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An overview on Rapid Urbanization and Induced Disaster Risk Factors in Bangladesh

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1. Introduction

Urbanization as a phenomenon has become a reality of the modern world. In our journey towards an "urban world" sometime between 2008 and 2010, the globe crossed a momentous threshold: more than half of the world's population (over 3.5 billion) is now living in urban areas (Preisner, 2012). This phenomenon is now being accelerated by the rapid globalization and expansion of local economies, especially in Asia. Similarly, Bangladesh a predominantly rural country is undergoing a transformation towards urbanization at a remarkable pace. As per recent UN data, about 35 million people, or approximately 25 percent of Bangladesh's population, currently living in urban areas compared to only 8 percent at the time of independence. This number will cross 80 million by 2030 (Lall, 2005). Thus, vulnerability caused due to urbanization is also increasing, which is reflected through different disasters in recent times in urban areas.

On the other hand, previously Bangladesh was known for rural hazards especially flood, but urban hazards are also becoming severe gradually. According to World Risk Report 2012, Bangladesh is the fifth in the list of 173 countries that are most prone to natural disasters worldwide. Among so many disasters, landslides in Chittagong metropolitan area, devastating fires and building collapse in Dhaka and frequent urban flood in cities are fresh memories to the citizens of

Bangladesh. City dwellers of Bangladesh are now facing more abrupt and manifold disasters than before. Our cities are becoming more and more vulnerable to both natural and man-made hazards due to rapid urbanization. However, very little attention has been made on the growing number of urban disaster risk hotspots, or the integration of disaster risk reduction and urban planning in Bangladesh. Current trends of rapid urban growth and ensuing environmental degradation are increasing common people's vulnerability to disasters. If left unchanged, disasters will take an ever-greater toll on lives and property.

A disaster-prone urban future can be avoided. Trend is not destiny. But as the population of Bangladesh becomes increasingly concentrated in large cities especially in Dhaka, we are seeing an urbanization accompanying disasters and disaster risk. This presents rapidly evolving challenges for city authorities, international agencies, NGOs, and central and local governments in how they approach disaster response in an urban setting, particularly in low-income areas where endemic poverty underpins vulnerability to disaster events.

2. Disaster Risk Augmented by Rapid Urbanization

The urban environment, which includes built elements, social structures, land, and ecology, is becoming progressively more fragile as a result of uncontrolled urbanization. Consequently, urban populations face increasing risks associated with economic, social, and environmental crises. Nowhere this is more evident than in Bangladesh where urban in-migration and population growth outpace local governments' capacity- to meet basic needs, plan and finance growth, and address growing vulnerabilities within the villages, towns, and cities (UN Habitat, 2010). High rate of rural-urban migration, growing trend of population and fragile economic conditions are triggering the rapid urbanization in Bangladesh. Urban areas of Bangladesh are characterized by the poor living standards, building construction without consideration of safety measures, lack of public awareness to hazards/risks, poorly enforced or nonexistent building code, and environmental degradation and resource depletion, adverse impacts of climate change and lack of comprehensive disaster management plan. These factors are making the cities more vulnerable to disasters.

City authorities of big cities in Bangladesh are facing challenges for providing basic infrastructure and services for the additional population every year. Therefore, this additional population is creating extra demand for the basic services, resulting price hike for these services. As a result, low-income people especially ultra-poor are bound to live in densely populated squatter settlements and slums. Extra demand for land in cities has led the poor people to settle in floodplains and unstable slopes which are prone to natural hazards. Horizontal expansion of cities in Bangladesh is disrupting natural drainage system. New housing projects in Dhaka, Khulna, Rajshahi, and Chittagong cities are encroaching floodplain zones. This kind of urban development increases the urban flood risk.

Many buildings are rising vertically and side-by-side, without proper zoning concept and guidelines, which is allowing extreme population density. In addition to that, fast growing cities of Bangladesh are allowing more and more poorly constructed buildings, old buildings to live and trashy maintained buildings. These buildings are very much vulnerable to earthquake, fire hazards and other types of building collapse causing unnecessary deaths. Besides the mentioned vulnerabilities the urban habitants are living with increased risk of industrial/ technological hazards and other health related risks. Increasing number of industrial complexes is taking place with rapid urbanization, even chemical and hazardous materials (e.g. Tannery Areas) are concentrating in cities. When a natural or man-made disaster occurs in an urban area, these industrial complexes and hazardous materials cause considerable secondary disasters such as fire, explosions, radioactive radiation etc. 'NimtoliFire' (2010) in Dhaka and explosion of nuclear power plant in Fukushima can be the recent examples of this kind of disasters.

