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Article

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Research Article

An approach to determining the linkage between livelihood assets and the housing conditions in urban slums of Dhaka

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ABSTRACT

In the backdrop of rapid urbanisation trends, the slum population has increased significantly in the fast-growing cities like Dhaka (the capital of Bangladesh). The increasing rural-to-urban migration, housing shortages, and the limited access to affordable housing, are recognised as some of the key underlying drivers of the same. Within the slum pockets, the households possess a varying level of livelihood assets which further determine their housing conditions. To establish a precise understanding of the linkages between the livelihood assets possessed by the slum households and their housing conditions, this study specifically focuses on the case of Dhaka. Building on the framework of sustainable livelihood analysis, and in reference to the World Bank's Urban Informal Settlements Survey 2016, a specific set of indicators are developed to assess the livelihood assets in different slum pockets of Dhaka and their linkage with the slum housing. Thereafter, correlation analysis of all household (secondary) data is conducted to derive broader findings, and an in-depth comparative analysis is conducted for two contrasting slum groups. Although the overall results do not reveal any direct linkage between the specific asset capitals and the housing conditions, the financial and natural capital are found to be the key factors in determining the level of livelihood assets. By comparing the locational characteristics, it is further found that the slums with highest level of livelihood assets are more located on the periphery of Dhaka city, while the contrasting slum groups are situated more in the central areas. Also, the comparison of housing conditions reveals that the households with higher level of livelihood assets have better access to durable and permanent alternatives for their housing structure. Although there is a huge scope of further research, it is hoped that the study findings will pave the pathway for enhancing slum housing conditions in Dhaka.

1. Introduction

1.1. Urbanisation trends and increase of slums in Dhaka

The urban population during 1950 marked 751 million globally, which has today surged to more than 4.2 billion, a near six-fold increase in seven decades (United Nations (UN), 2018). The 'World Urbanization Prospects' by UN (2018) further reveal that nearly 55.7% of the world's population presently live in urban areas, which is projected to reach 68% by 2050, an increase of another 2.5 billion urban residents in three decades-time. Further, around 90% of this projected increase is expected to take place in Asia and Africa

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alone. Cities – particularly in the developing world – are experiencing a rapid increase in their population, and there are several underlying reasons behind this phenomenon. One of the main causes is the increasing rural-to-urban migration, the side effects of which are resulting in prevalence of slums and squatters, inadequate access to basic services and consequent poverty and deprivation (Begum & Moinuddin, 2018). Also, as highlighted in ‘The New Urban Agenda’ (United Nations Human Settlements Programme (UN-Habitat), 2020) slums have now become a notable feature of urbanisation in South Asia.

To further study the characteristics of slum households, it is important to recognise that the livelihood of any household is composed of capabilities, assets (material and social resources) and activities that are essential for maintaining a living (Chambers & Conway, 1992). Although slum dwellers often face compromised living conditions, housing is one of the basic needs for people and the lack of access to safe housing can degrade one’s quality of life. UN-Habitat (2003) highlighted that traditional approaches of addressing concerns of livelihoods of the urban poor have mainly focused on physical elements such as housing or infrastructure, like in the form of initiatives for slum eradication or slum upgrading. However, there is also a need for considering the wider living environments of slum dwellers and livelihood assets, which likely determine the slum housing conditions.

Bangladesh, located on the Bay of Bengal in South Asia and one of the world’s fastest growing economies today, is very much a part of these urbanisation trends. Despite its relatively small land area, it is the eighth most populous country in the world with 163 million people, and ranks eighth amongst the countries with highest population density (World Bank, 2019a, 2019b). According to the ‘Census of Slum Areas and Floating Population’ conducted by the Bangladesh Bureau of Statistics (BBS) in 2014, nearly 2.23 million people – about 595 thousand households – live in slums across the country, a figure which was under 1.4 million and 334 thousand, respectively, in 1997 (BBS, 2015). Of these slum households, about 30% are concentrated in the country’s capital city ‘Dhaka’.

While the urban population in mega-cities like Dhaka is constantly increasing and slums pockets are expanding haphazardly, demand for housing as well as the issue of housing deficit has become a subject of huge concern (General Economics Division, 2018). In the ‘Sustainable Development Report 2020’, highlighting the performance of each country’s progress on Sustainable Development Goals (SDGs) (Sachs et al., 2020), UN indicates that although moderate improvements have been observed in Bangladesh, the progress in “[making] cities and human settlements inclusive, safe, resilient and sustainable” (as stated under the SDG 11) remains to be a major challenge.

1.2. Need of study and research objectives

Till date, a considerable number of studies have utilised the ‘Sustainable Livelihoods Framework’ (SLF) to analyse vulnerability contexts, policies or strategies involving livelihoods of the urban poor (e.g., Begum & Moinuddin, 2018; Chaudhuri, 2013; Minnery et al., 2013; Tolossa, 2010). However, focus on socio-economic aspects or livelihood assets of urban poor with the purpose of understanding underlying factors driving the physical housing conditions of slums remain limited. While there is a dearth of studies on quantitative measurement and analysis of livelihood assets, few attempts have been made to measure livelihood assets in site-specific scenarios (Chen et al., 2013; Mahama & Maharjan, 2019). The application of the livelihood framework in the context of slums has also not been discussed widely, though some researchers have utilised it to conduct qualitative research for reviewing slum upgradation initiatives (Minnery et al., 2013), for assessing the reality of slum dwellers’ lives (Begum & Moinuddin, 2018), or their food security situation (Tolossa, 2010). A wide range of studies have also assessed issues related to housing contexts of slums in Dhaka (elaborated in Section 3.2); however, no study has so far revealed the characteristics of individual households’ background in relation to specific housing conditions, such as the relationship between socio-economic status and housing structure types.

In that backdrop, the three main objectives of this study are: (1) to establish a broader understanding of urban slum conditions in Bangladesh, (2) to determine if there is any correlation between housing conditions and livelihood assets of slum households, (3) to determine specific differences between the two contrasting groups of 10 slums with highest and lowest livelihood levels. To study the relationship between various factors of livelihood assets and housing conditions of slum dwellers in Dhaka, this research mainly builds on existing literature and available secondary data. It is guided by the following research questions: How can livelihoods of slum dwellers be measured and assessed? What are key indicators to understand slum housing conditions? Is there any relationship between housing conditions and livelihood assets? While the study mainly focuses on determining interlinkages between livelihood assets and housing conditions in urban slums of Dhaka, it is hoped that research findings will also provide a deeper understanding of slum dwellers’ lives in the city and will help decision makers and planners to implement effective actions to improve lives of the urban poor.

The remaining part of the paper is structured as follows. Section 2 explores basic concepts of livelihood assets and the SLF framework, while revisiting the importance of housing to establish a theoretical foundation. Section 3 provides a general background of the study area (Dhaka) and context of urban slums. It also provides a precise overview of precedent studies in Dhaka, which are specific to housing contexts. With research objectives put into perspective, this section is then followed by Section 4, where each step of research methods and its purpose is explained. Detailed results obtained through data analysis are presented in Section 5, followed by further discussions in Section 6. Lastly, key conclusions and research limitations of the study are highlighted in Section 7.

2. Theoretical review

2.1. Livelihood assets and the Sustainable Livelihoods Framework

‘Livelihood assets’ represent the five interlinked core types of capitals namely, human, physical, financial, social and natural capital (Chambers & Conway, 1992; Scoones, 1998). These capitals are widely recognised as key indicators in determining the state of people’s livelihoods. Markedly, the concept of sustainable livelihoods approach was first introduced by Chambers and Conway (1992). Following

the initial concept definition, many international institutions such as Oxfam, United Nations Development Program (UNDP), Cooperative for Assistance and Relief Everywhere (CARE) and Food and Agriculture Organisation (FAO) have designed various frameworks to elaborate the concept.

Remarkably, most of the existing livelihoods frameworks (e.g., May et al., 2009; UNDP, 2017) have been developed based on SLF, which was established by the Department for International Development (DFID) in 1999 (as shown in Fig. 1). The key feature of SLF is its focus on people as resources, and grasps the connection between people and the environment. As Serrat (2017) underlines, SLF framework is a useful tool to organise factors involved in defining one's livelihood. Laying emphasis on establishing interrelation with external institutions and processes, it conceptualises the complexity of livelihoods in different vulnerability contexts, determining how livelihood strategies can be developed for better outcomes (DFID, 1999). A large and growing body of literature has utilised this framework in research as well as development practice and policy making. Mahama and Maharjan (2019) emphasise that the most prominent element of SLF is the asset pentagon, which comprises the primary determinants of livelihoods. The asset pentagon depicts interconnections between the five capitals, which shapes one's livelihood.

