

6-9-2020

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Recommended Citation

Elsayed, Marwa; El Badrawy, Asmaa; and Sheta, Sherief (2020) "An Approach towards Achieving Urban Resilience in Threatened Urban Communities.," *Mansoura Engineering Journal*: Vol. 44 : Iss. 4 , Article 1. Available at: <https://doi.org/10.21608/bfemu.2020.94731>

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An Approach towards Achieving Urban Resilience in Threatened Urban Communities

نحو تحقيق المرونة الحضرية في التجمعات العمرانية المهددة

Marwa E. Ali, *Asmaa Nasr El-din Elbadrawey* and Sherif A. Sheta

KEYWORDS:

Resilience, urban, sustainable, community.

المخلص العربي:- إن الأحداث القائمة والمخاطر المحيطة بالمدن ، سواء كانت طبيعية ، مثل الزلازل أو الفيضانات ونقص الموارد والتصحر أو البشرية مثل الفقر والبطالة ونقص الموارد والتكديس العمراني بمناطق حضر ، قد أدت إلى الحاجة إلى دراسة مسألة المرونة وقدرة المدن على مقاومة مثل هذه الضغوط والمخاطر . يقدم البحث دراسة نظرية تحليلية لمبدأ المرونة وخصائصها ومفهوم المرونة الحضرية في المجتمعات الفقيرة في إطار دراسة مرونة المدينة وأهدافها ومؤشراتها ، كما تم التوصل إلى دراسة تحليلية تم خلالها إجراء تحليل مقارنة لثلاثة أمثلة من المدن التي تشبه طبيعة مصر في المخاطر التي تتعرض لها وأخيراً تم التوصل إلى مخلص للحصول على منهجية لحل المشاكل وطرق التعامل معها خاصة فيما يتعلق بالتنمية الاقتصادية والاجتماعية وجوانب التأقلم لكل منها في إطار تحليلي، من خلاله تستهدف التوصيات أهم العناصر الحضرية للمناطق الفقيرة بالمدينة ، والتي يمكن تقديمها لتطويرها والنهوض بها.

Abstract— the ongoing events and risks surrounding cities, whether natural, such as earthquakes, floods or unnatural ones (poverty, unemployment and lack of resources, etc.) have led to the need to examine and resilience of cities to resist such pressures and risks. This research presents the theoretical study of urban resilience and its characteristics and the concept of the resilient city in addition to studying the framework of the city's resilience and its goals and indicators. An analytical study is also undertaken in form of a comparative analysis of three city examples that face similar risks to that of Egypt. Finally, a summary is to have a methodology that is formulated to solve the problems and ways of dealing with them, especially economic and social development (the socio- economic aspects of resilience) in an analytical framework. Through which recommendations are targeting the most important urban elements of the city's poor areas, which can be given to develop and advance them.

I. INTRODUCTION

RESILIENCE. Mainly urban resilience has spread out nowadays all over the world. It refers to how to look at a city holistically and understand the systems and components that make up a city, including the interdependencies and stresses they face. It also cares to strengthen the underlying structure of a city and better conception of the potential shocks it might face. In which a city can improve its evolution trajectory and the prosperity of its citizens. (foundation, 2018).

Resilience has become a key thought underpinning the sciences involved with sustainability through the last four decades. The term resilience has been employed in various ways and in many different fields; at the local, national and international levels. Resilience has even become a priority in urban planning, having been included as a main objective in native strategies. (Brand, 2007) (Davoudi S. a., 2012) (Vale, 2014) (Kim, 2016) (Meerow, 2016)

The expression of resilience has aroused from the domain of ecology in the seventies, to characterize the capacity of a system to preserve or recover functionality in the case of disruption or disturbance. It is viable to cities because they are complicated systems that are permanently adapting to the changing state of affairs. The concept of a resilient city has become conceptually pertinent when chronic stresses or unexpected shocks threaten widespread disturbance or the

Received: (3 September, 2019) - Accepted: (14 November, 2019)

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breakdown of physical or social systems. A conceptual limitation of resilience is not to be necessarily accounted for the power dynamics which are inherent in the method cities function and deal with disruptions. (ARUP, 2014).

A. The Problem

From earthquakes, Amazon rainforest wildfires (becoming one of the major risks threatening the whole world in the environmental sense) to flooding, fast immigration to cyber-attacks, many cities are facing several kinds of shocks and stresses, some are natural and others are human-made. Nowadays, our cities and citizens together face new, amplified and expanded challenges as a result of rapid urbanization, a changeable climate and political instability. So as to mitigate this transfer and reduce the negative influence they have on people, the universe is increasingly realizing that resilience is an urgent need and we have to build it into our cities by empowering and reinforcing the capabilities of local government and their partners, including native populations. (un-habitat, 2018) Egypt current situation of economy has deteriorated in the last several years. The poverty line of citizens has decreased, which mean that many people now suffer from severe poverty (32.5% percent of Egyptians live below the poverty line. (CAPMAS, 2019).

