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(Re)Thinking the Off - Grid City

Household Level Study



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The UKRI-GCRF (Re)Thinking the Off-Grid City (referred to as the 'Off- Grid City' project hereon) is an ESRC funded research project, with the Institute of Development Studies, as the Lead University and partner institutions across Asia and Africa. As a part of this research project, the partner institutions are undertaking research across sites in Ghana (Tamale), South Africa (Mossel Bay), Zimbabwe (Epworth), Sri Lanka (Colombo) and India (Bengaluru). The Indian Institute for Human Settlements (IIHS) as one of the partner institutions in this research consortium, is undertaking the research in Bengaluru, India.

Introduction to the Off- Grid City Project

The aim of the Off- Grid City research project is to reframe infrastructure planning, governance and participation in various city contexts to better support the lives of their most marginalised residents. In particular research will reimagine what infrastructure means in such contexts, where it is rarely experienced in the way envisaged by planners as the progressive realisation of access to a formal, city-wide 'grid' (Pieterse et al., 2018). Focus in particular will be on infrastructure 'assemblages', i.e., the multiple arrangement of infrastructure access determined not only by physical infrastructure, but the social, ecological and political relationships, and ideologies operating and influencing access at multiple city scales. Research will examine the interactions between five types of infrastructure assemblage: energy, water, sanitation, transport and communication. Whilst these infrastructures can be planned in silos, marginalised people's daily experience across these infrastructures needs to be researched together. In this research the focus is to understand how infrastructure constraints can combine to add to the vulnerability of the most marginalized to longer-term shocks and stresses and exacerbate their inability to meet basic needs. We will concentrate on food and nutrition security as one set of basic needs, which is significantly dependent on these infrastructures. Charting infrastructure interactions as they relate to food outcomes at multiple scales (city, neighbourhood, household) offers an innovative conceptual and methodological approach to unpack such interactions, and better understand the everyday means of coping, gaps and governance implications they entail.

This will enable a deliberate typology of cities and a range of different grid access - from being formal city- wide grid systems, to local micro grid systems, as well as off- grid systems, with formal, as well as informal practices, associated with each, to be read in relation to the regulatory environment within which they are situated. The settings are well known to the research partnership and the methodology will pinpoint sites in which marginality and infrastructure poverty combine, so as to allow charting the time and cost burdens to residents and their vulnerability to political, social and environmental disruptions which exist in such neighbourhoods.

Background and context

We have selected Ward X, in Bengaluru, as our primary field site for the household level study, continuing from the community diagnostics study undertaken there. The ward is located within the municipal limits of Bengaluru and is characterized by several registers of social and economic marginality, as per the data collated from multiple sources, including the Census 2011, as well as other secondary sources and primary surveys undertaken in the area. The residents of the selected ward belong to multiple religions, caste groups and income profiles. At least six regional languages are spoken in the ward, including Kannada, Hindi, Urdu, Dakhni, Telugu and Tamil. In addition, some residents (usually those that represent social, business and/ or political leadership) also have a working knowledge of English. These languages represent a history of people in- migrating to the city, including those that are recent migrants, as well as those that have been Bangalore/ Karnataka for one or more generations. The social heterogeneity within the ward is strongly represented in the variety of foods (both cooked and non- cooked) available in neighbourhood retail outlets and vending outlets, as well as the food choices of the residents. Selecting the entire ward as the study area allows us to draw on secondary data sources, such as the Census, where the data is presented at the ward- level. At the same time, the ward area is small enough for the sampling in the primary research design to be spatially representative of the ward's housing and socio- economic characteristics.

Despite, being located within municipal limits, the ward selected for study did not get access to gridded infrastructure services, such as water, sewerage, drainage, power supply, sanitation services, formal systems of cooking fuel (LPG) distribution, etc., as a part of a plan. Rather, the residents of the ward have secured access to basic infrastructural services incrementally, through neighbourhood- scale mobilisations, acts of violent and non- violent protests and the leveraging of politicized terrains of lobbying with government officials. In this, political representatives, political groups and social organisations, located in the ward itself, have played a significant role. Local leaders have also helped residents secure access to government approved IDs and documentations, including personal IDs, property-linked documents, financial transaction IDs, etc., which are necessary to get a connection to government provided utilities. While the ward has in time been integrated into city- grids of water, power, sewerage, etc., the actual quantity and quality of supply remains poor. The pipes do not guarantee provisioning. In the absence of good quality, assured supply from city- grids, the residents are dependent on local micro grids and off- grid systems of infrastructure provisioning to meet their needs. These local and off- grid systems include government- provided systems (e.g. local borewell grids), market- provided systems (e.g. private water tankers and small cylinders for cooking fuel refillable at retail stores), systems provided by local social/ religious organisations, such as local mosques, temples, the Dalit Sangharsh Samiti, etc. (e.g. Water ATMs and public toilets) as well as individual acts of repair and provisioning (e.g. 'valve- men', plumbers, electricians and local leaders that act as

'problem- fixers'). The social and economic heterogeneity in the ward has a bearing on the high density of locally active social/ political groups/ institutions, which continue to facilitate infrastructure provisioning. The learnings from the ward provide rich insights into non- linear infrastructural trajectories beyond the grid/ off grid binary, and lived experiences of urban residents coping with these non- linear trajectories, by being simultaneously situated at multiple points along the infrastructure griddedness spectrum.

