic, likewise, can be used to show changes in settlement conditions over time. Variables like infrastructure access or housing quality, can be measured as individual snapshots in several time periods; through a graphical overlay one can see whether conditions are changing—for the better or for the worse—over time.

Before presenting this analysis, we must introduce a caveat regarding scoring and scales. Of the four elements of the diamond, two—unit quality and infrastructure—lend themselves more easily to normative judgment and scoring on a scale of 0–100 where a higher value is better. That is, housing units made of permanent materials can be judged as better than units constructed of mud and wattle, and the higher the proportion of households with units constructed with permanent materials the better. Similarly, a settlement with working sewerage or septic systems provides better living conditions than a settlement where households have to rely on lower level options such as pit latrines.

<sup>(5)</sup>The diamond could be used to evaluate living conditions in the cities of the developed world as well. As an example, we can speculate on how New York City would emerge in an analysis based on the diamond. As with other cities, the framework can help show: (i) an aggregate picture of what New York City looks like; (ii) whether there are differences across the five boroughs; and (iii) the extent to which neighbourhoods differ, both within and across boroughs. The borough-level and neighbourhood-level variations would, in turn, raise questions about why the differences exist and, hopefully, also precipitate action to help ‘close’ the differences. We expect a comparison of boroughs like Manhattan and the Bronx, for instance, would show some distinct differences. We anticipate large differences on neighbourhood/location (eg, vis-à-vis crime, access to jobs/employment) and housing quality (eg crowding); we expect few differences on access to infrastructure and services, but potentially more relative to quality. The tenure variable—and how it relates to the other aspects—would be very interesting to investigate. Owner-occupancy, for instance, is remarkably similar in the two boroughs—only 24.03% of Manhattan residents own their homes; the comparative figure is 22.2% for the Bronx (2008 New York City Housing <http://www.nyc.gov/html/hpd/downloads/pdf/Selected-Findings-tables-2008-HVS.pdf>).

<sup>(6)</sup>The data from the surveys are most fully reported in World Bank (2006) and Gulyani et al (2010).

In contrast, the neighbourhood/location and tenure vertices are harder to score and a higher absolute score may not necessarily be better. For instance, for neighbourhood and location, the assumption in the literature is that centrality and connectedness to an economic hub provide a significant locational advantage; however, given the complexities of residential location decisions for individuals and households, this may be just one of several factors to be considered in assessing a neighbourhood's locational quality. On the other hand, a hazardous location—such as being situated on a flood plain—can clearly be deemed a bad location and should be scored as such. For the analysis below, we have opted to score perceived safety of the neighbourhood—that is, proportion of tenants that perceive their settlement to be safe—and, here again, the higher the score the better.

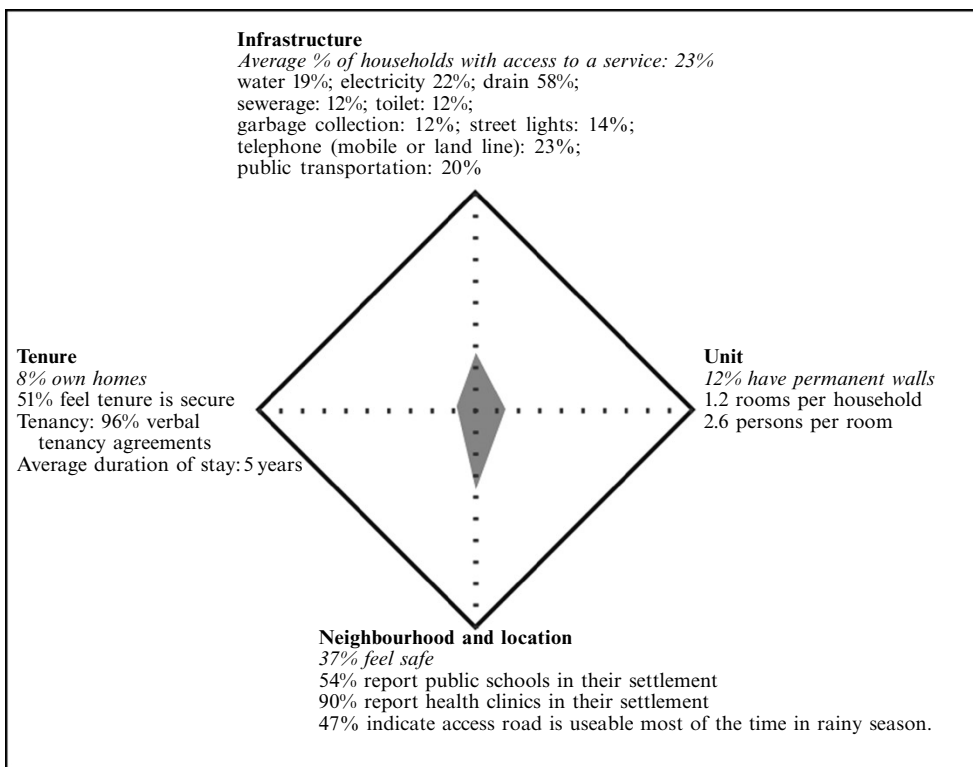
Similarly, tenure-related variables, such as tenure mix, are difficult to score.<sup>(7)</sup> While there is a general assumption in the literature (and in public policy) that owner-occupancy has positive impacts on neighbourhood quality, there is no a priori reason for believing that a tenure mix where the ratio of owners to tenants is 80:20 is better than 70:30 or vice versa. Nevertheless, in the analysis below we have plotted tenure mix, and the value of doing so is: (i) to analyze its relationship with the other three dimensions in any given case and (ii) to see how it varies across cases (that is, across cities and neighbourhoods.)