Egypt has also suffered from several crises such as natural hazards (flooding, earthquakes...) over the last 20 years, which resulted hundreds of people killed with estimated economic damages to the infrastructure and buildings destroyed.

It is expected that climate change will increase the potential impact of hazards. Most of the population and infrastructure in Egypt are concentrated in the Nile Delta and along the Mediterranean coast, making the country vulnerable to the impacts of rising sea levels, especially flooding and intrusion of saltwater.

B. Aim of Research

The research aims to studying urban resilience and its relation to sustainable urbanism in order to upgrade the situation of poor people and mitigate poverty's damaging impacts. To attain this aim, the research analyses three case studies and their resilient solutions to poverty problems and set guidelines that can be applied to the poor communities of Egypt. These guidelines and recommendations help researchers design and lead a city that can have the ability of applying resilient solutions to mitigate shocks and long-term crisis like poverty.

II. METHODOLOGY

The research methodology consists of theoretical and analytical instruments:

a) Theoretical research: In the field of resilience, the several definitions of resilience and urban resilience. The research also studied the concept of resilient city and its characteristics.in addition to studying city resilience framework. The framework of social and ecological resilience which is applied to urban systems concentrates not only on the system's persistence and continuation, but also on the capability of learning, being innovative, resilient and flexible.

It supposes that humans can make conscious interventions into the operation, diminishing, sustaining or enhancing resilience. (Marta Suárez, 2016) (Davoudi, Brooks, & Mehmood, 2013)

b) Analytical research: Focuses on studying the resilience concept and solutions in three case studies from several areas to get recommendations and guidelines to make the city resilient.

III. RESILIENCE – UNDERSTANDING THE PHENOMENON

A. Definition of Urban resilience

RC-Resilience Cities-organization defines Urban Resilience as the "capacity of individuals, communities, establishments, businesses, processes and systems within a city to adapt, survive, and grow no matter what kinds of sudden chronic stresses and severe shocks they experience." (100resilientcities). (Meerow, 2016)

Resilience is the idea of adapting and decreasing vulnerability. It is the capability of city systems to deal with external effects and changes whilst maintain its construction, structure, vital functions and identity. (Holling, 1973).there is also a relationship between resilience and adaptation concept and evolution and sustainability, research concludes that resilience is much more than "becoming adaptable". (Chelleri, 2012) Figure.1



Figure 1: six conceptual tensions in definitions of urban resilience. Source: S.Meerow et al./Landscape and Urban Planing 147 (2016)38-49

B. Resilient City: What does it mean?

Cities confront a growing range of distresses and challenges during the 21st century, starting from the effects of climate change to increase migrant populations to inadequate and insufficient infrastructure to pandemics to cyber-attacking hacks. Resilience is the way that helps cities adapt and convert in the face of these challenges, supporting them to arrange for the expected effects and the unexpected ones. In the context of city issues, resilience has helped to bridge and tighten the gap between disaster danger reduction and climate change adaptation.

It changes the idea of traditional disaster risk management, which is founded on risk estimation that relate to specific risks. Instead, it accepts the possibility of a wide range of

devastation –both risks and shocks – might occur but are not essentially predictable. Resilience focuses on enhancing and improving the performance of city systems within the face of several hazards, instead of the prevention and the loss of assets because of specific sudden events. (Adams, 2014)

C. Resilience Theory

The most challenging advance of a resilience approach which applies to cities is exactly the idea that not everything can be controlled or planned because of the dynamic, active and highly complicated nature of urban areas. Resilience also encourages the integration and combination of eco-system’s functions and social dynamics. (Béné, 2014), Figure.2



Figure 2: Resilience evolution, Retrieved from (Béné, 2014)

Characteristics of a Resilient System

The systems of the city must be designed and functioning in a way that they can withstand and adapt to stresses and crises in order to build a city's resilience. The CRF is built on many years of research on resilient systems. It illustrates seven characteristics of resilience in the city, Figure.3



Figure 3: seven characteristics of Resilience, Source: 100resilient city

The following concepts have been considered by UN-Habitat as critical in building Urban Resilience, Source: (un-habitat, 2018), Figure 4

IV. EXAMPLES FOR RESILIENT CITIES CHALLENGES

Four examples are selected to indicate the idea of resilient sustain cities. Each one has succeeded in its challenge on the environment or the economic stress.

1. Los Angeles

Los Angeles is considered as a global destination in the United States. It has a population of over 4 million. The