At the last stage a Community Diagnostics Study was undertaken, comprising of three components:

a. **Part A: Neighbourhood- level Infrastructure Assessment**- This was undertaken to understand the types of infrastructure assemblages functioning at the NH scale for the provisioning of water, drainage, sewerage, electricity, cooking fuel, transportation, and communication. 37 interviews were undertaken with key- persons, including local social and political representatives, government officials responsible for infrastructure and utilities in the ward, residents, food retail businesses, operators of Public Distribution System (PDS) shops, as well as neighbourhood- level ground staff, such as the 'valve-men' (responsible for turning the water supply on and off in the neighbourhood) and solidwaste collection staff.

b. **Part B: Household- level Assessments of Infrastructure:** A dip- stick study through interviews with 15 households was undertaken to understand the household- level infrastructure usage, constraints, disruptions and repair/ redressal mechanisms. How infrastructure is linked to food preparation, cooking and food- related health issues was explored only at a preliminary level. The households were selected taking into account the socio-economic and spatial diversity of the ward.

c. **Part C: Retailer- based Neighbourhood- level Food Provisioning Study-** The third part of the study involved 15 interviews with food retailers and vendors, in the neighbourhood to examine the types of infrastructure assemblages supporting and shaping the functioning of food outlets/ vendors at the NH scale and how they in turn are influencing and shaping infrastructure access and infrastructure assemblages at the NH scale. The retail Public Distribution Shops (PDS), which sell raw 'rations' and Indira Canteens, which sell subsidised cooked meals were also included.

The Community Diagnostics study was able to offer preliminary understanding about the relationship between infrastructural stories and the food choices and cooking/ eating practices of the residents. This report provides details of these relationships in more detail.

Introduction to the Household Level Study

The Diagnostics Study highlighted that the food- infrastructure nexus is not easily unpacked through semi- structured interviews with key- persons and needs to be studied at the household scale.

The objectives of the household study undertaken were three- fold:

1. Understand the demographic, socio- economic and infrastructural conditions of marginalized households in the study area.
2. Understand the household- level linkages between food and infrastructure through daily decisions regarding food purchase, storage, preparation, cooking, eating, as well as infrastructure access, including collection, storage, bill payments and strategies for coping with disruptions.
3. Understand the temporal connections between food and infrastructure at the household-level through a daily journaling approach to capture food and infrastructure activities and choices.

Our approach to the household study was shaped by two key dimensions, which were revealed at the earlier Diagnostics phase. The details of these two dimensions are detailed below.

The gender dimension- Identifying the key responder for the household- study

The dipstick household study undertaken in the Diagnostics Study highlighted that women carry the bulk of the burden of handling infrastructural disruptions, as well as food preparation and cooking activities. As such, the study was designed keeping in mind that the survey would identify an adult female member of each household as the key responder. We also recognized at the Diagnostics Study phase that the gender dynamics in the households were such that women were likely to provide responses that minimized the challenges and burden implications of their activities, if they were interviewed in the presence of the men in the family. As such, the survey was undertaken with the key responder when she was either working with other women in the households, or was working on her own, in the house.

We also assessed that the social dynamics, associated with gender in the study area, would be better navigated, if we could bring on- board women who were from the neighbourhoods into the survey process, as community enumerators. We reached out to the local social and political leaders in the area, whom we met at the Diagnostics phase of the study to identify young women from the neighbourhoods who were likely to be interested. Finally, we on-boarded a select number, who showed interest, and trained them in the use of tablets for survey- taking, survey methodologies and research ethics. As community enumerators, these young women undertook the daily journaling part of the household study, in their

neighbourhoods, using a Kobo interface on tablets, which we procured for them. The IIHS research team members worked alongside them on the field, and carried out the other parts of the household survey (non- journaling parts). More details of the overall research design and research methodology adopted for the household study, including the process of
10 bringing on- board community enumerators, has been detailed in a later section.

The government dimension- Identifying the spatial sampling strategy for the household study

Unlike the previous stage of the study where the spatial scope covered the entire ward, the household study was scoped to capture the parts of the ward where the income and social marginalization was highest. This assessment was based on narratives of key persons interviewed at the Diagnostics phase, as well as observational inputs regarding housing quality across the ward. After identifying the pockets with the highest levels of observable social, economic and housing marginality, the areas were further sub- categorized into 'incremental plotted housing area' and 'resettlement colony housing area'. 'Incremental plotted housing area' included areas with housing built on owned land plots, where owners have built additional floors, over time. These additional floors either accommodate the extended family, including sons and daughters who have married and established their own households, or are given out as rental properties, which secures an income- stream for the owners. Incremental plotted housing, in the study area, typically range between two to four floors. The 'resettlement colony housing area' refers to public housing built by the Slum Development Board, through an in- situ slum redevelopment project. The resettlement colony housing was allotted to families that lived in a slum in the ward itself previously, as well as families that lived in slums in other parts of Bengaluru. The resettlement colony housing is four floors in height (G+3), and do not have elevators.

The sub- categories of 'incremental plotted housing area' and 'resettlement colony housing area' were used in the spatial sampling strategy of the household study, to explore if public housing (where it is expected that basic infrastructure services would be provided by the government), fared better than incremental housing (where households have had to protest, mobilise and lobby to get infrastructure services).

Research Design

Spatial Sampling Strategy

The primary research at the household- level was conducted to focus on marginal populations living in the study area. Sample households were selected from the slum resettlement colony located at the study site and an area with incremental plotted housing located near the railway line to understand the variations of infrastructure and food provisioning between these two typologies of areas.

We selected 11 households from each area to understand the overall level of infrastructure and food consumption and purchase patterns. The research team conducted semi-structured interviews with the selected households to understand the linkages between infrastructure provisioning and food. The questions explored linkages between infrastructure access patterns, documentation, disruptions, repair cycles and expenses incurred for accessing infrastructure, along with food consumption and purchase patterns.

The second part of the household study involved a household- level daily journaling of activities such as food consumption, purchase, storage and accessing infrastructure. For this, 8 households were selected out of the 11 households. Their day- to- day activities were recorded using a journaling method by community enumerators.

