

Climate Change and the Economic Competitiveness of Cities: Making the Business Case for Adaptation

Principal Investigator: Meenu Tewari¹

Project Team: Saon Ray, Amrita Goldar, Indro Ray, Zeba Aziz, Vidhya Unnikrishnan,
Sahana Roy Chowdhury, Sandeep Paul, Utkarsh Patel

List of Background Papers

1. Policy Brief: Economic Resilience of Cities in a Changing Climate: Interim Findings. 2013.

Urban Climate Change Resilience, Policy Brief, No.6, UCCR Policy Brief Series. Asian Cities Climate Change Resilience Network

Authors: Meenu Tewari, Saon Ray, Amrita Goldar, Indro Ray, Sahana Roy Chowdhury, Zeba Aziz and Vidhya Unnikrishnan

Available at https://www.acccrn.net/sites/default/files/publication/attach/final_version-policy_brief_6_icrier_economic_resilience_of_cities_in_changing_climate.pdf

2. Climate Change, Infrastructure and Basic Services in four Indian Cities, City Profiles, ICRIER Rockefeller Project Team, August 2015.

Abstract

The relationship between infrastructure availability and competitiveness of a city is well established. The annual Global competitiveness Report by the World Economic Forum lists infrastructure as one of the twelve pillars of competitiveness.² Aspects such as connectivity and transportation services directly affect economic efficiency and the ease of doing business in an area. Access to basic urban services such as water, sanitation and solid waste management, and so on. has a direct impact on the health and overall well-being of the workforce, another pillar of competitiveness. Thus, cities strive to provide better infrastructure and services to not only serve their residents better but also enhance their competitiveness in the region.

¹ Associate Professor, University of North Carolina at Chapel Hill; Email:mtewari@unc.edu

² http://www3.weforum.org/docs/GCR2013-14/GCR_Chapter1.3_2013-14.pdf

In this paper we present a brief overview of where our four cities stand with respect to infrastructure and basic services and the gaps that remain. We review five infrastructure systems for this assessment – Transportation, Water, Sewerage Disposal, Storm Water Drainage and Solid Waste Management. Data presented here have been obtained from a range of sources including city CDPs, Master Plans, Mobility Plans, the Census or from sector specific studies undertaken by MoUD. Most data are from 2010 or earlier, unless specified.

3. Mapping Resilience through an Analysis of City Plan Documents: Intersections between Climate Action and City Development Plans in Four Indian Cities, Zeba Aziz, ICRIER, August 2015

Abstract

In this paper we profile our four cities by mapping their planning efforts. We do so by examining the range of publicly available documents prepared by public agencies operating at different levels in Surat, Pune, Kochi and Ludhiana for assessing and planning the growth of these urban centers. We divide the assessment into four broad categories – Temporal coverage, geographical coverage, sectoral coverage and coverage in terms of climate and environment considerations. Overall we find that there is some strategic framework or vision for adaptive planning at larger scales (state/region) for each of our cities. However, there is an absence of detailed climate action plans with financing and institutional interventions at the urban scale for all our four cities. The CDPs provide a comprehensive overview and planning for bridging the service gaps for each of our 4 cities, yet are mainly silent on the issue of climate related risks and need for climate adaptive planning for the cities. Much of the current climate focus in the above plans (except Surat’s Resilience Strategy) is on the aspect of mitigation or reduction of the carbon footprint.

