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Distribution and Access to Urban Infrastructure by Residential Property Occupiers in Minna, Nigeria

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Abstract

Urban infrastructure encompasses the essential amenities, facilities, and services that make life easy and comfortable for residents within neighbourhoods. The provision of nine basic urban amenities across thirteen neighbourhoods in Minna, and measurement of access to amenities by households are the points of evaluation in this study. A total of 1,134 housing units were sampled using the stratified and systematic random sampling techniques. Data were generated from questionnaires, inspections and enumeration in the study area. Weighted mean scores were computed and indexed to determine overall accessibility to amenities. The location quotient (LQ) was used to estimate the degree of concentration of the amenities, while the Welch adjusted analysis of variance tested for a significant difference in the distribution of urban amenities across neighbourhoods. The adjusted Welch's F ratio was 2.959, which was significant at the 0.05 alpha level, suggesting an uneven distribution of amenities across neighbourhoods in the study area. This study emphasises that government at all levels should prioritise provision and development of amenities and also support efforts by communities regarding basic amenities and services.

Keywords: Access; Households; Neighbourhoods; Provision; Urban amenities

1. Introduction

It is generally accepted that urban infrastructure has positive and indispensable impact in the development of nations. Asides its influence on productivity of labour and capital, infrastructure adds to the overall welfare of households. Consequently, it increases urbanization. To enjoy its

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merits, emerging economies invest heavily in infrastructure projects, with sizeable portion in shopping centres, educational institutions, health care centres, recreation centres, roads, waste disposal facilities, security, electricity, and portable water supply. The Queensland Government (2007) describes investment in basic urban amenities as vital for the health, well-being and economic prosperity of communities.

According to Bhagat (2010), access to these basic amenities is a critical determinant of urban quality of life. Rossiter and Greig (2011) describe urban amenities as essential elements of liveability, which is vital in delivering quality and socially sustainable urban outcomes in newly developed areas. The provision of amenities contributes to the development of healthy and sustainable communities by ensuring that population growth is supported by a network of facilities and services that are accessible, affordable and responsive to local community needs (Rossiter & Greig, 2011). Anofojie et al. (2014) emphasise that the provision of neighbourhood amenities are basic requirements that determine the socio-economic well-being of an area. Graham and McFarlane (2014) discuss how urban infrastructure projects are vehicles for achieving development policy goals that can have critical impacts on urban lives. What infrastructure means to city inhabitants and how it impacts their lives are two aspects of exploration in this study.

In the past years, there have been documented cases of inadequate urban amenities in many developing countries, and agitations for government to live up to its responsibility in that regard. Empirical studies have also revealed that urban infrastructure is unequally distributed across communities in developing countries. In such situations, many people get entrapped in a never-ending struggle to gain access to infrastructure in their pursuit for quality life (Oyerinde, 2006). In a 2006 report, the World Bank (2006) reports that quite a number of citizens in developing countries do not have access to basic amenities. Ujoh and Kwaghsende (2014) observe that the provision of adequate amenities and facilities is becoming increasingly difficult due to rapid population growth. While Otegbulu and Adewunmi (2009) describe the presence or absence of amenities as the major difference between a slum and a non-slum area, Saed et al. (2015) explain that lack of urban amenities is a good catalyst for squatter formation and worsening housing conditions in urban districts. NISER (2001), Onokerhoraye (2002), and Halpern and Mumssen (2006), identify factors such as rapid urbanization, insistent economic and political crises, bad governance, inefficient infrastructural delivery systems, as well as low investment in the sector as reasons for the low level of amenities in developing countries.

Duflo, Galiani and Mobarak (2012) observe that inadequate amenities (particularly access to water and sanitation) is particularly pressing in cities, and pressure on available amenities are increasing beyond capacity of the facilities. Anofojie et al. (2014) describe the inadequacy or complete absence of amenities in housing estates as a major setback or hindrance to the quality of such estates. It is widely accepted that major challenges associated with infrastructure result from increased urban growth and density, as well as the inability to effectively manage existing infrastructure. Pieterse and Hyman (2014) emphasise that the urban infrastructure inadequacies are more disturbing for developing countries due to greater amounts of current infrastructure capital stocks that are crumbling and the increasing rates of urbanization that necessitate new infrastructure development.

