

## Occupational Resilience to Floods across the Urban-Rural Domain in Greater Ahmedabad, India

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**Abstract:** *Identifying and acting on the consequences of smaller hazards can strengthen the communities to face the greater events of the future. These hazards disrupt the everyday lives of the majority of the population who rely on daily wages or are engaged in informal economic opportunities. This paper explores the potential the post-disaster employment opportunities have in recovery from disasters across urban, peri-urban and rural areas of Greater Ahmedabad in India through a household survey conducted in flood hit areas in February-March 2013. It adopts an approach where occupations vulnerable to a disaster are identified and their related characteristics are established. Through the combination of descriptive and explanatory statistical analyses of quantitative data the paper concludes that for the surveyed segment of population: (i) there is insignificant help from within the communities or community based organizations for economic recovery of affected population, and government is seen as the primary stakeholder for recovery (ii) for a low income household the concepts of disaster and unemployment are interchangeably used (iii) the rural areas have been traditionally dependent on the urban areas post-disaster, but in this case the urban population also rely on their assets and social network in the rural areas in case of both unemployment and disasters.*

**Keywords :** *occupational resilience, vulnerable occupations, Ahmedabad, urban-rural linkages, floods*

## 1. Introduction

The International Labor Organization (ILO) (2010) states that there are approximately 1.5 billion vulnerable workers all over the world; characterized by inadequate earnings, less likelihood of having formal work arrangements, low productivity, lack of decent working conditions, inadequate social security, and ineffective representation by trade unions and similar organizations. The majority of the population engaged in such vulnerable jobs face economic difficulties immediately after disasters. There are numerous tools and methodologies to assess the direct and indirect macro-economic losses. It is very difficult to ascertain and assess the loss at the micro-economic level as well as loss of livelihood opportunities, as these losses vary across sectors and groups with varying vulnerability (Jigyasu 2011) and have distinct recovery periods. While many victims recover in a short period of time, others are left without ample economic opportunities to revive their lives and attain the same quality of life as prior to the disaster. This pushes them into a cycle of chronic poverty through accumulation of risk with every disaster. It is important to single out vulnerable occupations as a separate category for assessing the impact of a disaster, particularly on the low income population residing in developing countries. Strengthening the resilience of the population employed in vulnerable occupations will facilitate an increase in the resilience of the entire population. The identification of vulnerable occupations can serve as an effective vehicle for faster disaster recovery, the absence of which would cause an increase of unemployed population with every recurring disaster. In other words, the overall resilience of the community can be achieved through occupational resilience. This provides for the elevation of the low income segments of the society without any focused strategies for recovery. This would not only quicken the recovery process by strengthening the local economy, but would also make the communities better equipped to tackle the recurring disasters by devising their own coping strategies over a period of time.

The low income population engaged in vulnerable occupations resides in urban, peri-urban and rural areas. Since urban, rural, and peri-urban areas (the immediate areas dependent on urban areas) are part of an interconnected system, a disaster event in any of these areas is bound to affect other areas and its inhabitants. This is especially true in the cases of developing countries which are primarily rural such as India, where urban and rural areas are linked through several elements: people, natural resources, financial resources, product, waste, information, social interactions and governance (Srivastava and Shaw 2013). Therefore, the challenge is to devise a plan to maximize the positive relations between these interconnected systems of urban, rural and peri-urban areas, benefitting the low income segments of the population.

Most disasters have effects on these interconnected systems, in addition to the areas where they occur undermining the resilience of the communities residing within these systems. Sapountzaki (2012) interprets resilience “as process of self-organization and self-change”. This notion is derived from the

theory of complex adaptive systems, where in the absence of a definite plan for the system, the various interacting agents act according to their own principles or intentions (Stacey 1995). Waldrop (1993) states that such systems just do not passively respond to events, but actively try to turn the events into advantageous position, through “reallocation of energy and action” (Comfort 1995). This reallocation can take place within an urban-rural system.

Hazards can be of various scales defined by magnitude and frequency; small and large. This paper focuses on the effects of small hazards, like floods in Ahmedabad, on vulnerable occupations. By small hazards the authors, in general, mean high frequency low magnitude hazards, which cause minimum damage to the lives of people. These hazards do not feature in the official list of disasters considered by concerned authorities. However, the authors believe that they do have an impact on the lives and livelihoods of the population. In this particular case, the floods are considered as small hazards which occur with a frequency of every two years and with magnitude of affecting upto 5 km area along the river Sabarmati within Greater Ahmedabad. The floods cause economic loss such as damages to assets, property and housing; as well as environmental loss. This has caused people to migrate from their native villages, temporarily or permanently as they lose their occupations, or experience a disruption in carrying out their economic activities. In recent times, floods have occurred in Greater Ahmedabad in 2001, 2003, 2005, 2006, 2008, 2010 and 2013.

A complex relationship between employment and disasters is seen to exist in Gujarat, India. In urban areas, the government’s recovery and relief plans exclude the large majority of the working age population, as they are engaged in the informal sector which is unrecognized by formal government institutions and financial machinery. In rural areas, the economy is based on primary sector industries such as agriculture, the disruption of which paralyzes the livelihood base for the rural population. Additionally, a significant population in urban, peri-urban and rural area is linked with household or cottage industries. These are also disrupted by disasters, hence affecting the assets and earning capabilities of the concerned population (Vatsa 2001).

Based on a household survey conducted in flood hit urban, peri-urban and rural areas of Greater Ahmedabad region in February-March 2013, this paper explores the potential role of post-disaster employment opportunities in disaster recovery.. This paper intends to, identify the vulnerable occupations in this case and their coping strategies against floods It includes the urban and rural survival strategies in reducing the risk. Overall, it reiterates the importance of a disaster recovery model focused on occupational resilience as the key to achieve the overall resilience of both urban and rural communities.

## 2. Occupational Resilience and Urban-Rural linkages

This section throws light on the development of the concepts of occupational resilience and vulnerable occupations, and the potential of post-disaster employment opportunities in reducing the impact of the disasters.

### 2.1 Resilience and Occupational Resilience

The concepts of resilience and vulnerability are often considered diagonally opposite to each other (Kasperson and Kasperson 2001; Cannon 2008 and Sapountzaki 2012), which implies that the higher the vulnerability, the lower is the level of resilience and vice versa (Cannon 2008). However, other authors do not share the same view, for example, Lei et al. (2014) puts forward that the damage and losses due to a disaster are determined by both the vulnerability (inner attribute of a social-ecological system), and resilience of the affected population (reactive response to a disaster) (Initially, vulnerability as a concept included only the loss of life and material, and has later expanded to include other dimensions. Cutter (1996) and Cutter, Boruff and Shirley (2003) defined vulnerability as a sum of exposures, social condition, and spatial dimension of 'integration of potential exposures and societal resilience'. While defining vulnerability, Cannon (1994) considers 'economic resilience' or 'livelihood resilience' as one of the key aspects of vulnerability, which determines the capacity of an individual to resist the impact of a disaster. Hufschmidt (2011) suggests that vulnerability involves complex processes at several temporal and spatial scales, and the interdependencies at these scales. A livelihood is considered to be environmentally sustainable when it is capable of maintaining or enhancing the assets associated with it, and socially sustainable when it can recover from the shocks and stresses (Chambers and Conway, 1992). Therefore, occupational resilience has to be a sum of environmental and social sustainability.