2.2. Importance of housing

Till date, numerous definitions of 'healthy housing' or 'adequate shelter' have been put forward by international organisations such as the World Health Organization (WHO) or UN-Habitat, all of which emphasise that 'housing' does not solely imply the existence of a physical structure, but further extends to necessary services and facilities in the surrounding environment (UN, 1996; WHO, 2018). The definition of 'adequate shelter' provided in the Istanbul Declaration and the Habitat Agenda has been the basis of several other definitions and guidelines, which states that an "adequate shelter means more than a roof over one's head". More importantly, an ideal extent of adequacy is reliant on several other key factors such as privacy, space, physical accessibility, security of tenure as well as physical structure, basic infrastructure, sanitation and environmental quality (UN, 1996).

Generally, housing is conceived as one of the three immediate basic needs along with food and clothing. Adequate shelter is also important for providing households with 'security along economic, social, cultural and psychological dimensions' (Wood & Salway, 2000). The UN-Habitat (2014) report, 'The Right to Adequate Housing', further summarises that there has been several international conferences and declarations, like the Vancouver Declaration on Human Settlements in 1976, Agenda 21 in 1992, and Istanbul Declaration on Human Settlements in 1996, which establish the importance of the right to adequate housing and raise international awareness. As human rights are all "interdependent, indivisible and interrelated", the lack of adequate housing is a critical factor affecting other basic rights of living. Thus, access to adequate housing is also recognised as an essential condition for human wellbeing and development (UN-Habitat, 2014).

3. Case Study Area - Dhaka, Bangladesh

Dhaka, the capital and largest city of Bangladesh, is one of the most densely populated cities in the world (UN, 2018). In 2019, its population was recorded at 21.7 million, demonstrating an annual growth rate above 3.5% throughout the last decade (UN, 2019). Since the nation's independence in 1971, Dhaka has constantly witnessed a staggering growth in its population, which has primarily been attributed to the rural migrants (World Bank, 2007). By 2035, it is predicted half of the country's population will be living in urban areas

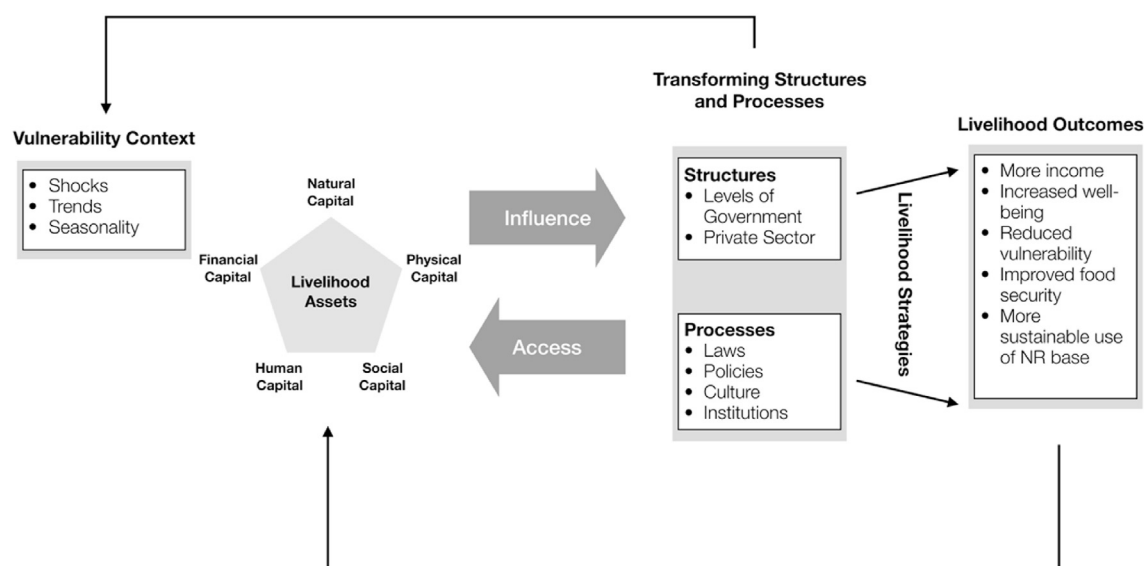


Fig. 1. Sustainable Livelihoods Framework (Image Source: Prepared by authors in reference to DFID, 1999).

and, more notably, Dhaka alone will see its population double in the next 12 years (UN, 2018).

The mass inflow of migrants to Dhaka city – one of the fastest growing megacities in the world – has become the cause of several urban issues such as increased pollution, congestion, poverty, housing shortages and deteriorating living environments (UN, 2018; World Bank, 2007). Located in the delta of Ganges-Brahmaputra-Meghna system, Dhaka also experiences flooding on a regular basis. However, due to increase in population and shortage of affordable housing, majority of the urban poor are left with no choice but to informally settle on flood-prone areas of the city (Braun & Aßheuer, 2011).

3.1. Overview of urban Slums in Dhaka

Securing an adequate shelter is one of the major hardships that the urban poor face in Dhaka. Due to continuous migrant inflow, a significant proportion of population is forced to settle on insecure or hazardous lands, which compromises their quality of life (World Bank, 2007). To address this situation, several investigations (both qualitative and quantitative) have been conducted in the past, such as the census and mapping of slums in selected six cities of Bangladesh (Centre for Urban Studies (CUS), et al, 2006) and population and socioeconomic census of Dhaka and Gazipur city (ICDDR, 2016).

Reportedly, slums in Dhaka predominantly prevail on government and private vacant lands, while some of them also expand on abandoned buildings and houses, rail tracks, and pavements (World Bank, 2007). Due to limited space and lack of basic services, the environment of slums is generally very dense, in terms of overall population within an area as well as density within housing units (Braun & Aßheuer, 2011). Yet, slums continue to develop on lands with insufficient basic infrastructure and services, which increases the vulnerability of slum dwellers to both natural and human-induced disasters (Braun & Aßheuer, 2011). Usually, housings where slum dwellers reside in, referred to as *Jhupri* (thatch), *Kacha* (wood, hay or mud), *Semi-pucca* (wall made of brick or other solid material) or *Pucca* (cement or concrete), are built of affordable or available materials, which commonly have flimsy structure. In reference to the World Bank survey data (further explained in Section 4.1), Fig. 2 below provides a schematic overview of slum housing types in Dhaka, indicating their main construction materials and relative durability among the different housing types.

3.2. Review of existing literature on slum housing in Dhaka

Over the last three decades, more than 45 studies have investigated slum ‘housing’ in Dhaka. These research documents were identified through a methodical search on Scopus (the largest abstract and citation database of multidisciplinary literature), using ‘slum’, ‘housing’, and ‘Dhaka’ as key search terms. To provide a comprehensive overview of existing literature, key aspects explored in these precedent studies have been illustrated in Fig. 3. Through literature review, it has been found that earlier studies of slum housing in Dhaka have looked at various aspects such as sanitation, health, education, economy, safety and environment, and some of these studies have also adopted multidisciplinary approach.

Evident from Fig. 3, numerous studies have examined issues and alternatives for sanitation in slum households, water supply systems or networks (Islam et al., 2010, 2011; Rausch et al., 2018), a few have also focused on promoting sanitation (Ali & Stevens, 2009; Yeasmin et al., 2020). While slum housing environments are typically known for their unhygienic living conditions, a number of studies have also examined the health concerns of slum dwellers (Hall et al., 1994; Harris et al., 2016; Khalequzzaman et al., 2007; Khan et al., 2014), and few other studies have assessed spatial distribution and characteristics of health outcomes (Gruebner et al., 2011; Khan et al., 2009). Likewise, financial capital of slum dwellers is generally perceived to be low, but recent studies have looked at the potential of urban microfinance (Hossain & Naimul Wadood, 2020) or other coping strategies that slum dwellers obtain (Begum & Moinuddin, 2018). A study on consumption and investment patterns of slum dwellers conducted by Miah and Weber (1991) also reported on the characteristics of slum dwellers, and their strong desires for improved living conditions.

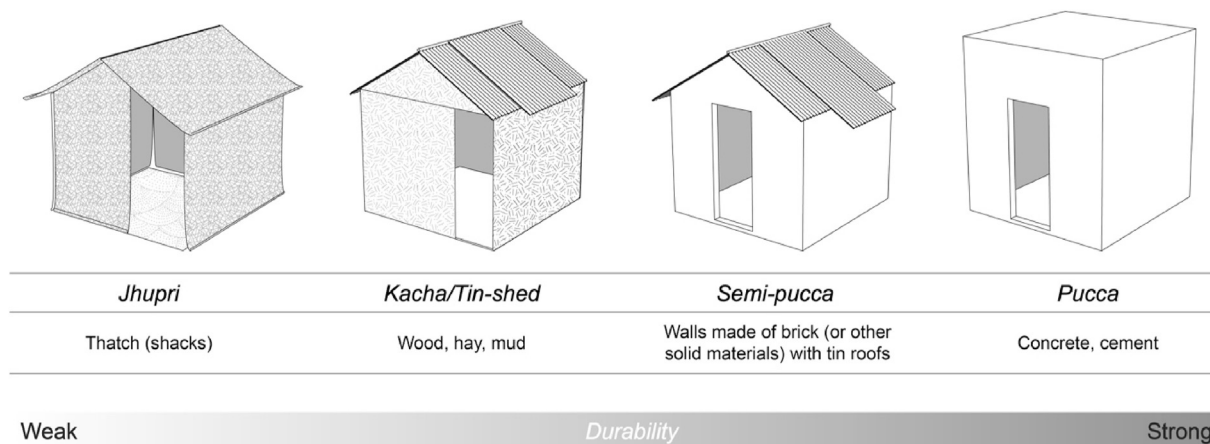


Fig. 2. Schematic overview of slum housing types and materials in Dhaka (Image Source: Prepared by authors in reference to The World Bank (2016) survey data).

