CITY BLUEPRINT APPROACH: KEY OPPORTUNITIES FOR INDIA'S URBAN WATER CHALLENGES

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The City Blueprint Approach (Koop and Van Leeuwen 2017) has been developed by KWR Watercycle Research Institute, Netherlands. In the light of the India-EU Water Partnership, experiences and knowledge from the EIP Water, and the City Blueprint action group in particular, is assisting in fulfilling this purpose for India. The Blueprint provides an integrated overview of water management in cities. The easy to understand, timely and relevant, and useful method has been applied in 57 municipalities and regions in 30 different countries, mainly in Europe. Ahmedabad is the first Indian city to have been assessed for the purpose. Based on the promising results of the study, KWR Water cycle Research Institute, Utrecht University, CEE, and Wetskills Foundation strive to assess several Indian cities according to the City Blueprint Approach in the coming years.

INTRODUCTION

The challenges of water, waste, and climate change are staggering because of their complexity, uncertainty and largely unknown risks that can have large impacts. Even if all countries implement their intended contribution to reduce GH Gemissions, as agreed at the Paris Climate Conference in December 2015, warming is projected to reach 2.7°C above pre-industrial levels by 2100 (UNFCCC 2015). Hence, it has become a necessity to adapt to a changing climate with more extreme weather patterns and a rising sea level. In cities, population growth and migration are estimated to lead to an urban growth of about 2.4 billion people by 2050 (UN 2015). This unprecedented increase already leads to vast urban expansion in flood prone areas, large-scale surface water pollution and depletion of freshwater resources (Ligtvoet et al. 2014; Koop and Van Leeuwen 2016). India is a rapidly urbanising country and the expected urban growth is about 404 million people by 2050 (UNDESA). Fresh water is becoming scarce due to inefficient agricultural practices, while at the same time, the industrial and domestic use is projected to double between 2005 and 2025 (Burton et al. 2011). The urbanisation and population growth are already putting strong pressure on India's cities and are projected to form a serious barrier to the country's economic growth and development. In the search for solutions to India's urban water challenges, the focus has been on technology. However, technological hardware only works within an existing network of cooperating institutions, practitioners and stakeholders (OECD 2015; Bird, 2016). At present, the local governance networks often lack sufficient capacity to implement the strategic goals and maintenance schemes set by national institutions (Kumar et al. 2012). Hence, improving India's water management and water infrastructure mainly requires a strengthening of water-related institutions, especially at the local scale or level. Therefore, this paper aims to provide useful insights and heuristics in how to incorporate governance aspects into India's Smart City approach. This is done by introducing the City Blueprint Approach, providing a brief overview of our main results in Europe and beyond, assessing the water governance of the city of Ahmedabad, and finally, formulating next steps to improve India's urban water management and governance, and encourage cities to become water-wise.

The City Blueprint Approach (Koop and Van Leeuwen 2017) has been developed by KWR Watercycle Research Institute in the Netherlands: https://www.watershare.eu/tool/city-blueprint/ and most recently published in the Urban Water AtlasforEurope (European Commission 2017). It is also an action of the European Innovation Partnership (EIP) on water, which claims to speed up innovations that contribute to solving societal challenges, enhance Europe's competitiveness and contribute to job creation and economic growth. In the light of the India-EU Water Partnership, experiences and knowledge from the EIP Water, and the City Blueprint action group in particular, may assist in fulfilling this purpose for India. One of the first steps in this process has been the cooperation with Wetskills Foundation and its partner Centre for Environmental Education (CEE) to do a first assessment of the city of Ahmedabad.

METHODS

The City Blueprint® Approach (Koop and Van Leeuwen, 2017) can identify the main point of improvement in India's urban water management and governance. The approach consists of two main assessments: the City Blueprint performance Framework (CBF) and the water Governance Capacity Framework (GCF). Both components have been developed by KWR Watercycle Research institute in cooperation with Utrecht University, in the Netherlands.
The CBF aims to be the first step in the strategic planning of urban water management. The framework consists of twenty five indicators divided over seven broad categories: 1. water quality, 2. solid waste, 3. basic water services, 4. wastewater treatment, 5. infrastructure, 6. climate robustness, and 7. governance.
The indicators are scored from 0 to 10 scale and presented in a spider diagramme (Fig. 3). The results are summarised in the Blue City Index (BCI), which is the geometric average of the twenty-five indicators. The GCF method consists of nine conditions each with three indicators that together determine the governance capacity needed to address a water challenge (Table 2). For Ahmedabad, the challenges of 1. water scarcity, 2. flood risk, 3. wastewater treatment, 4. solid waste treatment, and 5. urban heat islands, are assessed separately. The GCF indicators are scored according to a Likert scale that ranges from very encouraging (++) to very limiting (– –), the governance capacity needed to address each of the five water-related challenges. A detailed description of the scoring method of both the CBF and GCF are publicly available on

the European Innovation Partnership website (Koop and Van Leeuwen, 2017): *http://www.eip-water.eu/City_Blueprints*. The scoring is based on an interactive process with local experts and stakeholders including water utilities, city councils, companies, water boards, etcetera. In this process, publicly available reports and semi-structured in-depth interviews provide the necessary information. Both the CBF and GCF methods provide important strategic and practical insights while they require relatively little time and resources to be executed.