Taking into account such complexities related to livelihood, the authors have established the concept of occupational resilience in an earlier paper (Srivastava and Shaw 2014). It is defined as the ability of an occupation exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of providing livelihood to its erstwhile employees (Adapted from ISDR (2004) definition of resilience). A disaster recovery model focused on occupational resilience would be a sustainable model of recovery as it would provide economic opportunities to strengthen assets and earning capabilities. Such a model would have to consider the market demand and be contextually appropriate to the local scenario. Therefore, while providing for employment opportunities, the existing skills and experiences of the local population must be carefully studied. The ultimate goal should be to enhance the social dignity and earning options for the population engaged in vulnerable occupations (WRC 2009). As Srivastava and Shaw (2014) put it, the occupational resilience model aims to attain multiple goals of providing occupational opportunities with stable income, rebuilding of assets, minimizing the recovery time, limiting migration in search of

employment, and consequently uplifting the social status in the community. This finds strong support in the works of Sharma and Krishna (2007), who say that the current levels of employment and unemployment play an important role in determining the standard of living, disposable income, savings, education, health and overall psyche of the society, thereby determining the well-being of a community. Surjan and Shaw (2009) state that people with higher incomes have higher resilient capacities against disaster, but people with low incomes can also have capacities which can enhance their resilience ().

The solutions of occupational resilience can range from the provision of training and placement programmes, to for-work programs such as, cash-for-work and food-for-work. Various cases talk about resilience of occupations. Neef et al. (2015) states that few small businesses in fisheries, farm sector and tourism in Thailand, could recover from Indian Ocean Tsunami in 2004. This happened due to strong individual support systems in their social networks and diversification of their business strategies. There was no government support or large scale institutional donations to these businesses. In Cambodia, fishing communities resorted to unrelated livelihood options to diversify their income and be resilient against the shocks and stresses (Marschke and Berkes 2006).

## **2.2 Urban and rural linkages**

Urban areas are sometimes considered as places of refuge for the rural population and at other times, the hotspots of risk. Both these roles impact the linkages between these spatial zones. These urban-rural linkages or interactions are defined as “key components of livelihoods and local economies” and “engines of economic, social and cultural transformations” (Tacoli 1998), for their integral role in defining the future growth of the urban-rural system. The nature of the relationship between the urban and rural areas is bound to be affected after a disaster. Both these areas have their own resisting capacities to disasters. Urban resilience is determined by a number of factors such as institutional resilience, participatory management, economic system, physical growth, social diversity, good governance and regional resilience (Surjan, Sharma and Shaw, 2011) and has been widely studied. On the other hand rural resilience is a comparatively neglected and under-researched concept. Rural resilience is defined as “the degree to which a specific rural area is able to tolerate alteration before reorganizing around a new set of structures and processes” (Heijman, Hagelaar and Heide 2007). It is a rural area’s ability to cope with its inherent economic, ecological and cultural vulnerability (Heijman, Hagelaar and Heide 2007).

The reason why these linkages need to be understood and utilized to enhance occupational resilience is two-fold. Firstly, it has been established that urban-rural linkages have the potential to spread the effects of development, through the generation of employment leading to poverty reduction (Okpala 2003; Srivastava and Shaw 2013). For example, the Rural-Urban Partnership Programme (RUPP) in Nepal (31% urbanized) focuses on overcoming the bottlenecks in commercializing agricultural and rural production with the objective of alleviating poverty. The linkages between urban and rural areas can

provide markets to rural products achieving “Regional Economic Resilience” (Hill, Wial and Wolman 2008). Secondly, in specific cases of low income and vulnerable groups in urban and rural settlements, there are differences in the associated characteristics of occupations, corresponding to these areas. However, the strategy should improve the resilience of the respective occupations and maintain the balance of growth of the region at the same time. To positively sustain the development of a metropolitan area, comprising of both urban and rural areas, affected by a natural hazard, there has to be an emphasis on how these linkages and the communities behave in a disaster scenario.

### 3. Methodology

The study was conducted to investigate to a greater extent the two major concepts of ‘Urban- rural linkages’ and ‘vulnerable occupations’ through the field study in urban and rural areas of Greater Ahmedabad, Gujarat in India, along the river Sabarmati in February-March 2013. This section explains the methodology used for the household survey and subsequent analyses. The questionnaire was based on the above mentioned concepts as explained in the following paragraphs.

#### 3.1 Framework of the study - Urban-Rural flow elements and parameters for Vulnerable Occupations

The objective of this study is to observe the effects of floods on the occupations carried out by population in different spatial locations. These effects are assessed using the parameters established in an earlier study (Srivastava and Shaw 2014). It also identifies the coping strategies adopted by the communities to minimize the damage to their economic activities and accelerate their recovery processes.

India’s population is predominantly rural with 68.84% population distributed in 640,000 villages, compared to 31.16% urban population in 6166 urban agglomerations, occupying 2.5% of the total geographical area in India (Census of India 2011). The complex social, economic, political and environmental interdependence between the urban and rural areas can be defined as a framework which includes eight elements (See Table 1 (a)). These linkages can be strong, weak, uni-directional or bi-directional across sectors and spaces (Srivastava and Shaw 2012).

There is an absence of a standardized methodology for measuring vulnerability (Birkmann and Wisner 2006, Villagran 2006; Gall 2007 in Hufschmidt 2011). Often the impact of disasters on urban poverty is also underestimated, with the general absence of the metrics that include low-income groups in their assessment of disaster impact (ISDR 2009). Table 1 (b) illustrates the parameters used to identify the vulnerable occupations established by Srivastava and Shaw (2014). These parameters were included in the questionnaire to understand the effect of floods on the occupations and to determine the vulnerable occupations in this particular case of floods.

Three important parameters for assessing vulnerable occupations in this region are recovery time, loss of working days and workforce participation as established in an earlier study of the same region (Srivastava and Shaw 2014). The recovery time is the time taken to restore the household earnings to the pre-disaster level. The recovery period was divided into four categories of 0-2 days, 3-10 days, 11 days to a month, and more than a month. Similarly, the loss of working days was also categorized into the same categories. Individuals and communities try to shorten their recovery period through various coping strategies, thereby contributing to the occupational resilience. The parameter workforce participation is an indicator of economic well-being and is calculated as the number of days a person is employed in a year. The workforce participation is reduced due to lack of job opportunities all the year round, especially immediately after a changed scenario in the wake of disaster, and restricted capacity to compete for the limited jobs, or lack of skills for the available jobs.

Table 1 (a) Urban-Rural flow elements and (b) Parameters to identify vulnerable occupations

S. no.	Urban-Rural flow elements	S. no.	Parameters to identify vulnerable occupations
1	People	1	Loss of productive asset
2	Natural Resources	2	Displacement and migration
3	Product	3	Loss of employment
4	Finance	4	Decline in productivity
5	Waste	5	Reduced income
6	Information	6	Workforce participation
7	Social Interactions	7	Change in occupation
8	Governance	8	Effect on social structure
		9	Recovery time

(Source: Srivastava and Shaw 2013)

(b) (Source: Srivastava and Shaw 2014)

The questionnaire is constructed on the basis of the parameters of vulnerable occupations and the flow elements between urban-rural areas. It included questions on disaster experience, displacement (nature, period, and reason), occupation (main and secondary, income, and number of earners), loss to productive assets used in carrying out occupations or household industries, loss of working days and its reason, recovery period, loss of social respect (perceived social status and if there has been a change in it), the presence of other stakeholders, membership of community-based, religious or occupation-based organizations, and the coping strategies (both perceived and currently utilized).

With regards to urban-rural linkages the survey examines three out of the said eight elements, namely; people, finance, and social interactions. The key informant survey conducted at an earlier stage had given evidence of these three parameters being affected significantly during the floods (Srivastava and Shaw

2014). The urban-rural linkages vis-à-vis disasters are explored through the urban and rural survival strategies of households residing in the study area. The authors define the reliance of rural population on urban areas, as the urban survival strategy. These strategies may be in the form of financial assistance, shelter, or as an opportunity for employment. Similarly, the reliance of the urban population on rural areas is known as rural survival strategy. The respondents were asked questions about what would be their strategy in case of a disaster, and also their strategy in case of unemployment. The correlation of the responses in the two different scenarios of disasters and unemployment was investigated to understand the degree of differentiation in the people's perspectives related to disasters and unemployment.

Following a combination of descriptive and explanatory statistical analyses of quantitative data derived from the questionnaire survey conducted in three spatial zones – urban, peri-urban and rural Ahmedabad, the various factors are correlated to gauge their inter-dependencies.