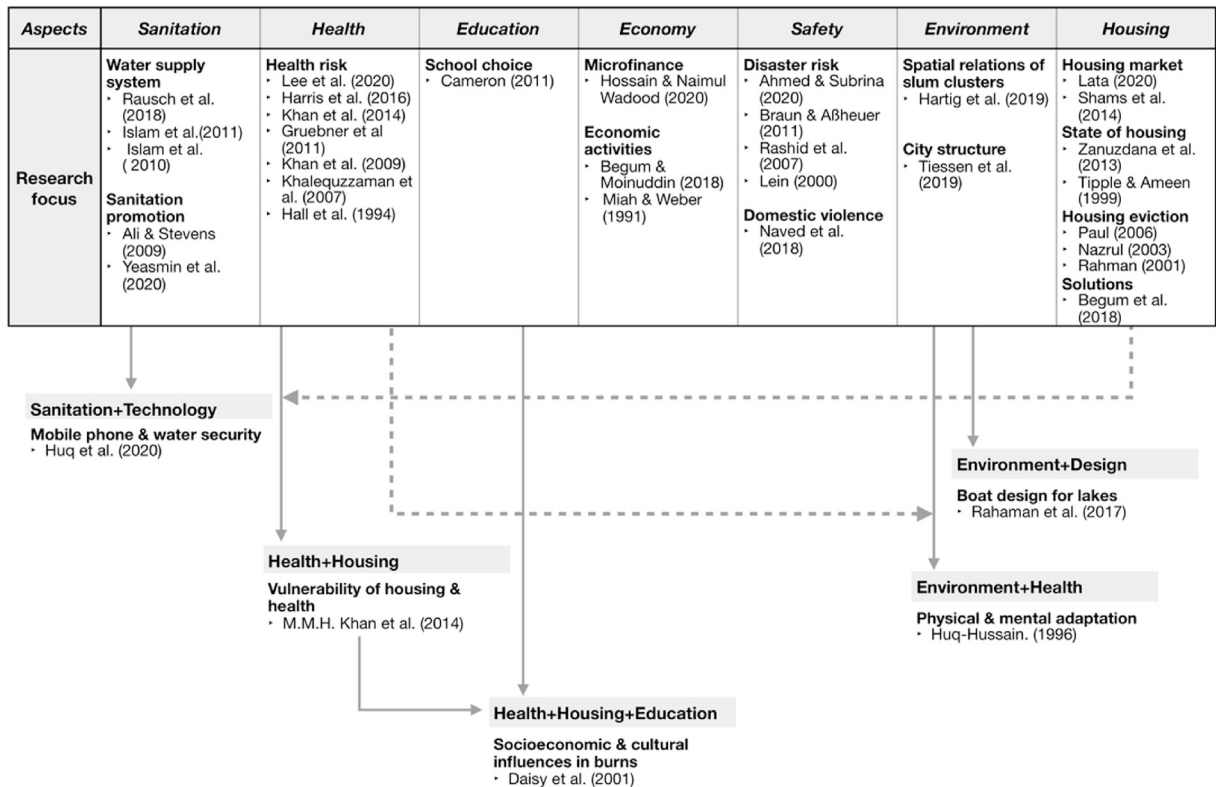


Fig. 3. Overview of precedent studies on slum housing contexts of Dhaka (Image Source: Prepared by authors). (Cameron, 2011; Lee et al., 2020; Lein, 2000; Rahaman et al., 2017)

Slum housing environments in Dhaka are not only exposed to natural hazards like floods (Braun & Aßheuer, 2011; Rashid et al., 2007), or fire (Ahmed & Subrina, 2020), but also experience other safety concerns, such as domestic violence (Naved et al., 2018). In addition, a few researchers have looked at spatial characteristics of slum clusters (Hartig, Friesen, & Pelz, 2019) or city structures (Tiessen, Friesen, Rausch, & Pelz, 2019). Various studies have also taken multidisciplinary approaches to study vulnerability of housing and health aspects (Khan & Kraemer, 2014), socio-economic and cultural factors of children's burns (Daisy et al., 2001), physical and mental adaptation of migrated women (Huq-Hussain, 1996) or the application of mobile phones in water security (Huq et al., 2020). Other scholars who have predominantly studied housing conditions in Dhaka focused on housing eviction (Nazrul, 2003; Paul, 2006; Rahman, 2001), housing shortage and market (Lata, 2020; Shams et al., 2014), reality of housing or satisfaction of dwellers (Tipple & Ameen, 1999; Zanzudana et al., 2013), and potential solutions for affordable housing (Begum et al., 2018).

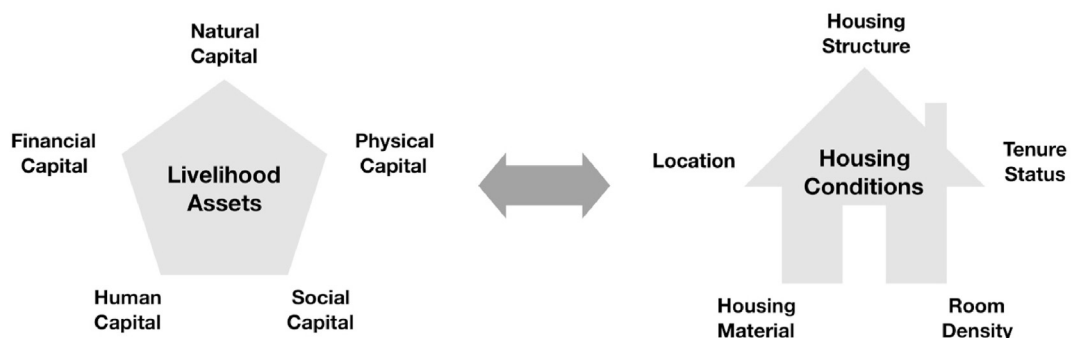


Fig. 4. Research framework adopted for study (Image Source: Prepared by authors).

4. Research methods

4.1. Indicator-based research framework

To assess the interlinkages between livelihood assets and housing conditions in urban slums of Dhaka, this study first sets out relevant indicators for both these aspects. Fig. 4 below provides an overview of study framework, wherein the core dimensions of livelihood assets and the housing conditions have been highlighted. While the livelihood asset pentagon has earlier been discussed in Section 2.1, definition of ‘adequate shelter’ has also been highlighted in Section 2.2. Correspondingly, the key parameters of adequate shelter like room density, tenure status, housing material, shelter structure and location are taken into consideration for determining housing conditions. Whereas other factors (within the definition of adequate shelter) like security, basic infrastructure, sanitation, and suitable environment quality, have been considered as sub-indicators for determining livelihood assets. Subsequently, the main criteria for the assessment of slum housing conditions in Dhaka is framed under the following five categories namely, 1) Housing structure (H1); 2) Tenure status (H2); 3) Room density (H3); 4) Housing materials (H4); and 5) Location (H5).

For the assessment of defined indicators, this research mainly builds on the ‘Bangladesh Urban Informal Settlements Survey’ data recorded by The World Bank (2016). This dataset has been selected primarily due to its comprehensive detailing and its fit with intended research objectives. Data contents of this sample survey include general household information, housing conditions, water and sanitation conditions, and consumption information of a total of 588 slum households within Dhaka City Corporation. The sampling frame for this study was based on ‘2014 BBS Census of Slums and Floating Population’ conducted by BBS (2015), wherein a ‘slum’ is referred to as a cluster of compact settlements (with five or more households) which develop in an unsystematic and haphazard manner, in unhealthy conditions and atmosphere on government and private vacant lands. The survey was conducted amongst five households from each of the six small slum community and 10 households from each of the 57 medium-to-large size slum community. In the World Bank Microdata Library, all interview questions and observation contents of this survey, as well as detailed results of all 588 households from 63 different slums of Dhaka are provided. From this comprehensive database, specific data related to defined housing conditions were extracted and categorised for this study accordingly.