RESULTS

3.1 City Blueprints: Enhancing City-to-City Learning Around the World

The City Blueprint provides an integrated overview of water management in cities.The method is designed to be easy to understand, timely and relevant, and useful for the end-users, who are policy makers, decision makers, water managers and citizens in general. It is a first step in the strategic planning process of urban development and enables cities to exchange experiences, knowledge and best practices. The method has been applied on 45 cities (Koop and Van Leeuwen 2015) and at present includes 57 municipalities and regions in 30 different countries, mainly in Europe (Fig. 1; Fig. 2).

Based on the indicator scores of all these cities, we have applied a statistical hierarchical clustering analysis in order to identify categories of cities with similar features. Based on this analysis, we identified different stages of urban transformation towards becoming water smarter water-wise cities (Table 1). Provided that cities know what their most important points of improvement are, cities can leapfrog their transformation by exchanging experiences, knowledge, best practices and apply this knowledge in their long-term action plans and implementation strategies.

3.2 Ahmedabad's capacity to address its water challenges

Ahmedabad is the first Indian city that has been assessed by the City Blueprint Approach. It is the largest city of Gujarat state. Gujarat earns a substantial share of approximately 15% of India's total GDP. The city suffers from drought and heat waves during the dry season and water nuisance during the monsoon period (Gupte 2011). Ahmedabad's fresh water supply is largely dependent on the Narmada canal. Ahmedabad is

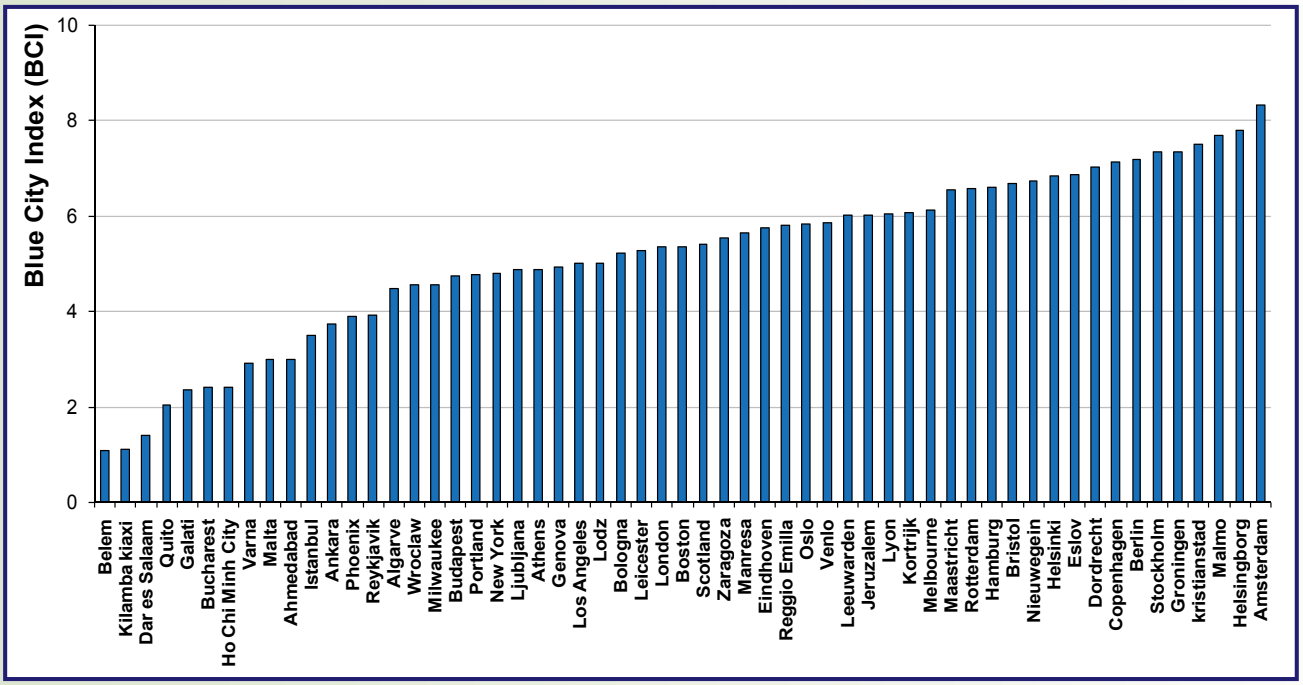

Figure 1: The geometric average of twenty-five water management indicators are summarised in one value, the Blue City Index (BCI). Here, the BCI of 57 municipalities and regions in 30 different countries are provided. Fig. 3 shows the twenty-five indicators for the city of Ahmedabad, India.