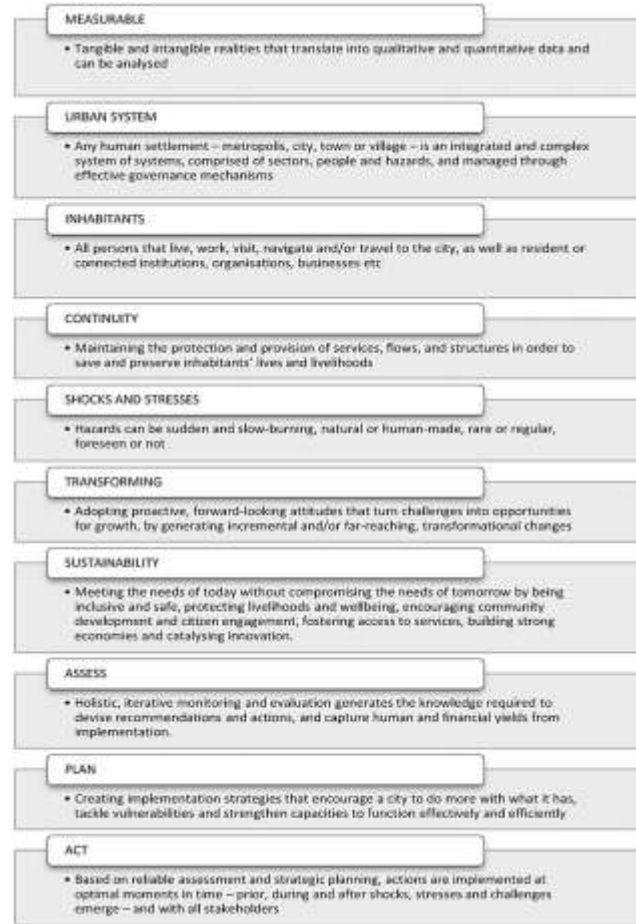


Figure 4: concepts in building Urban Resilience, by the researchers.

resilience strategy for Los Angeles provides strategies to help the City prepare specifically for emergencies and catastrophes, economic security for all people, environmental challenges, and expand and reinforce its base. (Marissa Aho, 2018)

Resilience directors studied city functions, curating an in-city network of resilience practitioners to advance initiatives, and institutionalizing that each City Department should contribute to and be responsible for the resilience of Los Angeles. Resilience managers are going together on initiatives focused on critical infrastructure, disaster preparedness and recovery, and extreme heat mitigation. The metropolis are also prioritizing partnerships by joining forces through various groups of stakeholders and institutions to stitch together resources and innovative solutions for a Resilient Los Angeles. (100resilientcities). Figure.5



Figure 5: Los Angeles, CA, United States, Retrieved from <https://www.mercycorps.org/sites/default/files/Building%20100%20Resilient%20Cities.pdf> on 11-5-2019

2. Paris, France

As a cultural and economic hub full of history and innovation, Paris has leveraged its partnership with 100RC to expand and redefine the city's concept of resilience. Because of, including terrorism, migration, air pollution, poverty, and social cohesion, the resilience plan of Paris covers a wide range of issues. The town suffers from a severe lack of green space for residents. Just 9.5% of Paris consists of greens and parks, less than other European urban centers. The heat wave happened in 2017 in Paris pointed out that the city's impermeable asphalt-covered schoolyards were an impediment to ongoing efforts to fight heat, rising temperatures and asphalt trapping heat in the city. (Grégoire, May 2019)

The city initiated an effort to address these issues head-on, unveiling the campaign "Schoolyard Oasis," enhancing community cohesion and increasing urban alienation. In all upgrades, the greening of schools will also be mainstreamed, making it the modern touchstone. When fully implemented, the plan has the potential to impact every citizen in the city, Figure.6



Figure 6: Paris, France, Retrieved from <https://www.mercycorps.org/sites/default/files/Building%20100%20Resilient%20Cities.pdf> on 11-5-2019

3. Norfolk, VA, United States

Due to Norfolk's prime location along the Elizabeth River and Chesapeake Bay, the city has a risk factor, Making it vulnerable to rising and flooding at sea level. Therefore, relying on a small number of industries can jeopardize it if global economic trends change. The city has taken advantage of the 100 RC network, including the largest grant in city history to leverage its resilience work. (Gentile, 2017)

It also helps Norfolk tackle a number of challenges in terms of resilience, including the establishment of a Coastal Resilience Center, improvements to public housing for low-income housing areas, Improvements to the storm-water infrastructure to protect communities along its Ohio Creek from potential flooding and continuing rise in sea level Norfolk's city council has also passed new zoning with an eye to the area's effect of heat, concentrating on lower-income areas.(100resilientcities), Figure.7

4. Wellington, New Zealand

It is New Zealand's capital city metropolis. It is known to be one of the most livable metropolitan centers in the world. It

boasts a thriving economy based on strong movie and engineering industries, and the public sector, and counts as valuable assets the natural beauty and the active harbor. But its coastal location on top of a major fault line that makes Wellington susceptible to earthquakes, tidal flooding and storm surges. City officials responded by prioritizing financial support and resilience-building projects and by changing the way they interact with the community, enabling residents and businesses to participate actively in urban planning processes as the city is preparing to grow and change. (Lester, 2017)



Figure 7: Norfolk, VA, United States, Retrieved from <https://www.mercycorps.org/sites/default/files/Building%20100%20Resilient%20Cities.pdf> on 11-5-2019

The urban center has accomplished its objective of retrofitting buildings that pose a risk to public safety from seismic activity The energy utility of the city has paid a surcharge to improve its power network in order to withstand disasters and recover faster. The urban center also completed the development of 22 rivers and fed emergency drinking water sites so that all Wellingtonians would have access to drinking water in case of an earthquake break of underground pipes. (100resilientcities), Figure.8