For further data analysis, variables under each of the defined categories of housing conditions are assigned a value, as shown in Table 1. *Jhupri*, *Kacha* or tin-shed, *Semi-pucca* or *Pucca* are the 4 types of housing structure (H1) (also refer to Fig. 2 in Section 3.1). Tenure status (H2) also comprises of 4 variables, *Own*, *Rented*, *Rent Free* or *Others*. Room density (H3) is assigned to have a continuous value, which is the quotient of the number of rooms and number of household members in each housing unit. Housing material (H4) looks at specific materials of Wall (H4-1), Roof (H4-2) and Floor (H4-3). Herein, Wall and Roof material have 6 variables each: *Chhan* (*Chhan* leaf), *Straw*, *Leaf*; *Gunny* (*Jute*), *Polythene*, *Thick Paper*; *Bamboo*, *Wood*; *Tally* (*tile*); *Brick/Cement*. Further, Floor material comprises of 4 variables namely, *Mud*, *Bamboo/Wood*, *Brick/Cement* or *Others*. Lastly, corresponding whereabouts of Metropolitan *Thana* were collected for determining slum locations (H5), based on locational information available from utilised data source. Remarkably, the administrative structure under the central government in Bangladesh is divided into several different jurisdictions (like Divisions, Districts, *Upazila/Thana* and Union *Parishads*), wherein, the *Upazila/Thana* are generally utilised for administrative purposes (Yasmin et al., 2017).

So far, the SLF has predominantly been applied for qualitative analysis, however, recent studies have also attempted to establish quantitative methodologies for measuring livelihood assets (Chen et al., 2013; Dutta & Guchhait, 2018). In due consideration to existing literature (mainly referring to the guidance note published by UNDP (2017)) and availability of corresponding slum household data

Table 1

Indicators of Housing conditions and corresponding values assigned (Source: Prepared by authors based on indicators extracted from The World Bank (2016) survey data).

H	Housing Condition	Value	H	Housing Condition	Value
H1	Housing Structure		H4-2	Roof	
	<i>Jhupri</i>	1		<i>Chhan/Straw/Leaf</i>	1
	<i>Kacha/tin-shed</i>	2		<i>Gunny/Polythene/Thick Paper</i>	2
	<i>Semi-pucca</i>	3		<i>Bamboo/Wood</i>	3
	<i>Pucca</i>	4		<i>Tally</i>	4
H2	Tenure Status			<i>Tin</i>	5
	<i>Own</i>	1		<i>Brick/Cement</i>	6
	<i>Rented</i>	2	H4-3	Floor	
	<i>Rent Free</i>	3		<i>Mud</i>	1
	<i>Others</i>	4		<i>Bamboo/Wood</i>	2
H3	Room Density			<i>Brick/Cement</i>	3
	HH Size/Number of rooms	X		<i>Others</i>	4
H4	Housing Material		H5	Location	
H4-1	Wall			Name of Metropolitan Thana	Y
	<i>Chhan/Straw/Leaf</i>	1			
	<i>Gunny/Polythene/Thick Paper</i>	2			
	<i>Bamboo/Wood</i>	3			
	<i>Tally</i>	4			
	<i>Tin</i>	5			
	<i>Brick/Cement</i>	6			

X: Continuous value
Y: Categorical variable

recorded by The World Bank (2016), relevant indicators of livelihood assets are identified for this study. Further, scaling and indexing methods utilised by Dutta and Guchhait (2018) have been adopted, and a score for different livelihood asset of slum households is accordingly determined. All selected indicators under the five livelihood assets and their corresponding scores are as shown in Table 2.

4.2. Data analysis

For all defined indicators of housing conditions and livelihood assets in Section 4.1, The World Bank (2016) data corresponding to 588 slum households are first organised in Microsoft Excel (Microsoft; Seattle, WA, USA). Then, for each of the household data, the average score of indicators within each of the five livelihood assets 'capitals' (A-B-C-D-E) is derived to obtain livelihood asset scores

Table 2

Indicators of livelihood assets and corresponding scores (Source: Prepared by authors based on indicators extracted from The World Bank, 2016 data).

A	Human Capital	Score	C	Financial Capital	Score
A1	Education Level		C1	Relief Received	
	Above SSC/Dakhil	1		Yes	1
	SSC/Equiv.	0.75		No	0
	JSC/Equiv.	0.5	C2	Income Source	
	Completed Class V	0.25		Service	1
	Completed Class IV			Cottage Industry	
	Completed Class III			Business	
	Completed Class II			Garments Worker	0.66
	Completed Class I			Transport Worker	
	Currently Class I			Construction Worker	
	Never Attended	0		Agri-Labour	
A2	Occupation			Porter/Day Labour	0.33
	With Earning	1		Rickshaw/Van	
	Without Earning	0		Not working/Disabled	0
A3	Household Size			Student	
	6 or more	1		Hawker	
	2 to 5	0.66	C3	Rent Fee	
	Single	0.33		No Rent Fee	1
A4	Mobile Phone Ownership			0 < Rent ≤ 1500	0.8
	Yes	1		1500 < Rent ≤ 3000	0.6
	No	0		3000 < Rent ≤ 4500	0.4
B	Physical Capital	Score		More than 4500	0.2
B1	Drinking Water		C4	Fear of Eviction	
	Tube Well	1		No	1
	Tap			Yes	0
	Well	0.75	D	Social Capital	Score
	Pond/Ditch	0.5	D1	Feeling of Security Inside Slum	
	Canal/River	0.25		Sufficient Security	1
B2	Toilet Facility			Mediocre Security	0.66
	Single	1		Insecure	0.33
	Shared	0		Very Insecure	0
B3	Source of Light		D2	Length of Residence	
	Solar Electricity	1		More than 40 years	1
	Electricity	0.66		31–40 years	0.8
	Kerosene	0.33		11–20 years	0.6
B4	Source of Cooking Fuel			1–10 years	0.4
	Gas	1		Under 1 year	0.2
	Kerosine Heater	0.8	D3	Toilet Installation	
	Electric Heater	0.6		D-WASA	1
	Wood/Bamboo	0.4		DPHE	
	Straw/Leaf/Paper	0.2		Mosque/School/Clinic	
B5	Landline Connection			NGO/CBO	
	Yes	1		Community Leaders	0.5
	No	0		Landlord/Mastaans	
B6	Internet/email Connection			Don't Know/Household	0
	Yes	1	D4	Water Installation	
	No	0		D-WASA	1
				DPHE	
				Mosque/School/Clinic	
				NGO/CBO	
				Community Leaders	0.5
				Landlord/Mastaans	
				Don't Know/Household	0
			E	Natural Capital	Score
			E1	Flooding Occurrence	
				No	1
				Yes	0

(e.g., average score of A1 to A4 for overall score of Human Capital). In the next step, scores of all five capitals (A-B-C-D-E) are added to get the overall score of livelihood assets, where resulting scores range between 0 and 5. Likewise, the livelihood asset scores for all 588 slum households have been calculated. These scores are then utilised as the basis to conduct correlation analysis with the values assigned to indicators of housing conditions (in Table 1).

Broadly, two steps of analysis are then conducted to determine any potential linkage between livelihood asset scores and housing conditions in urban slums of Dhaka, as follows:

1. To evaluate the extent and nature of interlinkages between the score of each livelihood asset and corresponding values of housing conditions, a correlation analysis of livelihood asset scores for all 588 households is conducted. It is intended to explore if livelihood assets are interrelated amongst themselves or with certain housing condition.
2. In line with the third research objective of this study, two contrasting focus groups (with highest and lowest livelihood asset scores) are then identified to conduct further analysis. Based on the average total score of livelihood assets in each slum, all 63 slums are first ranked from highest to lowest score. In order to compare contrasting observations, the household data for 10 highest scoring slums (hereinafter referred to as 'Highest 10 Slums') and 10 lowest scoring slums (hereinafter referred to as 'Lowest 10 Slums') are extracted for the second step of analysis. Housing conditions (H1 to H5) of all corresponding households are also accumulated in one data sheet. Also, the Metropolitan *Thana* location of each of these slums is marked on a map to study their locational factors and spatial distribution. Indicators of each housing condition are then compared between the two groups to find any inclination with the overall housing conditions and livelihood asset scores.

5. Results

5.1. Correlation analysis for all urban slum households

Fig. 5 highlights correlation coefficients 'R' obtained through parametric correlation test of all household data variables. In here, the value of coefficient 'R' mainly helps to interpret the strength and direction of the relationship between various indicators of 'Livelihood Assets' and 'Housing Conditions' considered in this study. Corresponding interpretations of the study results are shown in Table 3.

As highlighted in red in Fig. 5, a strong positive correlation is observed between 'Total score' of livelihood assets and 'Natural Capital' ($R = 0.86$), and also between 'Housing Structure' and 'Wall Material' ($R = 0.78$). From this result, it can be likely inferred that out of the five livelihood assets, natural capital has greatest influence on the total score. As for 'Housing Structure' and 'Wall Material,' high possibility of housing structure determined by wall material can be interpreted, and vice versa. Similarly, a moderate positive correlation is found to exist between variables of 'Housing Structure' and 'Roof Material' ($R = 0.60$), indicating moderately high possibility that housing structure could be determined by roof material, and vice versa. Further, 'Total Score' and 'Financial Capital' ($R = 0.43$) are found to have a weak positive correlation.