There are two major sources of uncertainty of the methodology. Firstly, the occupations have been categorized into fewer categories for the sake of analysis of vulnerability on comparative basis. This categorization is done by the authors based on their understanding on the basis of skill set, income, and number of working days. Secondly, few responses are based on the perception of the respondents.

### **3.2 Correlation Analysis**

The bivariate correlation between the parameters of vulnerable occupation and the elements of urban-rural linkages needs to be determined to identify the factors which affect a particular decision of the respondents in case of unemployment and disaster. In this study, Pearson correlation coefficient has been determined using the correlation analysis. It is a numerical measurement of the strength of the linear relationship between the explanatory and response variables. For the purpose, interval data for the variables such as household annual earnings, loss of working days, loss in social respect, number of visit to rural/urban areas, asset ownership in villages/cities, change in occupation, family residing in rural areas and rural/urban survival strategy have been correlated with rural/urban survival strategy in cases of unemployment and disaster. The data is represented in percentage. In the analysis of the results, only those correlation coefficients have been considered at 0.05 significance value (i.e. at greater than 95% confidence level). The correlation values are categorized into three categories: 0.2 to 0.4 (low), 0.4 to 0.6 (medium) and greater than 0.6 (high).

## **4. Case Study : Ahmedabad, Gujarat, India**

To understand the complex relationship between employment and disasters, the case of Greater Ahmedabad region in the state of Gujarat is taken up as a case study. Gujarat is situated on the north-west coast of India bordered by the Arabian Sea in the west, state of Rajasthan in the north and north-east, and by the state of Maharashtra in the south and south-east. It is a state which has experienced natural



disasters such as earthquakes (Bhuj earthquake 2001), cyclones, as well as hydro-meteorological disasters like frequent floods and droughts, which occur with alarming regularity. The total population is 60 million, of which 34 million are rural and approximately 26 million urban (Census of India 2011). The urban population grew at the rate of 36% against the 9% rural growth from year 2001 to 2011. This shift demands the need to accommodate the exploding population in urban areas, without damaging the nearby rural areas. Within Gujarat, Greater Ahmedabad is one such region which has certain well developed regions with urban, sub urban and hinterland character with multi-hazard profile.

#### 4.1 Scope of the study

The communities interviewed are situated on the banks of river Sabarmati in urban, peri-urban and rural areas and have experienced floods. Although not severe; the impact of these small hazards on the lives of the vulnerable population is worth examining. 255 households were surveyed during the months of February and March 2013, which included 105 from five urban locations (Dariyapur, Behrampura, Mangal Talawadi, Sabarmati and Ramapir no Tekro), 50 from two peri-urban locations (Parvati Nagar and Gupta Nagar) and 100 from five rural areas (Shahpur, Randesan, Saroda, Mota Chhapra and Mahijda). For site details and characteristics refer to Table 2 and for map of locations refer to Figure 1. The percentage of household surveyed, to total households at various locations range from 3.77 to 12.42%. These locations were selected on the basis of data on the flood prone areas provided by the Flood Control cell of Gujarat Government and the key informant survey elaborated in Srivastava and Shaw (2014).

The study evaluates the experiences of urban, peri-urban and rural populations following the Bhuj earthquake in year 2001. Peri-urban areas defined in this study refer to outgrowths of urban areas with minimum agricultural activities, and predominantly urban activities. The people who live in slums and have migrated to the study locations more than 12 years before have been considered as the residents of the locations, instead of migrants, for the sake of the study.

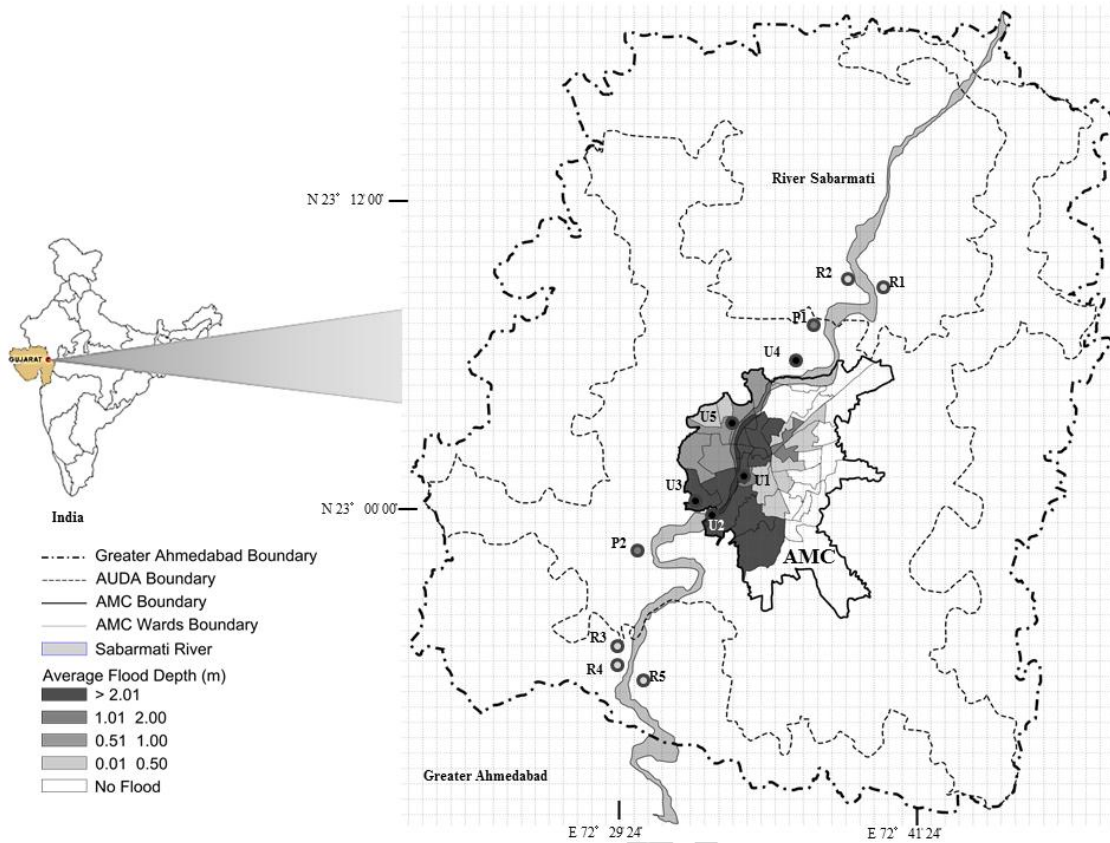


Figure 1 Location map of Greater Ahmedabad with the study locations in urban, peri-urban and rural areas

#### 4.2 Categorization of Occupations

The categories of occupations for the study have been determined by considering three associated characteristics of skill set, income, and number of working days. The resulting five categories are given below:

- (i) Service Sector – includes government and private sector jobs
- (ii) Labor – includes construction labor and daily wage labor in urban and peri-urban areas, and agricultural labor and daily wage labor in rural areas
- (iii) Cultivator – includes small land owners who cultivate their own land
- (iv) Hawker – includes door to door small vendors
- (v) Others – For urban and peri-urban areas ‘others’ includes rag pickers, shopkeepers, private nursery owners, paper wrapping industry, cobbler, vegetable vendor, rickshaw puller. For rural areas it includes people involved in animal husbandry and shopkeepers.

