Towards
Urban Resilience

Photo: AIDMI.

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ABOUT THIS ISSUE

We live in an era of unprecedented urbanization. Since 2008, for the first time in human history, more people live in cities and towns as compared to the countryside. Moreover, the number of city and town dwellers is expected to swell up to 5 billion by 2030. This great number has huge implications for the risk profile of urban centres.

As the pressure on the resources of urban centres gets escalated, more and more people get pushed into the column of vulnerability. This issue of *Southasiadisasters.net* focuses on the theme of urban risk and resilience. This issue has been titled 'Towards Urban Resilience' as it contains articles detailing the efforts made by various agencies and organizations to reduce the risks faced by urban centres. The theme of urban resilience is also important to focus upon as it is inextricably linked to broad development outcomes.

Meticulously researched and lucidly written, the articles in this issue provide the reader with a broad overview of the best practices and interventions apropos urban resilience with special focus on Asia. Interesting pieces such as the disaster risk reduction plan of Shajahanabad in Delhi and the pilot risk assessment of Ahmedabad have been included. This issue is a must read for all those who are interested in the broad and ever evolving area of urban resilience. ■

The Importance of Urban Resilience

According to the United Nations' World Urbanization Prospects 2014 edition, by 2050, 66% of the world's population are expected to be living in urban areas. This is an increase of 120% since 1950, when only 30% lived in urban centres. Over the next 35 years, the bulk of the growth will be in Africa and Asia. Currently, 40% and 48% of these populations live in cities, significantly less than the worldwide average of 54% today. However by 2050, these rates are expected to grow to 56% and 64% respectively, catching up with the world average. India, China and Nigeria are together expected to make up 37% of the projected growth between 2014 and 2050. Whereas not long ago the world's largest cities were found in the most developed regions, today's largest cities are to be found in the Global South. The fastest growing today are small to medium sized cities.

As the world grows increasingly urbanised, communities, humanitarians, development actors, businesses and markets must adapt to the scale, density, and diversity of urban environments. As the population of a city grows, so does the demand on infrastructure and services. Particularly in the faster growing small and medium-sized cities, this puts pressure on local governments which may not have sufficient resources to provide for the rapidly expanding population. As cities become denser, space is limited and neighbourhoods are established on higher risk land. Hoping to take advantage of the opportunities that cities can provide, the poor flock to cities leading to the emergence of slums. The urban poor are especially vulnerable, having fewer resources, living and working in areas with less infrastructure, greater hazards and often facing marginalization by the rest of the urban population and local government.

Urban environments, however, can hold great opportunities in the technology and network power it has access to. The concentration of power and resources, government and media in urban centres can shine a spotlight on urban challenges. Strong markets and business hubs can assist urban communities to self-recover following crisis events. However the complexity of urban systems means that often opportunities go underutilised. More and more, urban planners, urban DRR specialists and urban humanitarian responders are looking at urban resilience, in other words the degree to which urban systems and communities are able to effectively adapt and react to the hazards they face. Approaching urban systems and structures in a holistic way, urban resilience allows us to understand the existing infrastructure, systems and networks which help a city mitigate, prepare for and respond to hazards and crises. With the growing scale, density and diversity of urban areas, as well as the immense potential impact that urban crises can have, urban resilience is an important approach. ■

– Leah Campbell,
Researcher,
ALNAP

The Urban Resilience Approach

As the word suggests, "Urban Resilience" is the capacity of an urban center to absorb the shock of a sudden or unforeseen disaster provoked by an event without necessitating massive extra territorial aids and resources to maintain its urban performance quality. These shocks could be of manmade origin (war, social disturbances, invasions, etc.) or of natural causes (tsunami, flood, cyclone, earthquake, landslides, etc.). An event is termed as a 'disaster' only when it causes considerable loss of life and property leading to a lowering of the living condition.

The quality of urban resilience or in other words its absorbing capacity depends upon the management quality of its governance system, its resources availability, its infrastructural facilities and maneuverability, the participative dynamics of its citizens and most importantly its visions and preparedness mechanism at all levels to counteract the disasters and emergencies.

In fact, an urban center is a complex entity of a total system composed of innumerable sub-systems representing different urban elements and parameters. They are interlinked and acting in an interactive manner holding this total system in equilibrium. If any or more of these sub-systems or their linkages with the total system is threatened by an external force or event of high magnitude such as a disaster, the shock is transmitted throughout the entire urban system triggering a set of chain reactions between them to prevent rupture. If the shock is not strong enough to break their chain i.e., within their resilient capacity, the urban center can withstand the shock; failing which the disaster will take place.

To counter act the roots of the risk factors or minimize their effects, we need to prepare a systemic analysis (cause & effect link) of all its urban parameters, their strength and vulnerability, their critical resilient capacity in terms of rupture limit. Such an analysis (SWOT) will determine the different measures necessary to face both the inherent (fixed) risks factors (geographical and environmental) as well as created ones (faulty urbanization, inadequacy in infrastructural provision, poor administration, etc.). In fact, most of the worst disasters we have so far experienced are consequences of unmindful anthropogenic activities (urbanization in the flood prone or other risky areas, too near to the sea-shores – especially in the tropical zones, geologically weak areas, rampant deforestation leading to soil erosion and landslides, etc, & etc).

The magnitude of disaster is measured by its impact on human life. However, the majority of our urban settlements are situated in various risk areas and are continuing their physical expansion under development pressure (an increasing proportion of population is becoming urban), pushing these centers to growing threats of risks. Today, the global climatic changes constitute the most vulnerable risk that the humanity has ever confronted with, leading to consequential effects on all aspects of planetary life system. We cannot remove our vulnerable settlements (specially in developing countries) but we can strengthen their resilience capacity to minimize the magnitude of disasters.

Today, we possess a good number of scientific means and knowhows (GIS, forecasting, simulation of scenarios and magnitude of disasters' effects, etc.) to understand, to envision and to modelise these risks and minimize their impacts on settlements. To encounter the disasters and improve the resilient capacity of the settlement centers, three basic strategies are needed to be developed:

1) Anticipation and envisioning of the "causes & effects chain" that constitute the total urban system of the settlement centre.
2) Improve the early warning and preparedness capacity, infrastructural mobility and governance system.
3) Incorporating necessary measures in the development program to rectify the planning errors.