Figure 8: Wellington, New Zealand, Retrieved from <https://www.mercycorps.org/sites/default/files/Building%20100%20Resilient%20Cities.pdf> on 11-5-2019

V. CHARACTERISTICS OF CITY RESILIENCE FRAMEWORK (CRF)

CRF-City Resilience Framework- is a unique framework developed and sophisticated by Arup organization with support from the Rockefeller Foundation, based on extensive and comprehensive research on cities. It provides an imperilment lens to understand the complication of cities in

addition to the drivers that participate in their resilience. Using these drivers can help cities assess the scope of their resilience, to identify critical spots of weakness, and to identify and characterize actions and programs to develop the city’s resilience. It consists of 4 dimensions reaching 12 goals and divided into 52 indicators, Figure.9 (ARUP, 2014)



Figure 9: City Resilience Framework Dimensions. By the Researchers

A. Health & Wellbeing

The first dimension relates to people– health and well-being of citizens living and working in the city. The dimension considers the range to which the city enables its citizens to have their basic needs like (food, water, and shelter), especially in times of crisis and shocks. It considers to what extent the city supports opportunities of diverse livelihood, in addition to business investment and social welfare. Finally, it deems if a city is capable of safeguarding population health or not through emergency healthcare provisions and normal ones, Figure.10



Figure 10: Relationship between Health & Wellbeing category goals and indicators, Retrieved from City Resilience Index December 2015 <https://assets.rockefellerfoundation.org/app/uploads/20160201132303/CRI-Revised-Booklet1.pdf> on 15-6-2019

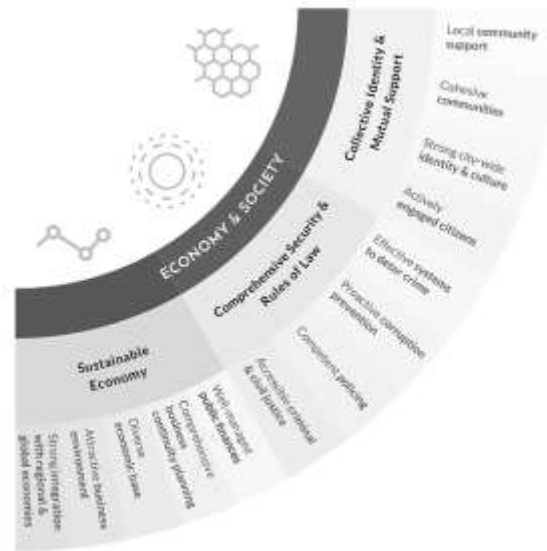


Figure 11: Relationship between Economy & Society category goals and indicators, Retrieved from City Resilience Index December 2015 <https://assets.rockefellerfoundation.org/app/uploads/20160201132303/CRI-Revised-Booklet1.pdf> on 15-6-2019

B. Economy & Society

The second dimension relates to cities organization and the way social and economic systems can enable urban population to peacefully coexist, act and collaborate with one another. This dimension includes the systems that enforce law and guarantee business management. The environment among a town that creates collective identity and mutual is additionally thought of open areas and cultural heritage play a vital role in this condition. This is only possible once their physiological desires are met through a basic level of support of food, water, sanitation, energy, and shelter.

C. Infrastructure & Environment

The third dimension relates to place and the quality of infrastructure and ecosystems which protects, supply and connect us. The CRI considers the robustness and durability of infrastructure and ecosystems that withstand natural hazards. The durability of critical services, under shocks or stress situations is also important and critical. In particular, water supply, energy distribution, and solid waste management; transportation systems that enable and modify the flow of people, services, goods, and information technology. Figure.12



Figure 12: Relationship between Infrastructure & Environment category goals and indicators, Retrieved from City Resilience Index December 2015
<https://assets.rockefellerfoundation.org/app/uploads/20160201132303/CRI-Revised-Booklet1.pdf> on 15-6-2019

D. Leadership & Strategy

The last dimension is underpinned and based on knowledge. A resilient city ought to learn from the past actions and takes appropriate and suitable ones based on evidence. Thus, a city should have efficient leadership and urban administration, characterized by inclusive and wise governance involving the government, jobs and civil society; it conjointly should do evidence based decision making. A city must also empower and authorize its stakeholders by providing access to data and education, so that people and organizations can take acceptable action. The city also develops in an integrated way that aligns its vision with sectorial methods and plans for individual projects, Figure.13



Figure 13: Relationship between Leadership & Strategy goals and indicators, Retrieved from City Resilience Index December 2015 on 15-6-2019

VI. CASE STUDIES

The reason for selecting these three case studies is that they face similar circumstances in the developing world like Egypt.

Also from the threats they suffer from is poverty. From the 100 resilient cities organized by the Arup and Rockefeller organization, the research selected towns that have stresses including poverty and have resilience challenges.