#### 4.1 The diamond as a diagnostic and comparative tool

As the shaded diamonds in figures 2 and 3 demonstrate, living conditions in Nairobi's slums are dramatically different than those in Dakar—only a small portion of the Nairobi diamond is shaded while almost three quarters of the area of the Dakar diamond is shaded. Second, the graphics seem to suggest either a strong correlation between the various dimensions or a strong city effect or, perhaps, a combination of both. It is striking that in Dakar the scores for the unit, infrastructure, and tenure mix are all high—96% have permanent walls, 82% have an electricity connection, and the ratio of owner-occupiers to tenants is 74:26. Similarly, in Nairobi the scores are low for all three of these dimensions—about 12% have permanent walls, 22% have electricity, and the ratio of owner-occupiers to tenants is 8:92. The correlation between the various dimensions is clearly an area for further research; such research is required to improve our understanding of the empirical links between the various dimensions and also shed light on the direction and strength of the causality (if any). Given that each vertex is multidimensional, we take a closer look at different indicators of the four dimensions.

Housing unit quality in Nairobi is poor compared with Dakar. As mentioned above, only 12% of units in Nairobi have permanent walls as compared with 96% of those in Dakar. Residents in Dakar also have larger structures with the average number of rooms per household being 4.1. Most of Nairobi's slum residents live, eat, and sleep in roughly one room. In terms of crowding within structures, the two cities are more closely aligned—there are 2.6 persons per room in Nairobi and 2.8 persons per room in Dakar; this reflects the fact that the average household size in Dakar (9.6) is significantly larger than in Nairobi (3.0). Housing units in Nairobi's slums are constructed with less permanent materials and are smaller, but not more crowded, than those in Dakar.

<sup>(7)</sup>Duration of stay is easy to score, but challenging for interpretation. For instance, short-term residents have fewer incentives to invest in their settlement, but excessively long stays may well be a sign of 'immobility' and/or a nonfluid housing market, which could also negatively impact upon inclination to invest. For all such indicators, it is worth plotting the values and studying them over time and across locations.