Conclusion

To build up a resilient city, we need to proceed first with a SWOT ANALYSIS of its urban parameters; particularly those that are vulnerable to disaster and to determine how to minimize their weakness and to improve their reactive capacities. Improve the existing resilient capacity of the sub-systems. Build up public awareness to causes of disasters and their participatory mechanism to meet disaster situation. Provide effective early-warning measures to build up up-stream preparedness actions. Undertake correct planning actions to minimize or eradicate disaster causing elements.

Only through such combined actions can we improve the resilient capacity of our urban centers. ■

– **Hari Baral,** Architect, Town & Regional Planner, Director ENVITEC Paris, France

How Resilient is India's Infrastructure?

Investments in infrastructure are essential for India's economic growth. But how resilient is infrastructure in India? Is existing infrastructure resilient to disaster risks? Are investments in new infrastructure addressing disaster risks? A lot more can be known about this and that may be one reason why the Prime Minister who chaired 5th meeting of National Disaster Management Authority (NDMA) on October 28, 2013 talked about investments in preparedness but did not discuss resilience of infrastructure.

A total $700 million are put aside by India with Asian Development Bank (ADB) help to support national efforts to accelerate investment in the infrastructure that India urgently needs to ensure strong economic growth. But is this investment considering resilience of infrastructure against disasters and climate risks? This is not clear to either national and state disaster authorities or the victims and vulnerable citizens. Even the investors are not fully aware of this reality.

The Government of India estimates that $1 trillion in infrastructure investment is needed to achieve economic growth of 8.4% under its 12th five-year development plan, and expects nearly half of that to be financed by the vibrant private sector. At the same time one disaster after another—floods in Uttarakhand and cyclone in Odisha most recently—cause loss and damage of infrastructure. Roads are damaged. Power lines collapse. Bridges are lost. Building disaster risk resilient infrastructure is yet to attract investment amounts that match the needs. In fact investors do not seem to discuss disaster risk adequately either among themselves or with the recipients of such investment. Limited money is available to develop resilient infrastructure features for road, railway, airport, energy, or city development. And whatever money is available is not disaggregated in various reports and records as money invested in reducing risk. As a result we do not know how much money India is investing in making its infrastructure safer. And therefore it is so difficult to say how resilient is India's infrastructure.

Greater care is needed in reviewing investments in infrastructure to protect investments (and citizens) from loss and damage caused by disasters. All India Disaster Mitigation Institute's (AIDMI) work finds that this need is especially pronounced in the North East India; high altitude towns such as Leh in Ladakh; coastal district headquarters such as Ganjam or Puri in Odisha; and large tracks of land that are subject to regular flooding in Bihar and Assam. Several of these states of India have active and able state disaster management authorities (SDMA). But these SDMAs have also not taken up any review to find out how resilient state infrastructure is.

AIDMI's district level work finds that project planning for infrastructure needs early risk audit in its formative stages of estimating investments. Hazard and vulnerability assessment need to be more focused on both, risk of disaster and climate change in these estimates. What lacks in local level project planning is focus on process that captures risk concerns, risk reduction as a clear goal, and defines targets to build resilience in infrastructure. There is challenge of partnerships and capacities for such planning: where are such capable partners in India? The recent 2013 Human Security Conference: Humanitarian Perspectives and Responses Conference, October 24-27, 2013 in Istanbul concluded that to build human security for the citizens authorities must invest more and better in infrastructure that protects and expands human security.

The additional investments of millions cannot only accelerate economic growth but also protect this growth if the NDMA invites the large infrastructure investors to show evidence of their investments being disaster risk resilient. Such an evidence will surely shape the agenda for the 6th meeting of NDMA to discuss resilience of infrastructure. ∎

– Mihir R. Bhatt

Bridging Gaps in Urban Resilience

The efforts towards achieving Urban Resilience on global level are still facing gaps at numerous levels. Regarding the same issue an exchange of dialogue took place between AIDMI and McMaster University, Canada.

From the exchange of thoughts it was concluded that to understand the gaps there is a need to document the feedback at three levels, 1. The slum residents, who are at the receiving end of this cycle, 2. The civil society organisations and other social organisation who acts as bridge between slum residents and Govt. officials, and 3. The Govt. sector, which is responsible during the process of making policies. AIDMI helped in expanding the areas of study and capturing the local voices. ∎

Towards Urban Resilience

Resilience is proving to be a helpful way of furthering our understanding of how to improve efforts in disaster management, both in reducing the scale of impact beforehand and in providing a better response afterwards. This especially appears to be the case in forging alliances between seemingly disparate groups, who we know need to work closely together, but for a variety of reasons often do not. This for instance was a key reason for the emergence of resilience as a uniting and readily understandable term between the development and disaster wings of the UK donor DFID as recommended by the independent 2010 Humanitarian Emergency Response Review (HERR), and subsequently adopted by other donors and agencies.

Similarly, 'resilience' was used as a key word to bring together urban designers (architects, planners and others) and aid workers at a conference 'Design for Urban Disaster' held at Harvard University in May 2014. At that event, co-hosted by Harvard's Graduate School of Design along with IFRC, Habitat for Humanity and Oxford Brookes university, some 150 practitioners, academics – and critics – presented and debated the practical application of resilience in reducing vulnerability in towns and cities. Chief among the outcomes was the need to negotiate better understanding among and within disciplines: for urban designers to consider the importance of negotiated process and ownership among stakeholders from civil society; and for humanitarians to consider the importance of urban form and fabric – in considering responses that engage urban professionals in long-term recovery, and in preparedness planning for

A market quickly re-establishes after Typhoon Haiyan.

building stronger and safer communities.

Two important current applications of stronger resilience discussed at the conference concerned cash-based programming and 'big data'. For the former, people affected by disaster get cash to buy goods, thereby stimulating markets and reducing transaction costs in providing aid to people. This is proving to be quite a 'game-changer' – in a recent review of the response to the Philippines' Typhoon Haiyan[1] a Country Director of a large international NGO stated,'cash is the number one intervention besides food and water'. In towns and cities the use of cash is not hard to understand, and while not perfect – corruption is often cited as issue, though little if any evidence currently exists to say cash is any worse than other sectors - the shift to more cash based programming is rapid. Concerning the use of big data: while five years ago crisis mapping and use of volunteer and technical communities in urban disaster response was unheard of, now this has become central to tracking population movements and providing usable information, often

in the form of maps, to responding agencies. An opportunity now exists to improve preparedness planning through the application of big data in the work of urban planners and other shapers of towns and cities.