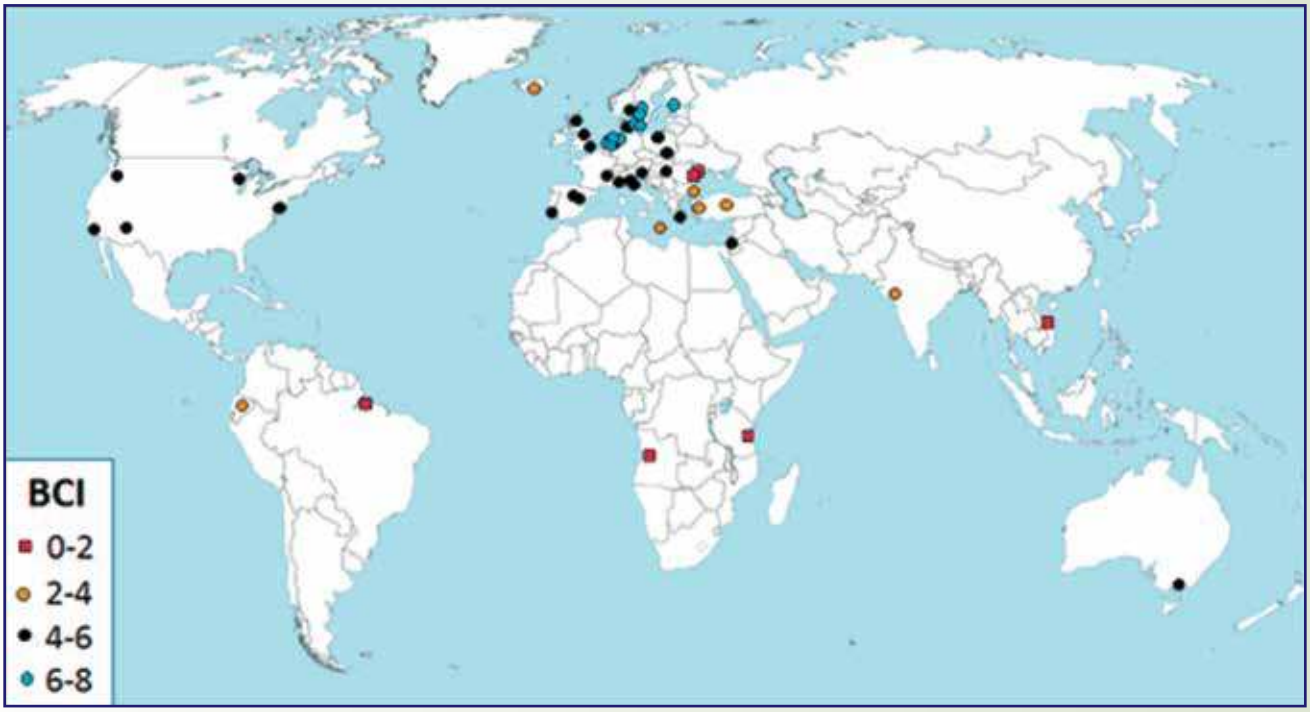

Figure 2: Overview of the 57 municipalities and regions in 30 different countries that have been assessed with the City Blueprint® Performance Framework (CBF). The overall score, the Blue City Index (BCI) provides a first summary of the state of urban water management.