4. Reflections on Migration and City Competitiveness: A Comparative Analysis of Four Indian Cities with Surat as a Special Case, Sahana Roy Chowdhury, 2015

Abstract

This paper provides a brief sketch of the size, composition and spatial pattern of migration in Surat city based on discussions in the existing literature and interactions with local firms, workers and SMC officials during field trips to Surat. It sheds light on the migration ‘specificity’ of Surat compared with migration flows in other major cities. The paper builds a competitiveness index to rank the four cities in our project—Surat, Pune, Kochi and Ludhiana—using the Principle Component Analysis technique and interprets the role of migration in building a city’s competitiveness. While migration adds strains on urban resources [e.g., growth of informal settlements] and makes a city more ‘vulnerable’, it also enriches a city’s supply chains, which eases labor market tightness and makes it more competitive economically. We find a positive link between migration and a city’s competitiveness in

general. Competitiveness is here taken to be a composite of several socio-economic variables, over and above what is generally meant by purely economic competitiveness. Based on the commonalities of the variables that explain the principal components (PC) the most (i.e., those that have significant loadings in the component), the PCs are redefined as ‘Absorption Spillovers’ and ‘Strength of Pull’. We find that though Surat is placed in the 2nd rank among all our four cities in terms of overall competitiveness, its competitiveness is primarily driven by the ‘Strength of Pull’ rather than ‘Absorption Spillovers’. The policy implication is that urban adaptive mechanisms would benefit from bringing in more of this latter dimension to achieve a balanced, inclusive and sustainable competitiveness.

5. Burden of Disease and Climate Interactions: A study of Surat City, India. Amrita Goldar, Meenu Tewari, Flavy Sen. 2016. (Under review, to be published as a ICRIER working paper)

Abstract

Public health is a central pillar of urban well-being and resilience. It is an outcome of interactions between a city’s natural environment, anthropocene pressures and the quality of local governance. Surat, located on the banks of the River Tapi, has temperature and humidity patterns that can be climatologically described as creating ideal mosquitogenic conditions. In the past, a large share of malarial cases within India, and Gujarat state in particular, were reported from Surat. In recent years however, government interventions and public health programmes have led to a plateauing of the number of cases reported. This deceleration in cases reported has occurred despite the increase in size of the city since 2006.

Climate change induced probable increases in temperatures and rainfall are likely to exacerbate malarial risk within the city. This paper attempts to develop an urban climate impact assessment model with a focus on public health. Using past data on disease cases, climate trajectories (temperature, precipitation) the paper establishes the disease incidence relationship for malaria within the city and uses it to predict the probability of new cases of malaria emerging in the future. This health risk is then monetized to help establish the burden of malaria that the city is likely to face from an economic perspective. If viewed from a different angle, this estimated monetized value of health risk is also the disease burden that could be avoided due to possible health interventions (adaptation strategy). To compare against these, an estimation of health intervention costs undertaken by the government at a public programme level and households at a micro disease-treatment level is carried out to assess adaptation finance requirements against malarial risk.

6. India Water Tool and Urban India's Water Crisis, Indro Ray, ICRIER, 2016

Abstract

The story of India's urban water supply and demand is marred by multiple challenges. With limited resources, the situation is likely to become grave with increased competition for water among domestic, industrial, and irrigation uses as urban populations grow and the pressures of climate change bring new risks. These include unpredictable rainfall, increased risk of flooding, higher frequency of drought years, and a rise in pathogens in water bodies due to an increase in mean temperatures. This paper undertakes an assessment of the current availability and future demand for water resources for all 53 million plus cities in India using the India Water Tool 2.0 developed by the World Business Council for Sustainable Development and launched in February, 2015.

The analysis suggests that low availability of surface and ground water combined with high demand and extraction across sectors along with unpredictable climate patterns have resulted in high water stress in more than half of India. Under such circumstances it is critical for cities to take steps and implement programs that can mitigate the risks of future variability and shortages. One of the initial and important steps a city can take is to prepare a water master plan where the scenario of high demand and low availability is taken into consideration and all other respective plans for different sectors subsequently also take this scenario into consideration. At the city level, other measures to tackle low water availability and high uncertainty include proactive initiatives by local governments such as aggressive implementation of programs involving reduction, recycling and reuse of water, rainwater storage and large scale programs such as the rejuvenation of surface water sources (rivers, lakes, tanks, streams) within and outside city limits. On the demand side water conservation strategies, recycling, boosting efficient use of water, through pricing and other mechanisms such as informational nudges, as well as traditional practices for sustainable water use (aggressive leakage repair, metering, tiered tariffs) need to be promoted. Data visualization and data analysis tools such as the India Water Tool 2.0 can become an integral part of future decision making at the utility and household levels to promote climate-adaptive behaviors in the water sector.