Resilience applied to towns and cities therefore currently has value, as a readily understandable concept among a wide variety of stakeholders. This is not to ignore debates about the 'exact meaning', the range of originations of the term (from ecology, engineering and psychology for example) or whether it is better to 'bounce forward' than to 'bounce back'. The chief challenge is to continue to build our collective understanding of what works best, by reaffirming central themes and principles to be found within resilience that resonate also in previously-widely-followed approaches such as livelihoods and rights based approaches, given that undoubtedly in five years time -or less - the humanitarian community will have moved on to a new over-arching concept. ∎

– **David Sanderson**, Professor, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

1 Sanderson, D and Delica Willisen, Z (2014) *Philippines Typhoon Haiyan response review,* for the DEC and HC. 2014. London and Ottawa.

Disaster Risk Reduction Plan
Case: Shahjahanabad (Walled City), Delhi

Shahjahanabad, or *Purani Dilli*, was built by Mughal Emperor Shahjahan in the period of 1638-1649. And, to present day, it is home to a thriving community living in its narrow meandering lanes and magnificent '*havelis*'. The Walled City is slated for inscription as UNESCO World Heritage City under the nomination submitted for 'Imperial Cities of Delhi' by Ministry of Culture, Govt. of India. Assuming its significance, a Disaster Risk Reduction Plan has been outlined in the following paragraphs.

1. Risk Assessment and Vulnerability Mapping

Though the Walled City was planned for a population of 60,000; 420,000 people were living in it in the year 1961. It is highly dense with about 1500 persons per Ha (pph). Consequently, the residential structures were taken over and converted for non-compatible commercial uses resulting in unauthorized construction which has added to the vulnerability of these structures to fire-hazards and collapse owing to shaking. Many buildings are in a state of dilapidation since neither the landlord nor tenant(s) are able to arrange for repair and maintenance. Unauthorized electric connections have created a tangled web of cables along the narrow streets making them highly vulnerable to fire.

The area has grown as one of the Central Business Districts dealing with about 75% of Delhi's wholesale trade. Hence, it attracts a substantial share of floating population which will also be at risk in case any earthquake hits the area. Moreover, damage to business-establishments in the area will result in heavy loss for the City of Delhi and the Economic Region as well.

Shahjahanabad is rich in both cultural and architectural heritage which attracts both domestic and international tourists. Out of the 170 protected monuments listed by Archaeological Survey of India (ASI) in Delhi, 40 are within the limits of the Walled City. The community living within the Walled City exhibits unique traditional art and craft. Hence, any damage to the built-fabric will mean a significant loss to our collective Cultural Heritage too.

Delhi Jn. Railway Station is well within the limits of Shahjahanabad; and the New Delhi Railway Station is next to it on the West. Hence, on account of any earthquake the railway service will be severely affected.

Seismic Profile of Shahjahanabad, Delhi:

Delhi Region has been categorized as Seismic Zone – IV. A study by Srivastava and Somyajulu (cited in Iyenger & Ghosh, 2004) mentions that the Sonepat- Delhi - Sohna dislocation is responsible for major seismic activity in and around Delhi. However, there are no major faults within 50 kms of the Study Area. No major earthquake has hit the Area since its inception.

Overlaying of Shahjahanabad over the geo-morphological map of NCT of Delhi reveals that the Study Area is essentially built on old alluvial plain, since the Walled City was built on the banks of River Yamuna. Similarly, superimposing the Study Area on the First Level Seismic Microzonation Map of NCT of Delhi reveals that the area exhibits moderate to high hazard.

2. Risk Reduction Plan

i. **Structural retrofitting:** Mapping of structural health of building stock need be conducted by the Local Body (i.e. North Delhi Municipal Corporation) so as to identify and classify building-clusters by stages of dilapidation and type of structural solution needed. Unsafe building-clusters need be notified and suitable redevelopment project shall be formulated.

ii. **Rent structure** of rented properties (both residential and commercial) need be revised so that the landlord and/or tenants may allocate adequate share for repair and regular maintenance. A revolving fund may be created by Residents' Welfare Association (RWA) and Traders' Welfare Association (TWA) to facilitate repairs.

iii. **Building bye-laws** need be drafted specially for the Area, aligned with the safety standards of National Building Code and guidelines of Delhi Fire Services.

iv. **Services:** Water, Drainage, Sewerage, Power and Telecommunication - are the basic lifeline service infrastructure. For speedy recovery post-disaster, it is essential that potential damage to these services is minimized. Hence, integrated trunk lines shall be designed to convey the pipelines.

v. **Minimizing fire-hazard:** Shahjahanabad Redevelopment Corporation (SRDC) has started undergrounding of exposed electric cables. Fire-fighting equipments and water-reservoirs may be designed at critical areas of the Walled City.

vi. **Safe Zones:** Open spaces in the City (Gandhi Maidan opposite Delhi Jn., Daryaganj, Red Fort Ground, park in front of Jama Masjid, etc.) may be demarcated and designed as 'safe refuge areas' where people may congregate in case any disaster-event. An 'Emergency Evacuation Plan' need be prepared indicating adequate signage, so that the residents may safely reach these 'Safe Grounds' within and outside the Walled City. Routes shall be designed so as to avoid lanes passing through vulnerable neighbourhoods.

vii. **Decongestion:** High density neighbourhoods, vulnerable to building-collapse and fire-hazard, need be decongested. Phased relocation within the Walled City or in neighbouring areas in Delhi needs be planned.

viii. **Public Awareness:** Awareness Campaigns and mock drills shall be organized on regular intervals to develop preparedness.

ix. **Disaster Debris Management Plan** need be prepared for quick recovery of arterial routes.

To ensure implementation and monitoring of the mitigation measures prescribed above, following action plan need be considered.