Nonetheless, in reference to the correlation analysis of all urban slum household data, no significant evidence has been revealed to substantiate if there is any obvious linkage between the score of certain livelihood assets and specific housing conditions.

	Human Capital	Physical Capital	Financial Capital	Social Capital	Natural Capital	Total Score	Housing Structure	Tenure Status	Room Density	Wall Material	Roof Material	Floor Material
Human Capital	1.00											
Physical Capital	0.19	1.00										
Financial Capital	0.09	0.14	1.00									
Social Capital	-0.03	-0.05	0.07	1.00								
Natural Capital	-0.01	-0.02	0.12	-0.22	1.00							
Total Score	0.32	0.21	0.43	0.03	0.86	1.00						
Housing Structure	0.09	0.32	0.22	0.13	-0.07	0.10	1.00					
Tenure Status	-0.07	-0.10	-0.07	-0.36	0.24	0.08	-0.10	1.00				
Room Density	0.05	0.12	0.16	0.10	0.02	0.11	0.02	-0.11	1.00			
Wall Material	0.09	0.27	0.23	0.07	0.05	0.18	0.78	-0.05	0.02	1.00		
Roof Material	0.05	0.26	0.17	0.05	-0.06	0.05	0.60	-0.08	0.03	0.37	1.00	
Floor Material	0.05	0.21	0.10	0.12	0.10	0.18	0.37	0.00	-0.08	0.32	0.12	1.00

Fig. 5. Results of parametric correlation test of all household data variables (Image Source: Prepared by authors based on data analysis results).

Table 3

Interpretation of correlation coefficient 'R' Data source: Moore (2007).

'R' Value	Interpretation
$0.7 < R < 1$	Strong positive linear relationship
$0.5 < R \leq 0.7$	Moderate positive linear relationship
$0.3 < R \leq 0.5$	Weak positive linear relationship
$0 < R \leq 0.3$	Very weak positive linear relationship
$R = 0$	No linear relationship
$-0.3 \leq R < 0$	Very weak negative linear relationship
$-0.5 \leq R < -0.3$	Weak negative linear relationship
$-0.7 \leq R < -0.5$	Moderate negative linear relationship
$-1 \leq R < -0.7$	Strong negative linear relationship

5.2. Comparing the 'highest 10 slums' and 'lowest 10 slums'

In the second step of analysis, average livelihood asset scores of 'Highest 10 Slums' and 'Lowest 10 Slums' are compared, wherein the most significant difference is observed in scores of 'Natural Capital', which is measured by the risk of exposure to floods (Fig. 6a and b). Also, by studying spatial locations of these slum groups based on located Metropolitan Thana data, it is found that 'Highest 10 Slums' are mostly located on the periphery of Dhaka city, while 'Lowest 10 Slums' are primarily concentrated in central areas (as illustrated in Fig. 7). The visualisation of the geo-spatial arrangements of 'Highest 10 Slums' and 'Lowest 10 Slums' in that manner also gives an indication that slums located in central Dhaka are more exposed to flood risks, which likely brings down the overall livelihood asset scores of slum dwellers in 'Lowest 10 Slums'.

Furthermore, 'housing structure' and 'wall material' are found to differ significantly between the two contrasting groups (Fig. 8a and b). While *Katcha* or Tin-shed structure is the mainstream 'housing structure' amongst households of 'Lowest 10 Slums' (89%), households of 'Highest 10 Slums' showcase *Katcha* or Tin-shed structure (43%) and Semi-pucca (48%) as the main 'housing structure' types. Also, Tin is found to be the predominant wall material amongst households of 'Lowest 10 Slums' (86%), while categories, Brick or Cement (52%) and Tin (48%) account for the majority of households in 'Highest 10 Slums'. This provides an indication that households of 'Highest 10 Slums' possess more permanent and durable structures and wall materials, compared to households in 'Lowest 10 Slums'.

On the contrary, it is found that 'roof materials' and 'floor materials' do not vary significantly between the two contrasting groups. As shown in Fig. 9a., although about 15% of households in 'Highest 10 Slums' reside under roofs made from brick or cement, tin is found to be the most predominant roof material in both slum groups. Interestingly, both groups saw the vast majority of households with floors constructed by brick or cement (Fig. 9b).

From Fig. 10.a, it is apparent that 'room density' in households of 'Lowest 10 Slums' is generally very high, with 0.2–0.3 room/person (=1 room with 3–5 people) being the most common. For households in 'Highest 10 Slums', a 'room density' of 0.5–0.6 room/person (=1 room with less than 2 people) is observed. 'Highest 10 Slums' have a wider range of 'room density' status, ranging from highest room density of 0.1–0.2 room/person to lowest room density of 0.7–0.8 room/person. This highlights the crowded living environments especially in households with lower score of livelihood assets.

No significant differences were observed in 'tenure status' of the two groups (Fig. 10b). Majority of households in both groups have rented their dwellings, followed by households who own their dwellings. Interestingly, households in 'Lowest 10 Slums' have higher percentage of owned dwellings (29%) in comparison to households of 'Highest 10 Slums' (19%).

Together, these results indicate that households of 'Highest 10 Slums', which are less exposed to floods, have more durable housing material and structure, with lower room density. On the other hand, households of 'Lowest 10 Slums' face higher risk towards floods and are living in less durable housing structure with relatively fragile housing material, whilst living in higher room density conditions. From these observations, it has been found that the state of livelihoods is a considerable factor in determining the housing conditions of slum households.



Fig. 6. Spider Maps: a) Average livelihood asset scores of households in Highest 10 Slums; b) Average livelihood asset scores of households in Lowest 10 Slums (Image Source: Authors).

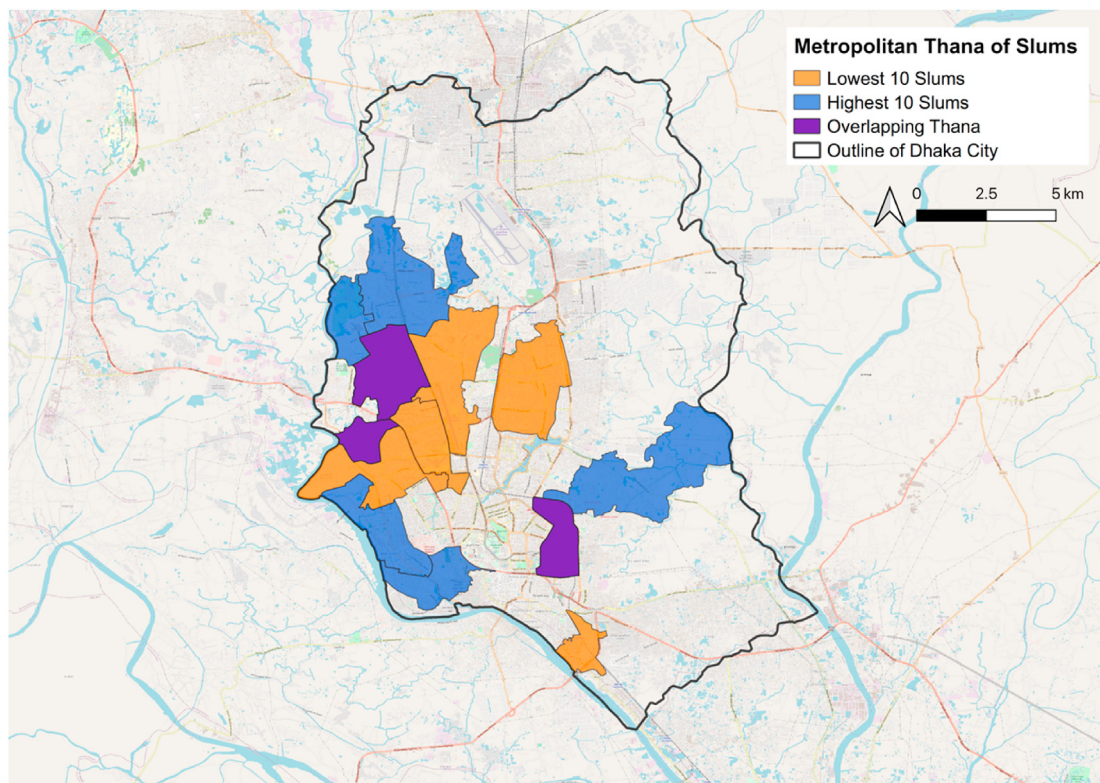


Fig. 7. Spatial locations of Highest 10 Slums and Lowest 10 Slums in Dhaka city (Image Source: Prepared by authors in reference to GIS data from OCHA, 2015).