Community Enumerators

As mentioned earlier, the community enumerators selected were residents of the area. The selection of the enumerators was critical as they had to have a good rapport with the households and maintain sensitivity through the journaling exercise.

The research team selected the community enumerators on the basis of the following parameters:

- Age (the team recruited women between 18 – 28 years old)
- Language (preference given to women who can read, write and understand English as well as at least one of the locally spoken languages in the area)
- Place of residence (women from the same zones were recruited)
- Educational qualifications (women pursuing graduation / post-graduation were preferred so that the survey training and research experience would be useful additions to their resumes)

An intense two-day training workshop was conducted with the enumerators to train them on research ethics, methodologies and the survey tool. The community enumerators practiced with the research team to understand the journaling method in a detailed manner. As the data collection was to be done on tablets, the enumerators were provided with tablets during the training session so that they were comfortable with using it on the field.

Design of the questionnaire

The questionnaire was designed in two sections. The first part focused on understanding the larger narrative of the settlements from the household perspective. The overall improvement of the infrastructure and service delivery over time is evident from the responses to this part of the questionnaire. The broader story of the settlement in terms of what is usually done to access services, who does infrastructure provisioning, what is done when provisioning cycles are disrupted and the overall food consumption and provisioning for the households is mapped through this part.

The questions were broadly divided into the following sections to gain an understanding of infrastructure and food linkages at a household level:

1. Household profile
    a. Household size
    b. Demographics (gender, age)
    c. Type of work
2. Infrastructure
    a. Access story (through documentation and stakeholders
    b. Current status of infrastructure (grid and off-grid arrangements, timings, process)
    c. Expense profile (on rent, infrastructure, food)
    d. Income and asset ownership
3. Food habits
    a. Consumption patterns
    b. Purchase patterns
    c. Storage patterns
    d. Provisioning during the pandemic

The second part of the questionnaire involved a journaling exercise. This was designed to record the recall of the key responder to the previous day and from this understand the everyday events in the household, along with the coping strategies deployed on an everyday basis, in the face of infrastructural and food disruptions. This helped to gain an everyday

perspective of the households. The journaling process was also instrumental in noting the exact process of accessing a particular infrastructure and the time split across various activities.

Survey Tool - KOBO Toolbox

Semi-structured interviews and journaling questions / prompts were created with the assistance of the KOBO toolbox. KOBO is an open source software that helps in collecting and managing data. The research team created and reiterated KOBO forms so as to ease the collection of primary information. The exercise took over three to four weeks. Team meetings were set up to manage the KOBO form and arrange the semi-structured questionnaire in a format that will allow for a free-flowing conversation on the field. The KOBO platform was also used to design an interface for the questionnaire that would allow the filled responses to be stored offline and uploaded later, when internet connectivity was available. This was essential since internet is not accessible on the study site and it allowed the community enumerators, especially, to continue with the surveys, even they did not have regular access to the internet.

Stages of Fieldwork

The fieldwork followed the following sequence of activities:

Stage 1: Undertaken by the IIHS Research Team

1. Visit the selected households to explain the study
2. Seek and record consent from the household and identify the key responder
3. Conduct the semi-structured interviews at a date and time mutually convenient to the interviewer and interviewee
4. Following this, the IIHS research team explained the context for the journaling exercise to be undertaken by the community enumerator to the key responder and sought and recorded consent for the exercise.

Stage 2: Undertaken by the Community Enumerator

1. The IIHS research team accompanied the community enumerator on their first visit to the household
2. Following this, the community enumerators visited the selected households twice a week, for four weeks, to journal the daily activities related to food and infrastructure on the day before. The two days in the week were selected based on the Kaveri (used for drinking) water supply schedule in the area. Each area receives Kaveri water only twice a week. The

journaling is done for a 'water day' (when Kaveri water is supplied) and 'non-water day' (when Kaveri water is not supplied). The 4-weeks timeline helped us understand the everyday activity cycles and coping strategies. The journaling exercise was completed on the KOBO interface and designed, such that the responses could be stored offline on the device, when internet connectivity was not available.

3. At the end of either each day or each week, the IIHS research team would sit with the community enumerators to look over their entries and then provide them with internet access so the forms could be uploaded on to the IIHS servers.
4. The community enumerators were also asked to maintain their own diaries to record their experiences and observations after conducting the journaling exercise. These were also

14 discussed with the IIHS team each week.

It was critical to engage community enumerators in the process, both as a way to enable a comfortable environment for the women who were the key responders to reflect on the previous days activities and challenges with someone they knew well, as well as a way to stimulate prompts and provocations from the women who were the enumerators, who were also residents in the area and as such had experienced the same disruptions on the previous day and therefore were able to ask the right questions.

Timeline

The research team spent about four to five months on the field for this phase of the study. One month was allocated to shortlisting of community enumerators with the assistance of the key persons identified in the neighbourhood. Once the shortlisting of enumerators was done, the research team spent about one to two weeks training and onboarding the enumerators in accordance with the protocols of the institution. Further, three weeks were then spent on field to identify the households and establish rapport with the households so that the fieldwork could be efficiently conducted. The research team and the enumerators then spent two months interviewing the households and recording journal entries.

Learnings

Bringing community enumerators into the process was undertaken as way to incorporate some pathways of impact into the research process itself. Employment and income are two of the key aspirational pathways for social mobility on the study site, which we discovered during our time on the field. Through this process, we trained the community enumerators and built their communication skills, survey skills, technical skills to navigate the KOBO platform, and helped them gain familiarity with the use of tablets. As we learnt, our study site

regularly draws a lot of research interest from various researchers, and that there have been instances of local enumerators being recruited. However, they are either not paid or not trained properly. We hope through this exercise we have helped some of the women we have worked with gain some income, some experience and some confidence to negotiate better, the next time there is a prospect of them being involved in surveys. We also hope that this training and experience will add to their resumes and translate to their job seeking elsewhere. Further, we would be providing them with a letter of experience, and we hope that this will be of value in their future job searches.