Measures	Agency
Special Building Bye-Laws for Shahjahanabad and stringent compliance to it	North Delhi Municipal Corporation
Redevelopment Plan to ensure redistribution of population and redevelopment of properties	Delhi Development Authority, North Delhi MC
Preparation of **Sub-District Disaster Mitigation Plan**	District Disaster Mitigation Authority (DDMA – Central Dist.), GNCTD
Survey / Mapping of Structural Safety of Built-structures; Declaration of Unsafe Buildings	North Delhi MC (in association with BMPTC & IIT-Delhi's Civil Engg. Dept.)
Reform of Rent Control/Tenancy Act (to revise rents)	Govt. of NCT of Delhi
Preservation of **Heritage Monuments** and preparation regulations for neighbouring development	Archaeological Survey of India (ASI), National Monuments Authority (NMA)
Awareness Campaigns	Residents' Welfare Association(s), Traders' Welfare Association(s)

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– Deepanjan Saha,
An Architect-Planner, Planning Consultant with Delhi Development Authority, Delhi

Disaster Management in India:
The Case of Mumbai Floods and Cyclone Phailin

India is located in Southern Asia. It is the seventh-largest country in the world by area of 3,287,263 sq km.

The climate of India varies from tropical monsoon in south to temperate in north, due to its vast size. India experiences climate from three major climate groups- Tropical wet (humid) climate group, Dry climate group and Sub-tropical humid climate group.

India is entirely contained on the Indian Plate, a major tectonic plate that was formed when it split off from the ancient continent Gondwanaland (ancient landmass, consisting of the southern part of the supercontinent of Pangea).

1. Main Hazards

1.1. The extent of damage experienced in previous disasters:

Sr. No.	Name of Event	Year
1	Kangra earthquake	1905
2	Bihar Earthquake	1934
3	Bengal Cyclone	1970
4	Maharashtra Drought	1972
5	Andhra Pradesh Cyclone	1977
6	Drought in Haryana & Punjab	1987
7	Latur Earthquake	1993
8	Orissa Super Cyclone	1999
9	Gujarat Earthquake	2001
10	Indian Ocean Tsunami	2004
11	Kashmir Earthquake	2005
18	**Mumbai Floods**	**2005**
12	Kosi Floods	2008
13	Cyclone Nisha of Tamil Nadu	2008
14	Andaman Islands earthquake	2009
15	Cyclone Aila	2009
16	Flood in Orissa, Karnataka, Kerala, Gujarat and Andhra	2009
17	Cyclonic Storm Phyan	2009
18	Cyclonic Storm Jal	2010
19	Cyclonic Storm Laila	2010
20	Eastern Indian storm	2010
21	Ladakh floods	2010
22	Sikkim earthquake	2011
23	Himalayan flash floods (Uttarakhand)	2012
24	**Cyclonic Storm Phailin**	**2012**
25	Assam floods	2013
26	Bihar Flood	2013
27	Cyclonic Storm Helen	2013
28	Cyclone Lehar	2013
29	Floods (Uttarakhand) due to cloudburst	2013

2. Selected Disaster Event

2.1. Mumbai Floods, 2005: The incident of Mumbai floods which occurred on Jul 26, 2005. There are 19 megacities in the world out of which 13 megacities are in coastal areas, 11 out of the 13 megacities are in Asia. Mumbai is one of them. Mumbai is identified as one of the 3 most vulnerable cities of the world which will be adversely affected by climate change by the Intergovernmental Panel on Climate Change (IPCC).

On July 26th–27th 2005, unusually heavy rains battered suburban Mumbai and Thane, causing one of the worst floods in the history of the state. The floods were caused by the eighth heaviest ever recorded 24 hour rainfall figure of 944 mm which lashed Mumbai on 26 July and continued intermittently over the next day. Nearly half of the annual average rainfall in Mumbai (2363 mm) was received in 24 hour period.

2.1.1 Causes of the Flood:
i. Unprecedented Rainfall.
ii. High tides aggravated the flood conditions as the water could not recede from the city.
iii. Urban flash flooding rose rapidly within 3-4 hours, submerging roads and railway tracks. One third of the city got flooded; the metropolis was practically cut off from other parts of the country.

2.1.2 Flood Impact:
i. Urban Transportation System
ii. Infrastructure and Amenities
iii. Economic Impact
iv. 5,000 people died in the incident.
v. Thousands of animals were trapped and died in the flood; most of them were floating in the flood water raising concerns about the possibility of disease.

2.1.3 Immediate Response:
i. Hot lines established between Navi Mumbai, Military and MCGM.
ii. Response time for reaching accident spot reduced from 15 to 8 minutes by commissioning of 07 new fire stations and 06 Regional Command Centers.
iii. 35 Automatic Weather Stations were installed.
iv. Over 4,500 beds proposed to admit patients of water borne diseases in Municipal and government hospitals.
v. Training programs for disaster management.

2.2. Cyclone Phailin in Odisha, 2012: Cyclone Phailin made landfall in Odisha, India on 12th October 2012 at around 9:15 pm local time with wind speeds of around 200 km/hour. The cyclone was a Category 4 storm (Hurricane Katrina, in comparison, was a Category 3 storm upon landfall). This was the biggest storm to have hit the Indian coast in the past 14 years. Last in 1999, Cyclone 05B caused massive devastation, killing more than 10,000 people and destroying substantial housing and public infrastructure in coastal Odisha.

2.2.1 Post disaster report: 72 hours later after Phailin, the official death toll is 38 people, less than 0.4 % of the death toll from the 1999 cyclone.

2.2.2. Preparedness: Following the disaster in 1999, Odisha set up the OSDMA (Odisha State Disaster Management Authority), the first state agency focused exclusively on disaster management in India.

i. Evacuation exercise and relief preparations.
ii. Involvement of International NGOs to tackle the cyclone.
iii. Mock drills.
iv. Community's responsiveness.
v. Counsel from UNDP for coordination and cluster preparedness.
vi. The NDMA has deployed, the National Disaster Response Force in Andhra Pradesh, Odisha and West Bengal.
vii. Close to a million people were evacuated to cyclone shelters in Odisha and Andhra Pradesh.
viii. A number of buildings, like schools, community halls, office complexes and other buildings away from the effect of expected storm surge were identified and people were shifted before the cyclone Phailin came.
ix. Central Medical teams' were kept ready.
x. The Department of Communication and National
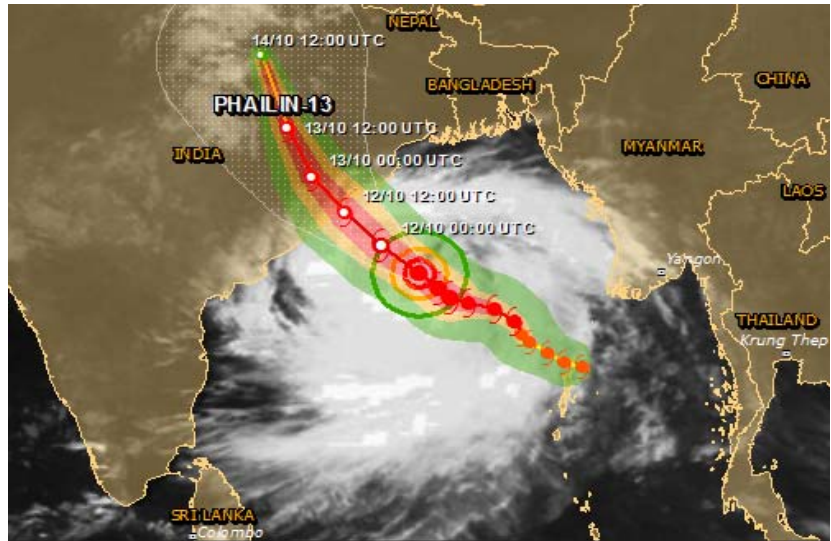
Map showing landfall of Cyclone Phailin.   (Source: JRC)