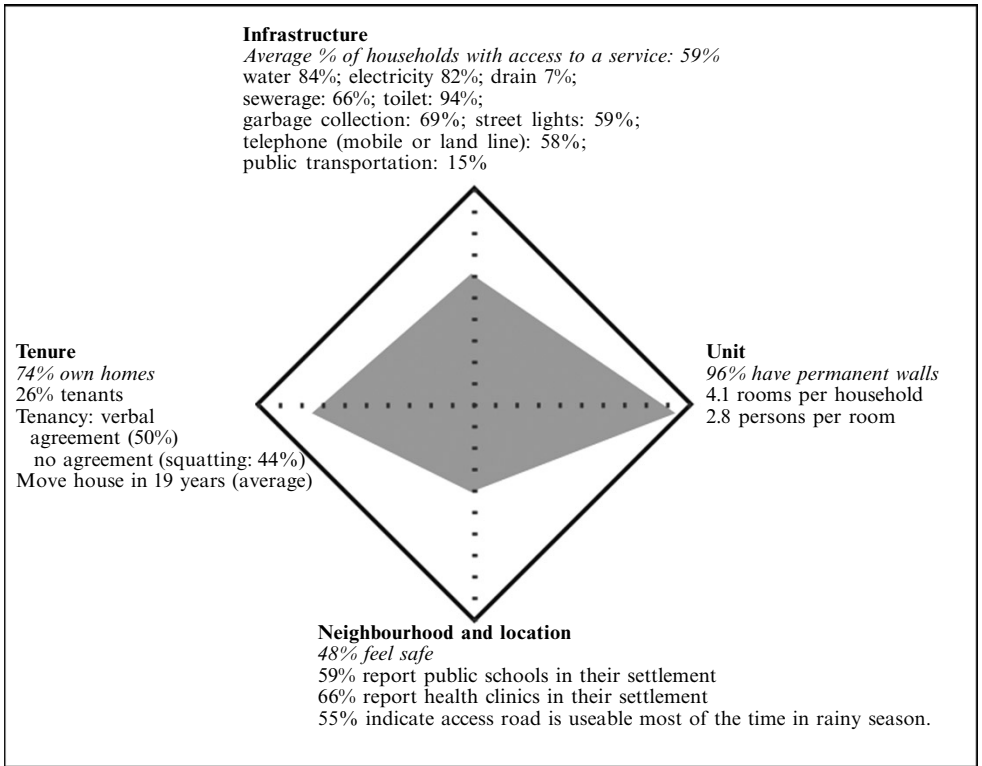


**Figure 2.** Living conditions diamond for Nairobi. (The figure in italics for infrastructure represents an overall average of reported *access* to any one of the nine services listed. Access roads were omitted from the calculation because the data were not directly comparable across the two cities.)

Access to various kinds of infrastructure in Nairobi's slums is appalling compared with Dakar. As illustrated in figure 2, only 22 % of slum residents in Nairobi have access to electricity and 19% have access to piped water in the form of an in-house connection or a yard tap. Dakar's residents are served quite well: 82% have electricity and 84% have a piped water connection. There is one exception—drainage infrastructure: only 5% of households in Dakar report that they have a *working* stormwater drain outside their house, compared with 25% in Nairobi.

Tenure status in the two cities differs dramatically. Nairobi's slums are comprised of tenants—only 8% of settlement residents reported that they own their own home.<sup>(8)</sup> The vast majority of the remaining 92% pay rent to absentee 'structure owners'; these owners do not own the land, just the structures erected upon (primarily) government land. In Dakar the majority own their homes and just over a quarter are tenants (26%). Nairobi settlements, moreover, are characterized by greater mobility and high resident turnover, with the average Nairobi slum resident staying in a home for about five years. Dakar's turnover is low with residents staying in the same home for an average of nineteen years. Finally, the situation relative to perceived tenure security is quite different across the two cities: 71% of Dakar's slum residents compared with 51% of Nairobi's perceive their tenure as secure.

<sup>(8)</sup> The finding of high levels of rental tenancy in the Nairobi settlements is consistent with the work of Amis (1984; 1996) amongst others.



**Figure 3.** Living conditions diamond for Dakar. (The figure in italics for infrastructure represents an overall average of reported *access* to any one of the nine services listed. Access roads were omitted from the calculation because the data were not directly comparable across the two cities.)

With respect to the neighbourhood, we have limited data. This is because the survey instrument was not based on the diamond—the survey was designed and implemented before the diamond was developed. Nevertheless, we do know that slums in Nairobi are characterized by high density, irregular layouts, and narrow access roads. By comparison, Dakar’s settlements tend to be less dense, less irregular, and have wider (but usually unpaved) access roads. We do have survey data on ‘perceived safety’ of the neighbourhood. The data reveal that residents’ own perception of safety is low in absolute terms in both cities, but better in Dakar in relative terms—only 37% of Nairobi’s slum residents report that they feel safe in their own settlement as compared with 48% of those in Dakar.

#### 4.2 The diamond as a tool for designing interventions in Dakar and Nairobi

Why does the quality of living conditions differ so dramatically in the two cities? What actions can help improve conditions? We examine each city in turn. We will start with Dakar and illustrate how the diamond was used to gather more specific information on living conditions and how it works as a tool for making critical decisions about interventions.

In absolute terms, are living conditions in Dakar’s slums acceptable? What additional interventions, if any, are required? A closer look at the infrastructure vertex of the diamond indicates that, although unit-level level access to utility infrastructure is high (eg 84% for water and 82% for electricity), access to certain neighbourhood-level services, especially drainage, is poor—a mere 5% have a working

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drain outside the house.<sup>(9)</sup> From a normative perspective, the goal is universal access to these basic services—that is, a 100% score on the infrastructure vertex. From a practical perspective, it is important to determine whether lack of a given service is really a problem in a given context and whether households consider it a priority. For example, the fact that 95% of Dakar’s slum residents lack a working drain outside their house signals a huge problem, but it would be less of an issue if there is little or no rainfall in this city.