Identification of basic urban infrastructure that sustains the residential properties in Minna and an examination of their distribution across residential neighbourhoods are the two points of emphasis in this paper. It further examined residents' ease of access to the identified infrastructure and provided workable recommendations to forestall urban disintegration.

2. Provision and Access to Urban Amenities in Urban Centres

With the increased rate of urbanization in parts of developing countries, improved access to urban amenities have become essential. Over the years, government in Nigeria has been the principal provider of amenities. However, in recent times, the attention of government has gradually shifted from being the principal provider, to being a facilitator in the process of providing the amenities (Ogu, 2001; UNCHS, 2006). In the observation of Ogu (2001), private sector and community participation in development are increasingly gaining recognition as an important tool for mobilising resources and organising people to take collective action in providing for their welfare in Nigeria.

Ogu (2005) identifies three broad strategies for the development of infrastructure in Nigeria. These are: the public or conventional approach, characterised by urban policies in which physical planning, implementation and maintenance of urban infrastructure are firmly in the hands of public agencies; the private approach, which seeks to incorporate private operators in infrastructure development; and the participatory approach which seeks to improve infrastructure services through participatory partnerships of non-governmental organisations (NGOs), community based organisations (CBOs), international organisations, communities, as well as private and public sector groups. Ibem (2009) identifies six main categories of community organisations involved in public infrastructure provision in Ohafia, which were independent from the framework of the local government authority.

The first two are community development unions (CDUs) and the age grades. The other four are women, youth, socio-cultural and faith-based organisations, which were identified to have made significant contributions in the provision of facilities in the area. Facilities provided include educational, health, power supply, sanitation, recreation and transport related facilities. This study suggests that partnership between government and community-based organisations has great potential in addressing the poor state of public infrastructure in low-income communities in Nigeria. Ibem (2009), however, emphasises that community infrastructure provision approaches may not be viable for certain categories and scale of infrastructural projects, such as large scale or capital intensive projects.

Worley Parsons Resources and Energy (2010) outlines government/private sector roles in the provision of infrastructure and they include: spatial planning, prioritisation, funding (equity and debt), building, owning and/or operating infrastructure assets, and public acquisition of sites. Exclusive government roles are: establishing standards, environmental approvals, regulation, taxation, and financiers of last resort. Jibril and Garba (2012) explain the roles of the Federal Capital Development Authority (FCDA) and private developers in the provision of infrastructure in mass housing estates in Abuja. As contained in the development lease agreement between the developer and FCDA for allocations done between 2005 and 2007, the Authority was responsible for the provision of primary infrastructure like major road arteries, power supply from the main electrical grid, water supply from the main trunk line, and major sewer line connection. Developers were expected to provide the secondary infrastructure like secondary roads and local streets within the estate, drainages and sewer lines, power supply to the individual dwelling units, and local facilities for shopping and recreation. However, it was observed that the government often failed to fulfil its own side of the bargain and has failed to provide the primary infrastructure to most of the districts as agreed in the development lease agreement (Jibril & Garba, 2012).

It is pertinent to note that the need to consider the priorities of end users in the provision of urban infrastructure is also important. Due to the unique nature of different geographical areas, as well as preferences of end user, certain infrastructure is highly demanded in certain areas than others. In an effort to address challenges associated with the provision of urban infrastructure, Worley Parsons Resources and Energy (2010) recommended that policymakers in coming years will need to: improve efficiency in the construction and operation of infrastructure, increase efficiency levels in the use of infrastructure through better management of demand, ensure infrastructure are reliable and resilient, enhance the design and capacity of infrastructure to meet future environmental and security challenges, and ensure adequate maintenance, upgrading, and refurbishment of existing facilities.

3. Methodology

A total of 1,134 housing units in thirteen (13) selected residential neighbourhoods in Minna were sampled for this study with focus on nine elements of urban infrastructure: shopping centres, educational institutions, health care centres, recreational facilities, major roads, waste disposal sites, electricity, portable water and security. Questionnaire was administered on household heads of the sampled housing units. The questionnaire was pilot tested for its reliability. Cronbach alpha (α) statistic revealed a Cronbach alpha (α) coefficient of 0.78; an indication of good internal constancy. This aligns with the view of Pallant (2011) who describes a reliability coefficient of 0.7 and above as acceptable. A total of 1,473 questionnaires were administered and 1,134 were completed and returned representing a 77% response rate.