Another outcome, which emerged, which was unintended and unforeseen, was that enumerators themselves gained knowledge of the history of the settlement. They have started understanding the issues more closely and in our conversations, we have gathered that some of them have become more intent in participating in the social mobilisations around infrastructure, in particular, and we hope in the future may even consider taking a leadership role. In this, we realize that the process has helped to transfer certain forms of tacit knowledge regarding the settlement that was held by an older generation of women (who are acting as key responders) to the next generation (community enumerators).

For us, engaging with the community enumerators has been a significant learning opportunity, in terms of research methods. The community enumerators undertook the journaling exercise both by recording responses on the tablets provided, as well as their own diary entries, regarding their experiences and observations, in notebooks we provided. The detailed diary entries are have been very useful for understanding the reasoning behind the decisions made by the households. Kobo is useful in looking at household data together and mapping patterns. But, the reasons for certain decisions often emerged during the conversations between the key responder and the enumerators. The research team met with community enumerators regularly and frequently, so as to stay current with the insights they were gaining from the field, which was not immediately apparent in the KOBO data format. In this, the community enumerators' familiarity with the area and neighbourhood was key as they were able to understand and interpret the experiences and perspectives of the households. They were also able to establish rapport and trust with community members more easily, leading to more accurate and detailed data collection.

We anticipated challenges in the process as well, particularly personal biases and errors during data collection. We mitigated this, by being continuously present on the field, with the community enumerators. However, we did not accompany them on their surveys. We conducted semi-structured interviews with a different set of households, while they conducted the journaling exercise with another set of households. However, since the research team was familiar with all the households and their broad activity patterns via the semi- structured interviews, it was also possible to keep track of discrepancies between what

we heard from the households and what the community enumerators heard. We discussed these discrepancies with the enumerators to gain insights and avoid errors. The use of the Kobo toolbox also ensured that data entry was in a particular format. The team trained the enumerators research ethics to ensure that the confidentiality and privacy of the households were not compromised.

Based on our experience, we believe that journaling exercises by community enumerators is a useful research technique for collecting in-depth, qualitative data on the experiences and perspectives of a community. However, the process needs ongoing hand- holding, monitoring and discussions. As such, it should not be treated as a way to outsource work or as a way to reduce the time- burden on the research team. In our experience, it is quite the opposite. The research team may have been able to do the work faster than the community enumerators, but would have gained fewer insights from the whole process. Various registers of risks, including those of maintaining confidentiality and privacy have to be carefully anticipated and mitigated when community enumerators are brought into the research process. For us, as a method, engaging community enumerators has proven to be quite helpful. The outcomes were multi-fold; journaling as an activity allowed households to reflect with the enumerators, new spaces were created for conversations on co-creating solutions and finally, the activity allowed enumerators to gain research experience.

Findings from the Household Study- Incremental Plotted Housing Areas

Most of the study area has housing that may be described as 'Incremental Plotted Housing'. As mentioned, this is housing built incrementally (either through sub- division of the floor-space in ground- only structures, or through the construction of additional floors in multi-storeyed structures) by owners of land plots for self- occupation or for rental purposes.



Figure: Incremental plotted housing

We selected households near the railway line to undertake the household level study. This location is low- lying and faces greater infrastructural constraints (as highlighted in the Diagnostics study report) and there are higher levels of social and economic marginality amongst the families living in this area. Observationally, this area has housing that uses more impermanent building materials and has smaller plot sizes. Infrastructure provisioning in the area has also followed the trajectory of incremental house- building, as population densities have increased.

Households in this area comprise of mostly Muslim families, who have been living here for two to three decades. Most households own the plot of land on which their houses are built. The original built structures have been expanded to accommodate the requirements of the growing family or to create sources of rental income. Houses have either expanded vertically with two-three units on each floor with shared toilet facilities or single floor houses (usually with roofing made of impermanent materials, such as corrugated tin- called 'sheet' houses) have been divided into two/ three units. The family and kinship extensions, which have prompted the incremental expansion/ subdivision of housing in the area has also led to

strong ties of kinship and social networks amongst households in the area. The rental units are given out to migrant workers and rental agreements are usually oral, rather than written. The stories of infrastructure provisioning, which have emerged from the household study in this area have strong and frequent references to the identity of their 'gully' (*street*). 18

The area has experienced incremental upgradation of infrastructure. Social, rather than political networks have facilitated the laying of infrastructure grids and their incremental upgradation over time.



Figure: Political parties hold events to leverage on social networks

Water

The area has moved between gridded and off-grid arrangements of water provisioning over the years. Most households depended on wells, before grids were laid out. The Kaveri pipeline was extended to the area and pipes were laid after households paid the BWSSB. Significant effort from the households was needed to get this extension. The households that received connections first provided water to other households that were being constructed in the area. Usually, the households sold Kaveri water at a reasonable rate to other households in order to ensure that there is no wastage of water and there is some recovery of the initial capital investments they made. BWSSB was involved in laying the grid and providing these connections, but it had no role in these negotiations.

