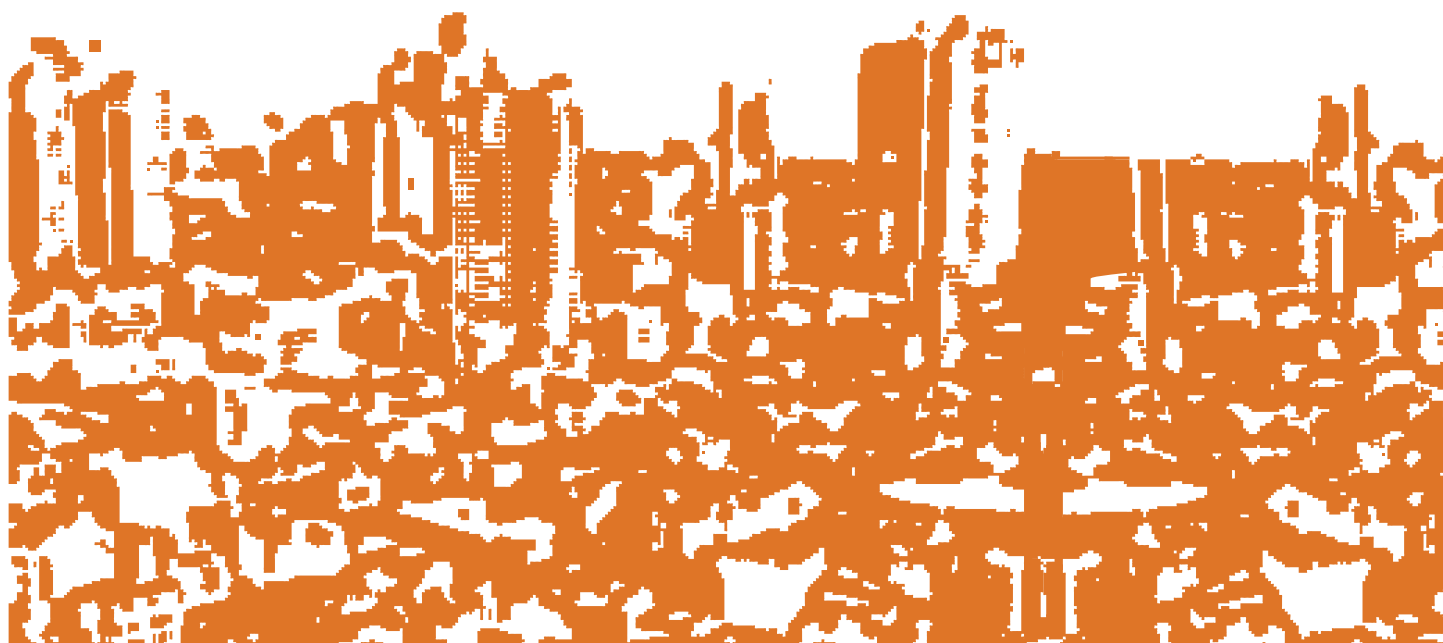

Asian Cities Climate Resilience

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City adaptation strategies

Recognising livelihood struggles of migrant workers in India

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Abstract

This paper examines the adaptation strategies of migrant workers to diverse livelihood risks and uncertainties in Indian cities. This research was part of a larger study that examined the vulnerability contexts of migrant workers to climate change and health inequities in three cities: Kochi, Surat and Mumbai. The findings of this paper are inferred from data collected through qualitative interviews from 45 migrant workers in the three cities. Insights are provided on the following adaptation strategies: mobility; livelihood diversification; risk pooling; asset conservation, storage and enhancement; self-remedy; market exchange; structural adaptation; and informal entrepreneurship. This paper asserts that informal entrepreneurship could be poised as a successful adaptation strategy. Such a framework also provides an opportunity to develop a framework that blends agency-based adaptation with a socio-ecological system perspective.

1 Introduction

This paper is part of a larger study that examines the vulnerability contexts of migrant workers to climate change and health inequities in three cities of India. The larger study was organised into three thematic components:

- Vulnerability contexts of migrant workers in the informal sector to climate change and health inequities (Santha *et al.*, forthcoming),
- Adaptive social protection (Jaswal *et al.*, forthcoming), and
- Diverse adaptation strategies of migrant workers including informal entrepreneurship.

In this paper, we mainly discuss insights drawn from the third component namely, adaptation strategies of migrant workers to diverse risks and uncertainties amidst their day-to-day livelihood struggles. It specifically examines the adaptation strategies of migrant workers in the informal sector to diverse livelihood risks and uncertainties in the cities of Kochi, Surat and Mumbai.

Adaptation in the context of climate change is referred to as the ‘adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities’ (IPCC, 2007: 869). Scholars engaged with livelihood risks and uncertainties understand adaptation as the enhancement of the capacity and thereby reducing the vulnerability of individuals, groups, communities or states. According to Osbahr (2007:6)

Adaptation is the ability of social and environmental systems to adjust to change in order to cope with the consequences of change. It is seen as the heterogeneity of a system or the diversity amongst institutions and assets available in social systems. Adaptation is not a solution for development problems, however it does offer an opportunity to rethink our approach to longer-term risk and engage different discourses.

In this regard, it would be beneficial to focus on the opportunities that climate change adaptation offers to develop innovative technical and institutional strategies that strengthen the resilience and livelihoods of vulnerable communities (Scheffran *et al.*, 2012).

Adaptation can be the planned or unplanned response of a system to a change in its environment (Burton *et al.*, 2006; Tol *et al.*, 2008; Christoplos *et al.*, 2009). It can involve both building adaptive capacity thereby increasing the ability of individuals, groups or organisations to adapt to changes, and implementing adaptation decisions, i.e. transforming that capacity into action (Adger *et al.*, 2005). Social resilience could be then understood as ‘the ability of communities to absorb external changes and stresses while maintaining the sustainability of their livelihoods’. (Adger *et al.*, 2002: 358). In this paper, we hold the view that the adaptation strategies of migrant workers need to be seen as social, economic and political processes, and not as mere technical exercises (Tol *et al.*, 2008). Migration has often been referred to as an adaptive strategy to climate change impacts (Renaud *et al.*, 2007). In this regard, scholars have explored migration as an indicator of vulnerability and adaptive capacity as well (McMichael *et al.*, 2012). For many migrants, the move to a new location can alleviate health deficits or avoid extreme hazard situations. In this sense, migration contributes to adaptive capacity (ibid).

Migration, at any level, can be considered as a function of exposure and adaptive capacity (McLeman and Smit, 2006). An inherent characteristic of vulnerability is thus the population's adaptive capacity (Blaikie *et al.*, 2003). Adaptive capacity can be understood as the livelihood resources and environmental entitlements that urban poor have access to or make claims upon to secure their livelihoods and thereby respond to climate change (Nelson, 2011). It is also about the ability of these people to actively engage in processes of learning and respond to new crisis situations (*ibid*). The adaptive capacity is determined based on available assets and conditions such as knowledge, impact, intensity and the level of vulnerability (Kronic and Verner, 2010). DiGiano and Racelis (2012) have identified five key factors that determine adaptive capacity of social-ecological systems: the biophysical attributes of the system, the institutional context, connectivity, livelihood diversity and social memory. Nevertheless, Raleigh and Jordan (2010) point out that issues surrounding climatic thresholds, coping strategies and cumulative disasters are critical factors which have not yet received attention among social scientists studying migration. The poor capacity of migrants and other vulnerable groups in cities to adapt to environmental risks and hazards could force them to move from those spaces of risk (Kates, 2000).