Highways Authority of India kept their resources ready to be moved at a short notice.
xi. NDMA also kept the media informed.
xii. Media played an important role in early warning and corresponding preparedness.
xiii. Control rooms have been set up.

2.2.3 Emergency Response:
i. Community members were moving to safer locations such as schools and pucca building.
ii. Several trees have been felled by community members as pre-emptive measures to prevent death caused by trees falling over people.

iii. 29 teams of the National Disaster Response Force have been deployed in Odisha. The teams have been equipped with satellite phones and wireless sets for communication.
iv. India Red Cross Society (IRCS) has been actively assisting in the evacuation process, and provided assistance in the government evacuation centres.

2.2.4 Recovery and Reconstruction: Rehabilitation and reconstruction work have simultaneously started to restore normalcy which is going to take some time. ∎

– Mutum Chaobisana Devi,
Architect/Urban Planner, Delhi

COMMUNITY VOICES

Voices from Small and Medium Entrepreneurs of Puri, Odisha on 2011 Floods

(with UNDP support)

Lack of Invention of new machineries and inadequate protective action from government has put a full stop on handicraft items: Floods made this full stop bigger and everlasting. Without SWAD and my SHG it is not possible to recover on my own. Collective recovery is more likely to be successful.

– Shushma Guru,
Hadicraft and Coir Worker, Jaipur village, Puri

During floods there is no alternative source of income. There is no nearby market. Relief can only help but only to an extent. How to start my business? How to link up with customers? How to replenish working capital? Should I spend my time to restart my business or rebuild my home? I had never thought about these before and hardly could plan when disaster struck. **– Santosh Prashti,** *Jeweller, Madhuban village, Puri*

South–South Cooperation for Cities in Asia

The coming wave of technological innovations aimed at global South cities will dominate civic debates whether people wish it to or not. Already, futuristic, 21st-century cities are being built around Asia from scratch. I had the privilege of visiting a couple of them in 2012 while researching the fourth issue of our magazine, Southern Innovator (http://www.scribd.com/SouthernInnovator). Each city had a different focus for its construction – one was seeking to be an "eco-city" and the other one called itself a "smart city," focused on becoming a regional business and technology hub. Both aimed to use the latest information technologies to make the way Asian cities operate on a day-to-day basis smarter – and greener.

Large information technology companies – including India's Infosys (infosys.com) – have their sights set on selling all sorts of technological solutions to common problems of urban living. This aspiring revolution is built on two foundations: One is the Internet of Things – in which everyday objects are connected to the Internet via microchips. The other is Big Data, the vast quantities of data being generated by all the mobile phones and other electronic devices people use these days.

Much of this new technology will be manufactured in Asia, and not just that – it will also be developed and designed in Asia, often to meet the challenges of urban Asia.

By their nature, cities are fluid places. People come and go for work and pleasure, and successful cities are magnets for people of all backgrounds seeking new opportunities. This fluidity puts stress on cities and leads to the constant complaints familiar to any urban dweller – inadequate transport, traffic jams, air pollution, poor housing, and a high cost of living.

If handled well and with imagination, new information technologies can ensure Asian cities do more than pay lip service to aspirations to improve human development. They can make cities resilient places - able to bounce back from disasters, whether man-made or natural.

During the late 1990s, I saw first-hand the pressures placed on one Asian city, Mongolia's capital, Ulaanbaatar. The country endured the worst peacetime economic collapse since World War II while confronting the wrenching social and economic stresses of switching from a command economy during Communism to a free-market democracy. The city's population grew quickly as rural economies collapsed and poverty shot upwards. I can only imagine now how the response could have been different with the technologies available today.

In 2010, I interviewed one of the editors of the Cities for All book, Charlotte Mathivet (http://globalurbanist.com/2010/08/24/cities-for-all-shows-how-the-worlds-poor-are-building-ties-across-the-global-south), and she stressed the importance of South-South cooperation to ensuring cities are good places to live for everyone.

"A lot of social initiatives based on the right to the city are coming from these 'new cities of the South,'" Mathivet said. "The book highlights original social initiatives: protests and organizing of the urban poor, such as the pavement dwellers' movements in Mumbai where people with nothing, living on the pavements of a very big city, organise themselves to struggle for their collective rights, just as the park dwellers did in Osaka."

Recently, an Indian restaurant uploaded to the Internet a video of what it claimed to be the first drone delivering a pizza in an Indian city. While this may or may not be a practical solution to traffic congestion, the subsequent negative fallout – angry police and public officials – from this use of new technology highlights the promise and perils of innovating in the real

Southern Innovator's fifth issue on Waste and Recycling (http://www.scribd.com/doc/207579744/Southern-Innovator-Magazine-Issue-5-Waste-and-Recycling), shows how innovators are tackling the challenge of improving human development on a planet with finite resources and a growing population.

world of Asian cities (http://
/www.bbc.co.uk/news/
b l o g s - n e w s - f r o m -
elsewhere-27537120).

Micro electronics are
becoming cheaper and more
powerful by the month.
Small businesses armed
with a only laptop computer,
access to the Internet and/or
mobile phone networks, and
cloud computing services,
can offer very powerful
business and public services
solutions. And sharing
solutions across the global
South via information
technologies has never been
easier.