7. Urban Form and Transport in the face of climate change: a Spatial Analysis of Surat, India, and an assessment of economic vulnerabilities, Zeba Aziz, 2015, ICRIER.

Abstract

The role of urban areas as agents of climate change is well documented, and equally significant is the vulnerability of cities to the impacts of this change. Extreme events such as heat waves, rainfall and storms, are expected to occur with increasing frequency and intensity while sea-level rise can threaten established economic networks and resources in cities. Some urban areas

are already vulnerable and the additional stress posed by climate stress and further underlines lives and livelihoods of people living there.

What steps, then, should cities take to safeguard their competitiveness? As they plan for the future, how can cities channel their growth and investments so as to build their adaptive capacity resilience? A key step in any resilience building strategy is anticipating impacts, assessing exposure, vulnerabilities or risk and assessing adaptive capacities. These form the foundation for an adaptation plan. Global and regional models (such as the Coupled Model Inter-comparison Project 5 (CMIP5) used by the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)), provide an overview of climate projections for different parts of the country, and insights into the kinds of impacts cities may experience with climate change. Cities can use this information to assess their vulnerability. In this paper we illustrate a similar economic vulnerability assessment exercise where we assess the exposure of a city's transport system to climate risk at the city level. We also highlight the nuances and challenges of such an undertaking as well as the opportunities offered to policy-makers as a result, and present an example – of Surat city – for such studies in the Indian context.

8. An exploration of the linkage between governance and adaptive capacity: Provision of Water Service in ULB's: A Performance Gap Analysis, Vidya Unnikrishnan, ICRIER, July 23 2015.

Abstract

An important factor responsible for the abysmal water service delivery mechanism in India is the lack of accountability on behalf of urban local bodies. An effective way to make local governments accountable is to rank ULB's based on their performance gap. Using principal component analysis this study ranks the provision of water services across 14 urban local bodies in India for two time periods. The rankings shed light on the difference between pre-defined JNNURM benchmarks and the actual performance of ULB's, such that a higher gap is indicative of poorer performance and vice versa. The results clearly indicate consistently outstanding performance on the part of Surat in both the time periods. The corporation has the lowest performance gap indicator and according to our analysis, the key factors contributing to this include relatively efficient water supply and a strong revenue mechanism for water service. Given the important role that the delivery of water services plays in mitigating climate risks such as flooding, and protecting the city's water supply during such events, we argue that the ranking of performance gaps can be a viable yardstick to evaluate the resilience of ULB's in India, as well as push them toward improved action.

9. Governance: Analyzing Adaptive Capacity Through Local Government Budget Analysis Vidya Unnikrishnan, July 2015

Abstract

Though the impacts of climate change are often felt on a local level, the role played by the budgetary capacity of local government in building urban resilience is often not well understood. This paper unpacks the sources of revenue and expenditure patterns of four Indian municipal governments (Surat, Kochi, Pune and Ludhiana) to understand the link between climate risks, governance (as defined by budgetary capacity) and the economic competitiveness of cities. The study first develops indicators to establish links between these three factors, and then uses information from both secondary sources and stakeholder interviews to measure the indicators. The study finds that awareness about climate risks is highest amongst government officials in Surat. The proximity of government officials to citizens is highest in Kochi, likely due to its smaller population and participator structure. And all the four sample cities are highly dependent on grants from the state government for their revenue income.