Table 2 Characteristics of the study locations\*

	STUDY LOCATIONS	LOCATI ON	SURVEYED HOUSEHO LDS	OCCUPATI ON	HAZA RD	CHARACTERIS TICS and OBSERVATION S
URBAN						
U 1	DARIYAPUR	CENTRA L	20	Primarily Daily Laborer, Hawkers and enaged in Other occupations. Also comprise of Construction laborer , Government Sector, Private Sector	Local Floodin g (and River Floodin g)	<b>Physical</b> - Close to river bed in the central city, <b>Housing</b> - Mostly semi- <i>pucca</i>
U 2	BEHRAMPURA	SOUTH	21		River Floodin g and Local Floodin g	<b>Physical</b> - Adjacent to river bed, <b>Housing</b> - Mostly <i>Kutcha</i>
U 3	MANGAL TALAWADI	SOUTH	23		Local Floodin g	<b>Physical</b> - Low lying area adjacent to a natural pond, <b>Housing</b> - Mostly <i>Kutcha</i>
U 4	SABARMATI	NORTH	21		Local Floodin g (and River Floodin g)	<b>Physical</b> - Close to river bed, <b>Housing</b> - Mostly <i>Kutcha</i>
U 5	RAMAPIR TEKRO	NORTH	20		Local Floodin g	<b>Physical</b> - Close to ponds and natural drainage of the river, <b>Housing</b> - Mostly <i>Kutcha</i>
PERI URBAN						

P 1	PARVATI NAGAR	NORTH	25	Majorly daily labor with others engaged in	Local Floodin g	<b>Physical</b> - Close to river, <b>Housing</b> - Mostly semi-pucca and Kutcha
P 2	GUPTANAGAR	SOUTH	25	government sector and Other private jobs	Local Floodin g	<b>Physical</b> - Poor drainage, <b>Housing</b> - Mostly Kutcha
<b>RURAL</b>						
R 1	SHAHPUR	NORTH	20	Majorly Agricultural Labour and Small landholder Cultivator with few engaged in daily labour, household industry, and hawking	Occasio nal River Floodin g	<b>Physical</b> - Upstream Village, River is deep and wide, <b>Housing</b> - Pucca
R 2	RANDESAN	NORTH	20		Occasio nal River Floodin g	with low percentage of Kutcha, Residential Areas located on high elevation traditionally distant from the banks. Agricultural lands, are also located away from the banks with natural drainage towards river. Good infrastructure with good connectivity to both Ahmedabad and Gandhinagar
R 3	SARODA	SOUTH	22		River Floodin g	<b>Physical</b> - Downstream Village, River is
R 4	MOTA CHHAPRA	SOUTH	18		River Floodin g	narrow and shallow, <b>Housing</b> -

					g	Mostly <i>Kutch</i> ,
R 5	MAHIJDA	SOUTH	20		River Floodin g	Poor connection to the urban areas, agricultural lands adjacent to the river bank. Poor public infrastructure
		Total	255			

\* See Notes for explanation of terms Pucca and Kutch

## 5. Key findings

The survey results from 12 sites across Greater Ahmedabad were processed and analyzed under three main headings – spatial characteristics, coping strategies and the correlation of parameters under urban/rural survival strategy. This section highlights the key findings.

### 5.1 Preliminary findings with reference to spatial characteristics

**Urban area:** In urban areas, majority of the surveyed population (63%) is engaged as labor, primarily as daily wage labor and construction labor. A considerable percentage (22%) is also engaged in other occupations (See Table 3). The loss of working days for these occupations due to floods is primarily distributed in the ranges of 3 to 10 days, and 11 days to a month. Similarly, the time taken to recover is primarily on higher side at 11 days to a month or more than a month for 78% respondents. (See Figure 2). A considerable 22% of respondents change their occupation; more than two-thirds being attributed to either loss of jobs or productive assets (See Table 3). All the respondents were asked about their survival strategy in two cases: (a) in case of unemployment, and (b) in case of a disaster. 34% of urban respondents are willing to migrate to rural area in case of unemployment and 44% in case of a disaster (See Figure 6).

Table 3 Occupational Profile and change in occupation of respondents in Greater Ahmedabad

	Urban	Peri Urban	Rural
<b>Occupation Type</b>			
Service Sector	7	10	6
Labour	63	86	37
Cultivator	0	0	55
Hawker	8	2	1
Others	22	2	1
<b>Change in Occupation</b>			
Do not change	78	98	96
Change due to loss of income at previous occupation	6	2	2
Change as cannot carry out previous occupation	15	0	2
Change due to loss of transportation to jobs	1	0	0
All figures are in percentages			

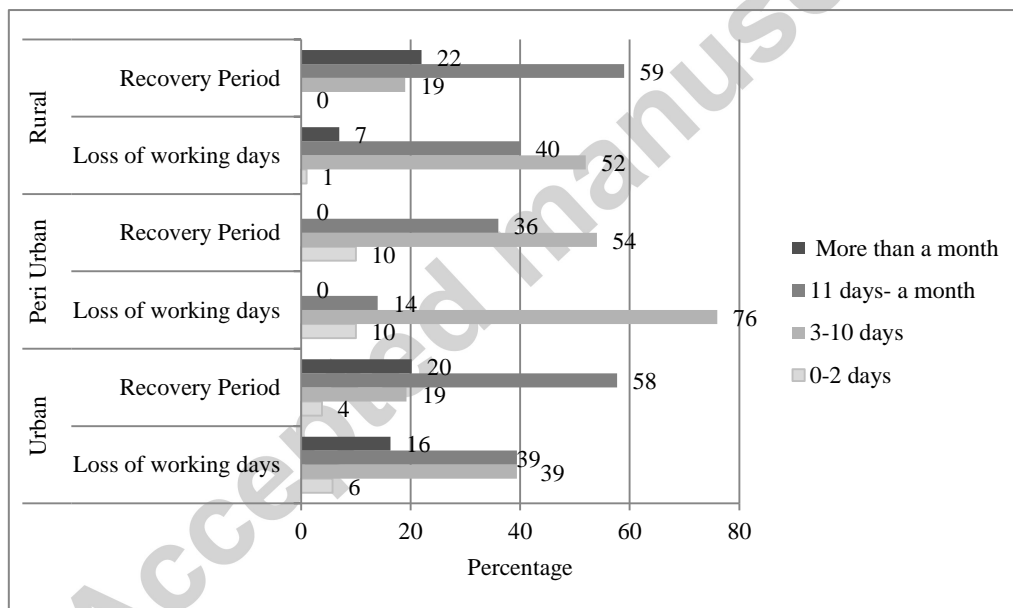


Figure 2 Impact of floods on urban, peri-urban and rural areas in Greater Ahmedabad

**Peri- urban area:** High percentages (86%) of respondents are employed as non-skilled daily wage labor or as construction labor (See Table 3). The loss of working days to the respondents is majorly between 3 to 10 days. If the loss of working days is 3-10 days the trend shows that the days taken to recover is usually greater than 10 days (See Figure 2). The local street flooding in these areas do not cause loss of work exceeding a month and hence does not take more than a month to recover. The change of occupation is also negligible. The peri-urban respondents' selection of the survival strategies relying on rural areas in case of unemployment and disaster is limited to 8% and 14% respectively.

**Rural area:** 55% respondents are small land owners who cultivate on their own land, while 37% respondents are engaged in agricultural and related labor activities (See Table 3). The loss of working days is distributed mainly between 3 to 10 days and 11 days to a month. If the loss of working days is 11-30 days the trend shows that the days taken to recover is usually greater than 11 days to more than a month (See Figure 2). The change of occupation is negligible. In terms of rural-urban survival strategy, 40% rural respondents would choose urban survival strategy in case of unemployment and 50% in case of disaster (See Figure 6).

## 5.2 Vulnerable Occupations and their coping strategies

**Urban area:** Hawkers, Labor, and Others categories showed 66.7%, 24.2% and 8.7% change in occupation respectively. Based on the above results, the Service sector can be considered least vulnerable in urban areas because of limited change in occupation, low loss in working days and lower recovery period. People engaged as hawkers seem to be most vulnerable with loss of productive asset at 22.2%, and approximately 55.6% respondents suffer a loss between 3 days to 10 days, and 33.3% suffering a loss between 11 days to a month. The recovery days for hawkers lies in 11 days to a month for 33.3% hawkers, and more than a month for 44.4% of hawkers. Other occupations in urban areas are also vulnerable as 43.5% respondents suffer a loss between 3 days to 10 days, and 34.8% suffering a loss between 11 days to a month. The recovery days for Others lies in the range 11 days to a month for 73.9% people, More than 24% laborer change their occupations which is considered as one of the coping strategy.