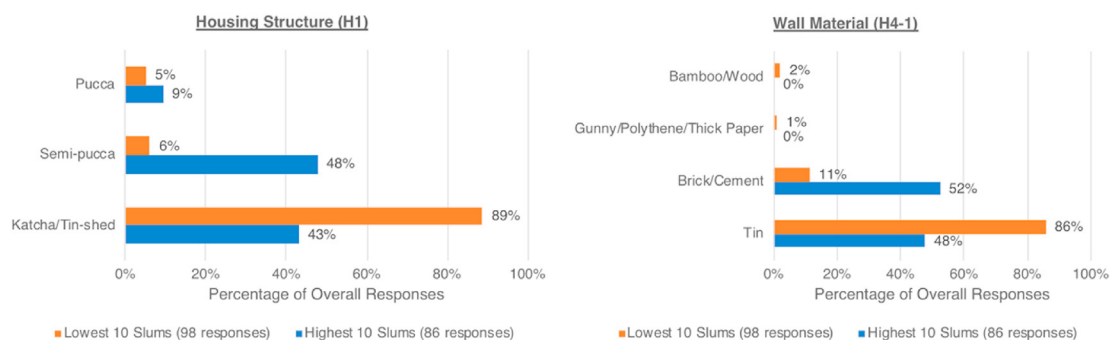


Fig. 8. a) Distribution of housing structure; b) Distribution of wall material (Image Source: Authors).

6. Discussion

6.1. Broader implications in lines with the Sustainable Livelihoods Framework

As underscored in Section 2.1., the livelihood asset pentagon is the key aspect of the SLF framework. Through secondary data analysis, this research provides useful insights on various components of SLF and helps to better understand the precise reality of particular strengths and weaknesses of slum dwellers. Further in-depth analysis of each livelihood asset is, however, required to assess specific vulnerability contexts. As in the context of this study, research findings presented in Section 5.1 and Section 5.2 have depicted that spatial distribution and locational characteristics of urban slums are to an extent linked with the level of livelihood assets and slum housing conditions, which also provides a basis for conducting further research.

More specifically, 'natural capital' (in Section 5.1) is found to be an influential factor in determining the overall level of livelihood assets. In other words, households with low natural capital are more likely to have low overall score of livelihood assets. Inferring these results together with findings in Section 5.2, it is realised that apart from downgrading the overall livelihood asset scores, exposure to

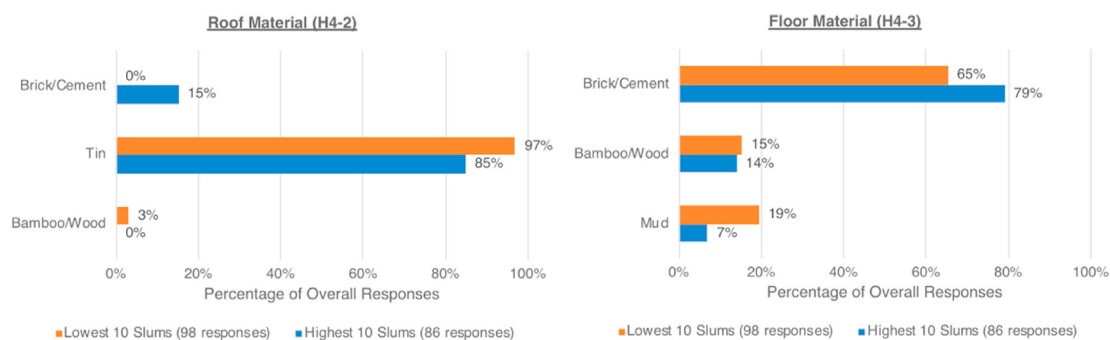


Fig. 9. a) Distribution of roof material; b) Distribution of floor material (Image Source: Authors).

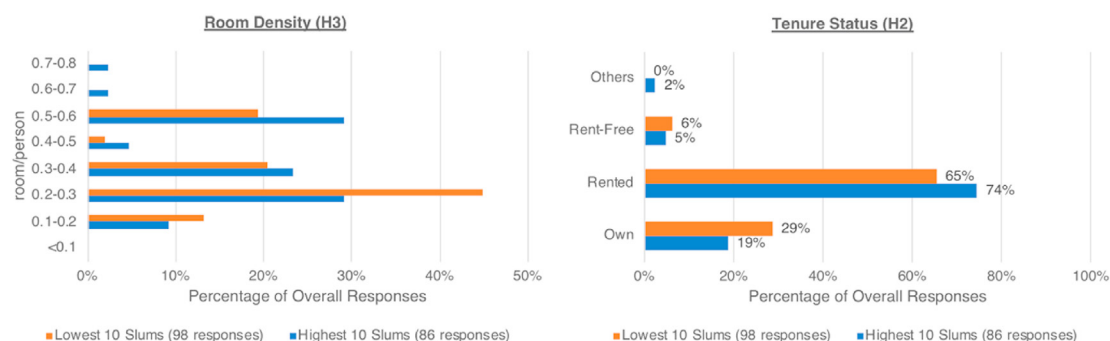


Fig. 10. a) Distribution of room density; b) Distribution of tenure status (Image Source: Authors).

flooding may also be responsible for driving certain indicators of ‘housing conditions’ like the less durable structure and materiality observed in ‘Lowest 10 Slums’ (Fig. 8a, b, 9a, 9b). Given these results, resilience towards flood risks could be recognised as one of the most immediate concerns for local governments or other private sectors to target, in improving livelihood outcomes of the urban poor.

Also, notable from Section 2.1 (refer to Fig. 1), transforming structures or processes are key stakeholders in providing access to means or resources to obtain livelihood strategies. In the case of Dhaka, policy implementation or institutional support could accordingly focus on or direct their investments towards enhancement of natural capital of slum households to raise their overall level of livelihood. Such interventions may also aim to improve access to durable materials to achieve safer housing structures (refer to Section 5.1). Also, spatial distribution of slum pockets and its characteristics (refer to Section 5.2) can serve as a guide for different jurisdictions in Dhaka towards determining vulnerable areas in need of improvement. For instance, given that slums in central parts of Dhaka city are found to be more vulnerable to flood risks, specific measures to enhance flood resilience in central areas could be focused on as an urgent issue prior to reaching monsoon season.

6.2. Further directions on upgrading urban Slums in Dhaka

Presently, there are many organisations in Bangladesh – local and international, bilateral, and multilateral, government and non-government bodies – working on slum upgradation initiatives. However, actions are not always carried out promptly (Banks et al., 2011). Recently, there have been several slum upgradation projects in Dhaka, not all of which have been successful due to issues like mismanagement and lack of accountability for the rapid and haphazard expansion of slums (UNDP Bangladesh, 2019). As Sikder et al. (2015) states, comprehensive understanding and improvement of slums through active participation from primary and secondary stakeholders is imperative for sustainable management of urban lands. Thus, by understanding the state of livelihood assets in slum households (also incorporating housing conditions), diverse stakeholders involved in slum upgradation initiatives can have clearer targets to act towards improving living conditions of the urban poor.

7. Conclusions

The present study was aimed at determining the linkage between housing conditions and livelihood assets possessed by the slum population of Dhaka. Building on the review of precedent studies and utilisation of available secondary data, a unique indicator-based research framework is developed for this study, over which specific correlations between different indicators have been discussed.

As a general finding, the indicator-based approach reveals financial capital and natural capital as key determinants of a slum household’s overall livelihood assets. Similarly, wall material and roof material are found to be key determinants of housing structure of

slum households. Although study findings do not reveal any direct linkage between specific livelihood assets and housing conditions, precise observations are made on contrasting conditions between ‘Highest 10 Slums’ and ‘Lowest 10 Slums’ (in Section 5.2). Further, locational characteristics of these contrasting slum pockets, housing structure, housing material and room density are also found to differ significantly. Together, the study results suggest that there is certain linkage between livelihood assets and housing conditions in urban slums of Dhaka. However, further assessment of these indicators with larger sample size of slum households is deemed necessary.

Moreover, the indicator-based assessment approach utilised in this study provides a valuable basis for similar studies in the future in varied geo-spatial contexts. The unique approach of deriving co-relations through available secondary data could also be considered as a transferrable tool for different research purposes, particularly in the context of informalities where access to data sources is limited. It is also hoped that the study results shall serve as a useful source of information for policymakers in enhancing slum housing conditions in Dhaka, and other fast-growing cities worldwide.

Towards the end, the authors acknowledge that this research is subject to certain limitations. For instance, the study has only used secondary data for analysis and there is a need for further cross-validation from other data sources. Also, indicators utilised in this study are subjected to data availability on the World Bank survey. The research framework also did not explicitly comprehend other important factors of urban settings such as transportation infrastructure or other basic services. Thus, extensive field surveys and further research is deemed necessary to determine specific factors and extent of linkage between the livelihood assets and housing conditions in urban slums of Dhaka.