10. 'Climate Proofing' Urban Water Services: Evidence from the City of Surat, by Indro Ray and Meenu Tewari

Abstract

Water supply systems are vital to a city's economic, social and civic wellbeing. The uncertainties and pressures of climate change have created new logistical, political, and economic barriers to safeguarding these networks and for cities to take creative action to diminish risk to water systems. This paper examines the institutional drivers and the innovative strategies that the city of Surat in India has deployed to climate-proof its water resources and enhance sustainability and the longevity of water supplies, thereby promoting public health and economic competitiveness. Today Surat is considered to be on the forefront of cities that have made serious progress toward "climate-proofing" some of their key urban systems, particularly water. We examine the mechanisms, processes and the institutional form that these outcomes have taken, asking how replicable are the benign top-down systems that were followed here, in other cities, and what they leave out.

11. Industrial risks and industrial structure, by Meenu Tewari and Saon Ray

Abstract:

A city's productive base and related institutions are key to urban job creation and economic competitiveness. Urban production networks can however be deeply vulnerable to climate change risks depending upon the nature of their inputs, their capital assets, technologies, location, spatial structure and supply chain dynamics. While climate mitigation studies have

focused on industrial structure to document the effect of effluents, emissions and other forms of pollution on urban climate vulnerability, the adaptation practices around a city's production networks are much less studied and not well understood. This paper uses the case of Surat, a rapidly growing industrial city in Gujarat, India, to study the vulnerability to climate risk of two key industries: textile weaving and printing, and diamond cutting both of which are deeply embedded in the city structure. Drawing on detailed field work, evidence from a rich manufacturing dataset and a brief comparison with large capital intensive investments on the suburban coastal outskirts of the city, the paper argues that higher value industries and higher value activities within industries are the first to be protected from future climate risks by firms and private actors, leaving lower value and labor intensive sectors and activities more exposed to future risks. There is thus a strong case to be made for concerted collective and public action to address the vulnerabilities of lower value, labor intensive industries and relatively lower value activities within industries.

12. Building an Economic Case for Adaptation: Case Study of Surat City, Gujarat. Amrita Goldar and Indro Ray.

Abstract

Indicator analysis has very often been used in the literature to establish inter-relationships between variables. Indicator analysis becomes specifically important for urban research in data scarce environments. The aim of this paper is to synthesize indicators found in two large bodies of work that look at climate resilience and urban competitiveness. The second aim of the paper is to use PCP and AHP analysis to showcase how data reduction and indicator analysis techniques could be used to study the inter-relationships between climate resilience and urban competitiveness using the case of Surat and Kochi.

13. A Diagnostic Handbook for Assessing the Economic Effects of a Changing Climate on Cities, Meenu Tewari and Amanda Martin. 2017.

Abstract

The purpose of *Economic Effects of Climate Change in Cities: A Diagnostic and Assessment Guidebook* is three-fold: (i) to help city-level stakeholders build an understanding of how climate change will affect the city's economy, (ii) to provide a basis for developing policies and programs that reduce the impact of climate change on businesses, workers, markets, and the public sector, and (iii) to help cities communicate with businesses, government, residents, and NGOs about climate change and economic prosperity. The goal is to allow local policy-makers to self-diagnose the risks that new climate stressors impose on their particular cities, prioritize and assess the costs of these risk and explore strategies that can help them mitigate and adapt to these risks and evaluate, in an ongoing and dynamic way, the conditions under which they can succeed. The guidebook proposes a framework to understand the effects of

climate change in cities through the lens of economic activity. This framework and the process associated with it can be adapted to different formats; bringing together stakeholders that represent a variety of expertise will enhance the depth of the assessment findings, but should time or resource constraints make such a format infeasible, a single analyst could use this tool as well. A team of analysts or stakeholders can complete the assessment in multiple phases, or use just one section of the assessment methodology at a time.

ICRIER Working Papers

1. **The economic Impacts of Temperature on Industrial Productivity: Evidence from Indian Manufacturing**, Anant Sudarshan and Meenu Tewari, July 2014, ICRIER Working Paper No. 278

Abstract

We provide empirical evidence indicating that changes in surface temperatures may directly impact manufacturing output through their impact on worker productivity. We utilize a multiyear panel of manufacturing plants in India, as well as daily worker productivity measures from selected case-study units to show that (i) manufacturing output decreases at high temperatures by 1-3 percent per degree celsius; (ii) this reduction appears to be driven by declining worker productivity. Our results suggest that climate-economy models may underestimate the costs of climate change by neglecting to account for reduced worker productivity. The causal channel we identify could explain a portion of the strong negative correlation observed between temperature and GDP.