**Peri- urban area:** Here, labor occupations are the most vulnerable, with 81% suffering loss of working days in the range of 3 to 10 days and recovery period for 60.5% in the range of 3 to 10 days, and rest 39.5% in the range of 11 days to a month. Other occupations also suffer without security.

### **Rural area:**

Rural area sees higher loss in social respect with all occupations reporting high percentage due to continued effect of floods - Service Sector (51.2%), Labour (46.2%), Cultivator (63.2%), Hawker (44.4%) and Other occupations (60.0%). Both labor and cultivator occupations are related to the land and these suffer the major damage during the effects of floods; hence most vulnerable occupations. These are agricultural sector and agro-related occupations. Laborers have 65.4% loss of working days in range of 3 to 10 days, while 26.9% suffer loss of working days from 11 days to a month. The cultivators suffer a loss of 47.4% in range of 3 to 10 days, while another 47.4% suffer loss of working days from 11 days to a month. The recovery for these two occupations also lie more than 50% in the range of 11 days to a month. Here as well, service sector is least vulnerable.

Government is the most reliable stakeholder in the times of disaster (See Figure 3). The reliance of urban, peri-urban and rural population on government is 42.6%, 32.0% and 90.0% respectively. Around 68%

peri-urban respondents approach no one in particular for help. People's reliance on community is scarce and is found only in urban area (8%) where the people with similar occupational background live together. There is no evidence of presence of community-based organizations based on religious, occupational or any other common characteristics. However, communities with common occupations live together in slums or squatter settlements in urban areas. In the rural areas, individuals help each other during the floods, but there is lack of a community plan. The results also establish that employment is the priority sector in all the three spatial domains of urban, peri-urban and rural areas; the respondents believe that better employment opportunities can reduce the adverse impact of the floods (See Figure 4).

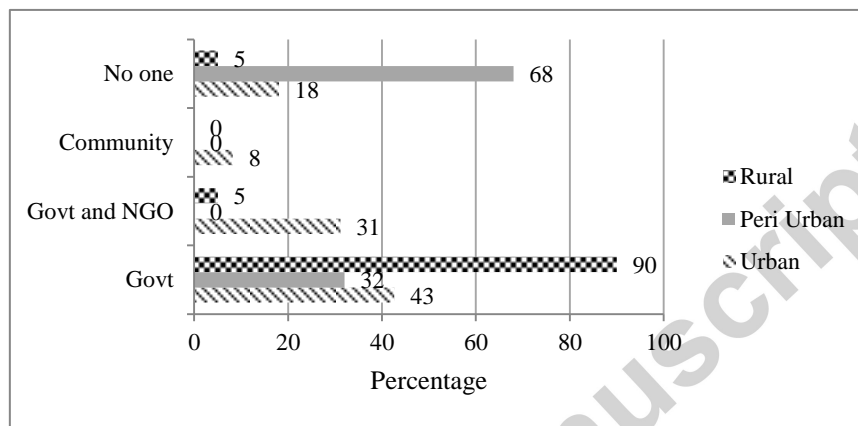


Figure 3 Most reliable stakeholders during the floods in Greater Ahmedabad

The study finds evidence for three types of flow elements between urban, peri-urban and rural areas, namely; people, finance, and social interactions (See Figure 5). Flow of people refers to movement of human beings between the spatial areas in search of employment, better employment opportunities, education, and health services. Social interactions include the intangible interactions between the city dweller and the villagers. It also involves the cultural exchange which plays a vital role in strengthening the ties (Srivastava and Shaw 2013). Majority of the population (80% urban, 50% peri-urban and 84% rural) visit the urban/ native rural areas, and hence are in constant touch with the family members. 37% urban respondents have their family in rural areas, while 46% of peri-urban respondents have their family in nearby rural areas. Amongst rural respondents only 6% have their family in urban areas of Greater Ahmedabad. A small percentage of these family members send remuneration or transact financially for reasons such as education, and living expenses. Approximately 50% of urban and peri-urban respondents own assets in villages, such as land and house. Only 9% of rural respondents own houses or land in urban areas.



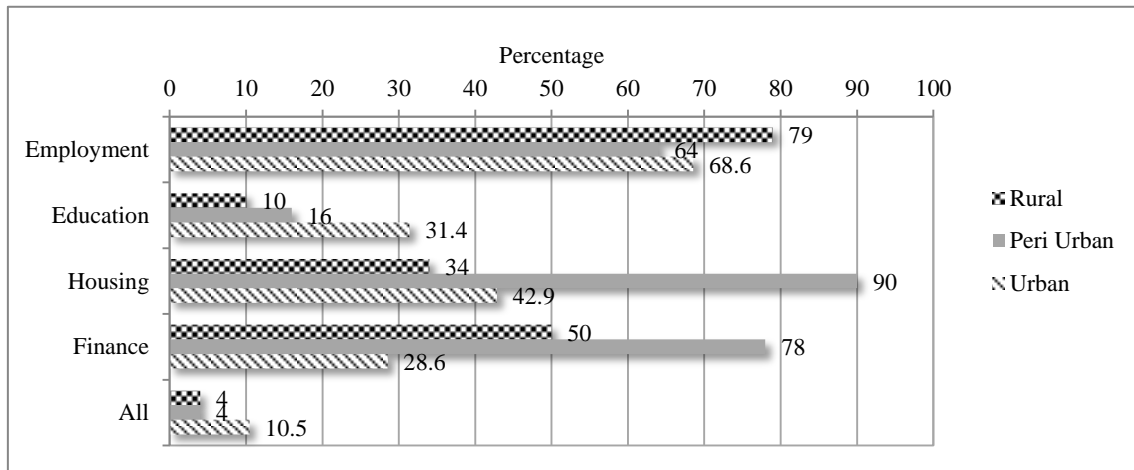


Figure 4 Priority sectors to reduce the impact of floods in Greater Ahmedabad

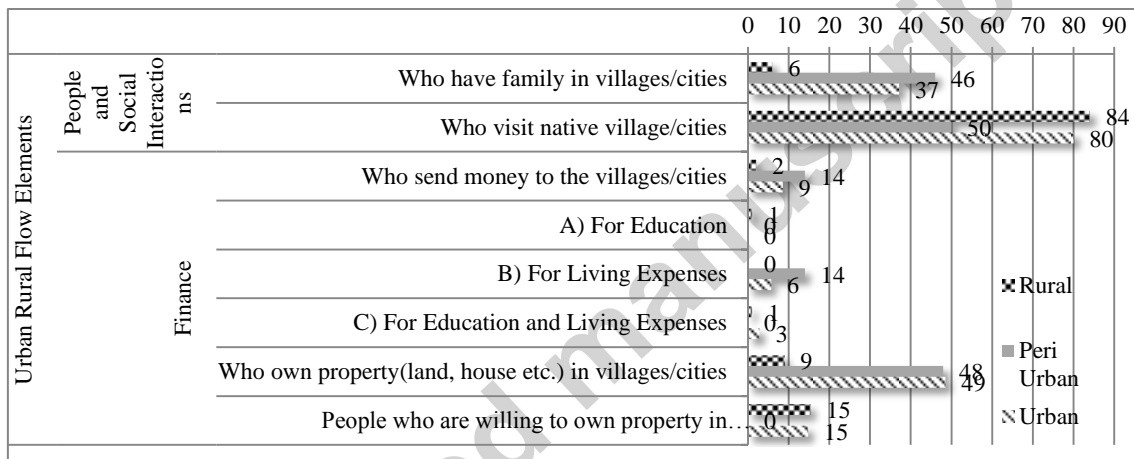


Figure 5 Urban-Rural Linkage Flow Elements in urban, peri-urban and rural area

### 5.3 Correlation Findings

In urban areas, the choice of rural survival strategy (See Figure 6) in case of unemployment (RSSU) is correlated to asset ownership in villages (0.382 (sig. 0.000)), family residing in rural areas (0.333 (sig. 0.001)), and the households experiencing loss in social respect (0.272 (sig. 0.005)). The choice of rural survival strategy in case of disaster (RSSD) is moderately correlated to asset ownership in villages (0.486 (sig. 0.000)) and also correlated to family members residing in rural areas (0.374 (sig. 0.000)). The RSSU is highly correlated to RSSD at 0.737 (sig. 0.000) (See Table 4).