Stratified and systematic random sampling was adopted at different stages in the study. First, the study area was divided into strata based on geographical area, i.e., each of the sampled areas/neighbourhoods constituted a stratum. The next stage involved the selection of respondents from each stratum using the systematic random sampling technique, with the selection of every 7th house for sampling. Inspections focused on the numbers of infrastructure in each of the sampled areas and were recorded. Ordinal variables were postulated on a three point scale to measure the accessibility of dwelling units to each of the identified amenities.

The measurement scale for access to infrastructure by residents was derived based on the consensus opinions of respondents during the pilot study. Respondents described a walking distance of 1 to 15 minutes to any of the amenities as 'acceptable.' However, residents were not willing to walk more than 30 minutes to access any of the facilities. Consequently, a walking distance of 1 to 15 minutes was considered as 'very close,' 16 to 30 minutes considered as 'fairly close,' while a walking distance of more than 30 minutes was considered 'far.' This is similar to the recommendation of the Leeds Unitary Development Plan (2006) which describes the local accessibility standard to an amenity site as equivalent to 10-minute walk time. Regarding security, electricity, and water supply, the number of police stations, electricity transformers, and public boreholes were used as proxies.

The location quotient (LQ) estimated the degree of concentration of infrastructure in the sampled areas. For instance, a LQ of greater than 1 indicates a heavy concentration of a particular infrastructure relative to its average across the study area; a LQ of 1 means a fair share of a particular infrastructure, while a LQ of less than 1 represents a low concentration of infrastructure relative to its average across the study area. The Welch adjusted ANOVA was employed to test if the observed differences in the distribution of urban infrastructure across the study area (given by their LQs) are statistically significant. The Welch adjusted ANOVA was adopted following the violation of the homogeneity of variance assumption. Since homogeneity of variance is a stringent assumption underlying ANOVA, the most common assessment of homogeneity of variance (i.e., the Levene's test) was used to test for homogeneity of variance for urban infrastructure location quotients. XLSTAT (2016) affirms that the Welch ANOVA is more reliable than the classic *F* when variances are unequal. In other words, when the assumption of homogeneity of variance is not met, the one-way ANOVA is not robust enough to be used. Thus, the Welch ANOVA is much more accurate.

4. Data Analysis

4.1 The Distribution of Urban Infrastructure across Neighbourhoods

The number of each amenity/infrastructure across the sampled neighbourhoods is presented in Table 1.

Table 1: Number of each externality in the sampled areas

Neighbourhood	Shopping centers	Educational Institutions	Health care Centres	Recreation centres	Major roads	Refuse dumps	Security (No. of police stations)	Electricity (No. of Transformers)	Water supply (No. of boreholes)
Barkin Saleh	1	2	1	0	1	8	1	3	2
Maikunkele	4	2	1	0	1	5	1	3	1
Chanchaga	5	5	2	0	2	7	1	4	1
Kpakungu	6	3	1	1	2	13	1	5	0
Maitumbi	3	2	1	1	2	10	1	3	2
Gbaganu	4	1	2	0	0	8	0	2	2
Nyikangbe	4	1	1	0	0	7	0	2	2
Shango	3	1	1	1	2	7	0	3	0
Sauka kahuta	8	1	0	0	3	6	1	4	2
Tayi Village	3	1	1	0	1	5	0	2	1
Tudun Fulani	3	3	1	0	1	9	1	3	2
Fadikpe	6	0	1	0	1	5	0	3	1
Gidan Mangoro	0	2	1	0	1	4	0	1	3
All the Neighbourhoods	50	24	14	3	17	94	7	38	19

Note: Researchers' data analysis, 2019

At a glance, Table 1 reveals an unequal distribution of urban infrastructure across neighbourhoods. However, the location quotient (LQ) was further used to estimate the degree of concentration of the infrastructure in the sampled areas.

4.1.1 Location Quotients of Urban Infrastructure in the Sampled Neighbourhoods

The location quotients for the nine urban infrastructures under consideration were computed for each of the sampled neighbourhoods and presented in Table 2.