A. Melaka, Malaysia.

1) Profile of Melaka:

Malaysian experience in development is one of the best experiences in the Middle East and Asia. In 2008 Melaka was considered as one of the UNESCO World Heritage Sites due to its value in history. In 2010, the Organization for Economic Co-operation and Development announced it as a developed state, Figure.14

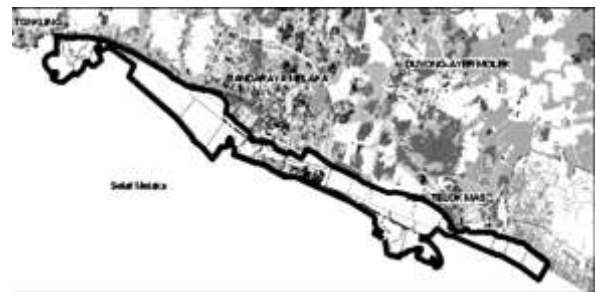


Figure 14: Land Use Zoning for Coastal Repair, Central Malacca Local Plan 2003-2015. Source: Adapted from Central Malacca Local Plan 2003-2015

2) Shocks and Stresses:

The government authorities have initiated several policies and plan initiatives to develop the country's willingness in managing, preparing and moderating issues of overpopulation, the rate of environmental degradation, structural washout, failures and natural disaster so as to increase the resiliency versus the unexpected impacts. (Jamaliidin, 2018)



Figure 15: ancient and new square & streets of Melaka



Figure 16: ancient and new Coastal beach of the town showing ships and fishing activities

3) Melaka's Resilience challenges:

During history, Melaka was a center for Southeast Asian navigation and shipping. It makes avails from the economic growth made by both tourism and foreign investment. Nevertheless, the investment in infrastructure development causes significant congestion in traffic and reduces the quality of air. Over the long - term, these stresses could cause tourism reduction, the health of people to decline and a severe increase of the city's greenhouse gas emissions and its effect to humans, Figure.15-16

Melaka has an increased risk of flooding caused by rainfall as a result of unsuitable drainage facilities and rising highly tides. Quality of life is being impacted by flooding in multiple ways by hindering accessibility to critical infrastructure, which causes damage to heritage buildings and historic areas, disrupting urban services like waste management, and moreover exacerbating traffic congestion. After-floods, the city must heal increased disease outbreaks and remove the wreckage resulted. Melaka has begun to focus on these challenges through several initiatives, one of them is Green Cities Action Plan, (Bank, April 2014) (Jamaliidin, 2018) which is supported by the Asian Development Bank, ensuring sustainable evolution. The city is currently trying to develop integrated and comprehensive plans studying resilience challenges, Figure.17

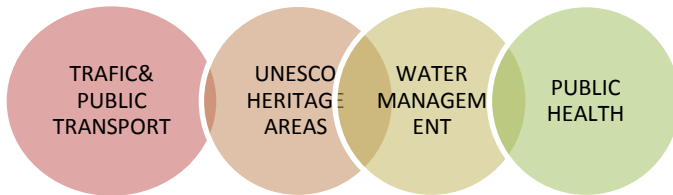


Figure 17: Resilient Melaka- four core areas, By the Researchers.

4) The Emersion of Resilience City Concept and notion in Malaysia:

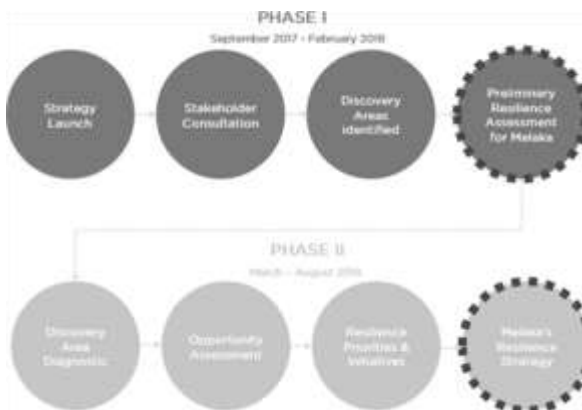


Figure18: phase 1& phase 2 of the city resilience plan, Source: (Jamaliidin, 2018)

Among the first resilient city challenges by the Malaysian Government and people was the implementation of how to make Cities Resilient using Campaign named (MCRC) in 2011 featuring Putrajaya, Kuala Lumpur and Malacca as

model cities (UNISDR, 2011). United Nations Office for Disaster Risk Reduction (UNISDR) has launched MCRC together with native partners, including authorities and local governments having aims of raising awareness of resilience in addition to disaster risk reduction between the local governments and communities, Figure.18

B. Chennai-India

1) Profile of Chennai:

Chennai, the capital of Tamil Nadu, was settled in 1639 and is considered as the fourth largest metropolitan town in India. The population of Chennai as of the 2011 Census of India, is 46, 46,730 citizens that cover an area of 426 sq.km. With an increased growth rate of 2% throughout the decades 1951-61 and 1961-71 that is greatly attributed to its industrial increase (India, 2006).The city is greatly tormented by the speedy urbanization inflicting pressure on the obsolete infrastructure. Cyclones (that has hit the coast 29 times in the last 50 years), tsunami happened in the Indian Ocean (2004), flooding caused by rainfalls are the major type of disasters that the city is susceptible in addition to other such coastal disasters (Shaw, 2010), Figure.19-20