As the area densified, water demand increased. The households in the area mobilized and made a demand for a separate Kaveri grid. They wrote applications and protested outside the municipality office. These activities got the attention of the local elected representatives and the grid was laid out in the area. As per the official process, the households had to then submit applications to the BWSSB to get independent connections in their houses. However, at the time, households did not have enough money to pay for the material, labour and water meter and ended up getting connections through private means, by hiring local plumbers. The BWSSB conducted random checks to cut 'private' connections. In response households either re-established connections by hiring a local plumber, or filed an official application to secure an approved water connection and water meter. The official process was time-consuming and expensive (INR 5000 – 8000). In time, most households in the area have secured 'official' connections and water meters. In addition, to the capital outlay for the water meter etc., households also pay INR 200 - 300 every month for the provisioning of water. Tenants also pay a fixed amount for water and electricity.



Figure: Wells used before the water grids



Figure: Kaveri water connection

However, the grid and the official connection does not necessarily guarantee the provisioning of water. Actual supply depends on whether the household is connected to the main pipeline or to the branch pipeline and what kind of motor the household uses. If one of the households owns a particularly powerful motor, it nullifies other motors attached to the grid. In this area, however, the scale and scope of confrontations that this is likely to trigger is mitigated by extensive practices of sharing of water motors between households.



Figure: Water motor physically carried.



Figure: Underground sump

When the Kaveri supply is disrupted, as it is at least once every quarter, households have to depend on (off- grid) water ATMs for drinking and cooking purposes. This area is located at a distance from the water ATMs and most households use their own transport system to get to the ATM. The households here are not able to use water tankers, as the narrow entry road prevents tankers from entering the streets. While water ATMs allow households to fulfill basic drinking and cooking needs, without water tankers bathing and washing activities are restricted. Households have raised the issue of poor road infrastructure affecting their water needs multiple times with the authorities.

The borewell grid in the area, connected to community standposts made of plastic, has become defunct over time. It was not maintained, as households were fairly comfortable with the supply of Kaveri water, when it was first provided. Households stopped paying the valve man and in time most of the plastic standposts broke. Unlike other neighbouring areas, households here did not invest in replacing plastic standposts with steel ones.
In the interviews with the household, we discovered that the identity of the 'gully' (street) breaks apart in some areas, especially the relatively low lying areas, which in this zone get the advantage of getting easier access to Kaveri water than the rest of the street, due to the pressure difference in the pipes and because they also own the most powerful motors. This has led to tensions within the households. Most households in the low-lying area are also

constructing additional floors and creating rental units. Thus, they draw more water than what they did previously.

In summary, the households have been able to develop coping strategies (which are heavily gendered) to deal with problems of water supply, but there are significant day-to-day implications.

Sanitation and hygiene

Sewerage arrangements have incrementally improved over the years in the area. There were septage systems before sewerage lines were laid. As population density in the area increased, the households in the area mobilized and visited the municipal office to demand sewerage connections. They organized regular protests and reached out to political representatives before elections. Once the main sewerage line was laid, households paid separately for the material costs and the labour costs to connect their houses to the line.

The frequency of disruptions in the sewerage system is low as compared to the water system and from our household study, we understand that this may be because households were continually involved when the pipeline was being laid and that the sewerage line laid is quite wide and has the capacity to absorb future densification. However, disruptions do occur at least once or twice a year. Households call the municipal office or the valve man to procure a cleaning truck, which takes a week to respond. Individual households spend about INR 2000 – 3000 to get blockages cleared. Blockages are usually caused by shared toilets, which are present in houses with impermanent sheet roofing and used as rental units.

Solid waste disposal is a major issue in the area, because of the narrow street widths, which do not allow the municipal garbage collection trucks to enter the area. Households have been unable to arrive at a consensus regarding the hiring and payment of a garbage collection person, privately. So households, have the responsibility to dispose off waste. Women of the household are responsible for collections, while the men are responsible for disposal. Complaints have been made to the elected representative, multiple times by the households, but there has been no resolution.

Electricity and cooking fuel

The houses in the area have electricity connections and meters. Most households in the area made an initial capital investment to get connections to the power grid. They applied to get their electricity connections while constructing their houses. The rental units either have a

separate meter or pay a fixed amount to the houseowner. Disruption in electricity supply is not frequent however there are significant problems when power cuts are scheduled to coincide with water supply timings, highlighting the inter-dependency between infrastructure systems.

The area is not well lit, as street lights do not function most of the time. This translates to roles being split along gender lines by day and night.

Most households use LPG. Cylinders are transferred (permanently) and exchanged (temporarily, when a family runs out of gas at the end of the month) within extended family networks. Sometimes households negotiate with the delivery person directly, for delivery. The use of wood, kerosene and charcoal is not prominent in the area.

Food and infrastructure

The multiple grid and off-grid arrangements of infrastructure provisioning plays a significant role in ensuring that eating, food preparation and access to drinking water in the area is never so severely compromised that it affects a household's ability to eat. The household study findings highlight that the time commitment in times of infrastructure disruptions, does not severely affect the purchase and consumption of food. Most households consume two to three meals everyday. In part, this is because access to food retail outlets, vending outlets and cooked food options, in the neighbourhood are close, affordable and multiple. The mixed land use of the area plays a significant role in compensating for the unreliable and time- consuming infrastructure related activities. For example, one of the households surveyed runs a grocery store with everyday items such as milk, bread and eggs, within the house. The flexibility also encompasses the spectrum from vendors at one end, to formal shops on the other.



Figure: Local market- systems

Water storage is a key coping mechanism for the households to ensure that daily activities such as cooking, food preparation, eating, access to drinking water and washing pots and pans are not affected. Most households have constructed sumps and created spaces for keeping plastic drums, and reported that storage of water is not a major concern. Cans for drinking and cooking water are also brought from the water ATM and stored in case there is a disruption.