Table 2: Neighbourhoods' location quotient for urban infrastructure in the study area

Neighbourhood	Shoping centers	Educational Institutions	Health care centers	Recreation centers	Major roads	Refuse dumps	Security (No. of police stations)	Electricity (No. of transformers)	Water supply (No. of Boreholes)
Barkin saleh	0.390	3.002	1.394	0.000	1.148	1.661	0.691	1.541	2.054
Maikunkele	0.996	1.915	0.889	0.000	0.732	0.662	1.106	0.983	0.655
Chanchaga	1.057	4.066	1.510	0.000	1.244	0.787	1.581	1.113	0.556
Kpakungu	0.836	1.607	0.498	2.322	0.819	0.963	0.850	0.916	0.000
Maitumbi	0.426	1.092	0.501	2.366	0.835	0.755	1.106	0.560	0.747
Gbaganu	0.743	0.714	1.326	0.000	0.000	0.790	0.000	0.489	0.977
Nyikangbe	0.728	0.700	0.650	0.000	0.000	0.677	0.000	0.479	0.957
Shango	1.148	1.472	1.367	6.379	2.251	1.425	1.580	1.511	0.000
Sauka kahuta	3.022	1.453	0.000	0.000	3.333	1.145	2.911	1.988	1.988
Tayi village	2.055	2.635	2.447	0.000	2.015	1.822	1.106	1.803	1.803
Tudun Fulani	1.057	4.065	1.258	0.000	1.036	1.686	0.614	1.391	1.854
Fadikpe	2.066	0.000	1.230	0.000	1.013	0.916	1.106	1.360	0.906
Gidan mangoro	0.000	6.842	3.177	0.000	2.616	1.893	1.382	1.170	7.023

Note: Researchers' data analysis, 2019

The varied location quotients in Table 2 re-affirm the unequal distribution of urban infrastructure across neighbourhoods in the study area. Table 2 shows that shopping centres, educational institutions, health care centres, recreation centres, major roads, refuse dumps, electricity and water supply are unevenly distributed across neighbourhoods in the study area.

Precisely, Barkin Saleh, Maikunkele, Kpakungu, Maitumbi, Gbaganu, Nyikangbe, and Gidan Mangoro had low concentration of shopping centres relative to its average across the study area. Location quotients of less than 1 ($LQ < 1$) signifies this. Shopping centres in Chanchaga and Tudun Fulani had location quotients of 1.057 each, which signifies that the two areas had a fair share of shopping centres. In Shango, Sauka Kahuta, Tayi Village and Fadikpe, shopping centres had location quotients of 1.148, 3.022, 2.055, and 2.066 respectively. These imply that the areas had heavy concentration of shopping centres relative to its average across the study area.

Location quotients of 0.714, 0.700, and 0.000 for educational institutions in Gbaganu, Nyikangbe and Fadikpe respectively implies that the areas had less than fair shares of educational institutions compared to its average across the study area. With LQ of 1.092, Maitumbi had a fair share of educational institutions, while Barkin Saleh with 3.002, Maikunkele with 1.915, Chanchaga with 4.006, Kpakungu with 1.607, Shango with 1.472, Sauka Kahuta with 1.453, Tayi Village with 2.635, Tudun Fulani with 4.065, and Gidan Mangoro with 6.842 had high concentrations of educational institutions. In terms of health care centres, five (5) out of the thirteen (13) neighbourhoods had a very low concentration relative to its average across the study area. The indicators of the very low concentration are location quotients of 0.889 for Maikunkele, 0.498 for Kpakungu, 0.501 for Maitunmbi, 0.650 for Nyikangbe, and 0.000 for Sauka Kahuta.

On the one hand, quite a number of major roads span across the sampled neighbourhoods, illustrations in Table 2 shows that while Gbaganu and Nyikangbe had no major roads (i.e., LQ = 0.000 each), Tudun Fulani and Fadikpe with location quotients of 1.036 and 1.013 respectively had a fair share of major roads, relative to its average across the study area. On the other hand, Sauka Kahuta, Shango and Tayi Village with location quotients of 3.333, 2.251, and 2.015 respectively had a high concentration of major roads, while Maikunkele, Kpakungu, and Maitumbi which had location quotients of 0.732, 0.819, and 0.835 respectively had low concentration of major roads relative to its average across the study area.