The poor and marginalised sections of the urban population often have limited access to institutions (Cleaver, 2005). An analysis of the nature of institutional linkages and access across different social groups therefore becomes critical before designing planned adaptation projects (Agrawal, 2008). Adaptation contexts are also sites of social interaction, negotiation and contestation among diverse stakeholders who possess different values, interests and power (Giddens, 1984; Long, 2001). It involves socialised ways of interacting and underlying worldviews, as well as structures and organisations that influence resource allocation (Adger, 2000). A practice-based approach to adaptation could then reveal the implications of diverse adaptation strategies specifically with respect to localised practices and the relations of power within which they are structured (Mehta *et al.*, 1999).

2 Theoretical frames on adaptation

Climate change adaptation from a social justice lens emphasises that ‘those whose lives and livelihoods are most vulnerable to the consequences of climate change and who have contributed the least to its causes should receive preferential support’ (Mearns and Norton, 2010: 10). In this regard, from a climate justice framework perspective, Bulkeley *et al.* (2014) have argued that research needs to engage with how climate change action creates both costs and benefits, which could be unevenly experienced across cities. Thus, it is important to engage substantively with the notion of climate justice as the recognition of vulnerable and marginalised groups (*ibid*). Recognising these groups helps us to understand whether climate change adaptation addresses the existing vulnerabilities and inequities within these groups (*ibid*). It also provides an opportunity to explore how climate change is affecting the city and in turn worsening existing vulnerabilities (*ibid*).

Effective and equitable adaptation can only be achieved through design strategies that are integrated with existing approaches to poverty reduction and development (Mearns and Norton, 2010). It also needs to be understood that adaptation in response to climate change does not stand alone. Instead, it needs to be integrated into larger policy and development planning strategies (Kronic and Verner, 2010). Accordingly, ‘social safety nets, social funds, community-driven development, micro-finance, weather-based index insurance, and other mechanisms for social protection will be critical for helping poor people adapt and for helping when adaptation fails. Inclusive and responsive institutions are needed to ensure that the provision of critical services (health care, housing, education) can adapt to a changing situation’ (Mearns and Norton, 2010).

Asset-based adaptation approaches draw crucial linkages between the livelihoods and capabilities of the population at risk (Bebbington, 1999). These approaches are relatively flexible, long-term oriented and incorporate the access of vulnerable groups to social, economic, political, physical, human and natural assets (Moser and Satterthwaite, 2010). Moser and Satterthwaite (2010) assert that the asset portfolios of individuals, households and communities are a key determinant of their adaptive capacity. Nevertheless, asset-based adaptation strategies do not happen in an institutional vacuum (*ibid*). Factors such as government policy, political institutions, civil society actors, laws, environmental forces and regulatory frameworks will determine the nature and success of adaptation strategies (Moser and Satterthwaite, 2010; Kronic and Verner, 2010). Consideration must be given to the interaction of social interfaces that emerge when planned and autonomous adaptation strategies interact with one another (Long, 2001; Moser and Satterthwaite, 2010). What is deemed to be a successful adaptation strategy on one hand may erode the stability of asset-based adaptation in other contexts (*ibid*). Adger *et al.* (2005) observed that elements of effectiveness, efficiency, equity and legitimacy are important in evaluating the success of adaptation strategies. However, in the context of migrant workers in informal sectors in cities of India, such indicators may not be always successful in qualifying adaptation strategies. The informal sector is more complex and fluid. In addition, the implications of adaptation strategies need to be studied further.

3 Methodology

This paper is part of a larger study that examined the vulnerability contexts of migrant workers with respect to climate change and health inequities. A crucial component of this study was to explore the adaptation strategies of migrant workers in three cities of India, namely Kochi, Mumbai and Surat. Along with the semi-structured interview schedule used for the larger study, we used a checklist to capture the diverse adaptation strategies of migrant workers. The larger study covered 50 migrants in each of the three cities, totalling 150 interviews with migrant workers. However, with the aim of analysing the adaptation strategies among these respondents, 15 cases from each of the city were purposively selected.

The adaptation framework as proposed by Agrawal (2010), which considers the factors of mobility, diversification, storage, communal pooling and market exchange, guided our initial discussions with migrant workers. However, it was decided to keep the interactions open to other forms of adaptation strategies as well, as the adaptation strategies of migrant workers in a post-migration scenario in cities are quite different from adaptation strategies in a rural context. The qualitative data that we collected through interviews were then thematically coded and the emerging patterns were analysed. The diverse adaptation strategies that were categorised thematically are discussed in the following section.

There were several limitations with the study. During the interviews, we understood that for more than 50 per cent of respondents in each city, it was extremely difficult to unearth the diverse adaptation strategies within the given temporal-space dimensions. This was mainly because of the fact that most of these migrant workers were deeply rooted in their vulnerabilities and there were no inherent manifestations of successful adaptation strategies. It was also difficult to theoretically outline some of their immediate responses to crisis situations as adaptation. Our observation was that many of these migrant workers were falling from one vulnerability spiral to another, leaving less scope for adaptation as such. Thus, 45 cases were filtered out that seemed to be successful in dealing with diverse livelihood risks and uncertainties in the cities.

4 Livelihood strategies of migrant workers

Societal assessments of climate change adaptation have to begin with the identification of current conditions and exposures, and the past and present strategies that local communities have employed to deal with change (Karlsson and Bryceson, 2014). Therefore, research needs to fully understand the drivers of past adaptation efforts, the need for future adaptation, and how to mainstream climate into general development policies (Mertz *et al.*, 2009). Studies on adaptation to climate change have mostly focused on the adaptation strategies and capacities of rural communities, neglecting the cases of the urban poor (Agrawal, 2008; Davies and Bennett, 2007). Studies on successful adaptation strategies in drought-hit regions of Africa have shown that risk-pooling and aversion strategies, such as informal non-cash networks to access services and goods, are popular (Osbaahr, 2007). Other strategies included livelihood diversification and exchange mechanisms such as the enhanced sale of livestock, labour exchange and short-term migration for paid work (*ibid*).

Local strategies to manage climate variability are key to adapting to climate change in the long term (Eriksen and Selboe, 2012). Adaptation processes that are based on local knowledge systems, experiences and associated practices are often culturally rooted and autonomous in nature (Howell, 2003; Arachchi, 1998). Scheffran *et al.* (2012) have suggested strategies for innovating adaptation among migrants in the following avenues, i.e. strengthening the linkages between migrant income, remittances and resilience in both home and host communities. Migration decisions made at the household level also reflect the household's attempts to minimise exposure to risk and signify the role of remittances in adaptation (Stark, 1991; Ezra, 2001).

Another approach is to strengthen migrants' capacities to access diverse livelihood assets and enhance their capabilities (Scheffran *et al.*, 2012). Social networks also play an important pathway in enhancing resilience both in the city and at the place of origin. Collective action can act as an important means to enhance adaptive capacities (Osbaahr, 2007). Informal social relations and associations play an important role in sustaining basic assets for livelihood promotion (Eriksen and Selboe, 2012; Rodima-Taylor, 2012). Migrant social networks can help to increase social resilience in the communities of origin and trigger innovations across regions by the transfer of knowledge, technology, remittances and other resources (Scheffran *et al.*, 2012). Food rationing, using previous food reserves, borrowing resources, diversifying livelihoods, and even altering the built environment are other forms of local adaptation strategies (Arachchi, 1998; Agrawal, 2008; Macchi *et al.*, 2008; Parvin *et al.*, 2008). Nevertheless, the role of local responses and autonomous adaptation strategies of migrant workers in cities of developing countries are poorly understood.