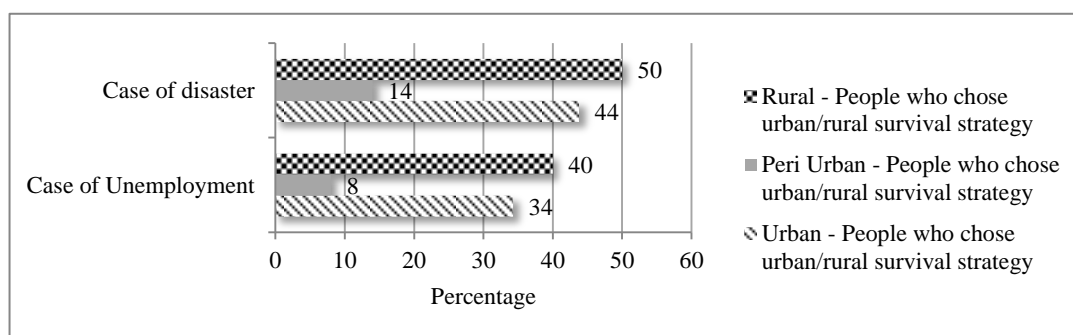


Figure 6 Urban / Rural Survival Strategy in case of disaster and unemployment

In peri-urban areas, the RSSU is correlated to loss of working days (11 days to a month) at 0.306 (sig. 0.031), and to asset ownership in villages at 0.307 (sig. 0.030). RSSU is also correlated to the household who have family residing in the rural area at 0.319 (sig. 0.024). The RSSD is moderately correlated at 0.420 (sig. 0.002) to asset ownership in villages, and to households with family living in rural areas at 0.437 (sig. 0.002). It is also correlated to change in occupation at 0.354 (sig. 0.012), once a month visit to urban area in a year, with the value of 0.383 (sig. 0.006) and household annual earnings between 90000 INR to 180000 INR at 0.313 (sig. 0.027). The RSSU is highly correlated to RSSD at 0.731 (sig. 0.000).

In rural areas, the urban survival strategy in case of unemployment (USSU), is positively correlated to asset ownership in villages (0.384 (sig. 0.000)), once a month visit to urban area in a year, with the value of 0.380 (sig. 0.000), loss of working days (3 to 10 days) (0.335 (sig. 0.001)), loss in social respect (0.253 (sig. 0.011)), and household earnings less than 20000 INR (0.235 (sig. 0.019)). The urban survival strategy in case of disaster (USSD) is similarly correlated to once a month visit to urban area in a year 0.405 (sig. 0.000), asset ownership in villages (0.313 (sig. 0.002)) and loss of working days (3 to 10 days) (0.200 (sig. 0.046)). The USSU is highly correlated to USSD at 0.816 (sig. 0.000).

Table 4 Correlation analysis

S.No.	Parameters			Urban		Peri urban		Rural	
				Rural Survival Strategy in case of unemployment RSSU	Rural Survival Strategy in case of disaster RSSD	Rural Survival Strategy in case of unemployment RSSU	Rural Survival Strategy in case of disaster RSSD	Urban Survival Strategy in case of unemployment USSU	Urban Survival Strategy in case of disaster USSD
1	Household Annual Earnings	<20000	Pearson Correlation	-.039	-.075	-.042	-.058	.235*	.160
			Sig. (2-tailed)	.693	.444	.771	.691	.019	.112
		20001-40000	Pearson Correlation	-.042	-.030	-.075	-.102	.057	.084
			Sig. (2-tailed)	.668	.759	.607	.481	.572	.406
		40001-70000	Pearson Correlation	.051	.084	-.079	-.197	-.221*	-.068
			Sig. (2-tailed)	.603	.392	.586	.170	.027	.504
		70001-90000	Pearson Correlation	-.010	-.058	-.020	.005	.125	.076
			Sig. (2-tailed)	.919	.560	.892	.972	.216	.450
		90000-180000	Pearson Correlation	-.032	-.005	.180	.313*	-.187	-.229*
			Sig. (2-tailed)	.745	.959	.212	.027	.062	.022
		> 180000	Pearson Correlation	.136	.111	-.042	-.058	.100	.035
			Sig. (2-tailed)	.167	.259	.771	.691	.323	.730
2	Loss of Working days	0 to 2 days	Pearson Correlation	.168	.196*	-.098	-.134	.123	.101
			Sig. (2-tailed)	.087	.045	.497	.352	.222	.320
		3 to 10 days	Pearson Correlation	-.249*	-.274**	-.180	-.043	.335**	.200*
			Sig. (2-tailed)	.010	.005	.212	.766	.001	.046
		11 days to a month	Pearson Correlation	.162	.159	.306*	.169	-.333**	-.245*
			Sig. (2-tailed)	.098	.105	.031	.239	.001	.014
		Greater than a month	Pearson Correlation	.009	.029	-	-	-.064	.039
			Sig. (2-tailed)	.925	.771			.527	.699
3	Loss in social respect	Pearson Correlation	.272**	.127	-	-	.253*	.120	
		Sig. (2-tailed)	.005	.195			.011	.234	
4	No. of visit to rural areas in a year (Once a month)	Pearson Correlation	-.071	-.087	-.075	.383**	.380**	.405**	
		Sig. (2-tailed)	.473	.380	.607	.006	.000	.000	
5	Asset ownership in villages	Pearson Correlation	.382**	.486**	.307*	.420**	.384**	.313**	
		Sig. (2-tailed)	.000	.000	.030	.002	.000	.002	
6	Change in occupation	Pearson Correlation	.006	-.004	-.042	.354*	-.063	.000	
		Sig. (2-tailed)	.955	.971	.771	.012	.537	1.000	
7	Family residing in rural areas	Pearson Correlation	.333**	.374**	.319*	.437**	-.034	-.084	
		Sig. (2-tailed)	.001	.000	.024	.002	.734	.405	
8	Rural/Urban Survival Strategy in case of unemployment	Pearson Correlation	1	.737**	1	.731**	1	.816**	
		Sig. (2-tailed)		.000		.000		.000	

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

## 6. Discussion

This section discusses the results obtained in the previous section, and how these results are relevant for the post-disaster recovery process. The population in Greater Ahmedabad is dispersed in various geographic locations, and has distinct exposure to floods as well as disadvantageous social conditions. These factors contribute to differential vulnerabilities as stated by Cutter (1996) and Cutter, Boruff and Shirley (2003). The communities surveyed in the urban areas were mostly grouped based on the occupation of residents. Residents in communities with a similar occupational background have common needs of sustenance which strengthens the resilience of the community as a whole. - On the other hand, the resilience of communities in rural areas can be strengthened by the provision of multiple occupations in a single household, as demonstrated by some of the cases interviewed. This provides better economic security for the survival of rural livelihoods, as established by Ellis (2000) in his study on developing countries. However, as observed, there is a dearth of non-farm opportunities, limiting the households from reaching their full potential.

The problems faced by the rural and urban population regarding their occupations are mainly concerned with greater recovery time than the loss of working days. This implies that people engaged in vulnerable occupations take a longer time to retain their pre-flood earning capacity. This is one of the causes of persistence of poverty amongst this segment of the population. They are also bound to change their occupations. This is observed in urban areas where even during and after disasters there is availability of alternative occupations. This also draws the rural and peri-urban population towards the urban centers. The results show two aspects of coping strategies to minimize the loss of working days and recovery time. Firstly, there is willingness to rely on other spatial areas (urban/peri-urban on rural, or rural on urban) in case of disaster and unemployment. Secondly, the population feels that employment would play the most crucial role in recovery. The population expects government to be the benefactor and provider of opportunities.