Data in Table 2 shows that the LQs for refuse dumps also emphasised its uneven distribution across the study area. Seven (7) of the thirteen (13) neighbourhoods whose LQs of refuse dumps were less than 1 had low concentration of refuse dumps, compared to the other six (6) neighbourhoods which had high concentration. Similarly, Gbaganu, Nyikangbe, Shango, Tayi Village, and Gidan Mangoro had relatively low crime rates with 0.175, 0.343, 0.722, 0.646, and 0.839 LQs respectively, while Maikunkele with an LQ of approximately 1 had a fair level of crime occurrence.. Barkin Saleh, Chanchaga, Kpakungu, Tudun Fulani, and Fadikpe recorded relatively high levels of crime occurrence, which 2.209, 1.197, 1.183, 1.662, and 1.625 LQs respectively signified.

A cursory look at Table 2 further reveals that four out of the thirteen sampled neighbourhoods had low concentrations of electricity transformers relative to the average across the study area. These are Kpakungu with 0.916, Maitumbi with 0.560, Gbaganu with 0.489, and Nyikangbe with 0.479. Maikunkele with an LQ of approximately 1 had a fair share of electricity transformers, while Barkin Saleh, Chanchaga, Shango, Sauka Kahuta, Tayi Village, Tudun Fulani, Fadikpe, and Gidan Mangoro had high concentration of transformers relative to its average across the study area. Their location quotients which are 1.541, 1.113, 1.511, 1.988, 1.803, 1.391, 1.360, and 1.170 respectively are the indicators. The last column of the table also showed that five neighbourhoods had high concentrations of boreholes, while the other 8 neighbourhoods had low concentrations relative to the average across the study area.

Table 3: Mean Location Quotients

Neighbourhoods	N	Mean	Concentration of urban infrastructure
Barkin Saleh	9	1.32	High
Maikunkele	9	0.882	Low
Chanchaga	9	1.324	High
Kpakungu	9	0.979	Average
Maitumbi	9	0.932	Low
Gbaganu	9	0.56	Low
Nyikangbe	9	0.466	Low
Shango	9	1.904	High
Sauka Kahuta	9	1.76	High
Tayi Village	9	1.743	High
Tudun Fulani	9	1.44	High
Fadikpe	9	0.955	Average
Gidan Mangoro	9	2.678	High

Note: Researchers' data analysis, 2019

At an aggregate level, mean location quotients in Table 3 depict an uneven distribution of urban infrastructure across neighbourhoods in the study area. The table shows that Barkin Saleh, Chanchaga, Shango, Sauka Kahuta, Tayi Village, Tudun Fulani, and Gidan Mangoro had an overall high concentration of urban infrastructure (Mean LQs > 1) relative to its average across the study area, while Maikunkele, Maitumbi, Gbaganu, and Nyikangbe had an overall low concentration of urban infrastructure (Mean LQs < 1). In Kpakungu and Fadikpe, the mean LQ = 1, thus signifies a fair share of urban infrastructure.

4.1.2 Test for a Significant Difference in the Distribution of Urban Infrastructure across Neighbourhoods in the Study Area

The Levene's test is presented in Table 4.

Table 4: Levene's test of homogeneity of variances (for urban infrastructure location quotient)

Levene Statistic	df1	df2	Sig.
3.431	12	104	.000

Note: Researchers' data analysis, 2019

Table 4 shows the Levene's test of homogeneity of variances for urban infrastructure location quotients. It shows a Levene statistic of 3.431, and a corresponding p-value of 0.000. The p-value is less than the alpha level, i.e., p (0.000) < α (0.05), thus indicating a violation of the assumption that variances of urban infrastructure location quotients are homogenous.

Table 5: Welch test for equality of means for urban infrastructure location quotient

	Statistic[a]	df1	df2	Sig.
Welch	2.959	12	40.168	.005

a. Asymptotically F distributed

Note: Researchers' data analysis, 2019

Table 5 shows that Welch's F (12, 40.168) = 2.959, and p = 0.005. The Welch's adjusted F ratio is significant at the 0.05 alpha level, i.e., p (0.005) < 0.05, and implies that the means of urban infrastructure location quotients are not equal across neighbourhoods. It can, therefore, be concluded that there is a significant difference in urban infrastructure location quotients across the sampled neighbourhoods, and by implication, there is a significant difference in the distribution of urban infrastructure across neighbourhoods in the study area.