The households also did not report that food storage, food preparation and cooking are severely affected by power supply disruptions. Most households do not store perishable foods for extended periods of time. Refrigeration is primarily used for milks, spices and leftover vegetables. Households do not prefer to keep meat in the refrigerator as they claim that it affects the taste. Given the proximity of food outlets and vending outlets, they typically prefer to purchase fresh items regularly rather than store them for long periods of time. Households buy fruits, vegetables and meat every alternate day. Dairy products are brought nearly everyday, to ensure freshness.

Most households also have a separate kitchen area. This is usually constructed on a slightly elevated area within the house, to prevent it from being affected, in case of flooding. Households store dry ration either on make-shift shelves or over the platform counter in the kitchen. The household study highlighted that households did not face any severe issues in the kitchen area, even when there was heavy rain and flooding.

Households primarily eat food that is cooked at home, but they also purchase regularly from restaurants and savory snack shops located in the neighbourhood. These outlets are affordable and many respondents purchase food from them, as they perceive it as being fresh and hot. These small- scale but ubiquitous food market system, which is interspersed and woven into the neighbourhood's built fabric plays a significant role not only creating easy access to food in the area but also ensure that households do not miss a meal. The state authorities enable these neighbourhood level market- led food system through a mix of low licensing fees, flexible enforcement of planning regulations, such as land use changes and use of premise regulations, and lack of deep surveillance.

The market- led system is supplemented by the state system of the PDS shops and the Indira Canteens. Most households claimed that they did not use the Indira Canteens, even though it is less than a kilometer away, preferring to purchase from local restaurants and vendors. It is also an inconvenience for the households to plan their food according to the Canteen's timings (there are fixed timings for serving breakfast, lunch and dinner) as they have to manage accessing infrastructure on an everyday basis, with no guarantee regarding timings. In contrast, the restaurants, shops and vendors offer flexibility of timings whenever they want to access food.

Most households have ration cards and use the PDS outlets. They reported that they get rice and ragi from these shops. The rice from the PDS outlets, it typically used only for making '*idlis*' and '*dosas*', for which rice quality is less important, rather than as cooked rice. While there is an option to opt for cash instead of staples, most households prefer to buy the staples, as the cash given is low. The households also highlighted that while the PDS outlets also sell other items such as oil, cleaning detergents and shops but usually these are more expensive than the market rates, so they do not purchase them there.

During the lockdown, the households received food packets in the form of ration and cooked food. There was a mix of public and private players who were involved in provisioning of food during the lockdown. Indira canteens provided food for free. The municipal corporation supplied milk and biscuits, which were brought to the area every day. Dry rations as well as cooked food were distributed by public and private players in the area. However, in the household study, it was reported that there was unequal distribution of rations in the area during the pandemic.

The household study indicates that the households in the settlements have constructed coping strategies regarding food also through multiple actors associated with the state, market and society; however these coping strategies are still precarious in nature.

Findings from the Household Study – Resettlement Housing Colony

The 'resettlement colony housing area' refers to public housing built by the Slum Development Board, through an in- situ slum redevelopment project, located within the study site. The resettlement colony housing was allotted to families that lived in a slum in the ward itself previously, as well as families that lived in slums in other parts of Bengaluru. The resettlement colony is a notified slum. The project was financed by the Jawaharlal Nehru National Urban Renewal Mission, which is a national scheme.

Housing

The resettlement colony has 10 buildings. Each is a G+3 structure (four floors), without elevators. Houses were allocated through a lottery system to households who could produce an identity proof and a proof of residence (such as an address proof or a utilities bill) at the time of the enumeration exercise, undertaken by the municipality, in the slum that existed on the site previously, to count the number of households that were to be accommodated in the in- situ slum redevelopment project. The allocation was done on the primary principle of 'house for house'. The size of the household was not taken into consideration during the allocation process.

Semi-structured interviews with the households highlighted several design issues with the houses that were built. The old housing (which were part of the slum that was redeveloped), were located at the ground level, which allowed additions to the houses to be made both vertically, as well as further extensions on the ground level to accommodate growing families and their needs. The new housing does not allow this. At the time of allocation, there were no options for households to choose a particular floor or house. Yet, it is to be noted that the community leader of the resettlement colony was allocated a house on the ground floor, which is generally preferred.

The community leader of the resettlement colony has played an important role in securing services and addressing infrastructure disruptions in the area. The initial access to water, sewerage and electricity were mediated by the community leader. They continue to play a central role in terms of raising issues with the state authorities, liasoning with the implementing agencies and actively participating in the resolution of conflicts in the area. The leader also has strong connections with the political party in the area.

The households in the area were issued a temporary property document for15 years by the Karnataka Slum Development Board, when they were allotted the houses. These documents restrict selling, renting and use of commercial purposes of the property. It is possible that the

households will either get an extension on their tenancy or convert to a permanent property document in time. The tenure security in the resettlement colony is therefore precarious, in law, if not in practice.
During the house allocation process, there was an attempt to address inclusivity concerns by prioritizing ground floor houses for individuals who were old or disabled. The implementation of this was tricky in practice. Households did not have full information about this provision and at the time of allocation were operating with a deep sense of fear of "missing out", if they did not accept their allotment. As such, many households with old and disabled family members ended being allocated houses on the upper floors. As mentioned the buildings do not have an elevator. There were no provisions for 'formally' swapping houses once the allocation was done. Instances of personal negotiations, with payment, mediated through community leaders were highlighted when we interviewed the households. Households have also in time negotiated ways to use houses for residential-cum-commercial purposes. Possibilities of surprise checks by the Slum Board officials do exist. These arrangements are precarious and 'illegal' in the eyes of the law. Gaining legal legibility by securing various forms of government- approved IDs and documentation is a strong consideration for households in this area.