According to Agrawal, adaptation strategies could be understood in terms of mobility (pooling risk across space); storage (pooling and reducing risk across time); diversification (pooling risk across the assets and resources of households and collectives); communal pooling (meaning the pooling of risk across households that involves joint ownership of assets and resources; sharing of wealth, labour or incomes from particular activities across households; and/or mobilisation and use of resources that are held collectively during times of scarcity) and market exchange (2010: 183). Migration thus becomes an important adaptation strategy in terms of pooling risk across space.

Interactions with migrant workers revealed adaptation strategies through mobility; livelihood diversification; risk pooling; asset conservation, storage and enhancement; self-remedy; market exchange; structural adaptation; and informal entrepreneurship. In the remainder of this section, we discuss each adaptation component in detail, while Table 1 summarises the specificities within each of these adaptation strategies.

Table 1. Adaptation strategies of migrant workers in Indian cities

Mobility	<ul style="list-style-type: none"> Reverse migration Shifting to new worksites Seasonal migration
Informal entrepreneurship	<ul style="list-style-type: none"> Setting up business enterprises and scaling them up Skill enhancement Opportunity-seeking behaviour Maintaining strategic relationships Innovating new designs Product diversification Maintaining parallel value cum supply chains Establishing and controlling key segments of a value chain Product selection Innovating sales strategies Record keeping Use of Internet services and knowledge Working overtime
Structural adaptation	<ul style="list-style-type: none"> Local water drainage mechanism Using plastic covers for roofing Frugal water filters Designing structures above flooding levels Shifting storage sites Storing perishable goods Camouflaging worksites and housing structures
Livelihood diversification	<ul style="list-style-type: none"> Shifting from one occupation to another due to climate and health factors Shifting from one sub-sector to another Occupational shifts Two or more family members working in multiple sectors
Asset conservation, storage and enhancement	<ul style="list-style-type: none"> Savings Circulating money Remittances Restricting expenditure Restricting credit lending Technology Stocking grains and other food materials
Market exchange	<ul style="list-style-type: none"> Barter/exchange Credit-based buying and selling Selling assets
Risk pooling	<ul style="list-style-type: none"> Family members helping one another Insurance Shared accommodation Joining trade unions Borrowing money from relatives Informal chit funds Family members as workers EMI Strategic relationships Self-help groups
Self-remedy	<ul style="list-style-type: none"> Hygiene Rest and leisure Home remedies Pharmacy and self-medication Treatment from 'quacks' (unqualified 'doctors')

The adaptation strategies outlined in this paper display the characteristics of both coping strategies (immediate, short term response) and adaptation strategies that are long term and planned in nature. However, “*when climate hazards are repeated, the distinction between short-term and long-term adaptation (that is, coping versus supposedly real adaptation) breaks down, as does that between proactive and reactive adaptation*” (Agrawal, 2010: 182). In addition, it could be said that these strategies are equally relevant to coping and adaptation strategies as they both aim at addressing environmental risks and stresses (Agrawal, 2010).

4.1 Mobility

Mobility refers to adaptation across space in the post-migration scenario. Some of the mobility-specific strategies are reverse migration, shifting to new worksites, and seasonal migration. Migration often becomes an option at the end of a series of successive strategies to deal with risks and uncertainties, meaning that it is rarely a household’s first choice of adaptation (Gilbert and McLeman, 2010). Our study shows that migration as adaptation needs not always be induced due to climatic events and uncertainties at the migrants’ places of origin. Factors such as the social and economic endowments of households and communities, ecological contexts, social and institutional networks, accessibility and availability of resources, and power can also influence a household’s decisions to migrate (Gilbert and McLeman, 2010). Thus migration as an adaptation strategy needs not always be understood as mobility from the village to the city. Instead, a key finding of our study is that due to their heightened vulnerability contexts in the city (Santha *et al.*, forthcoming), migrant workers are forced to shift from their place of work or residence in the city to other places during times of extreme climatic events and natural hazards. Thus, irrespective of the spatial contexts (urban or rural), the poor and most vulnerable groups are forced to migrate during extreme climatic events.

Reverse migration is an important response of inter-state migrant workers in the three cities to deal with livelihood risks and uncertainties. One common strategy observed among inter-state migrant workers in Kochi is that they return to their respective places of origin at the onset of a health crisis, such as malaria or tuberculosis. This is because treatment is more affordable in their native place, communication with healthcare professionals is easier due to familiarity of language and culture, and family members are present to take care of sick people. The hostility of the resident host population and sensational reporting by the media also forces many migrant workers to move back to their places of origin immediately after being diagnosed with an infectious disease. It was observed that migrants from Odisha used to return immediately after a flood or heat event in Surat. Usually, they return when the floodwaters recede or when the heat incidences reduce. We also found that seasonal migration was common among migrant workers in Mumbai. Some migrant workers returned to their village to work as agricultural labourers during the lean season of their work in the cities. In most cases, the lean season coincides with the onset of monsoons in the city. In this regard, we came across some migrant workers who have been sustaining their practice of seasonal migration for the last 25 years.

Shifting worksites or keeping oneself mobile is a common livelihood strategy among those migrant workers such as street vendors, mostly observed in Mumbai, though it is becoming more common in Kochi and Surat. This is mainly a strategy to evade exploitative agents, such as the monitoring officials of the municipal corporations or the police, who often demand bribes. Migrant workers, such as vendors of toys or balloons, also prefer to move from one place to another, depending upon the income opportunities that one would get when compared with staying at a particular space. This also allows vendors to avoid paying monthly rents as other shopkeepers do, and move to various competitive spaces to attract more customers than being in fixed locations. People also shift their worksites permanently if they are not able to improve the working relationships in their neighbourhood such as with shopkeepers and the host resident population. Switching worksites also helps them to avoid paying bribes to municipal officials and the police. Some single female migrant workers mentioned that they shift their worksites if they feel that they are being exploited or abused by their employers. Other migrant vendors have been forced to shift their worksites because the owners of the surrounding buildings did not allow them to place their stalls permanently in that particular location.

Shifting worksites is also a valuable adaptation strategy, very common among migrant workers whose occupations or worksites are exposed to hazards affected by extreme climatic events, such as floods and waterlogging. Yet another corresponding finding we present in this paper is that adaptation strategies of migrant workers to climatic events and natural hazards are deeply embedded within those adaptation strategies that help them to deal with the day-to-day livelihood risks and uncertainties such as varying market conditions, opportunities and social relations. Experienced migrants in the city have developed capacities to find alternative livelihood spaces prior to the onset of hazard seasons, although usually as a temporary arrangement. In such cases, leaving one worksite does not mean that they will abandon the worksite completely. They will return after the subsiding of the hazard event. Some migrant workers in Surat and Kochi have mentioned that they have shifted their worksites due to a rise in mosquito menace which aligns with our observations that the respective worksites are prone to waterlogging and the accumulation of urban waste. Thus, a significant insight that could be drawn from this study is that an analysis of adaptation strategies to climate change cannot always be studied in isolation from the routinised adaptation strategies of the poor to diverse livelihood risks and uncertainties.