The U.S. Pentagon published
various reports and studies
in the 2000s forecasting a
dark future for cities in the
global South. As author
Mike Davis revealed in his
seminal work, Planet of
Slums   (http://
www.amazon.com/exec/
obidos/ASIN/1844670228/
nationbooks08),   the
Pentagon   saw   the
developing world's cities as
the "battlespace of the
twenty-first century." It
imagined sprawling, crime-
ridden cities full of poverty
and slums and needing tiny
drones and robots darting
back and forth, keeping an
eye on everything and
suppressing unrest. This
threat-based view of future
cities is one to be avoided. It
is possible, through the right
application of quick solutions
to the challenges that arise
as cities grow, to turn to
cooperation across the cities
of the global South to avoid
this pessimistic fate. ■

– David South, Editor,
United Nations Office for
South-South Cooperation
(UNOSSC), UK

Urban Risks in Uttar Pradesh

India is one of the major countries which witness natural and human induced disasters very frequently. Urban areas concentrate disaster risk due to the aggregation of people, infrastructure and assets, urban expansion, and inadequate management.

Uttar Pradesh is one of the largest states of India. About 22 percent of states' population resides in urban centers. There are 915 towns / cities as per Census, 2011. There has been 30 percent increase in the number of towns and cities during 2001 to 2011. There are 630 urban local bodies in the state viz. 13 Municipal Corporations, 193 Nagar Palika Parishads, and 424 Nagar Panchayats. Out of 13 Municipal Corporations, 5 Municipal Corporations fall under high seismic zone, 6 Municipal Corporations in moderate seismic risk zone, and 2 Municipal Corporations are in low and very low seismic risk zones. The state has been divided into 4 geographical regions viz, Central, Western, Eastern, and Bundelkhand.

Western region is more urbanised while Eastern region is flood prone and Bundelkhand region is drought prone. A large segment of urban population in the state resides in slums, peri urban areas, squatters and informal settlements. These settlements are often located in low laying areas prone to direct and indirect risks due to environmental degradation, including changes in the climate and lack of basic urban services. The urban poor living in slums and peri-urban areas and informal settlements are vulnerable as they reside in high-risk areas and faulty shelters, having limited access to basic and emergency services. Moreover, over exploitation of ground water resources in urban centers for quenching the thirst of increasing urban population, changing lifestyle, and water uses for various purposes is cause of concern. Due to unregulated housing and building construction, lack of proper drainage and sewer network and also ineffective functioning of sewerage system in the state, urban centers are at high risks. The blockage and choking in drainage and sever system leads to water logging and flash flood in urban centers.

Increasing urbanization, expansion of habitat into unsuitable vulnerable areas, higher population density, higher housing density, vulnerable housing and buildings construction, non engineered unsafe construction, and aging buildings and other infrastructure are some of the factors that have increased the vulnerability of hazards and disasters in urban areas. Growing urbanization is posing serious environmental concerns in India in terms of changing land use pattern, increasing carbon emissions, solid waste generation and its disposal, air and water pollution and poor sanitation amenities. Major challenge for cities in the face of rapid population growth is to maintain sustainability within the social, economic and environmental dimensions. The accelerated and uncontrolled urban growth has contributed to the ecological transformation of the cities and their immediate surroundings resulting in flash floods and water scarcity. Furthermore other factors depending on the local circumstances contribute to the urban vulnerability, hazards and risks.

Cities are hubs of the intensive resource demand, environmental degradation and greenhouse gas emissions. However, cities may play a critical role in promoting low carbon development through use of renewable energy, energy efficiency, green buildings and mitigating emissions from urban transport. The immediate problems of states' cities relate to inadequate institutional arrangements for solid waste management, drainage, sewage treatment and disposal and sanitation services. Thus, it is imperative to improve the municipal services, particularly sanitation services and urban local governments adopt the integrated urban planning for climate resilience and addressing the environmental problems. ■

– Dr. A. K. Singh, Assistant Director, Regional Center for Urban *and* Environmental Studies (Est. by Ministry of Urban Development, Government of India), Lucknow, Uttar Pradesh

Possible Heat Action Plans for Small Towns of India

Climate related extreme weather events are on the rise. These events range from floods and droughts to cyclones and extremes of temperatures. Heat waves, though extremely deadly and frequent are not as visible as other extreme weather events. There are projections of an increase in the frequency, intensity and duration of these heatwaves across the world. Unfortunately, the impacts of climate change are indiscriminate in their effects and are felt more in the less developed countries, societies and communities.

There is optimism in the fact that disaster preparedness is known to be an effective tool in reducing deaths. Formal evaluations of these plans show them to be effective and extremely cost effective. Various cities, especially in the west, have embarked on building disaster preparedness plans. We in partnership with NRDC, helped Ahmedabad to become the first city in South Asia in having a heat wave preparedness plan. However, a limitation of these plans is that they are quite urban focussed as they are typically implemented through the city governments. The need of the hour is to have these resilience strategies integrated into the disaster risk reduction framework at all levels -state, city and at grassroots levels.

Just as there is a limitation of available data from tropical countries that are more vulnerable, there is less data from the most vulnerable societies and communities within these countries. There are very few studies which have documented the effects of heat waves in small towns and rural areas. This lack of information is compounded by the difficulty in arriving at statistical associations from the low numbers of reported data. Consequently we are unaware of any preparedness strategies in place for small towns in India.

The rapid urbanisation currently taking place is in small towns and not big cities. Of the phenomenal growth in national urban population a remarkable level of growth has taken place in Class 2, 3 and 4 towns with a population of less than 1 lakh. Small towns should be a focus of preparedness plans as the high population vulnerability, weak infrastructure and governance structures as well as low attention in the national consciousness. There may also be unique behavioural aspects locally which make people more vulnerable to heat morbidity. For example, during an interview of rural women we discovered that the lack of toilets at home forced women to go out to the fields either during dawn or at dusk. To avoid visits in between they would cut back on fluid consumption leading to increased risk of dehydration and heat strokes. Physical labour based occupations may be predominant in workers, their lifestyle requiring them to spend more time outdoors and weak housing related infrastructural issues (green spaces, electricity and water supply) are more common to small towns. Thus, possible preparedness plans for small towns need to have recommendations based on local conditions and practices.