[An extended version of this paper is at: <https://ideas.repec.org/p/cde/cdewps/244.html>

The Impact of Temperature on Productivity and Labor Supply: Evidence from Indian Manufacturing. E. Somanathan, Rohini Somanathan, Anant Sudarshan, Meenu Tewari. 2015; latest version 2017 (Altered and extended version of the Sudarshan, Tewari 2014 working paper.).

Abstract

Cross-country studies have found that hotter years are associated with lower output in poor countries. Using high-frequency micro-data from manufacturing firms in India, we show that worker heat stress can substantially explain this correlation. Ambient temperatures have non-linear effects on worker productivity, with declines on hot days of 4 to 9 percent per degree rise in temperature. Sustained heat also increases absenteeism. Similar temperature induced productivity declines are replicated in annual plant output from a national panel. Our estimates imply that warming between 1971 and 2009 may have decreased manufacturing output in India by at least 3 percent relative to a no-warming counterfactual.]

2. Solid Waste Management in India: An Assessment of Resource Recovery and Environmental Impact, 2018, by Dr. Isher Ahluwalia and Utkarsh Patel. ICRIER Working Paper, No. 356

Abstract

This study analyses the environmental and financial sustainability of solid waste management in Indian cities. It presents an assessment of the rapidly rising volume of municipal solid waste, its changing composition, the continuing practice of mixing biodegradable (wet) waste with dry waste at the source of generation, and the growing volume of plastic in the waste. The present system is focussed on collection and transportation of largely mixed unsegregated waste. Resource recovery from the waste and safe disposal of the residual waste in scientifically designed landfills are grossly neglected. Rules have now been put in place for sustainable solid waste management, but the capacity to plan and manage the system and ensure the enforcement of the rules is a major challenge. The inability to ensure segregation of waste comes in the way of proper recycling, effective functioning of biomethanation plants, and also of safe operation of waste to energy plants which consequently leads to release of toxic pollutants into the atmosphere. Sites allocated for landfills are used as open dumping sites where far too much waste is dumped without resource recovery, generating leachate and methane gas. This study also presents the sources of greenhouse gas emissions from the solid waste sector. Besides presenting some mitigation choices to respond to the growing challenge, it also suggests mechanisms for ensuring that the system is financially sustainable.

3. The Role of Waterways in Promoting Urban Resilience: The Case of Kochi City, by Zeba Aziz, Indro Ray and Sandeep Paul. ICRIER Working Paper No. 359, May 2018.

Abstract

Coastal cities around the world are locales of high vulnerability. The issues are graver in the developing world where the challenges posed by the urbanisation and climate change multiply the existing risks. Here, we examine the case of Kochi, an Indian city located at the centre of a rapidly urbanizing coastal and estuarine region. In Kochi, a port city characterised by crisscrossing canals and rivers connected to a backwater system, waterways used to play a major role in the socio-economic and cultural development of the region. They not only supported the commerce and economy but also connected communities, supported a rich and diverse ecosystem and provided livelihood opportunities. However, poor planning and management of the industrialization and urbanization processes resulted in the neglect and widespread exploitation of this resource over the years, undermining its ability to support both ecology and connectivity. In recent years, partly due to growing recognition of climate change, and need for both mitigation and adaptation, there has been a renewed interest in investing in waterways to enhance connectivity in the region. The study examines how water ways can promote the climate, social and economic resilience of the city. It also critically compares these efforts against the global experiences and attempts to identify multiple limitations and

challenges to development of water ways in Kochi. The global experiences could be useful for Kochi as it is now starting to focus on waterways development as a crucial part of its integrated transportation network.