Shifting to a new occupational site is a coping strategy that has its own risk factors as well. The initial investment will be high and it will take some time to ensure the security of the space and restore business as usual. We also found that in Mumbai and Surat, migrant workers with experience and skill tend to shift from one sub-sector to another during crisis situations such as flooding or health problems. This was specifically relevant to those migrant workers in the textile and food industries respectively though this particular coping strategy is embedded within their larger responses to their day-to-day livelihood struggles.

4.2 Livelihood diversification

Livelihood diversification denotes that migrant workers maintain more than one occupation, sometimes involving multiple family members in income-generating activities. Studies have shown that livelihood diversification is a predominant adaptation strategy among migrants in slums. This implies that in many instances, they maintain more than one occupation, and multiple family members could be seen to be involved in income-generating works (Parvin *et al.*, 2013).

Our study found that climate change and variability, and health risks were some of the key drivers of livelihood diversification as an adaptation strategy, especially in the textile and food industries. Specific livelihood diversification mechanisms that were observed include occupational shifts, shifting within the sub-sectors and two or more members of the family working in multiple sectors to supplement the household income during crisis situations. However, as mentioned earlier, diversification is embedded within their larger responses to day-to-day livelihood struggles.

Informal livelihoods in the city are affected by the vagaries of weather and climate variability. Each segment of the value chain (production, storage and distribution) is linked to the stability and predictability of climatic conditions. Migrant workers such as hawkers are dependent on the distribution segment, while workers in the informal food-processing and textile industries rely on the production and storage segments. Our observations show that all these segments are considerably affected by extreme climatic events such as floods and rises in temperature. The hawkers find it extremely difficult to sell their goods during these times. On the other hand, the workers in the textile and food-processing industries are concerned with maintaining the quality of production and storage of their raw materials/products. Thus climatic uncertainties and extreme hazard events do affect the supply and demand of diverse services and goods that migrant workers rely upon for their day-to-day livelihoods in the city. Due to these concerns, many migrant workers shift from one segment of the value chain to another during intersections of climate variability and shocks. This is observed in their practice of occupational shifts with seasonal variations.

Livelihood diversification is an important strategy of migrant workers, which includes occupational shifts at regular time intervals. In Mumbai, we noticed that some migrant workers employed in the construction industry as semi-skilled labourers discontinue their work during the monsoons. Though construction work is available during monsoons, these migrant workers consider the job as hard, difficult and risky. Migrant workers such as the semi-skilled workers in the construction industry have to work outdoors even during the rainy season. With an increase in the intensity of rainfall and waterlogging events in the city, these workers find it extremely difficult to work outdoors. Remaining wet throughout day makes them vulnerable to fever, cold and other illnesses such as rheumatism, which in turn affects their capacity to earn a regular income. Accidents, such as falling from slippery surfaces, are also very common during the rainy season. For this reason, they shift to their traditional, skilled occupation, such as making and repairing shoes and umbrellas, during the monsoon. In a similar vein in Surat, some migrant workers have shifted from their jobs as they felt that they were more prone to infectious diseases like typhoid, dysentery and diarrhoea, which they attribute to poor water quality at the work place. Migrant workers observe that cases of illness peak after certain hazard events like waterlogging, heavy rains or heat events. For instance, we came across four migrant workers who had shifted from the textile sector to driving auto-rickshaws in the city after the 2006 floods owing to water contamination and illness.

Yet another dimension of livelihood diversification is that siblings and other family members were encouraged to work simultaneously in different sectors or take up different skilled/semi-skilled jobs in the city. This is a common strategy to ensure that there is a sustainable inflow of liveable household income amidst all risks and uncertainties. For example, if the father worked as a dyer in the textile industry of Surat, his son worked as an auto-rickshaw driver in the same city. We also noticed that some migrant workers tend to bring family members of productive age to the city and that they take up diverse jobs, to supplement each other's income. For instance, a migrant worker in Surat commented that he brought his wife and brother to the city. While he himself works as a security guard, his wife works as a casual labourer with the municipal corporation and his brother has also a job in the city. It is important to mention a curious case in this regard, whereby a migrant man was selling toys on a pavement in Surat and his wife and daughter were begging for alms at the nearby traffic signal. The hypothesis is that if extreme climatic events and seasonal climatic unpredictability were to continue impinging upon rural livelihoods, it would accelerate the migration of the rural poor to the city. And if these climatic variations affect day-to-day survival in the city, then this strategy of livelihood diversification would gather further prominence among migrant workers. This adaptation strategy is not something new in the life of migrant workers, as most of them have tried and tested diversification as an adaptation strategy back in their villages, prior to their decisions to migrate.

Some migrant workers take up multiple jobs to deal with risks and uncertainties. We came across a migrant worker in Surat who used to rear cattle during the day and work as a security guard at night. In a similar vein, a woman migrant worker used to sell vegetables and later in the day worked as a domestic maid in the nearby residential apartments. These multiple jobs are done to supplement their livelihoods with additional income. Some of the migrant workers who lacked housing would engage with multiple jobs during the day and night respectively. For instance in Mumbai, a man was found to sell balloons in the evening and working in bakeries or cloth shops during the day. The lack of access to basic livelihood assets forces migrant workers to take up multiple jobs in the city. In the future, with a rise in disruptions due to climatic events, the numbers of urban poor who will be forced to take up multiple jobs for a living will also increase.

Seasonality, migration and rural-urban livelihood linkages are key determinants of adaptation among most of the migrant workers who participated in our study. With variations in seasons and climatic conditions, these migrant workers have crafted their livelihood strategies both at the city and village level. Studies on rural livelihoods and climate change adaptation have earlier referred to seasonal migration as an adaptation strategy (Deshingkar, 2006; Tacoli, 2009). However, we also need to look at seasonal migration and climate change adaptation using an urban lens. Such an approach also emphasises the need to study the interlinkage of diverse adaptation strategies. There is a strong interface between livelihood diversification and mobility as adaptation strategies. None of the adaptation strategies act in isolation and are deeply embedded in the rural-urban-rural milieu. The adaptation strategies of migrant workers in the city are the subset of certain larger sets of adaptation strategies that most migrants adhere to at their places of origin. There is a need to contextualise seasonal migration and climate change within this larger spiral of rural-urban-rural milieu. This can be illustrated further through some of our observations.

Migrant floral workers interviewed in Kochi said they had migrated to the city due to drought conditions prevailing in their village in Tamil Nadu. However, their floristry business in the city also had a lean phase during the monsoons. Thus, their income-earning strategy was neither sustainable during the summer in the village nor during the monsoons in the city. Blending mobility with diversification, the floral workers maximised their income-earning potential. They worked in the city during the droughts in rural areas and in rural agriculture during the monsoons. The florists made arrangements such that their younger siblings replaced them at the florist shops in the city while they worked rurally. Such a strategy helps to draw an assured income during lean and peak seasons irrespective of the spatial contexts. It also ensures the availability of sufficient food stock (rice, wheat and cereals produced in their farms) and reduces food expenses for them in the city.

In a similar vein, seasonal migration was a strategy among some migrant workers in Mumbai. Forecasting climatic variations and associated reduction in income-earning opportunities, these workers used to return to their villages to work as agricultural labourers. Our observation also shows that most of the migrant vendors in Mumbai and Surat, who did not have a secure and safe worksite in which to conduct their business, used to return to their villages during times of flooding or most prominently during the monsoons (June to November). This is because they felt that the intensity and unpredictability of rains affected their access to safe vending spaces, decreasing sales below the threshold they needed to survive in the city.