We emphasize on the need for suitable research in these much neglected but rapidly urbanising areas. It is an opportunity to include resilience planning while the smaller cities are taking shape. ■

– **Gulrez Shah Azhar,
Priya Dutta, Ajit Rajiva** and
Dileep Mavalankar for the
Ahmedabad Heat Action group

Recognizing Heat Wave as a Health Risk

The city of Ahmedabad experienced a particularly hot summer due to heat wave in May-June 2014. The last time when a heat wave struck the city, then the total number of all cause mortalities stood at 4,462. This prompted the Ahmedabad Municipal Corporation (AMC) to draft a Heat Action Plan for Ahmedabad in collaboration with the Indian Institute of Public Health (IIPH) and the National Defence Research Council (NDRC).

All India Disaster Mitigation Institute (AIDMI) has also tried to contribute to this effort of raising awareness against heat waves by conducting action research with vulnerable communities of Ahmedabad to gauge at the debilitating impact that heat waves have on such communities. The objective of this research is to further knowledge upon the adverse impacts of heat waves on human health so as to advocate a greater uptake of efforts like the Ahmedabad Heat Action Plan by other states and cities of India. ■

– **Kshitij Gupta**

Cost Effective Green Building Techniques for Disaster Resilient Cities

The construction industry heavily depends upon natural resources for the procurement of raw materials to be used for erecting different types of structures. Bricks, cement, reinforcement bars all find their source in natural elements. But due to growing global concerns, there is an urgent need to look for alternatives to produce greener and cleaner building materials, which consume fewer resources, produce lesser pollution and are environment friendly. Another very important aspect being added to this concern is the disaster resistance capability of these materials. A brick which is greener in production can also be more disaster resilient. Discussed here are a few examples in that respect: fly ash bricks, compressed earth blocks and rat trap masonry bonding.

i) Fly Ash Bricks

Pulverised ash brick (PAB) technology is a process of converting industrial waste materials into quality building materials. At present, the technology is well established in converting thermal power plant waste into quality bricks. 'FLY ASH' is the extremely fine ash 'flying' along with flue gases is trapped in electro-static precipitators (ESP) and is collected. The relatively coarser ash generated at the bottom of the boilers is mixed with water, made into slurry and pumped into fill sites called 'ash ponds'.

Advantages of Fly ash brick over conventional bricks:

1. Due to high strength, practically no breakage during transport and use.
2. Due to the uniform size of these bricks, the mortar required for joints and plaster reduces almost by 50%.
3. Due to lower water penetration seepage of water through bricks is considerably reduced.
4. Gypsum plaster (plaster of Paris) can be directly applied on these bricks without a backing coat of lime plaster.
5. These bricks do not require soaking in water for 24 hours. Sprinkling of water before use is enough.
6. These fly ash bricks can be designed to be used in earthquake/cyclone prone regions.
7. They have higher compressive strength as compared to conventional bricks.
8. As there is no baking or kiln required, the environmental damages are very low.

ii) Compressed Stabilised Earth Blocks

The soil, raw or stabilized, for a compressed earth block (CEB) is slightly moistened, poured into a steel press (with or without stabiliser) and then compressed either with a manual or motorized press. CEB can be compressed in many different shapes and sizes. The input of soil stabilization allowed people to build higher with thinner walls, which have a much better compressive strength and water resistance. With cement stabilization, the blocks must be cured for four weeks after manufacturing. After this, they can dry freely and be used like common brick with a soil cement stabilized mortar. Costs are too often limited only to a monetary value. Another important aspect is the energy consumption involved in the material. The production of earth-based materials consumes much lesser energy and pollutes much lesser than fired bricks. CSEB and stabilised rammed earth are much more eco-friendly.

CSEB are most the time cheaper than fired bricks. This will vary from place to place and specially according to the cement cost. The cost break up of a 5% stabilised block would depend on the local context.

- Ideally, the production is made on the site itself or in the nearby area. Thus, it will save the transportation, fuel, time and money.
- Well-designed CSEB houses can withstand, with a minimum of maintenance, heavy rains, snowfall or frost without being damaged. The strength and durability has been proven since half a century.
- Requiring only a little stabilizer the energy consumption in an m^3 can be from 5 to 15 times less than an m^3 of fired bricks. The pollution emission will also be 2.4 to 7.8 times less than fired bricks.
- Produced locally, with a natural resource and semi skilled labour, almost without transport, it will be definitely cost effective! More or less according to each context and to ones knowledge!

iii) Rat Trap Bond Construction

Rat-trap bond masonry can be used to construct a small double storeyed residential building in load bearing construction, using the specific construction details which are followed in this technique. The principal requirement for rat-trap brickwork is the availability of good quality bricks. The following can be taken as guiding principle for strength of bricks for Rat-trap brickwork.

Advantages of rat trap bonding:

- The construction of this type of bonding uses 25 % less bricks, thus directly saving on the cost of material.

Type of building construction – Span not exceeding 4.2 metres, Roof/ floor loads as per IS 875	Recommended compressive strength of brick	
	Best Practice	Minimum allowable
Load bearing, double storeyed	More than 50 kg/cm²	40 kg/cm²
Load bearing, single storeyed	More than 40 kg/cm²	35 kg/cm²
Infill masonry in frame structure, no restriction on number of storeys	Minimum 35 kg/cm²	

- The cavity created on every subsequent course creates better insulation.
- Due to lesser use of material, the overall cost of material and the energy consumption in the product is evidently less.
- Interlocking bond between courses creates earthquake resistant construction.

Thus, major advances have been made in construction techniques which are greener, cleaner, disaster resilient and cost effective. As we witness historically unprecedented levels of urbanization, the challenge of growing sustainably can be successfully met by leveraging upon these traditional techniques. Architectural science has offered a vision of a resilient and sustainable urban space, it is up to the decision makers to implement these solutions to realise this vision. ■

– Aditya Jain

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SAFE CITIES

Important Aspects of A Successful Safe City Approach

"A city is not an accident but the result of coherent visions and aims."

– Leon Krier, The Architecture of Community

We live in an era of unprecedented urbanization. Since 2008, for the first time in human history, more people live in cities and towns as compared to the countryside. Moreover, the number of city and town dwellers is expected to swell up to 5 billion by 2030[1]. This colossal figure will have great ramifications on the evolution of modern cities in the developing world. Likewise this new wave of urbanization will dictate the exigencies of a safe city.

Since a city is a concrete expression of the fears, opportunities, aspirations and inspiration of the people who inhabit it, evolving over time into their social and cultural milieu, therefore it should necessarily address the safety needs of its citizens. Unsafe cities are no cities. Put simply, a safe city is one that provides a secure environment to all its citizens to live up to their fullest potential. This encapsulating view of a safe city subsumes a lot of factors such as effective coordination among various stakeholders, just allocation of resources and equitable distribution of social costs and benefits on citizens of different socio-economic backgrounds.