Figure 19: Poverty in Chennai, India - The Borgen Project, Source: <https://trynotlaugh.us/galleries/restrooms-homeless-people-living-in-india.html>



Figure 20: 271 million people India has been lifted out of poverty on multi-dimensional ways in the last 10 years, Source: <https://trynotlaugh.us/galleries/restrooms-homeless-people-living-in-india.html>

2) Shocks and Stresses:

Local Action Planning is coming up with the Pro-Poor Urban Governance in southern Chennai, India:

A slum community rose to the state of self-organizing through efforts for its own development by its members lately. It is actually a serious time in which the pro-poor policies emerge. Inside the homes of the poor, there is the kindly interchange, accommodation, even physical and psychological

collaborating and sharing. But, outdoors, there are limited choices. (Singh, 2015)

Research provides thoughts and vision into the emerging native action planning processes from the slums of Chennai, which enabled a varied range of participations in understanding how the slum communities organize itself, showing their capabilities in working with others for their own betterment with the aid of government.

3) *Chennai's Resilience challenges:*

Because of immigration, Chennai has been the fourth most inhabited metropolitan cities in the world. Informal marginal settlements in low-lying areas by the shore have low access to infrastructure and services. To protect these areas in the face of high floods, officials have arranged coordinate disaster response plans.

Chennai is also making efforts building on that experience, and learning from the past and providing best-practice solutions to other areas. This is similar to the way it responded in the aftermath of the 2004 Indian Ocean tsunami.

In addition, the town is putting budgets for its resources to improve waste collection so as to minimize its impact, during floods and as an environmental threat. (100resiliencities)

To make Chennai enlightened, just and integrated, a Strategy is driven by a collective-defined vision through missions that come up with the key challenge areas identified by stakeholders. Each mission's goals will be accomplished through a range of actions and recommendations, some of which are already under way, while some are being planned and others are still ideas.

The Resilient Chennai Strategy is an ambitious document that presents actionable, tangible and feasible initiatives, along with some relatively challenging, long-term, transformative efforts to build Chennai's resilience. The resilience challenges and solutions are examined and interpreted in an integrated manner and then the complex interlink ages of various shocks and stresses. Multiple stakeholders collectively formulate resilience challenges and identified potential solutions ensuring that the strategy is co-owned by citizens and city's leaders from diverse sectors.

A final set of proposed interventions is selected based on multiple criteria which converts into actions presented to cover a wide range of suggestions that is capable of offering a holistic approach to building Chennai's resilience. (Prakash, 2019)

C. *Amman-Jordan*

1) *Profile of the city:*

Amman is located in the Middle East.it is the capital and most populous city of Jordan Thus; it suffers from economic issues and circumstances that many countries in the Middle East suffer from.

2) *Amman's Resilience challenges:*

Through history, Amman city has grown in rapid way and adapted to accommodate its large migrant populations. But as other pressures such as the effect of climate change and lack of economic diversity, Figure. 23-24, Resource constraints

increased. Nowadays, the city is facing challenges for which it should get ready. (Shawarbeh, May 2017)

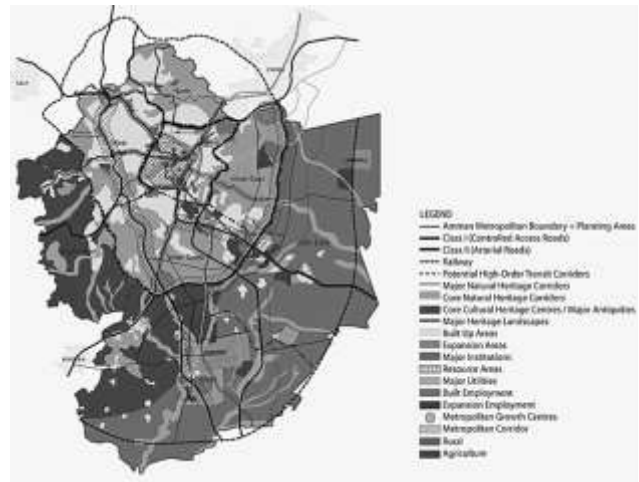


Figure 21: Metropolitan Growth Plan of Amman, Jordan, Retrieved from <http://svn-ap.com/projects/amman/> on 11-7-2019

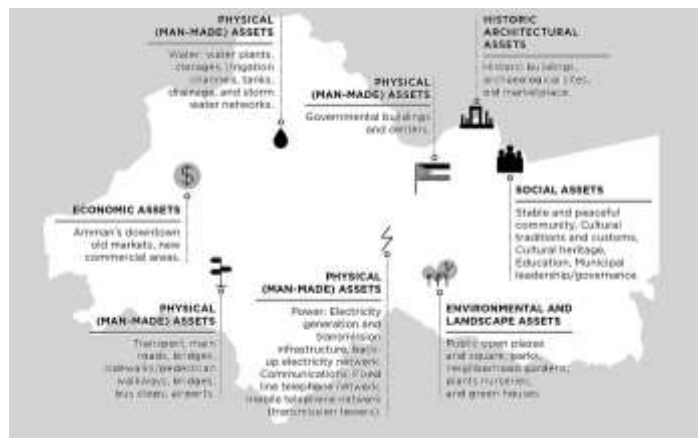


Figure 22: Summary of city assets, Retrieved from <https://www.100resiliencities.org/wp-content/uploads/2017/07/Resilience-Strategy-Amman-English.pdf> on 2-11-2018