4.3 Risk pooling

Risk pooling as an adaptation strategy involves the pooling of risk across migrant workers or their households and networks through the joint ownership and sharing of assets and resources. It is the sharing of wealth, labour or income from particular livelihood activities. These include family members helping one another in a particular enterprise or aspect of work, taking out insurance, sharing accommodation, joining trade unions, borrowing money from relatives, organising informal chit funds, stimulating an equated monthly instalment (EMI) economy, being part of self-help groups and maintaining strategic relationships.

Sharing practices were evident in our research and, to a certain extent, did enable migrant workers to reduce their living expenses in the city. It is a common practice for people from the same village or district to stay together. Such shared accommodation is one of the risk-pooling practices of migrant workers in Kochi and Surat. Migrant workers stay on a shared accommodation basis and further more on a shift-cum-shared accommodation basis in these cities. Thus, they end up paying less as the rent is divided equally amongst them.

We also noticed in Mumbai that, in order to control expenses, siblings and the families of migrant households stay together as a joint family. Though each person earns individually, they have a common kitchen so that groceries, vegetables and grains can be bought in bulk at a cheaper price. Moreover, these migrant workers believe that communal cooking is cheaper than cooking in nuclear families. There is also the sense that there are more human resources to share during times of crisis such as extreme weather events, hospitalisation and the loss of work. Moreover, migrant workers who are involved in their own ventures cannot afford to appoint staff for their support, but are able to accept help from their own families.

Though not so prominent, taking out insurance is considered to be a suitable strategy to reduce risks.¹ This is specific to the case of inter-state migrant workers in Kochi and some intra-state migrants in Mumbai. In Kerala, migrant workers employed in the construction industry are supposed to be insured by their employers. Thus, we have come across a few instances where employers have met health expenses. In Mumbai, the intra-state migrants benefit from state health insurance schemes and access government hospitals to deal with illnesses. For instance, we came across a migrant woman from a neighbouring district of Mumbai who had benefited from the government's Rajiv Gandhi Jeevandayee Arogya Yojna scheme to cover her huge medical expenses. Associational memberships also help to reduce risks, however, this

¹ The status of migrant workers' access to insurance schemes and their present status with respect to climate vulnerability are discussed in Jaswal et al. (forthcoming). However, none of these schemes have directly taken into account the vulnerabilities induced due to climate change and most often inter-state migrant workers are excluded from drawing benefits from these schemes.

trend of associating oneself with a collective was only observed in Mumbai and not in the other two cities. It was observed among the intra-state migrants in Mumbai that they were members of associations such as the Ambedkar Study Centre and Buddhist society, which work for the empowerment of Dalits and neo-Buddhists. These associations are supposed to be active during times of floods and waterlogging in the city, providing relief and shelter to the affected population. In this regard, we have also come across some studies that have found that such associational memberships act as social capital during times of floods and waterlogging in the migrant settlements of the city (Mishra, 2009).

Women migrant workers in Mumbai are part of certain self-help groups or '*mahila mandals*', which they believe are helpful not only in terms of providing financial and material support, but also in ensuring moral support during crisis situations such as floods. In a particular instance, one female migrant worker who had recently joined a self-help group to gain financial independence anticipated that it would allow her to run her household affairs, educate her children and also save for emergencies. This specific self-help group was trained in the manufacturing of incense sticks, candles and jewellery. They have formulated plans to sell their goods through door-to-door sales within the community and market their goods through their personal contacts outside the community and in schools. Earlier research has shown that during disaster situations, these community-based organisations have extended their function beyond normal accounting and networking functions to disaster response and relief (Mishra, 2009).

In yet another case, a migrant worker in Mumbai had initiated an informal chit fund with his known network.² In the words of this chit fund initiator,

We organised a chit fund with 15 members in it. We asked our known friends to be part of the chit fund. We collected Rs. 10,000 [US\$167] per person, the total collection thus came to around Rs. 150,000 [US\$2500]. In this group, every month, the members will bid for the money and the highest bidder will get the money that is left in the pool. Again when the money is collected, they will commence the bidding again. Once a person wins the bid, he cannot bid again. This is basically to help the members in need of large, immediate expenses. I won the bid, and with the money I earned, I started my business. Nevertheless, such chit funds will have only those people as members who are very well known to the initiator of the chit fund.

Such chit funds are essential support-based networks during times of shock including extreme climatic events. Unlike the chit fund, yet another common practice that does not necessarily have a positive outcome is the practice of borrowing money at high interest rates from informal moneylenders. However, unlike formal banking systems, these moneylenders loan money with minimum security. Migrant workers also borrow money from their relatives during emergencies.

Yet another strategy of migrant workers in Mumbai is to buy services and goods through equated monthly instalment (EMI) mechanisms. After extreme climatic events such as floods and infectious diseases, some migrant workers become extremely incapable of procuring raw materials in bulk by paying the complete amount to the retailers or the wholesalers. During such instances, they enter into a mutual understanding of procuring these goods and services through EMI schemes. Thus they procure the goods in advance by giving some token amount. And in a mutually agreed fashion, they decide to repay the remaining amount as instalments within a specified time period. The EMI arrangements could also be considered as a market exchange mechanism.

² In India, a chit fund is usually an informal arrangement where a group of people in a particular locality come together and pool money in a defined manner at periodic intervals. During the process of collection/repayment, any member of the group can draw a lump sum in various ways as prescribed and accepted by the group. Mostly, it is decided through a lucky draw or an auction.

4.4 Asset conservation, storage and enhancement

A prominent strategy among interview participants was asset conservation and their enhancement over a period of time. As part of the larger study, tangible assets were identified as natural, physical and financial resources, while intangible assets were labelled as human and social assets (Santha *et al.*, forthcoming). Though migrant workers' access to these resources is limited, the assets still play an important role in vulnerability reduction and climate change adaptation. Asset conservation and enhancement strategies help migrant workers and their households to cope with the negative impact of extreme weather events. Long-term adaptation strategies such as savings, circulating money with interest, and remittances are supplemented through coping strategies such as restricting expenditure during lean seasons and crisis situations, restricting lending (sales) on credit, and re-use of resources. All these strategies were found to be effective in dealing with livelihood risks and uncertainties. These strategies also were embedded with storage practices such as stocking food grains and other essential goods.

Saving money is an important means of asset conservation. It is not necessary that all the migrant workers save money through a bank account. Some vest the responsibility with their employers. Others send it as remittances to their families, who are supposed to save the money. Apart from investing their savings in agriculture back at home or spending it on marriage ceremonies and festivals, most migrant workers aim to enhance their savings through some enterprise. Nevertheless, our inquiry revealed that saving income has been useful for many migrant workers to survive in the city and compensate for the loss of livelihoods during extreme weather events. It also has helped them to rebuild their enterprise after extreme climatic events such as the 2006 deluge in Mumbai.

In Kochi and Mumbai, we came across a few migrant workers, especially women, who loan out their savings to known people with an assured interest rate. Thus, they earn the interest as a supplementary income to their savings. Apart from savings, controlling expenses during extreme weather events and associated seasons is an important coping strategy. Family members control or limit their spending on tobacco products, festivals, clothing and travel during times of crisis.