3. Factors that Make a City Vulnerable to Disaster

3.1. Rapid Growth and Inadequate Planning

Due to rapid urbanization, cities of Bangladesh have failed to manage this growth. With the limited resource of city authority coupled with the lack of strong motivation, disaster preparedness is far way in the planning process of Bangladesh. There is land use plan only for big cities, however these plan is not being implemented properly. In most cases, for small and medium cities, there is no land use plan. Urban land use plans of Bangladesh, do not consider the potentials disaster risk. There is no regular assessment of the hazards for which urban areas are vulnerable.

As a result, people are settling in disaster vulnerable areas of the city. There is no or limited disaster action plan for the cities of Bangladesh. Moreover, in majority cases, there is no evacuation plan or there is no systematic warning system for different disasters. Therefore, it can be said that there is so many 'NO's in the hands of city authority and local government for disaster management. Therefore, rapid growth and inadequate planning is making our cities more vulnerable in course of time.

3.2. Population Density

Bangladesh is one of the most densely populated countries in the world. The national population density is 1142.29 per sq. km (WB, 2012) where urban population density is 23378 per sq. km (Streatfield and Karar, 2008). Dhaka, the Capital city of Bangladesh, is the most densely populated city in the world with 44400 people per sq. km (Cox, 2012) other metropolitan cities also have high population density. Overall population growth will continue but the rural population will stop growing by 2030. The urban population however will absorb

the additional 70 million national population growth (Streatfield and Karar, 2008). This frightening growth will be driven predominantly by rural-urban migration, with a small component of natural increase.

With this litesome urbanization, slum population within the urban area is growing at double the average rate which is around 7 percent per annum (Streatfield and Karar, 2008). These slums are highly vulnerable to disaster like fire hazard. Therefore, more and more people becoming vulnerable due to urbanization in every year. Urban people are concentrating on a limited area, obviously a natural disaster have greater impact than the disperse settlement. Old part of the city and squarer settlements of the city are highly congested and consequently more vulnerable. This kind of urban area faces more casualties and more asset loss when a disaster strikes. Therefore, city planning authority and disaster management bureau should give special attentions on these densely populated areas during land-use planning.

3.3. Ecological Imbalance

Environmental degradation is a significant factor in reducing the adaptive capacity of societies to deal with disaster risk in many countries around the globe (World Risk Report, 2012). Urbanization changes the land use of an area; this has the adverse impact on natural ecosystems. Urbanization cannot take place without the interaction with the environment. Urban people change their environment through their consumption of food, energy, water, and land. The resultant reductions of biodiversity and alterations of ecosystems rival any of the mass extinctions that the Earth has experienced in the past.

Urban air is becoming more polluted due to the harmful gas-emissions from the factories and vehicles. Amount of suspended particulate matter in city air contributes to allergies and respiratory illness thereby becoming a health hazard. This change has the adverse impact on temperature, air and water.

Factories and automobiles are the symbols of urbanization. Most changes in the ecosystem are the result of rapid urbanization. This urbanization has resulted in significant landscape changes with the net result of an increase in habitat fragmentation, loss of species and decreased biodiversity, which can have a corresponding impact on the ability of these areas to act as a natural 'sink' for air pollutants such as CO₂, SO₂ and NO_x.

When urbanization takes place, water cycle changes as cities have more precipitation than surrounding areas. Due to dumping of sewage from factories in water bodies, water pollution occur which can lead to outbreaks of epidemics. These kinds of changes in local ecosystems can result natural disaster in urban areas. A shortage of appropriate drainage systems, filled-up flood flow and sub-flood flow zone of the cities by new development has made cities vulnerable to

flash-floods. When rainfall occurs, Buildings, roads, infrastructure and other paved areas prevent rainfall from infiltrating into the soil and so produce more runoff. Heavy and/or prolonged rainfall produces very large volumes of surface water in any city, which can easily overwhelm drainage systems. The officials reported that at least 150,000 people have also been stranded by the sudden flash-floods (Source: BBC News). Hill cutting is another problem associated with urbanization. Landslide is becoming more frequent disaster. Chittagong City where landslides hit repeatedly in recent years. At least 90 people have been killed in a recent landslide on June 27, 2012 due to heavy rains and multiple landslides over three consecutive days.

Also the use of concrete has changed the ability of soil to absorb water, leading to flash-floods. In others cases, deforestation has led to hillside erosion, making people vulnerable to landslides triggered by heavy rains. Over-use of groundwater resources leads to land-subsidence, making the area more vulnerable to flooding or earthquakes.