Water

Households in the resettlement colony are primarily dependent on the city- grid for Kaveri water for drinking purposes, and the local micro- grid connected to borewells for all other non-drinking uses. Kaveri water is supplied to community stand posts located in every block of the resettlement housing complex. The borewell water is supplied directly to the sumps constructed between the building blocks. The households then use water motors to pump the water to overhead tanks on the buildings to get supply in their household taps. The households are also dependent on water ATMs and water tankers (off-grid arrangements).

Water provisioning differs for each building block in the area. Each block has 16 houses and has access to only one community tap with Kaveri water supply (drinking water). Based on our observations and interviews with the households, we understand that the process of catching Kaveri water is hierarchical. One of the respondents provided an extreme example – their household collects the waste water from the Water ATM to perform household chores when they are unable to secure borewell or Kaveri water. The quality of the household's relationships with the local leader are also critical here, as they mediate the access to water tankers etc. when the need arises.

Borewell supply is not as much of a problem within the settlement. Households share a borewell connection and the sump. Sumps are periodically cleaned by the households. Initiative is taken jointly by households and the maintenance does not require any

intervention from other actors. One block in particular modified the borewell pipe by primarily establishing valves on each of the floors of the block through private plumbers. According to the households in this particular block, the valves allow them to distribute the water equally between the three levels. Some of the respondents during the household survey highlighted that they also use borewell water for drinking, after boiling it.



Figure: Water sump between two blocks



Figure: Water motor to pump water to overhead tank

Electricity

Houses in the resettlement colony were constructed with electric points, however they were not hooked onto the city's power distribution system and allotments were done without this basic infrastructure. Technically, provisioning of electricity within the public housing, which the resettlement housing represents, is the responsibility of the state. However, the household study highlighted that there is an ongoing conflict between the Electricity Board and the Slum Board regarding the installation of electricity meters. In the meantime, households have secured informal connections by employing local electricians and drawing connections from local power lines. Given the 'illegality' around these connections, these connections are frequently cut by the Electricity Board.

Power cuts in the grid also disrupt other infrastructure cycles and everyday routine for the households. Households often cope by waking up as early as 2.30 AM to fill water. Mostly the households are coping through informal connections, which is 'illegal', but also because they were not given formal connections as a part of a public housing project.

Sewerage, Waste, and Sanitation

The resettlement colony was constructed with individual household toilets and sewerage connections. However, the system has severe capacity issues and the sewerage lines get blocked frequently (almost two times in a month) with backflow, which is a serious health problem in the area, especially in the rainy season. The severity differs from block to block. Neighbours frequently have conflicts over water usage to clean common areas as it

sometimes causes backflow problems. Interviews with the households revealed the sewerage system is the most difficult for them to manage.

In terms of overall sanitation and waste collection of the settlement, the area does not have door-to-door waste collection. The municipality sweepers do not come to this area on a regular basis. Households take the responsibility of cleaning common spaces within the blocks.



Figure: Cleaning trucks called for removal of blockages

Food and Infrastructure

Though there are severe infrastructure issues in the resettlement area, which disrupt everyday life, but they do not seem to significantly change cooking and eating habits. Multiple families often come together to cook, especially weekends. Local vendors and restaurants also sell food at considerably cheap and affordable rates. Some households run kitchens for breakfast. Most households who are unable to find time to cook rely on these providers. The quality, price, taste and accessibility all make these private providers a much- needed option for the households. Households sometimes also skip breakfast due to lack of time, and compensate by drinking tea or coffee. Over weekends the common areas turn into a

community kitchen and cooking happens on a larger scale, with a preference for dishes such as biriyani or other non-vegetarian food. Most households use LPG, but use kerosene and wood, as backup fuel options. This is especially common when the LPG cylinder runs out and/ or there is a delay in scheduling or receiving new cylinder.

On Fridays, when Kaveri water supply is available, households get busy with the water schedule and prefer to get food from neighbourhood vendors. When there is disruption of Kaveri water supply households use the water ATM supply for cooking or eat bought from outside. Some households do not use either the ATM water or the borewell water as it discolours their food (turns the food “yellow”).

Sewerage issues, particularly backflow and foul smell, was a concern raised by households, who said that it affects their food preparation and consumption. In the household study, we also discovered that the storage of food grains is sometimes affected by the presence of rats. In general, households do not store / refrigerate any meat product, preferring to buy fresh.

Public food systems such as Indira canteen, PDS shops and school mid-day meals are present, but do not seem to get used extensively, as compared to the local vendors etc. However, these systems were important for food provisioning during the pandemic. In addition, the local community leader and her networks played a key role in food provisioning during the pandemic.



Figure: Fresh cooked breakfast vendor



Figure: Savoury shop

Comparative analysis: Incremental Housing and Resettlement Housing

Income profile of the sample households

The study was undertaken with households, experiencing high socio- economic marginalisation. As highlighted in the table below, the sample selected across the two areas had household incomes between a little more than INR 40,000 (~ 400 pounds) to less than INR 2500 (~ 25 pounds) per month. Most households earned between INR 10,000 and INR 40,000 (100 to 400 pounds) per month. This marginality, especially in the lowest income category, translated to most of the adult household members being working members of the family, to achieve a minimum family income level. At slightly higher income levels, family size of the households were larger, with more dependents per working person in the family. Family size and number of dependents increased with higher monthly income levels. On an average, the sample households had at least 2 working persons.