Storing perishable goods is an important strategy for migrants staying in waterlogging areas of Surat. They hang their goods from their rooftops so that these goods are not affected by floodwaters. We noticed that perishable goods such as onions, potatoes and lemons are hung from the ceilings to preserve them from both heat and floodwater. Also, during monsoons, people tend to shift their produce and work equipment from their worksite to their homes. Prior to the onset of monsoons, some migrant vendors in Mumbai observe that the price of purchasing products such as dry fish becomes costly. Therefore, to be on the safe side, they dry and stock dry fish in their home, and sell their fish when there is both a high demand and high price in the market. Some well-off migrant workers used to store their perishable goods such as fruits and vegetables in cold storage owned by known shopkeepers.

4.5 Market exchange

Extreme weather events and climate variability can result in the distress selling of basic livelihood assets. Thus market exchange strategies such as distress selling during a climate crisis may not be always supportive to the urban poor in the long term. Immediately after the 2006 floods in Surat, selling assets was an important coping strategy among some of the most marginalised migrant workers in the city, for example to afford to rebuild their workspace or to deal with health issues following the floods. There was one instance where a cobbler had to sell his stock of shoes to another cobbler to pay for malaria treatment. People also mentioned that they had to sell their livestock assets such as cows and goats to deal with health problems. Alternately, credit-based buying arrangements have offered support to migrant workers in Surat and Kochi during the lean seasons. They have arrangements with shopkeepers to borrow groceries and vegetables from 'kirana' stores on account, which they repay at the beginning of every month. Some migrant vendors who run mobile eateries and cold drinks stalls were found to have established informal networks with distributors of raw materials, which helped them to borrow products on credit.

4.6 Self-remedy

As mentioned earlier, the first phase of the larger research has looked at the vulnerability contexts of migrant workers to climate change and infectious diseases (Santha *et al.*, forthcoming). The study also found that self-remedy was an important and immediate response strategy of migrant workers to infectious diseases outbreaks (ibid). Migrant workers often resorted to home remedies, visited quacks (unqualified ‘doctors’) or used medicines directly from the pharmacy without any diagnosis (ibid). With the understanding that climate variability could result in more cases of infectious disease outbreak, self-remedy as a health-seeking behaviour needs to be seen as a negative adaptation strategy. Self-remedy is a matter of concern as some migrant workers in Surat and Kochi tend to compromise their health and security in their day-to-day livelihood struggles. In order to avoid the loss of their days’ income, they tend to neglect their health by resorting to home remedies or buying medicines from the pharmacy without any prescription. In Surat, many migrant workers also visit quacks for faster and cheaper treatment.

4.7 Structural adaptation

Structural adaptation including modification of existing structures could (temporarily) help in managing flood damage and risk mitigation. Structural adaption strategies were found to be innovative and included strategies such as constructing localised water drainage, designing rooftop rainwater collection and filtering systems, storing goods at height, and camouflaging³ worksites and accommodation. Anticipating hazard risks, some migrant workers have also built structures where they live and work. For example in Surat, migrant workers staying in areas prone to waterlogging have made their own drainage systems to drain water during the monsoons. Some have built structures so when waterlogging and flooding occurs, they can also climb onto this structure (see photo). During normal times these structures are used to store utensils and luggage.

Structures built to deal with flooding in Surat



Credit: Kaushik Datta, Photo taken during fieldwork

3 Camouflaging worksites and places of residence to avoid being exploited or harassed by the Municipal Officials and the Police.

We also observed that such practices are common among street vendors who stay in open spaces that are encroached upon, as they do not have any legal housing tenure in the city. During heavy rains or extreme heat situations, they use a plastic sheet as a roof by tying it to a tree or lamp post. As the rain becomes severe, some move to the basements of other shops. Migrant workers in Surat have also adapted facilities so as to access other resources like drinking water. For example, as the water in Surat is very hard and saline, people filter tap water using a towel.

4.8 Informal entrepreneurship

The most visible and direct adaptation strategy has been informal entrepreneurship. Williams and Nadin (2010: 363) have defined informal entrepreneurship as ‘involving somebody actively engaged in starting a business or is the owner/manager of a business that is less than 42 months old who participates in the paid production and sale of goods and services that are legitimate in all respects besides the fact that they are unregistered by, or hidden from the state for tax and/or benefit purposes (Williams, 2006, 2007)’. Advocacy documents have referred to informal workers as ‘green entrepreneurs’ and have cited examples of how their way of work has a lower carbon footprint (WIEGO, 2012; Arora, 2014). In addition, the informal sector exhibits several characteristics of urban resilience, mainly those related to flexibility and resourcefulness (Brown *et al.*, 2014). For instance, street traders source their goods locally, use far less packaging and produce less waste, rely on reuse and recycling, and many times use little or no electricity (WIEGO, 2012). In a similar vein, home-based workers depend on minimal transport, use less space and utilities and are more cautious of consuming excess electricity (*ibid*). However, the potential role of informality in contributing to urban climate resilience is poorly understood (Brown *et al.*, 2014). There is an urgent need to study how informal workers resist and respond to shocks and stresses, including those that will be caused by climate change (*ibid*).

Studies have also explored green economy and climate change adaptation in the context of informal markets (Benson *et al.*, 2014). Though informal entrepreneurship is interwoven into the fabric of globalised formal value chains, a major critique of these studies is that existing literature on green economy excludes the informal sector from their discourses (*ibid*). On the other hand, the informal sector could be more proactive in identifying innovative solutions to deal with climate change (Tandon, 2012). Tandon (2012) considers that female informal entrepreneurs are more proactive and alert to the opportunities and threats posed by environmental change. In this regard, Benson *et al.* (2014) observe that the urban poor have developed their own food services and other entrepreneurial strategies that are more resilient to flooding and extreme weather conditions.

As mentioned earlier, informal entrepreneurship seems to be the most active adaptation strategy of migrant workers to deal with diverse livelihood risks and uncertainties including climate change and health insecurities. Before detailing the key features of the observed informal entrepreneurship among migrant workers, it is important to examine its theoretical relevance as an adaptation strategy. In the beginning of the 20th century, informal entrepreneurship was considered as traditional and backward when compared to formal entrepreneurship (Williams and Nadin, 2010). However, in the later years, structuralist thought looked at informal entrepreneurs as those marginalised groups who are exploited by a global economic system and who are pushed into the informal economy due to their inability to find formal work (Castells and Portes, 1989; Williams and Nadin, 2010). From a neo-liberal perspective, informal entrepreneurs are those who reject and resist the forces of an over-regulated state and market (De Soto, 1989; Williams and Nadin, 2010). Recent scholarship from a post-structuralist perspective, however, contests the representation of informal entrepreneurs as economic actors and instead considers them as primarily social actors (Williams and Nadin, 2010). Informal entrepreneurship provides an alternative space in which participants can transform their work identity and reveal their true selves (Snyder, 2004; Williams and Nadin, 2010). Interpreting the works of few other scholars, Williams and Nadin (2010: 370) write,

Rather than portray informal entrepreneurs as unfortunate pawns in an exploitative global economic system, or as voluntarily exiting the formal realm because of over-regulation, post-structuralists thus again ascribe agency to informal entrepreneurship, but emphasize how it is a livelihood practice chosen for social, redistributive, resistance or identity reasons.

It is in the above-mentioned context, we need to consider informal entrepreneurship among migrant workers as an agency-induced adaptation strategy to deal with diverse risks and uncertainty in the city.