Figure 23: Deterioration of residential buildings and lack of



Figure 24: Narrow streets and lack of places to practice activities

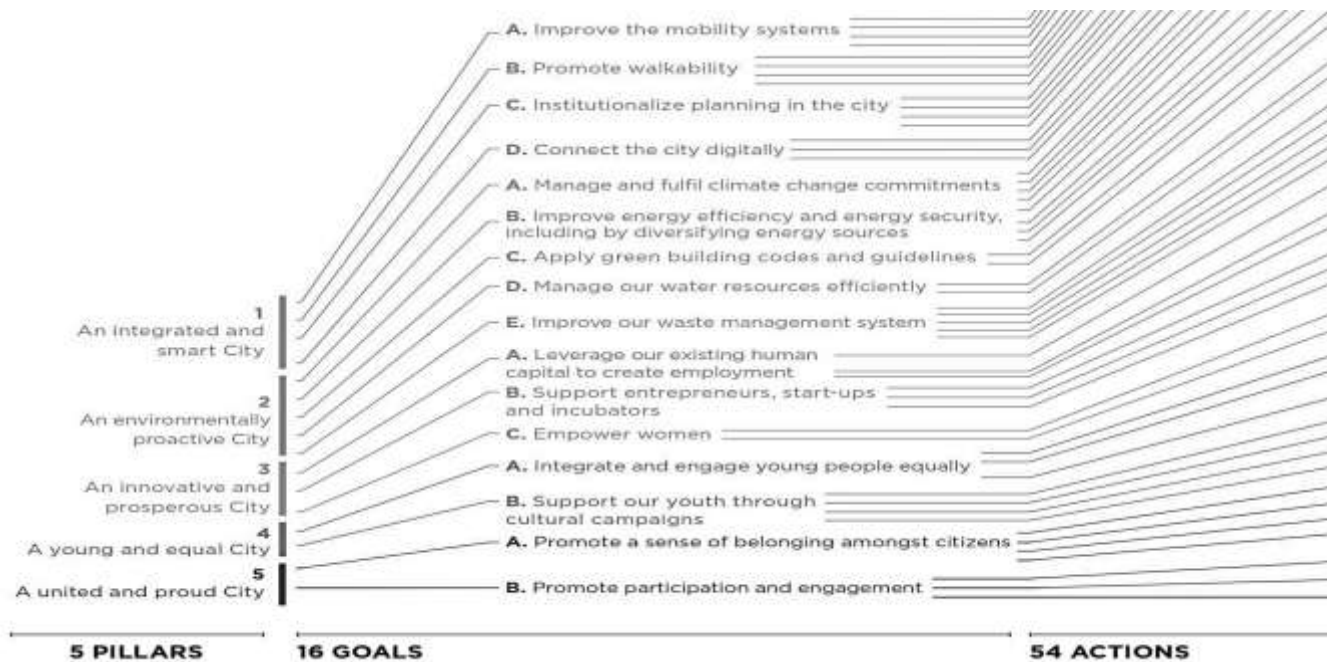


Figure 25: Amman's Pillars, Goals and Actions, Source: (ARUP f. r., 2017)

Summary of city Pillars, Goals and Actions

The above diagram illustrates and shows an overview of the pillars, goals and actions which is included in the strategy, their resilience value mapped through the CRF beside the relevant Sustainable Development Goals (SDGs), Figure.22-25

VII. CONCLUSION

The research is to do analytical comparison between three case studies and to get recommendations and guidelines which can be applied to any condition of poor city to make it more resilient and less vulnerable. The research concludes that:

- 1) To make cities more resilient after stresses and shocks, the city has to strengthen its vital living
- 2) Elements for citizens such as health and basic needs and shelter in emergency times like mosques and hospitals.
- 3) The towns that have historic background and coastal nature, such as Malacca face several stresses so it is important to set plans and policies to develop the country issues (e.g. Infrastructure, environment, and tourism) in order to increase its resilience versus the unexpected impacts.
- 4) Cities that face floods, greenhouse gas emissions, tourism reduction like Malacca and Amazon

rainforests in Brazil must put integrated plans along the short and long run.

- 5) Cities with overpopulation problems like Chennai and Amman chases pressure in the city services especially in emergency times.
- 6) A vary the range of Chennai citizens try to understand how the slum community organizes itself, showing their capabilities in working with others for their own betterment with the aid of government.
- 7) Crises like Tsunami and Cyclones which affected Chennai in addition to social stresses like immigration needed to self- organizing of the town through its own efforts
- 8) Emergency budget is an effective method which helped in Chennai city to provide resources for citizens.
- 9) Amman suffers from climate change and lack of economic diversity in addition to poverty so the government has put several plans to make the city resilient that aim to upgrade the city and citizens through 5 pillars in 16 goals and 54 actions (the change should be step by step, Figure 26.