Looking into the finer details of the coping strategies, it has been observed that traditionally rural population tends to depend on the urban area (Chambers and Conway 1992; Reuveny 2007) especially in the wake of a disaster in rural areas (Tao Yang and Zhou 1999; Paul 2005). Even in this study, the rural population is willing to rely on urban areas in an event of unemployment and also in an event of a disaster. In addition, interestingly, the results show that the urban population is also willing to depend on rural areas in case of unemployment and disasters, which is seldom observed, as was observed by Lesetedi (2003). Majority of the population living in urban and rural areas are in constant touch with their family members. Also, job opportunities in urban areas attract peri-urban and rural population during or after hazards. This gives them an opportunity to avail the benefits of the employment schemes, and other disaster recovery programmes in areas other than their places of residence.

The correlation analyses do not give the causal explanations for the preference of survival strategy. However, it gives useful insight into the factors that are playing a role in shaping up people's willingness to rely on other spatial areas. The mutual dependence is mostly governed by the presence of family members and asset ownerships in the other spatial area, as well as whether the population is visiting other spatial areas for any other reason. Other factors which determine the financial security of a household, such as household income, loss of working days, and change in occupation, also have a bearing on the people's perception.

Also, the high correlation between the urban and rural survival strategy in the cases of unemployment and disaster further proves that for the low income population the concepts of disaster and unemployment are interchangeably used and dealt. It is reflected in the communities' basic understanding of resilience through economic empowerment. The respondents were of the opinion that with stable jobs they could take care of other basic needs like housing, food and clothing. Housing is the next chosen priority by the communities after employment. Approximately, 30% of the population living in urban areas in low and medium income countries lives in informal settlements or overcrowded and deteriorating tenements (Dodman et al. 2013). The housing condition can be associated with the vulnerability of the population as most of the population residing in such conditions is dependent on vulnerable occupations. The results in the study show that the houses in the villages in downstream section of river Sabarmati are in poor condition. This can be attributed to lack of build-back capacity of the population which has been experiencing floods at regular intervals. This population is primarily based on agriculture and allied activities and adverse impact to the earning opportunities is reflected in the housing condition.

There is also dearth of community based (religious, occupation based) organizations in these study locations, thereby limiting their resilience. The lack of institutions is contributing to the lack of social cohesion. The role of non-traditional stakeholders such as Non-Government Organizations (NGOs) and Community Based Organizations (CBOs) needs to be acknowledged and utilized by both the government and the community. The cooperatives like Sehkari Dughd Samiti (milk cooperatives) and self-help groups already exist in Gujarat state. These encourage the local entrepreneurs and women. This advantage can be utilized to bring communities together for 'economic resilience' (Cannon 1994).

Due to the lack of traditional and non-traditional stakeholders active in these communities, the communities identify the government as the trusted stakeholder. It has the potential to implement certain policies which will make the occupations resilient. Both national and state governments already have various poverty reduction, employment generation, and basic services programmes in operation, such as Prime Minister's Employment Generation Programme (PMEGP), Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA), Food for Work Programme, Sampoorna Grameen Rozgar Yojana, Swarna Jayanti Gram Swarozgar Yojana (SYGSY), and Swarnajayanti Shahari Rozgar Yojana

(SJSRY). Unfortunately, these programmes do not include disaster recovery. These are positive endeavors but all the positive work done by such schemes in a year can be undone by one flood by draining of resources of the affected population. There is huge potential to start post-disaster employment schemes based on the local market conditions, and the skill set of the vulnerable population.

## 7. Conclusion

The smaller natural hazard events, such as in Ahmedabad, have the potential of seriously affecting the welfare of the household or community in question, but are not considered as disasters as their impact is not collectively significant in the bigger picture. Nevertheless, the cumulative effects of high-frequency smaller hazards over a longer period might have an appreciable effect at aggregate levels, like changes in the behavior of economic factors because of the perceived risks. The recurring nature of hazards every two years does not allow the communities to recover, countermining their resilience. Therefore, it is important to account for and analyze these events and their impacts through the methodological framework discussed in this study. The calculation of indirect economic loss to the population becomes incomprehensible, yet identification of the spheres of loss would certainly help prepare for reduced loss in the event of the next hazard.

This study identifies the vulnerable occupations and their spatial characteristics. Applying a combination of descriptive and explanatory statistical analyses of quantitative data the paper concludes that there is insignificant help from within the communities or community-based organizations for economic recovery of the affected population. This trait does not allow the communities to utilize the inherent potential in building their resilience. Also, a low income household perceives an event of disaster and situation of unemployment similarly. The government should have the same perception of managing the post-disaster recovery and provision of employment. This would help to devise policies addressing both the issues together, with an aim to gradually strengthen the resilience at the macro level.

The reliance of rural population on the urban areas post-disaster or hazard has been traditionally observed in the developing countries. This study adds that the urban population also relies on their assets and social network in the rural areas in case of both unemployment and disasters. This fact provides an opportunity to administer the urban-rural flow elements to the advantage of the low income population. Managing the flow of people, and money; and utilizing the social linkages of the population from the urban and rural areas, would utilize the inter dependencies of these spatial areas for faster disaster recovery. For example, provision of markets in urban areas for rural micro-enterprises, would limit the flow of people and maintain the flow of money. This would be specifically beneficial during the impact period of hazards when farm activities are most affected in rural areas, as non-farm micro-enterprises would have better chance of functioning during the period.

The governments in developing countries frame policies to achieve poverty eradication, employment generation and basic services for the poor. Additionally, after the disaster few of these governments are responsible for the recovery of the most vulnerable through public assistances and dole. The authors believe that the recovery can be accelerated if policy makers start providing employment opportunities pre and post-disasters. The solution lies in providing non-farm alternative livelihoods to rural population and restoration of assets to urban population.

The authors identify although there can be a variety of strategies for recovery, targeting vulnerable occupations would strengthen the socio-economic base to allow for speedier recovery. The recovery process should be used as an opportunity to rebuild and revive the economy at the grass root level. In the pre-disaster phase, livelihood recovery strategies which encompass spatial dimensions will enhance the occupational resilience.

Accepted manuscript

### Notes

Explanation of *Pucca* and *Kutch* housing types - Those houses, which have both, wall and roof made *pucca* material are called pucca. When both wall and roof are made of *kutch* materials the house is called *kutch*. If either wall or roof is made of *pucca* material and the other of *kutch* material, then the house is classified as semi-*pucca* (Census of India 1991).

Table 5 Classification of housing for the study (Source: Census of India 1991)

No	Materials		Typology
	Wall	Roof	
1	Burnt bricks, Glass sheets or other metal sheets, stone, cement concrete	Tiles, slate, shingle, corrugated iron, zinc, or other metal sheets, asbestos, cement sheets, bricks, lime stone and RBC/RCC Concrete	Pucca
2	Grass, leaves, reeds, bamboo, mud, un-burnt bricks, woods, etc.	Grass, leaves, reeds, bamboo, thatch, mud, un-burnt bricks, woods, etc.	Kutch

### Acknowledgements:

The first author acknowledges the support from the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) of Japan; and the Global Center of Excellence (GCOE) Program entitled "Global Center for Education and Research on Human Security Engineering (HSE) for Asian Megacities" of Kyoto University. The authors would also like to thank the respondents in Greater Ahmedabad area for providing their responses and time.