During our fieldwork, we observed that the migrant workers excel in finding appropriate opportunities to establish and scale up business enterprises. This is specific to the case of skilled and semi-skilled migrant workers. For instance, a migrant worker in Kochi established two tailoring shops and seized the opportunity available for unique fashions in the city. He employs many tailors and together they have created unique fashion trends. For example, the stitching looks different from that of his native peers, and they have placed zippers on both sides of men's trousers. The tailor-cum-entrepreneur had migrated to the city due to the unpredictable flood and drought situations in his village in Odisha. In a similar vein, a migrant worker in Surat was able to establish his eatery business at two sites, Chowk Bazaar and Delhi Gate. This was a strategy he devised to deal with the uncertainties related to flooding every year. His business is affected when water levels rise in Chowk Bazaar. However, he is able to sustain his livelihood by only working in his store at Delhi Gate. As discussed in Section 4.4 on asset conservation, storage and enhancement, lending money at a high interest rate to known networks is yet another entrepreneurial strategy of few migrant workers.

Another instance is the entrepreneurial skill of imitation-jewellery workers in Mumbai. These people do not have their own place in which to sell their jewellery. They are at the mercy of the gold and silver merchants who permit them to sit in front of their shops. Their business is worst affected during the rainy season, as no customer will purchase items standing in the rain. Instead of viewing this as a crisis, two workers studied the imitation-jewellery value chain in detail and have established assemblage units on the outskirts of the city. During the rains, they increase production in these units and export it to other states. Establishing and controlling key segments of a value chain is thus another important entrepreneurial characteristic.

We found that vendors in Mumbai and Kochi do not sell their goods on credit during lean periods such as monsoons. Moreover, they purchase much fewer quantities to sell, such that the capital invested will not end up in a loss. In the words of a fish seller in Mumbai,

If required, we purchase very little fish from the wholesaler. During lean season, it is better to reduce the quantity of fish to be sold, rather than increasing the price. When our customers realise that the product's price has been raised, then they will not buy from us. Instead, we reduce the quantity rather than increasing the price.

Some vendors do increase the price in one segment of a value chain, when there is loss in another segment while others work overtime to compensate for losses.

Looking at the nature of their customers – be they children, women or the elderly – they market their products using aspirational names or innovative designs. For example, a shoemaker we spoke to made shoes and sandals out of pure leather. However, the price of leather had increased for various reasons. As another shoemaker observed, the demand for leather footwear had declined in the past few years due to the unpredictability of monsoons. With a rise in the intensity of rainfall and waterlogging events in the city, the durability of leather footwear had considerably reduced. Therefore customers preferred footwear made of synthetic materials. In response, the shoemakers shifted to manufacturing footwear from synthetic materials such as rexin. They also changed the product design, taking cues available from the Internet. And they began to market the latest products by associating them with celebrity names or cartoon characters popular among children and their parents. In this way, customised and innovative design is yet another entrepreneurial strategy of migrant workers.

Product diversification is an important entrepreneurial strategy, with products designed according to changing cultural tastes and climatic and market conditions. For instance, some vendors in Mumbai and Kochi sell jute bags (bags made out of plant fibre) during the summer and umbrellas during the rainy seasons. Migrant workers running food stalls sell diverse products such as sandwiches, *chats* and *bhel* (spicy, crunchy snacks) during the summer. During the rainy season, they sell *idli* (steamed rice cakes) along with batter and chutney. These entrepreneurial strategies are characterised by a set of opportunity-seeking behaviours. In this regard, people see climate variability as an opportunity as well. Heavy rains are seen as occasions to enhance sales of umbrellas. In a similar vein, entrepreneurs shift to selling lemonade and *gola* (shaved ice) in the summer or during times of extreme heat. Opportunity-seeking behaviour thus enhances the adaptive capacities of migrant workers.

Maintaining strategic relationships with other actors not only helps in reducing risks but also aids in enhancing their entrepreneurial opportunities. There were instances where we observed that migrant workers maintained strategic, mutually beneficial relationships to reduce their insecurities. For instance, a balloon seller had secured his livelihood space in front of an apartment by informally acting as a watchman for the apartment's residents as well. This helped him to continue his occupation of selling balloons every day, irrespective of the vagaries of the weather. In a similar manner, fruit vendors and imitation-jewellery workers in Mumbai were able to secure shelters during heat events and monsoons in front of certain shops by agreeing to deal with their customers during the rush hour. In yet another instance, a shoe polisher in Surat had managed to stay in the basement of the police headquarters, thus securing not only an occupational space but also residential space. He polishes the shoes of police personnel in the building and is excused from paying rent. Moreover, unlike other migrant workers, he does not face the threat of being evicted by the police or other officials. In a similar vein, shoe polishers in Mumbai were found to maintain a strategic relationship with railway station staff or the police to ensure a livelihood space. These spaces also provide them shelter from rains and the scorching sun.

Skill enhancement is an important requirement to thrive in a competitive field. Though a migrant worker may first come to the city with limited skills, he or she will quickly pick up the essential skills to survive in the city. For instance, a migrant youth interviewed in Kochi had acquired flower decoration skills so fast that he is now in demand in other cities including Haridwar, Hyderabad, Delhi and Bangalore. We also sensed the entrepreneurial spirit in a migrant Dalit woman from Tamil Nadu. In her words,

I came to Kochi to work as labourer. I had no other skills. However, after coming here, I learnt to stitch both men's and women's garments. In my village in Tamil Nadu, nobody is ready to stitch dresses for people from the Dalit community. I will return to my village and open a tailoring shop specifically for Dalits.

The above two narratives on skill enhancement may not show any direct linkage with climate change. Nevertheless, as mentioned in the beginning of this section, we need to understand climate change adaptation as a subset of a larger set of livelihood adaptation strategies. Future research could explore in depth the role of skill enhancement in climate change adaptation.

5 Concluding observations

It should be stressed that the adaptation strategies we have discussed in this paper should not give the impression that migrant informal workers are always capable of overcoming their livelihood, climatic and health uncertainties on their own without the support of the state, civil society or the market. Out of a very small sample of 50 migrant workers in each city, only 15 migrant workers offered concrete adaptation strategies. This is mainly due to the fact that the adaptive capacities of the rest of the migrant workers were very limited, with most of them still bonded to their rooted vulnerabilities, including lack of access to basic livelihood assets, entitlements and choices. Nevertheless, our assumption was that the strategies outlined above could stimulate a future research framework linking climate change adaptation, urban resilience and the informal sector.

The strategies outlined in this paper display the characteristics of both immediate, short-term coping strategies and long-term, planned adaptation strategies. The discussions in this paper assert that both coping and adaptation strategies are embedded within the day-to-day livelihood struggles of migrant workers. With the increase in unpredictability and variability of extreme weather events, the distinction between coping and adaptation declines rapidly. In many instances, it can be seen that coping strategies to a certain extent supplement the long-term adaptation strategies. For instance, practices such as limiting household spending during extreme weather events and other crisis situations could be identified as an immediate coping strategy. On the other hand, these practices feed into long-term adaptation strategies of asset conservation and enhancement. In a similar vein, most of the structural adaptation strategies such as digging out a drain or constructing an elevated structure would have been an immediate response to rising water levels in the migrants' locality. However with the endurance of such practices over time and across extreme weather events, these practices would have gained acceptance as long-term adaptation strategies. Future research needs to look at the embedded relationship between coping and adaptation strategies and the larger political economy in which these relationships are structured.

Table 2 compares the prominence of each of the adaptation strategies in the three cities. Observations show those migrant workers' strategies of mobility, livelihood diversification, risk pooling and informal entrepreneurship in the city of Mumbai help these migrant workers to sustain their livelihoods amidst diverse risks and uncertainties. The structural adaptation strategies are very short-term coping strategies and will not necessarily help these migrant workers to overcome risks and uncertainties in the long term.