Employment profile of the sample households

The sample households were employed in diverse range of occupations. However there is a clear gender difference in the employment profile. A majority of the adult women were involved with housework. Most adult men have employment that involves manual labour, gig work and professional services. Housing profile of the sample households

Most households interviewed have lived in the area for more than 10 years. The sample also included 4 households that have moved to the area less than 3 years ago. All households surveyed have their own living space (not shared), either in the form of a house or an apartment, but 3 of the households (2 renters and 1 owner) have to share toilet facilities with other households. The house/ apartments of all the sampled households occupied a house/ apartment with at least 2 rooms, however one house did not have a dedicated space for a kitchen inside their house.

Households across the two neighbourhoods pay similar rents, households in resettlement colony pay almost no cost for accessing infrastructure. However, this is not because of government provisioning of infrastructure in the area but instead the lack of metering and 'informal' forms of provisioning that have been figured out in the absence of formal provisioning. As highlighted in the report earlier, the households in the resettlement colony lack metered connections to electricity and water, while in the area with incremental housing, households pay higher for infrastructure, where access to infrastructure is metered and transaction based.

Asset ownership profile of the sample households

Since we anticipated that the income reporting in the household survey would not necessarily be accurate, the household study also captured asset ownership along with income details to build a better understanding the households' socio-economic characteristics.

14 of the households owned a personal vehicle (Scooter, Bike, Auto). Only one of the four households with monthly earning of under INR 10,000 owned a vehicle.

All households in the sample owned a gas stove and most of the households owned refrigerator, television and mobile phones. Only households earning more than INR 10,000 owned a tank for water storage and had internet connection at home. One household in the sample didn't own refrigerator or any form of water storage (tank/drums). 3 households in the resettlement area owned a water motor/pump while 9 households in the incremental site owned a water motor/pump. This is also because of presence of community water motor in resettlement area. None of the households sampled owned an inverter or 4 wheeler.

Infrastructure profile of sample households

The summary findings regarding infrastructure from the household study included:

- Water: All households in the resettlement area receive and use both borewell and Kaveri water supply. All households in the incremental housing area reported using Kaveri water only, with 80% of the households reporting that they have private metered connections in the house. 20% of the households said they use community taps.
- Electricity: None of the households in the resettlement area have electricity meter connections. All households in the incremental area have metered electricity connections, with 80% of the households reporting that they have private metered connections in the house. 20% of the households said they share an electricity meter with someone else.
- Cooking fuel: In the resettlement area there is a diversity of cooking fuels used. 80% of households use LPG, but 18% also use kerosene and 9% also use wood. In the incremental housing area, all households use LPG.

Comparisons across the two areas - Drinking water supply:
Across the two sites, households in resettlement colony only had community connections for drinking water (Kaveri) and none of them had metered connection. Comparatively, most households had a private connection inside house and 2 households using a community connection in the house in incremental sites with 4 out of 11 households having no water meter. Households across the two sites store drinking water in plastic drums or small pots (bingiyas). 7 out of 22 households in the neighbourhood complained about sewerage smell or mixing of sewerage with drinking water especially during rainy season. When major disruptions occurred in drinking water, households reported informing local leaders/ ward councillor to get issues resolved. Households which did not get water supply due to low pressure would generally borrow water from neighbours.

Comparisons across the two areas – Borewell water supply:
Only households living in resettlement area reported using borewell connection where all of them have community connections. Households in the resettlement pay INR 10 - INR 20 per month to access borewell water. The most frequent complains related to borewell water in resettlement colony included bad quality of water, constant cleaning of borewell tank and breaking of motor.

Comparisons across the two areas – Electricity supply:
Households in the resettlement area do not have access to metered electricity connection and as such use direct connections from the supply line via informal connections. As such, they report constant problems of power cut due to disconnection by government officials and calling local electrician to reconnect. Households in the incremental site do have metered connections but complained about street lights not working and hence feeling unsafe in the evenings.

Comparisons across the two areas – Sewerage, Drainage and Solid Waste Management:
Households in both the areas had connections to sewerage and drainage lines and spend INR 10 - INR 30 monthly with occasional big costs for repairing or material replacement in the private connection or cleaning. Both the areas complained about having lack of Solid Waste collection facilities. While households in Incremental settlements would go to main street to dispose of waste, households in the resettlement area would dispose it in the sewer lines. As such, households in the resettlement area reported repeating complaints about blockage or backflow in the sewer and need for frequent cleaning.

Profile of food habits in the sample households

The household study captured more than 300 household meals across 16 households over a period of two months. A brief summary of the eating habits and food choices are provided below:

- At home: Households prepared and ate at least two meals at home on most days captured through the survey. Across both sites, households cook and eat the same food in more than one meal, on most days, in order to save time and energy. Staples (Rice/ Idli/ Dosa) and protein (Red meat/ chicken/ egg) were present in most meals. Home cooked meals also have a diversity of vegetables such as peas, green beans, drumsticks, green leafs, potato, etc. While most meals reveal a diversity of the food plate, there are times when the households cook meals such as “Rice and Tomato Puree” or “Idli and Dosa”, which lack nutritional diversity. Nearly 87% of all the meals captured for households in the incremental plotted housing area, were home- cooked. In the resettlement area, 84% of the meals were home- cooked. In both areas, the food from outside was procured mainly from neighbourhood shops, restaurants and vendors.

From outside: There were relatively few instances (54 meals) of households eating outside. More often, a part of meal was brought from outside and eaten with home cooked meal. Usually this is either a staple, protein, or processed food (such as Instant noodles, namkeens, chips) brought from a shop/ restaurant within the neighborhood. There are also some instances of people including part meals, which were cooked and shared by a relative. The most common items in outside food included breakfast items such as dosa, idli, vada, eggs, chutney and sambhar. 60% of meals eaten outside were eaten from shops/ restaurants in the neighborhood. While Indira Canteens are prominent in the neighbourhood, households reported awkward timings and food being over along with availability of cheaper local options as reasons for not eating at Indira Canteens.

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