### References:

- Birkmann J, and Wisner, B (2006) "Measuring the unmeasurable." The challenge of vulnerability. UNU Institute for Environment and Human Security (UNU-EHS) Source, 5.
- Braun, JV (2007) Rural-Urban Linkages for Growth, Employment, and Poverty Reduction. Ethiopian Economic Association Fifth International Conference on the Ethiopian Economy June 7–9 2007 Keynote Plenary Session I. Available at <http://www.ifpri.org/sites/default/files/publications/20070607jvbruralurban.pdf>, last accessed on 05 August 2011.
- Cannon T (1994) Vulnerability analysis and the explanation of 'natural' disasters. Disasters, development and the environment 13-30.
- Cannon T (2008) Reducing people's vulnerability to natural hazards communities and resilience. Research Paper no. 2008/34. UNU-WIDER.
- Census of India (2011) Rural urban distribution of Population (Provisional Population Tables). Ministry of Home Affairs, Government of India, New Delhi. Available at [http://censusindia.gov.in/2011-prov-results/paper2/data\\_files/india/Rural\\_Urban\\_2011.pdf](http://censusindia.gov.in/2011-prov-results/paper2/data_files/india/Rural_Urban_2011.pdf), last accessed on 12 September 2012.
- Chambers R, Conway G (1992) Sustainable rural livelihoods: practical concepts for the 21st century. Institute of Development Studies (UK).



Comfort LK (1995) Self organizing processes in disasters: a comparative study of response systems following the 1993 Marathwada, India and 1995 Hanshin, Japan earthquake. In: Koehler, GA (ed) The conference proceedings "What disaster response management can learn from Chaos theory", 1995. Available at [https://www.library.ca.gov/CRB/96/05/over\\_11.html](https://www.library.ca.gov/CRB/96/05/over_11.html), last accessed on 12 October 2013.

Cutter SL (1996) Vulnerability to environmental hazards. *Progress in human geography* 20 529-539.

Cutter SL, Boruff BJ, Shirley WL (2003) Social vulnerability to environmental hazards. *Social science quarterly* 84(2) 242-261.

Dodman D, Brown D, Francis K, Hardoy J, Johnson C, Satterthwaite D (2013) Understanding the nature and scale of urban risk in low- and middle income countries and its implications for humanitarian preparedness, planning and response. Human Settlements Discussion Paper Series Climate and Cities 4 International Institute for Environment and Development.

Gall M (2007) Indices of social vulnerability to natural hazards: a comparative evaluation. Dissertation, Geography Department University of South Carolina Columbia SC.

Hufschmidt G (2011) A comparative analysis of several vulnerability concepts. *Natural Hazards* 58(2): 621-643.

Heijman W, Hagelaar G, Heide M (2007) Rural resilience as a new development concept. In Development of agriculture and rural areas in Central and Eastern Europe 100th Seminar of the EAAE Novi Sad, Serbia.

Hill E, Wial H, Wolman H (2008): Exploring regional economic resilience, Working Paper, Institute of Urban and Regional Development, No. 2008,04

ILO (International Labour Organization) (2010) Global Employment Trends. January 2010 International Labour Office Geneva, Switzerland.

ISDR (International Strategy for Disaster Reduction) (2004) Living with risk: a global review of disaster reduction initiatives. United Nations, Geneva, Switzerland.

ISDR (International Strategy for Disaster Reduction) (2009) Risk and Poverty in a Changing Climate - Invest today for a safer tomorrow. The 2009 Global Assessment Report on Disaster Risk Reduction. United Nations, Geneva, Switzerland.

Jigyasu R (2011) Socio-economic recovery. Chapter 48 in Wisner B, Gaillard J, Kelman I (eds.) The Routledge handbook of hazards and disaster risk reduction Routledge New York.

Kasperson JX, Kasperson RE (eds.) (2001) Global Environmental Risk. United Nations University Press.

Lei Y, Yue Y, Zhou H, Yin W (2014) Rethinking the relationships of vulnerability, resilience, and adaptation from a disaster risk perspective. *Natural Hazards* 70(1): 609-627.

Lesetedi GN (2003) Urban-rural linkages as an urban survival strategy among urban dwellers in Botswana: the case of Broadhurst residents. *Journal of Political Ecology* 10(1): 37-46.

Marschke M J, Berkes F (2006) Exploring strategies that build livelihood resilience: a case from Cambodia. *Ecology and Society*, 11(1), 42.

Neef A, Panyakotkaew A, Elstner P (2015) Post-Tsunami Recovery and Rehabilitation of Small Enterprises in Phang Nga Province, Southern Thailand, in Shaw R (Ed.) Recovery from the Indian Ocean Tsunami, A Ten-Year Journey, Springer Publications, Tokyo, Japan: 487-503.

Okpala DCI (2003) Promoting the Positive Rural-Urban Linkages Approach to Sustainable Development and Employment Creation: The Role of UN-HABITAT. 2nd FIG Regional Conference, Marrakech, Morocco, December 2-5, 2003. Available at [http://www.fig.net/pub/morocco/proceedings/PS1/PS1\\_1\\_okpala.pdf](http://www.fig.net/pub/morocco/proceedings/PS1/PS1_1_okpala.pdf), last accessed on 10 July 2011 (2003).

- Paul BK (2005) Evidence against disaster-induced migration: the 2004 tornado in North-central Bangladesh. *Disasters* 29(4): 370-385.
- Reuveny R (2007) Climate change-induced migration and violent conflict. *Political Geography* 26(6): 656-673.
- Sapountzaki K (2012) Vulnerability management by means of resilience. *Natural Hazards* 60:1267-1285.
- Sharma BK, Krishna NT (2007) Employment-unemployment situation in Million Plus cities in India: A critical analysis. Directorate of Economics & Statistics government of NCT of Delhi. Available at <http://delhi.gov.in/DoIT/DES/Publication/paper61.pdf>, last accessed on 18 September 2011.
- Srivastava N, Shaw R (2012) Employment: Environment Disaster Linkages. In Shaw R, Sharma A (eds.) *Community, Environment and Disaster Risk Management* 9: 145-164.
- Srivastava N, Shaw R (2013) Establishing Urban-rural linkage elements for growth and poverty reduction in India. *Asian Journal of Environment and Disaster Management* 5(1): 1-22.
- Srivastava N, Shaw R (2014) Establishing parameters for identification of vulnerable occupations in a disaster scenario in Gujarat, India. *Risk Hazards and Crisis in Public Policy* 5(2): 212-238.
- Stacey, RD (1995) The science of complexity: An alternative perspective for strategic change processes. *Strategic management journal*, 16(6), 477-495.
- Surjan A, Shaw R (2009) Essentials of urban disaster risk reduction. In Shaw R, Krishnamurthy RR (eds.). *Disaster management: Global challenges and local solutions* University Press (India) Private Limited 543-555.
- Surjan A, Sharma A, Shaw, R (2011) Understanding Urban Resilience. Chapter 2 in Shaw R, Sharma A (eds.). *Community, Environment and Disaster Risk Management. Volume 6 Climate and Disaster Resilience in Cities.* Emerald Group Publishing Limited Bingley UK.
- Tacoli C (1998) Beyond the rural-urban divide. *Environment and Urbanization* 10: 3-4.
- Tao Yang D, Zhou H (1999) Rural-urban disparity and sectoral labour allocation in China. *The Journal of Development Studies* 35(3): 105-133.
- Vatsa KS (2001) The Bhuj Earthquake, A Reconnaissance Report: Identification of Priority Issues. Prepared for DRM-World Institute for Disaster Risk Management. Available at [http://www.drmonline.net/drmlibrary/pdfs/Gujarat\\_report.pdf](http://www.drmonline.net/drmlibrary/pdfs/Gujarat_report.pdf), last accessed on 29 July 2011.
- Villagran JC (2006) Vulnerability A conceptual and methodological review. *UNU Institute for Environment and Human Security (UNU-EHS) Source*, 4.
- Waldrop MM (1993) *Complexity: The emerging science at the edge of order and chaos.* Simon and Schuster.
- WRC (Women's Refugee Commission) (2009) *Building Livelihood, A Field Manual for Practitioners in Humanitarian Settings.* New York, ISBN: 1-58030-080-079-0., Available at <http://www.womensrefugeecommission.org/programs/livelihoods/research-and-resources/281-building-livelihoods-a-field-manual-for-practitioners-in-humanitarian-settings>, last accessed on 14 February 2014.