Table 2. Preferred adaptation strategies of migrant workers in the three cities (sample of 15 per city)

Adaptation strategies	Kochi	Surat	Mumbai
Mobility	**** (-)	**** (-)	***** (+)
Livelihood diversification	*	*** (+)	***** (+)
Risk pooling	** (-)	*	***** (+)
Asset conservation, storage and enhancement	***** (+)	*** (+)	**** (+)
Market exchange	*	**** (-)	*
Self-remedy	**** (-)	**** (-)	*
Structural adaptation	*	***** (+)	***** (-)
Informal entrepreneurship	***** (+)	*	***** (+)

Key: ***** Very high prevalence. **** High prevalence. *** Moderate prevalence. ** Low prevalence. * Very low prevalence.
(+) Observed positive impact. (-) Observed negative impact

5.1 Maladaptation

Reverse migration strategies in Kochi and Surat may not always signify migrants' adaptive capacity. This is a matter of concern, as many of the migrant workers return to their places of origin without their root causes of vulnerability being addressed. This is similar to other strategies as well such as self-remedy and risk pooling. Only practices such as asset conservation and informal entrepreneurship have a positive impact on their adaptive capacity to deal with diverse risks and uncertainties in their daily livelihood struggles.

In addition, some adaptation strategies may not enhance the adaptive capacities of vulnerable communities. External maladaptive measures may weaken the resource base of local communities, distributing costs and benefits unequally among populations. In this context, it is important to understand adaptation strategies as those mediated by complex, diverse factors including wealth, working power and social capital (Upton, 2012). On many occasions, planned adaptation strategies of the state and the market have failed to be innovative and become fully effective (ibid). The degree to which diverse adaptation strategies become effective are dependent to a great extent on contextual factors such as state policies and programmes, market fluctuations, technological innovations, and the costs involved (Santha, 2007). Individual adaptation strategies are not always autonomous and are constrained by institutional processes such as regulatory structures, property rights and social norms associated with rules in use (Adger *et al.*, 2005). Any limits to adaptation depend on the ultimate goals of adaptation, which are themselves dependent upon diverse values (Adger *et al.*, 2009). Factors such as perception of risk, habit, social status and age can limit adaptation action (ibid).

As Christoplos *et al.* (2009) point out, adaptation strategies can themselves contribute to downward spirals. On many occasions, traditional coping mechanisms can be exploited and widen inequalities among vulnerable groups (Osbaahr, 2007). Studies point out that on several occasions many of the migrant workers in urban settlements have limited scope to be freed from indebtedness and impoverishment (Raleigh and Jordan, 2010). Studies on Nepalese migrants in Indian cities show that their contexts of impoverishment seldom change due to migration (Smith-Estelle and Gruskin, 2003). These migrants only have access to those work opportunities that are hazardous or poorly paid, with limited scope for remittances (*ibid*). In India, opportunities for vulnerable migrants to improve their living conditions have been constrained by the new forms of unemployment associated with globalisation and the worsening quality of life of the urban poor contradicted by the high cost of living, and a very slow process of social transformation (Revi, 2008).

In some cases, adaptation strategies may deepen migrant worker vulnerabilities (Santha, 2015). The adaptation strategies of poor and vulnerable groups can impact on their livelihood sources and income even before the occurrence of a particular shock (Ribot, 2010; Santha, 2015). These shocks could further interrupt the social and physical well-being of the population, destroy essential livelihood resources and deepen social polarisations (Ribot, 2010). An important observation in this regard is that the poorer sections of the population are excluded from access to services, social networks and livelihood assets such as land or water, and will experience intensified climate-related vulnerabilities and losses. Nevertheless, these vulnerabilities and losses will be amplified by unequal social relationships of power and representation (*ibid*).

Adaptation strategies of the poor are very much interlinked with their livelihood strategies and their ability to interpret regular natural cycles and act accordingly using local knowledge and resources (Kronic and Verner, 2010). Nevertheless, traditional adaptation strategies and associated predictors can prove to be ineffective or obsolete in the context of drastic climate variability. In this context of failure or weakening of traditional authorities and knowledge systems, Kronic and Verner (2010) note that people look elsewhere for solutions to their problems, both by exploring other knowledge systems and even migrating to other places. In rural contexts and among ethnic communities, cultural institutions that are developed along regularised practices and rituals serve as effective means of adaptation (*ibid*). However, this may not be the case for the urban poor whose cultural institutions are still evolving and transcending. A predominant understanding in rural contexts is that the most vulnerable households are those whose assets and livelihoods are directly dependent on climate patterns and who have poor adaptive capacities (Heltberg *et al.*, 2009). However, this correlation between vulnerability contexts has seldom been illustrated in urban contexts, which this study attempts to address.

5.2 Next steps

The discussions we present in this paper suggest that there needs to be further research on the adaptive capacities of the urban poor. The adaptive strategies observed in rural areas do not necessarily function in the same way in urban settings. Moreover, there is a significant need to study rural-urban-rural livelihood linkages in depth when we study the adaptation strategies of the migrant poor. Asset-based cum value chain-based adaptation research could throw further light on the vulnerabilities and capacities of migrant workers in both rural and urban contexts.

Our findings in this paper were presented in a dissemination workshop at the Tata Institute of Social Sciences in Mumbai. Climate change experts, social workers and social scientists working in the field of climate change and sustainable livelihoods participated in the workshop. Here, opportunities for future research were discussed to further explore the relationships between climate change and adaptation strategies in the informal sector. Some of the key insights of this discussion are as follows.

The adaptation strategies of informal migrant workers are influenced by the structural-cum-exploitative factors that migrant workers face in their day-to-day livelihood struggles. In addition, adaptation strategies of migrant workers to climatic events and natural hazards are deeply embedded within those sets of adaptation strategies that help them to deal with their day-to-day livelihood struggles.

If extreme climatic events and seasonal climatic unpredictability were to continue impinging upon rural livelihoods, it would accelerate the migration of the rural poor to the city. And if these climatic variations affect the day-to-day survival in the city, then certain adaptation strategies would gather further prominence among migrant workers. These sets of adaptation strategies are not something new in the life of migrant workers, as most of them have tried and tested these strategies back in their villages, prior to their decision to migrate.

There is a need to recognise the interlinkage between diverse adaptation strategies. None of the adaptation strategies act in isolation and are deeply embedded in the rural-urban-rural milieu. These strategies also must be considered alongside the routinised adaptation strategies of the poor to diverse livelihood risks and uncertainties. The adaptation strategies of migrant workers in the city are the subset of certain larger sets of adaptation strategies that most migrants adhered to at their places of origin. We have to contextualise climate change adaptation in cities within this larger spiral of rural-urban-rural milieu.

A major contribution of this research has been to outline informal entrepreneurship as an adaptation strategy. This has helped to highlight the significance of the agency of actors involved in adaptation. Locating the adaptation strategies of informal workers not only signifies the agency of migrant workers in the city to understand and respond to climate change, but it also helps us to engage substantively with the notion of climate justice while recognising the situation of these vulnerable and marginalised groups (Bulkeley *et al.*, 2014).

An adaptation framework that blends agency of migrant workers within the dynamics of an informal-formal, urban socio-ecological system still needs to be evolved and deliberated. Future research could examine these opportunities.

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