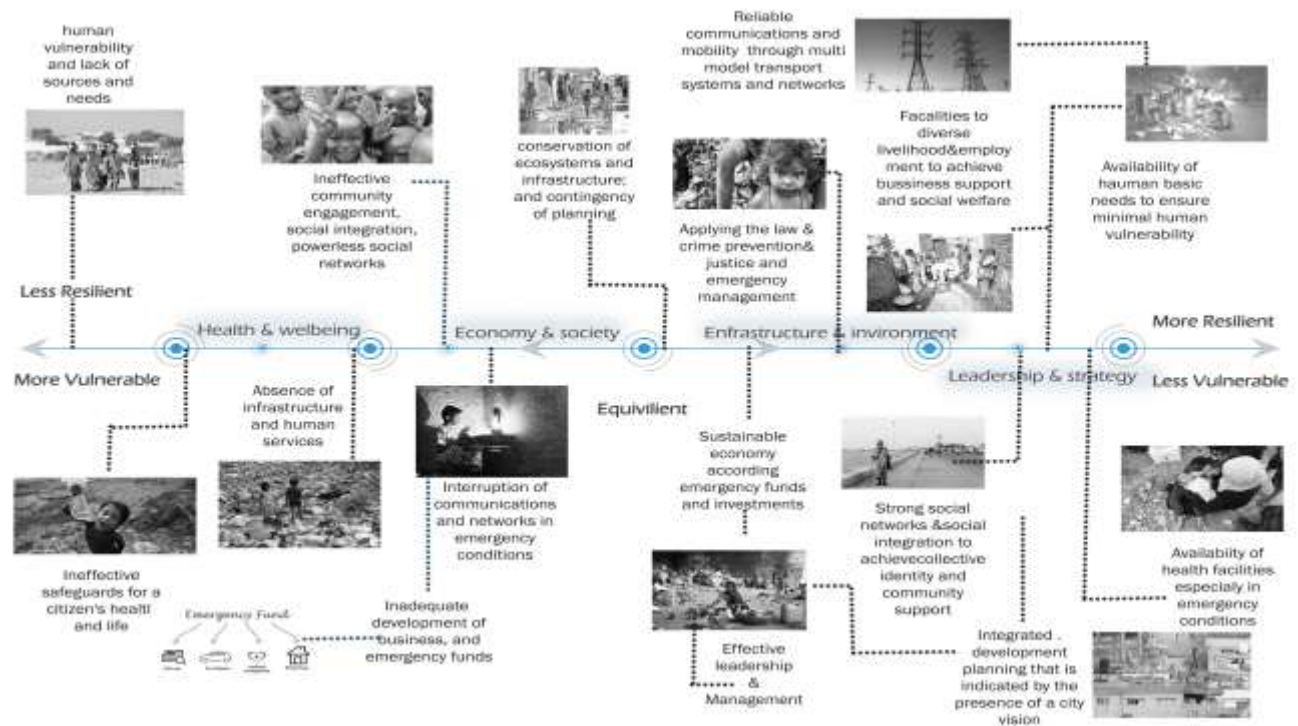


Figure 26: Guidelines to make cities more resilient and less vulnerable, by the researchers

VIII. RECOMMENDATION

To make cities more resilient:

1. The city should organize and coordinate future plans so as to comprehend and reduce disaster risk, based on participation of group of participants and civil society. In addition to building local alliances to ensure that all departments play their role in reduction of disaster risk and preparedness.
2. A budget should be assigned to reduce disaster risk and provide motivation for house owners, families with low incomes, communities, businesses and the public sector to invest in reducing risks.
3. The city ought to maintain up to the facts and data on hazards and vulnerabilities, and prepare risk estimations and use as the basis for urban development plans and decisions to ensure that this information and the plans for city's resilience are easily available for the public and completely discussed with them.
4. The government should invest and maintain infrastructure for critical situations, such as flood drainage and other vital services.
5. Enhancing schools, safety and health facilities in addition to upgrading them regularly.
6. The city ought to apply and enforce factual, risk compliant building regulations and land use planning rules and principles, identify safe places for citizens with low income and make efficient functional informal settlements.
7. The continuity of education and raising awareness programs on disaster risk reduction in schools and local communities.
8. The protection of ecosystems and natural buffers to relieve flooding, storm surges and other hazards to which the city may be vulnerable and adapt to crises by building on good risk reduction practices.
9. Early warning systems and emergency management capacities should be installed in the city and achieved regular public readiness drills.
10. After any disaster, the city ought to guarantee that the needs of the affected people are placed at the center of reconstruction, with suitable support for them and city organizations to design and help perform responses; this includes the reconstruction of houses and livelihoods to achieve better standards for quality of life.

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