To determine how worrisome some of these infrastructure deficits are, follow-up research was conducted in selected settlements in Dakar in August 2008. In-depth field research and household interviews revealed that the drainage problem is very serious and also a priority for residents (Iskander, 2008). Many of Dakar’s settlements experience flooding during the summer rainy season. Rainwater collects and lingers for weeks in stagnant ponds; the rainwater, moreover, is contaminated with organic wastes including wastes from overflowing pit latrines. The research team concluded that the drainage problem is undercutting the gains from more adequate provision of water and sanitation.

The improvement of stormwater drainage is a crucial intervention for improving living conditions in Dakar’s settlements—investments in drainage will reduce flooding and enable additional gains from the prior investments in water and sanitation. Should drainage be provided uniformly to all settlements in the city that currently lack it? Based on the research team’s evaluation of ‘neighbourhood and location’, the answer would be ‘no’—a more context-sensitive intervention is required (Iskander and Gulyani, 2010). Many northeastern settlements of Dakar are located on low-lying swamplands called the Niayes. Settlements here have high water tables year round and experience permanent flooding during the wet season (late July–early October). The location is inappropriate for settlement and infrastructure investment because there is little chance of managing storm water and groundwater in a way that can offset locational disadvantages. Proactive physical planning could have prevented this area from being settled: now the government faces the difficult prospect of destroying established housing stock and relocating the population or tolerating unsanitary conditions and bearing the resultant costs.

Compared with Dakar, living conditions in Nairobi settlements are deficient in all dimensions. Dramatically worse living conditions, however, do not translate into a key benefit that one expects from slum living: lower rents. Nairobi’s slum residents instead are trapped in a market characterized by low-quality but high-cost shelter (Gulyani and Talukdar, 2008). Why is quality so low and prices so high?

The answer is found in two dimensions of tenure: tenure mix and duration of stay. Nairobi’s settlements are overwhelmingly populated by tenants renting from absentee landlords. Put another way—in Dakar, the proportion of tenants to owner-occupiers is 24:76; in Nairobi there are ninety-two tenants for every eight owner-occupants. Duration of stay also plays a role. Residents of Nairobi’s slums are relatively transient—staying on average for five years in a settlement before moving on; residents of Dakar’s spend an average of nineteen years in a settlement. In Dakar the combination of high levels of ownership and low turnover rate has created incentives for residents to invest and also facilitated extension of infrastructure by utilities. In Nairobi slums, by contrast, low levels of resident ownership and the high turnover rate help explain why none of the three key stakeholders—the tenants, the absentee landlords, and the

<sup>(9)</sup> With respect to stormwater drainage, coverage is high in Nairobi (58% have a drain outside their house); but access to that service is lower (only 25% of respondents indicated the drain outside their house works). In Dakar 7% say that drains exist but 5% say that these work. Figures 2 and 3 show *access* to the services, not performance.

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government—have been either willing or able to invest in systematically improving the units, the infrastructure, or the neighbourhood layout and amenities.

A successful intervention in Nairobi would entail simultaneous action on two or, perhaps, three of the four components of the diamond—tenure mix, infrastructure, and, in many cases, the neighbourhood's layout and circulation. An intervention that increases the proportion of homeowners relative to tenants is likely to not only create incentives for investment but also help reduce the turnover rate. One option for altering the tenure mix is land reform—where the government, as owner of the land in the majority of slum settlements, could transfer rights to the tenants and refuse to recognize those of the absentee structure owners. However, as this would be politically difficult, Kenya's Ministry of Housing is currently working with a principle of 'one stakeholder, one right to a housing unit' (that is, every current tenant and structure owner has the right to one plot or unit in an upgraded or new settlement). The transformation in tenure alone will not be sufficient to improve living conditions—this is because neither the infrastructure nor the neighbourhood layout and circulation will improve without serious planning, negotiation among stakeholders (residents and structure owners), and a high level of capital investment to bring in basic services. Whether our proposed intervention is 'right' or acceptable is not really the point here—we are merely trying to demonstrate how one can use the framework to think through and design interventions to improve living conditions.