A globalized world has spawned newer challenges in building safe cities. This is particularly true of the developing countries in Asia. For, apart from a burgeoning population putting pressure on scant resources, developing countries are also ailed by great institutional challenges. The following areas should be accorded greater focus by policy makers and governments of developing countries in Asia to pursue the agenda of building safe cities.

1. **Effective coordination for effective response**
   A city is composed of several urban bodies (governance units) that are accountable for dispensing with the responsibilities of governance. However, the presence of a large number of governance units and departments complicates the process of coordination among them. One of the greatest

1 LINKING POPULATION, POVERTY AND DEVELOPMENT, Urbanization: A Majority in Cities https://www.unfpa.org/ pds/urbanization.htm

challenges to building a safe city is to ensure that there is effective coordination among various urban entities during an emergency. The city as a whole must respond to this crisis.

The All India Disaster Mitigation Institute (AIDMI) acknowledges the need of effective coordination during emergencies and has thus designed, developed and reviewed several City Emergency Management Exercises (CMExs) since the year 2007 in Ahmedabad, Mumbai, Chennai, Delhi and Guwahati in India. These city wide emergency management exercises are akin to city wide mock drills where different urban entities such as schools, hospitals, police department, fire department, etc. train with each other in a simulated emergency scenario. The idea behind this exercise is to promote coordination among these entities by giving them practice well before an emergency. Having successfully conducted CMExs in many Indian cities, AIDMI is now focusing on preparing standard guidelines for all those interested in facilitating a city wide emergency management exercise to protect the citizens.

2. **Thorough and Contextualised Urban Risk Assessments**
   Vulnerability to various risks can only be mitigated after their proper identification and comprehension. In this end, there are a lot of urban risk assessment tools and methods which help in mapping out various vulnerabilities and risks to which a city may be exposed to. However, cities differ from each other in a ways more than one. This makes a standard urban risk assessment redundant. Since risks are relative in nature, therefore any assessment or

framework that seeks to identify and understand such risks needs to be necessarily grounded in the local milieu.

In February 2014, AIDMI designed and developed an action research exercise for framing a contextualised urban risk assessment for the city of Ahmedabad in Gujarat, India. The unique risks faced by the city of Ahmedabad and the unique challenges faced by the city's vulnerable populations were all incorporated in the assessment. Once the framework for assessment was drafted, data was gathered from various stakeholders in the city based on the lines of the framework. The analysis of this data revealed a lot of details about the risk profile of the city. The details included that not only is urban risk dynamic but is also moving across time in multiple ways. AIDMI has forwarded the findings of this assessment to key policymakers busy with the HFA process so that the vulnerabilities identified may be addressed through institutional measures. The results will be addressed at AMCDRR in Bangkok, Thailand.

3. **Climate Compatible Development**
   As urbanization puts pressure on already distended urban centres due to waves of people from the countryside and rural areas migrating to such urban centres,

cities are faced with the a unique challenge. This is the challenge of sustainable development. To accommodate this burgeoning population, developing cities in Asia often pursue an agenda of indiscriminate infrastructural development. This only adds to the vulnerability of the city to various risks. This vulnerability is further compounded by the adverse impacts of climate change.

To strive for sustainability, cities should necessarily pursue the imperative of climate compatible development. A climate compatible development approach minimises the harm caused by climate impacts, while maximising the many human development opportunities presented by a low emissions, more resilient, future. Thus, such an approach is indispensable for building a safe city.

AIDMI has collaborated with the Climate and Development Knowledge Network (CDKN) to generate awareness about this approach and implement it in India for building safer cities.

While there are several other factors required for building a safe city, the three enumerated above are extremely important and pertinent to the context of the developing world in Asia. Focusing on them would lead us closer to building safer cities in Asia. ■   **– Kshitij Gupta**

AIDMI becomes a member of the Sustainable Development Solutions Network

The All India Disaster Mitigation Institute (AIDMI) is pleased to announce to its readers that it has just secured membership to the prestigious Sustainable Development Solution Network (SDSN). The SDSN works closely with United Nations agencies, multilateral financing institutions, the private sector, and civil society. The SDSN mobilizes scientific and technical expertise from academia, civil society, and the private sector in support of sustainable development problem solving at local, national, and global scales. AIDMI will now work closely related to the activities of SDSN. ■

HIF Funds Three New Projects with Disaster Resilience Focus

Disaster insurance for micro-enterprises is among three pioneering projects to be awarded grants by the Humanitarian Innovation Fund (HIF).

The successful projects, which will be run by Massachusetts General Hospital, All India Disaster Mitigation Institute (AIDMI) and Humanitarian Open Steet Map Team, will be developing and testing a range of innovations to help save lives and reduce suffering. The projects, who will work collaboratively with partners, will receive over £400,000 in total. This was the sixth round of funding since the HIF was launched in 2010.

The HIF, supported by the UK Department for International Development (DFID) and the Canadian International Development Agency (CIDA), funds projects across the world to develop and implement innovative products or services to improve the global response to natural disasters and humanitarian crises.

The three projects to receive funding in this round are:

Open Aerial Map (Humanitarian Open Street Map Team)
Open Aerial Map aims to be the first free, robust, and openly accessible online archive of satellite and aerial imagery. High-resolution satellite imagery is invaluable for disaster preparedness as ground imagery can be utilised to create base maps of disaster prone areas. During disasters, the imagery can provide situational awareness to aid interventions.

Strengthening resilience: low cost uterine balloon tamponade package (Massachusetts General Hospital)
The project will optimise, test and evaluate a device in Sierra Leone to mitigate postnatal haemorrhage – the leading cause of maternal mortality in this country. The innovation involves placing a balloon in a woman's uterus and inflating it with water to stop bleeding. The procedure is highly cost effective as materials can be sourced locally and includes a training package for local health workers.

Urbanization and Crises Program (All India Disaster Mitigation Institute with Harvard Humanitarian Initiative)
The project will pilot disaster insurance for micro-enterprises to improve the recovery of local markets that play a critical role in providing goods and services to vulnerable disaster-affected populations in urban settings.

More information about these projects will be available through their project profiles and blogging facility on the HIF website shortly. ∎

– AIDMI Team

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