3.4. Dependency on Infrastructure and Services

One of the important characteristics of urban area is the dependency on basic services. Urban people need potable water supply, electricity, gas, telephone and many other services. People in cities are highly depended on infrastructure and public services. It is unimagined that a city without these facilities. A city cannot run a single day without these facilities. Therefore, affordable basic services and infrastructure in cities are some of the most important engines of sustainable urbanization. As a result, more and more demand on basic services is increasing with the rapid urbanization. City authorities are unable to cope with this prompt demand.

However, dependency on services and infrastructure also represent a key point of vulnerability for urban populations during disasters. Just imagine what will happen if the electricity is cut, bridges have collapsed, telephones do not work and water mains are broken after a disaster. Essential services such as health care and firefighting are especially important after a disaster. Therefore, these critical services need to be located in such a way that the services will be available even after a disaster. The most recent 'Hurricane Sandy' in USA is a great example of this type of hazards related to providing urban utility services. This hurricane caused nearly 75 million people out of electricity. Moreover, many are lacking pure drinking water as well.

Now look into the current trend of urbanization in Bangladesh. Where people are fighting for the basic service in daily life, urban area has inadequate facilities and service; it seems a dream there to get these critical facilities in a disaster-resilient fashion. The availability of a reliable and affordable water supply is an essential

feature of cities; its sudden disruption creates threats and increases the vulnerability of crisis-affected populations. Urbanization and social instability add layers of complexity to the challenge, and loss of other service capacity (such as solid or liquid waste management) exacerbates already critical conditions. It must be a great concern to the city authorities to reduce all of these vulnerabilities with natural or human-made crises in urban area.

3.5. Concentrated Political, Economic and Other Resources

Unlike other developing countries in the world, rural-urban disparity is quite visible in Bangladesh. Even there are disparities among urban areas in term of resources concentration. Big cities in Bangladesh are consuming more resources than small cities. Dhaka is already the place of political concentration of Bangladesh- administrative units, commercial/ business centers all are concentrating in this Mega-city.

With the growth of urban areas, more and more resources concentration is taking place here. This kind of concentration increases the disaster vulnerability. Just imagine a devastating earthquake occurred in Dhaka- like Haiti and Tokyo. Administration of Bangladesh will simply break-down. Resource mobilization will be massively hampered. Financial market, economic activities will be affected. Relief work, disaster response activities all will be stuck as emergency management center is also located in Dhaka. At the end, recovery process will be affected by this disaster. Therefore, it is important for a resilient urban area to decentralize facilities, resources and centers in such a way that it will function effectively during and after a disaster strikes a large urban area.

3.6. Absence of Development/Implementation of Risk Resilient Design/Construction

From the past scenario of disaster in urban areas of developing countries, the interrelation between rapid urbanization and induced disaster risk due to inadequate control over design and construction practices can be clearly identified. In a rapidly growing city the rate of infrastructure development is very high, while in comparison with that concern regarding risk resilient infrastructure development and management is very poor in developing countries. Also strict monitoring and execution of infrastructure design and construction according to specifications has unfortunately been neglected.

For example: in June, 2010 a four-storey building collapsed in Dhaka, killing at least 23 people and injuring others. In 2006, at least 15 people dead and 50 injured when a five-storey building collapsed in Dhaka. And in 2005, more than 60 people died when an illegally-constructed garment factory collapsed near Dhaka (Source: BBC News). The causes were that the buildings were not constructed according to code, with additional construction above original height.

In order to ensure proper safety to reduce the disaster risk, it is of fundamental importance to have a good control over the entire practice of design and construction of structures. Loss of human life and properties can considerably be reduced if the whole system can be brought under a well-planned strategy. Experts from related arena and different stakeholders who are properly trained should work together under one umbrella to ensure a risk resilient infrastructure system.

A growing city like Dhaka firstly requires proper risk identification along with a standard or guideline for both structural and non-structural elements considering all aspects of disasters and thus covering proper measures and solutions against them. Additionally, effective regulations and implementation is necessary for experiencing the ultimate benefit of achieving risk resilient structures. Technical expertise and moral mindset of involved peoples are very important in this matter. However, it is not enough to develop a guideline and keep following it. Regular improvement and modification of existing design considerations and construction practice and introduction of new technologies through researches are very important to incorporate the latest knowledge in a practical manner.

For existing structures which have already been constructed need thorough investigation for vulnerability assessment. The structures identified as vulnerable to hazards should have proper treatment to improve their performance to sustain hazardous condition. Structural retrofit strategies need special care to be adopted. Overall improvement of structural and geotechnical performance might be required for existing structures to reduce the casualties during hazard incident.