4.2 Access to Urban Infrastructure in the Study Area

Households' access to urban infrastructure in the study area was measured and results are presented as follows:

Table 6: Access to Urban Infrastructure by Residents in the study area

Infrastructure	Level of accessibility			
	Very close	Fairly close	Far	Total
Shopping complexes	287 (25%)	427(38%)	420 (37%)	1134 (100%)
Educational institutions	232 (21%)	412 (36%)	490 (43%)	1134 (100%)
Healthcare centres	236 (21%)	400 (35%)	498 (44%)	1134 (100%)
Recreation centres	56 (5%)	187 (17%)	891(79%)	1134 (100%)
Major roads	263 (23%)	407 (36%)	464 (41%)	1134 (100%)
Waste disposal sites	325 (29%)	479 (42%)	330 (29%)	1134 (100%)
Electricity	429 (38%)	296 (26%)	409 (36%)	1134 (100%)
Public boreholes	342 (30%)	505 (45%)	287 (25%)	1134 (100%)
Police stations	521 (46%)	437 (39%)	176 (15%)	1134 (100%)

Note: Researchers' data analysis, 2019

Analysis in Table 6 depicts that only 25% and 21% of dwellers in the study area described the proximities of shopping complexes and educational institutions respectively to their dwelling units as 'close.' While describing accessibility to recreational centres, housing units of 79% of respondents were far from recreational centres, while only 21% of respondents had their housing units close to health care centres. Similarly, 23% of respondents reside close to major roads, 29% were close to refuse disposal sites, 46% were close to police stations, and 30% resided close to public boreholes.

Table 7: Weighted mean scores for accessibility to urban infrastructure

Infrastructure	Weighted mean score	Remark
Shopping complexes	1.89	fairly close
Educational institutions	1.78	Far
Healthcare centres	1.77	Far
Recreation centres	1.23	Far
Major roads	1.82	fairly close
Waste disposal sites	2	fairly close
Electricity	2.02	fairly close
Portable water	2.05	fairly close
Police stations	2.3	fairly close

Note: Researchers' data analysis, 2019

Analysis in Table 7 shows that residencies of respondents are fairly close to shopping centres, major roads and waste disposal sites, portable water, electricity and police stations. It also shows that respondents reside far from educational institutions, health care centres, and recreation centres.

Though adequate infrastructure is a key element of sustainable communities, the inequality in the distribution of these infrastructures across areas is a serious course for concern. These inequalities can mainly be attributed to rapid population growth and poor physical planning. It is, therefore, imperative that all concerned stakeholders make concerted efforts at ensuring the provision of adequate amenities in residential areas to effectively serve the teeming population.

5. Conclusion

Results in this research have shown that shopping centres, educational institutions, health care centres, recreation centres, major roads, waste disposal sites, portable water, electricity and police stations are unevenly distributed across neighbourhoods in Minna, Nigeria. The findings are consistent with those of Morenikeji (1995) which found an uneven distribution of social facilities in parts of Ondo State, Adefila (2013) which reports regional inequalities in socio-economic development in Nassarawa State, and Efobi and Anienobi (2014) which reports the uneven distribution of health and education institutions, road and rail transport system, recreational facilities, and public utilities such as water supply, electricity supply, and solid waste management facilities across 20 neighbourhoods in Enugu State. Other findings reveal varied degrees of respondents' access to the identified infrastructure.

This study further shows that the need for increased development and proper distribution of urban infrastructure, particularly in residential neighbourhoods. The perceived gaps should be closed within the shortest possible time to forestall urban disintegration. To achieve this, governments can establish more investor-friendly environments by designing more supportive policy and regulatory environments, creation of platform for more involvement of investors in infrastructure project developments and also ensure positive returns are scaled along with economic and social goals.

Even though every infrastructure has unique management challenges, effective infrastructure management can help improve performance in many vital areas and provide an impetus for adequate response to current and future challenges. The infrastructure inadequacies are more disturbing because of the challenges of upgrading existing infrastructure failures and inadequate funding to provide new projects and services. Inadequacy in infrastructure availability and affordable funding leave urban areas in the emerging worlds more vulnerable. For urban areas in the global south, the resulting vulnerability needs to be given urgent attention.

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