Declaration of interest

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Declaration of competing interest

The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Ahmed, A., & Subrina, S. (2020). Small changes with big impacts: Mitigating fire risks through small interventions in informal settlements of dhaka city, Bangladesh. In *Advances in 21st century human settlements* (pp. 135–148). https://doi.org/10.1007/978-981-15-4948-9_8
- Ali, M., & Stevens, L. (2009). Integrated approaches to promoting sanitation: A case study of faridpur, Bangladesh. *Desalination*, 248(1–3), 1–7. <https://doi.org/10.1016/j.desal.2008.05.030>
- Bangladesh Bureau of Statistics (BBS). (2015). Census of slum areas and floating population 2014. <http://203.112.218.65:8008/WebTestApplication/userfiles/Image/Slum/FloatingPopulation2014.pdf>
- Banks, N., Roy, M., & Hulme, D. (2011). Neglecting the urban poor in Bangladesh: Research, policy and action in the context of climate change. *Environment and Urbanization*, 23(2), 487–502. <https://doi.org/10.1177/0956247811417794>
- Begum, H., Heywood, P. R., & Susilawati, C. (2018). Assisted community housing initiative in dhaka: Rethinking role of NGOs in affordable housing development. *Environment and Urbanization ASIA*, 9(2), 214–229. <https://doi.org/10.1177/0975425318783573>
- Begum, H., & Moinuddin, G. (2018). Livelihood framework: Understanding poverty and vulnerability and coping strategies of the urban poor in Dhaka. *Journal of Social Sciences Research*, 4(7), 101–108.
- Begum, H., & Moinuddin, G. (2018). Livelihood framework: Understanding poverty and vulnerability and coping strategies of the urban poor in Dhaka. *Journal of Social Sciences Research*, 4(7), 101–108.
- Braun, B., & Abheuer, T. (2011). Floods in megacity environments: Vulnerability and coping strategies of slum dwellers in Dhaka/Bangladesh. *Natural Hazards*, 58(2), 771–787. <https://doi.org/10.1007/s11069-011-9752-5>
- Cameron, S. (2011). Whether and where to enrol? Choosing a primary school in the slums of urban dhaka, Bangladesh. *International Journal of Educational Development*, 31(4), 357–366. <https://doi.org/10.1016/j.ijedudev.2011.01.004>
- Centre for Urban Studies (CUS), National Institute of Population Research and Training (NIPORT), MEASURE Evaluation. (2006). Slums of urban Bangladesh: Mapping and census, 2005. <http://www.cpc.unc.edu/measure/publications/tr-06-35>
- Chambers, R., & Conway, G. (1992). *Sustainable rural livelihoods: Practical concepts for the 21st century*. Studies (UK): Institute of Development.
- Chaudhuri, S. (2013). Living at the edge: A socio-economic profile of kolkatas poor. *South Asian Survey*, 20(1), 44–58. <https://doi.org/10.1177/0971523114559814>
- Chen, H., Zhu, T., Krott, M., Calvo, J. F., Ganesh, S. P., & Makoto, I. (2013). Measurement and evaluation of livelihood assets in sustainable forest commons governance. *Land Use Policy*, 30, 908–914. <https://doi.org/10.1016/j.landusepol.2012.06.009>
- Daisy, S., Mostaque, A. K., Bari, S., Khan, A. R., Karim, S., & Quamruzzaman, Q. (2001). Socioeconomic and cultural influence in the causation of burns in the urban children of Bangladesh. *Journal of Burn Care & Rehabilitation*, 22(4), 269–273. <https://doi.org/10.1097/00004630-200107000-00004>
- DFID. (1999). *Sustainable livelihoods guidance sheets*.
- Dutta, S., & Guchhait, S. K. (2018). Measurement of livelihood assets in sustainable forest governance: A study in burdwan forest Division, West Bengal. *Transactions of the Institute of Indian Geographers*, 40(2), 203–216.
- General Economics Division. (2018). Sustainable development Goals: Bangladesh progress report 2018. In *United nations department of economic and social affairs* (Issue December).