4. Urbanization and Climate Change

Climate change is a worldwide problem that every nation is attempting to formulate specific answer and solution. The United Nations Global Report on Human Settlements, 2011 has identified that the proportion of human-induced Greenhouse Gas (GHG) emissions from cities is about 50% - 75%. Moreover, the report also states that the main sources of GHG emissions from urban areas are-energy supply for electricity generation (coal, gas and oil); transportation; energy use in commercial and residential buildings for lighting, cooking, space heating, and cooling; industrial production; and waste (UN, 2011). Therefore, there is no doubt that the urban areas are playing the most important role in 'Climate Change' through the production of GHGs.

Because of this increase of GHS concentrations in the earth's atmosphere, the earth is becoming warmer which is changing precipitation frequency, cyclone activity, glacial melt and sea-level-rise (Sioufi, 2010). Therefore, the projected impacts upon urban areas of these changes are as follows (UN, 2011).

- Warmer and more frequent hot days and nights over most land areas;
- Fewer cold days and nights;
- Heat waves over most land areas;
- Increased frequency of heavy precipitation events;
- Increase in areas affected by drought;
- Increases in intense tropical cyclone activity; and
- Increased incidence of high sea levels.

The last three events have the potential for population migration to larger cities like Dhaka and Chittagong. Moreover, due to extreme population densities the large cities are becoming vulnerable to earthquake and fire hazards (e.g. Dhaka and Chittagong). Cities near to sea-shore are vulnerable to sea level rise and tropical cyclones (Khulna, Cox's Bazar and Chittagong). Some cities are affected by drought through extreme heat events (e.g. Rajshahi and Rangpur). Heavy precipitation events cause flooding (Dhaka) and landslides in many cities of Bangladesh (e.g. Chittagong and Sylhet). Large cities tend to have higher air and surface temperatures due to the urban heat-island effect: the tendency of cities to retain heat more than their surrounding peripheral/ rural areas.

Due to the factors such as paving over vegetated land, increasing number of buildings and industries, temperature increases drastically. These anthropogenic changes have helped produce what is now termed as 'Urban Heat Island (UHI)' effect and contribute to increasing the stress on an already overburdened environment. This kind of UHI effect is applicable for a city like Dhaka, where the average temperature has increased by 6° Celsius over the past 20 years. By this way, the UHI effect is responsible for events like heat waves, fewer cold days and nights etc.

At the end, we can say that the direct/ indirect impacts of climate change upon urban areas may have ripple effects across many sectors of city life. The climate change impacts can be long-lasting and devastating as well. Therefore, the concerned city authorities should not ignore the term 'Climate Change in Urban Areas'. This change can adversely impact the southern coastal cities (Sea-Level-Rise and Cyclones), the northern region of Bangladesh (Monga) and other densely populated cities (UHI, Fire, Flood and Earthquake Vulnerability) of Bangladesh.

This is why different adaptation and mitigation policies should be taken depending upon the disaster characteristics of that particular city. These climate change policies should also address both short-term and long-term issues by giving priority to community participation. Proper measurements should also be taken to reduce GHGs and other air/ water pollutants.

5. Conclusion

Urbanization cannot be stopped as city is the engine of growth. This phenomenon is more challenging in a developing country like Bangladesh where resources are

scarce. Disaster vulnerabilities in our urban centers are clear and immediate, and they pose special challenges. Therefore, factor that makes cities vulnerable is needed to be well addressed in city planning and management. Urban Bangladesh is not yet ready for a major disaster. However, cities of Bangladesh are felt shaking many times in recent years and other hazards have raised awareness among people of Bangladesh. Now-a-days, many governmental and non-governmental organizations are working for disaster risk reduction in Bangladesh but till much more need to be done. Due to this awareness attempts at government and local level for developing safe and sustainable infrastructure with integration of performing appropriate structural design and quality construction along with performance enhancement of existing vulnerable structures have been taken into account. Several projects funded by government and international organizations have been launched to reduce the disaster risk and long term policies are also going to be adopted to make the cities disaster resilient.

For making the cities safer and reducing urban disaster risks, there is no alternative other than promoting reduction measures, building capacity of local government for ensuring effective services in emergency situations, decentralization of resources and empowering the decision making bodies towards the resilient urbanization. It is very much important to promote inter-agency engagement to disaster preparedness and response planning; to address the unplanned and rapid urbanization; to strengthen the capacities of the city authorities and immediate disaster response team. Proper implementation of land use plan with the integration of disaster vulnerability considerations into the approval processes and enforcement of building code also important to make an urban area more resilient to disaster. Social vulnerability can be reduced through the capacity building of the community by the creation of voluntary group, awareness creation, formal and informal framework for action during and after disaster. Multi-hazard approach need to be ensured in policies, regulations and plans to reduce urban risk that will make our cities safer in the long-run.

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