#### **4.3 Limitations of the framework**

There are a few limitations to acknowledge. First, while the framework provides a snapshot of the living conditions and provides insights into settlement dynamics, it does not isolate causal variables that explain *why* the conditions are good or bad. It is important to acknowledge that some factors influencing living conditions lie outside the framework—for example, government policy regarding whether or not to provide services in informal settlements may be a key reason why living conditions are poor. A second limitation is that the diamond focuses primarily on physical conditions and factors. To understand overall conditions in a settlement better, it is crucial to understand who lives there, what they do, the extent and nature of the social and political networks in that community, and so on. In our view, the diamond needs to be seen as one crucial piece of a larger analysis. The diamond would be more powerful if used in concert with frameworks or data that help capture at least basic information regarding social and economic development in a given settlement—including, at a minimum, income poverty or wealth, education levels, employment types and levels, and social networks. A third limitation relates to weighting and to the relative importance of the variables in the diamond. At present, all data are weighted the same: housing-unit variables are as important as tenure, infrastructure, and location. Given that this research draws on just two cases/cities, we are currently more comfortable presenting several indicators and not making a judgment on relative weights. But as the empirical base grows and as other analysts weigh in on this discussion, an index can certainly be created.

#### **5 Conclusions**

The cases of Nairobi and Dakar illustrate what we asserted at the outset: settlements dubbed slums are diverse and complex. To deal effectively with these settlements—and to understand them relative to places that are not considered to be slums, we need a multifaceted yet simple framework for depicting the contextual details of different types of settlements, optimally with a comparative and longitudinal perspective. The living conditions diamond, which we have presented in this paper, moves us in this direction. Theoretically, the diamond builds on the broader literature on urban poverty



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and housing and also contributes to it in three ways. First, the indicators associated with the four dimensions of the diamond create a composite that provides a comprehensive and multidimensional overview of settlement conditions. This composite allows us to analyze and compare settlements for quality better. Comparative analyses are powerful in that they provide a much needed and often missing objective perspective on settlement conditions; without such a comparative lens, levels of deprivation—such as the extreme levels experienced by Nairobi’s slum residents—can become accepted as the normal state of things rather than an anomalous and gross inequity necessitating action.

Second, while the framework presents a compelling static snapshot suitable for comparison it also emphasizes interactions amongst variables that are usually treated or studied in isolation; this, in turn, allows for a dynamic understanding of living conditions. A change in one factor can influence changes in the others. We do not pretend to know all the potential relationships here, nor do we contend that the relationships are necessarily consistent across all settlements, but we do argue for the utility of using the framework to deepen our understanding of settlements, particularly over time. If data were collected at periodic intervals and plotted using the diamond, the relationship between various factors (eg the neighbourhood) or interventions (eg titling) might be explored and changes in quality analyzed over an extended timeframe. By drawing attention to the dynamics—between variables and over time—the framework helps emphasize that settlements can follow different trajectories and that these can shift with time (eg ‘slums of hope’ can become ‘slums of despair’ and vice versa).

Third, because the diamond facilitates a more contextualized understanding of settlements, it also serves as a powerful tool for planning and evaluation of ameliorative interventions. In its static dimension—the diamond as a snapshot of quality at a given moment in time—the framework highlights which aspects of living conditions are the most dire and helps identify priorities for a given settlement. But, because the diamond also emphasizes interactions between variables, it can also help practitioners think through different strategies for how to address these problems. The diamond helps identify appropriate points of entry, think through the interactions or outcomes associated with the planned intervention, and sequence ameliorative actions. For example, practitioners can use it to determine whether they will directly invest in improving all four aspects, or act on a subset that will indirectly trigger improvements in the other dimensions. Through the consistent use of the diamond as a planning and evaluation tool we could start to flesh out our understanding of the relationships between its four vertices.

In proposing this framework it is not our intention to be definitive and to close ongoing debates around the term ‘slum’ or the living conditions in these settlements; rather it is an attempt to help structure them. We would argue for testing and refining this framework so that we might develop both context-specific definitions and, perhaps, also an agreed-upon cross-national definition of slum. Specifically, this framework can be used by individual countries to analyze physical living conditions *within any given city* (perhaps disaggregated by neighbourhoods) and define their own version of what constitutes ‘slum’ versus ‘poor quality’ housing. Because the diamond depicts in explicit terms relative levels of deprivation, countries and the urban residents can confront inequality and, while uncomfortable, decide whether the differences in living conditions across neighbourhoods are tolerable or are in need of urgent redress. If the framework were used consistently as a measurement tool by countries, cities, donor agencies, and academic researchers, it would facilitate comparison of living conditions *across cities* in different settings. In conclusion, while much is known about social and

economic development—we regularly gather and analyze data on key indicators of income poverty, education, and employment—the physical living conditions that are the focus of the diamond remain an analytically neglected but crucially important aspect of well-being and development. The diamond framework offers a step forward because it not only brings attention to this neglected aspect of well-being but also helps to structure inquiry and promises to improve our understanding of the dynamics of physical living conditions over time.

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