- Gruebner, O., Khan, M. M. H., Lautenbach, S., Müller, D., Kraemer, A., Lakes, T., & Hostert, P. (2011). A spatial epidemiological analysis of self-rated mental health in the slums of Dhaka. *International Journal of Health Geographics*, 10. <https://doi.org/10.1186/1476-072X-10-36>
- Hall, A., Conway, D. J., Anwar, K. S., & Rahman, M. L. (1994). Strongyloides stercoralis in an urban slum community in Bangladesh: Factors independently associated with infection. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 88(5), 527–530. [https://doi.org/10.1016/0035-9203\(94\)90146-5](https://doi.org/10.1016/0035-9203(94)90146-5)
- Harris, A. R., Pickering, A. J., Harris, M., Doza, S., Islam, M. S., Unicomb, L., Luby, S., Davis, J., & Boehm, A. B. (2016). Ruminants contribute fecal contamination to the urban household environment in dhaka, Bangladesh. *Environmental Science & Technology*, 50(9), 4642–4649. <https://doi.org/10.1021/acs.est.5b06282>
- Hartig, J., Friesen, J., & Pelz, P. F. (2019). Spatial relations of slums: Size of slum clusters. 2019 Joint Urban Remote Sensing Event, JURSE 2019, 1–4. <https://doi.org/10.1109/JURSE.2019.8809051>
- Hossain, B., & Naimul Wadood, S. (2020). Impact of urban microfinance on the livelihood strategies of borrower slum dwellers in the Dhaka city, Bangladesh. *Journal of Urban Management*, 9(2), 151–167. <https://doi.org/10.1016/j.jum.2019.12.003>
- Huq-Hussain, S. (1996). Female migrants in an urban setting - the dimensions of spatial/physical adaptation: The case of dhaka. *Habitat International*, 20(1), 93–107. [https://doi.org/10.1016/0197-3975\(96\)80775-2](https://doi.org/10.1016/0197-3975(96)80775-2)
- Huq, F. F., Holvoet, N., & Huq, M. (2020). Application of mobile technology in monitoring and evaluation of household water security for Dhaka city. *Technology in Society*, 62. <https://doi.org/10.1016/j.techsoc.2020.101308>
- International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). (2016). *Baseline Population and Socioeconomic Census Slums of Dhaka (North and South) and Gazipur City Corporations, 2015-16*. <http://uphrcp.gov.bd/cmsfiles/files/Baseline-Population%20and%20Socioeconomic%20Census.pdf>
- Islam, M. M., Chou, F. N.-F., & Kabir, M. R. (2010). Acceptability of the rainwater harvesting system to the slum dwellers of Dhaka City. *Water Science and Technology*, 61(6), 1515–1523. <https://doi.org/10.2166/wst.2010.049>
- Islam, M. M., Chou, F. N.-F., & Kabir, M. R. (2011). Feasibility and acceptability study of rainwater use to the acute water shortage areas in Dhaka City, Bangladesh. *Natural Hazards*, 56(1), 93–111. <https://doi.org/10.1007/s11069-010-9551-4>
- Khalequzzaman, M., Kamijima, M., Sakai, K., Chowdhury, N. A., Hamajima, N., & Nakajima, T. (2007). Indoor air pollution and its impact on children under five years old in Bangladesh. *Indoor Air*, 17(4), 297–304. <https://doi.org/10.1111/j.1600-0668.2007.00477.x>
- Khan, M. M. H., & Kraemer, A. (2014). Are rural-urban migrants living in urban slums more vulnerable in terms of housing, health knowledge, smoking, mental health and general health? *International Journal of Social Welfare*, 23(4), 373–383. <https://doi.org/10.1111/ijsw.12053>
- Khan, M. M. H., Krämer, A., & Grünner, O. (2009). Comparison of health-related outcomes between urban slums, urban affluent and rural areas in and around Dhaka Megacity, Bangladesh. *Die Erde*, 140(1), 69–87.
- Khan, M. M. H., Zanzudana, A., Burkart, K., & Krämer, A. (2014). Determinants of Diarrhoea in “urban” slums of dhaka and Adjacent rural areas: A household-level analysis. *Population, Space and Place*, 20(6), 498–511. <https://doi.org/10.1002/psp.1777>
- Lata, L. N. (2020). Neoliberal urbanity and the right to housing of the urban poor in dhaka, Bangladesh. *Environment and Urbanization ASIA*, 11(2), 218–230. <https://doi.org/10.1177/0975425320938520>
- Lee, T. W., Lee, S. J., Kim, M. S., & Choi, Y. (2020). Establishing a nurse-managed health center for the urban poor in Dhaka, Bangladesh. *Public Health Nursing*, 37(4), 560–568. <https://doi.org/10.1111/phn.12731>
- Lein, H. (2000). Hazards and “forced” migration in Bangladesh. *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography*, 54(3), 122–127. <https://doi.org/10.1080/002919500423735>
- Mahama, T. A.-K., & Maharjan, K. L. (2019). Determining the nature and spatial-temporal changes of the livelihood asset pentagon and its relationship with livelihood opportunities in Ghana. *Community Development*, 50(4), 460–483. <https://doi.org/10.1080/15575330.2019.1642929>
- May, C., Brown, G., Cooper, N., & Brill, L. (2009). *The sustainable livelihoods handbook: An asset based approach to poverty*. Church action on poverty and Oxfam GB. www.oxfam.org.uk/uk
- Miah, A. Q., & Weber, K. E. (1991). Slum dwellers’ household consumption pattern and its implication for cost recovery IN slum upgrading: Evidence from dhaka, Bangladesh. *Review of Urban & Regional Development Studies*, 3(2), 170–182. <https://doi.org/10.1111/j.1467-940X.1991.tb00027.x>
- Minnery, J., Argo, T., Winarso, H., Hau, D., Veneracion, C. C., Forbes, D., & Childs, I. (2013). Slum upgrading and urban governance: Case studies in three South East Asian cities. *Habitat International*, 39, 162–169. <https://doi.org/10.1016/j.habitatint.2012.12.002>
- Moore, D. S. (2007). *The basic practice of statistics/David S. Moore. (Fourth ed.)*. W. H. Freeman.
- Naved, R., Rahman, T., Willan, S., Jewkes, R., & Gibbs, A. (2018). Female garment workers’ experiences of violence in their homes and workplaces in Bangladesh: A qualitative study. *Social Science & Medicine*, 196, 150–157. <https://doi.org/10.1016/j.socscimed.2017.11.040>
- Nazrul, I. M. (2003). Slum eviction and housing rights in Dhaka City (1975–2001). *Japanese Journal of Human Geography*, 55(6), 60–74. <https://doi.org/10.4200/jjhg.1948.55.574>
- OCHA. (2015). Bangladesh - subnational administrative boundaries. Humanitarian data exchange. Downloaded from <https://data.humdata.org/dataset/administrative-boundaries-of-bangladesh-as-of-2015>. on November 27th, 2020.
- Paul, B. K. (2006). Fear of eviction: The case of slum and squatter dwellers in Dhaka, Bangladesh. *Urban Geography*, 27(6), 567–574. <https://doi.org/10.2747/0272-3638.27.6.567>
- Rahaman, M. M., Rahman, M. H., Hashem, M. A., & Islam, M. R. (2017). Design study of boat for gulshan-banani-hatirjheel lake in the capital city of Bangladesh. *Procedia Engineering*, 194, 211–217. <https://doi.org/10.1016/j.proeng.2017.08.137>
- Rahman, M. M. (2001). Basteer eviction and housing rights: A case of dhaka, Bangladesh. *Habitat International*, 25(1), 49–67. [https://doi.org/10.1016/S0197-3975\(00\)00026-6](https://doi.org/10.1016/S0197-3975(00)00026-6)
- Rashid, H., Hunt, L. M., & Haider, W. (2007). Urban flood problems in Dhaka, Bangladesh: Slum residents’ choices for relocation to flood-free areas. *Environmental Management*, 40(1), 95–104. <https://doi.org/10.1007/s00267-006-0233-7>
- Rausch, L., Friesen, J., Altherr, L. C., Meck, M., & Pelz, P. F. (2018). A holistic concept to design optimal water supply infrastructures for informal settlements using remote sensing data. *Remote Sensing*, 10(2). <https://doi.org/10.3390/rs10020216>
- Sachs, J., Schmidt-Traub, Kroll, G., & Fuller, G. (2020). *The sustainable development Goals and COVID-19. Sustainable development report 2020*. www.pica-publishing.com
- Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis*, 72. IDS Working Papers.
- Serrat, O. (2017). The sustainable livelihoods approach. In *Knowledge solutions* (pp. 21–26). Springer Singapore. https://doi.org/10.1007/978-981-10-0983-9_5
- Shams, S., Shohel, M. M. C., & Ahsan, A. (2014). Housing problems for middle and low income people in Bangladesh: Challenges of dhaka megacity. *Environment and Urbanization ASIA*, 5(1), 175–184. <https://doi.org/10.1177/0975425314521538>
- Sikder, S. K., Asadzadeh, A., Kuusaana, E. D., Mallick, B., & Koetter, T. (2015). Stakeholders participation for urban climate resilience: A case of informal settlements regularization in khulna city, Bangladesh. *Journal of Urban and Regional Analysis*, VII(1), 5–20. <https://doi.org/10.37043/JURA.2015.7.1.1>
- The World Bank. (2016). *The Bangladesh urban informal settlements survey (UIS)*. Microdata Library. Downloaded from <https://microdata.worldbank.org/index.php/catalog/2864/study-description>, on October 31st, 2020.
- Tiessen, T., Friesen, J., Rausch, L., & Pelz, P. F. (2019). Using remote sensing data and cluster algorithms to structure cities. 2019 Joint Urban Remote Sensing Event, JURSE 2019, 1–4. <https://doi.org/10.1109/JURSE.2019.8808973>
- Tippel, A. G., & Ameen, M. S. (1999). User initiated extension activity in Bangladesh: “Building slums” or area improvement?. In *Environment and Urbanization*, 11. Issue 1.
- Tolossa, D. (2010). Some realities of the urban poor and their food security situations: A case study of Berta gibi and gemechu safar in the city of Addis Ababa, Ethiopia. *Environment and Urbanization*, 22(1), 179–198. <https://doi.org/10.1177/0956247810363527>
- United Nations. (1996). Report of the united nations conference on human settlements (Habitat II). <http://undocs.org/A/CONF.165/14>.
- United Nations. (2018). World urbanization Prospects: The 2018 revision. <https://population.un.org/wup/>.
- United Nations. (2019). World population Prospects: 2019 revision. <https://population.un.org/wpp/>.
- UN-Habitat. (2014). *The Right to Adequate Housing*, 21(Issue 1).

- UNDP Bangladesh. (2019). Housing solutions for the urban poor in Bangladesh. <https://www.bd.undp.org/content/bangladesh/en/home/presscenter/pressreleases/2019/04/07/housing-solutions-for-the-urban-poor-in-bangladesh.html>.
- United Nations Development Program. (2017). Guidance note: Application of the sustainable livelihoods framework in development projects. [https://www.undp.org/content/dam/rblac/docs/Research and Publications/Poverty Reduction/UNDP_RBLAC_Livelihoods_Guidance_Note_EN-210July2017.pdf](https://www.undp.org/content/dam/rblac/docs/Research%20and%20Publications/Poverty%20Reduction/UNDP_RBLAC_Livelihoods_Guidance_Note_EN-210July2017.pdf).
- United Nations Human Settlements Programme. (2003). In *The challenge of slums: Global report on human settlements*. London: Routledge.
- United Nations Human Settlements Programme (UN-Habitat). (2020). The New Urban Agenda Illustrated. www.unhabitat.org/hsnumber:HS/035/20E.
- Wood, G., & Salway, S. (2000). Securing livelihoods in dhaka slums. *Journal of International Development*, 12(5), 669–688. [https://doi.org/10.1002/1099-1328\(200007\)12:5<669::AID-JID706>3.0.CO;2-Z](https://doi.org/10.1002/1099-1328(200007)12:5<669::AID-JID706>3.0.CO;2-Z).
- World Bank. (2007). *Bangladesh Dhaka: Improving living conditions for the urban poor*.
- World Bank. (2019a). *Population, total*. The World Bank Group. https://data.worldbank.org/indicator/SP.POP.TOTL?most_recent_value_desc=true.
- World Bank. (2019b). *Population density (people per sq. km of land area)*. The World Bank Group. https://data.worldbank.org/indicator/EN.POP.DNST?most_recent_value_desc=true&view=chart.
- World Health Organization (WHO). (2018). WHO Housing and health guidelines. <http://www.who.int/phe%0Ahttp://apps.who.int/bookorders>.
- Yasmin, R., Saria Sultana, M., & Researcher, P. D. (2017). Strengthening the local government and effective role of Upazila parishad in Bangladesh. In *Journal of public administration and social Welfare research*, 2. Issue 2 www.iiardpub.org.
- Yeasmin, F., Rahman, M., Luby, S. P., Das, J. B., Begum, F., Saxton, R. E., Nizame, F. A., Hwang, S. T., Alam, M.-U., Hossain, M. K., Unicomb, L., & Winch, P. J. (2020). Landlords' and compound managers' role in improving and sustaining shared latrines in Three Dhaka City Slums. *Water (Switzerland)*, 12(7). <https://doi.org/10.3390/w12072073>
- Zanuzdana, A., Khan, M., & Kraemer, A. (2013). Housing satisfaction related to health and importance of services in urban slums: Evidence from dhaka, Bangladesh. *Social Indicators Research*, 112(1), 163–185. <https://doi.org/10.1007/s11205-012-0045-5>