well-known for its various industries. The industries are large polluters of city's groundwater, surface water and the rivers and canals (Gupte 2011; Maheshwari 2016; Prajapati 2014). With a population of 7.34 million, Ahmedabad is the seventh largest Indian city. Ahmedabad's urbanisation rate of 3.3 percent, reflects the urban growth of India's ten largest cities of 3.0 percent annually. These urbanisation rates imply strong urban growth, as such, Ahmedabad population is projected to increase to more than 2 million by 2025 (UN Habitat 2016) and in the last five years, approximately half a million new citizens came to the city. It makes Ahmedabad the third fastest growing city in the world. Figure 3, shows the City Blueprint of Ahmedabad. The city scores high on drinking water consumption and solid waste collected because the per capita waste production and water consumption are relatively low compared to European cities. The city has policy and action plans regarding climate adaptation, in particular, combating extreme heat.Although the scores for access to drinking water, access to sanitation and drinking water quality are high, they are also ambiguous. A considerable part of the population lacks access to safe drinking water and sanitation, especially in slums. The piped water infrastructure is erratic, and most people rely on private bore wells and sand filtration to purify the water. Moreover, the abstracted ground water is increasingly polluted and salinised, driving households to buy expensive drinking water from private suppliers (Aartsen et al. 2017). Finally, there is much room to improve the city's wastewater treatment, solid waste treatment and water infrastructure. In this sense, the city resembles the wasteful city typology (Table 1).

Table 2 provides the overview of the water governance capacity assessment in Ahmedabad. Overall, the results show that there is much potential for improvement, especially with respect to four water-related challenges: water scarcity, flood risk, wastewater treatment and solid waste treatment. The city's governance capacity to address urban heat islands is high and sets an excellent example of how the other four challenges can be addressed. In general, the study of Ahmedabad's water governance (Table 2), revealed that visionary agents (ind. 6.3) within the government use their authority (ind. 7.3) to set ambitious goals (ind. 5.1) to address all five water-related challenges. However, statutory compliance (ind. 9.2) and use of policy instruments (ind. 9.1) are limiting the implementation

BCI	Categories of IWRM in Cities
0 – 2	**Cities Lacking Basic Water Services**
	Access to potable drinking water of sufficient quality and access to sanitation facilities are insufficient. Typically, water pollution is high due to a lack of wastewater treatment (WWT). Solid waste production is relatively low but is only partially collected and, if collected, almost exclusively put in landfills. Water consumption is low, but water system leakages are high due to serious infrastructure investment deficits. Basic water services cannot be expanded or improved due to rapid urbanisation. Improvements are hindered due to insufficient governance capacity and funding gaps
2 – 4	**Wasteful Cities**
	Basic water services are largely met but flood risk can be high and WWT is insufficiently covered. Often, only primary and a small portion of secondary WWT is applied, leading to large-scale pollution. Water consumption and infrastructure leakages are high due to a lack of environmental awareness and infrastructure maintenance. Solid waste production is high, and waste is almost completely dumped in landfills. In many cases, community involvement is relatively low
4 – 6	**Water Efficient Cities**
	Cities are implementing centralised, well-known, technological solutions to increase water efficiency and to control pollution. Secondary WWT coverage is high, and tertiary WWT is rising. Water-efficient technologies are partially applied, infrastructure leakages are substantially reduced but water consumption is still high. Energy recovery from WWT is relatively high, while nutrient recovery is limited. Both solid waste recycling and energy recovery are partially applied. These cities are often vulnerable to climate change, e.g. urban heat islands and drainage flooding, due to poor adaptation strategies, limited storm water separation and low green surface ratios. Governance community involvement has improved
6 – 8	**Resource Efficient and Adaptive Cities**
	WWT techniques to recover energy and nutrients are often applied. Solid waste recycling and energy recovery are largely covered, whereas solid waste production has not yet been reduced. Water-efficient techniques are widely applied, and water consumption has been reduced. Climate adaptation in urban planning is applied, e.g. incorporation of green infrastructures and storm water separation. Integrative, centralised and decentralised as well as long-term planning, community involvement, and sustainability initiatives are established to cope with limited resources and climate change
8 – 10	**Water Wise Cities**
	There is no BCI score that is within this category so far. These cities apply full resource and energy recovery in their WWT and solid waste treatment, fully integrate water into urban planning, have multi-functional and adaptive infrastructures, and local communities promote sustainable integrated decision-making and behaviour. Cities are largely water self-sufficient, attractive, innovative and circular by applying multiple centralised and decentralised solutions

Table 1: General categorisation of urban water management based on the results of the municipalities and regions assessed by the City Blueprint (Figure 2; Koop and Van Leeuwen 2015).

of these ambitious goals while the monitoring (ind. 3.1) and policy evaluation (ind. 3.2) are insufficient to improve the policy implementation. In general, the awareness, management ambition and financial viability (respectively conditions 1, 5 and 8) are often encouraging adequate water management. On the other hand, continuous learning, stakeholder engagement and implementing capacity (respectively conditions 3, 4 and 9) are in many cases limiting the capacity to govern Ahmedabad's water challenges. Especially, the development of capacity to implement current policy, can be considered a priority. For a detailed discussion of the results, we refer to Aartsen et al. (2017).

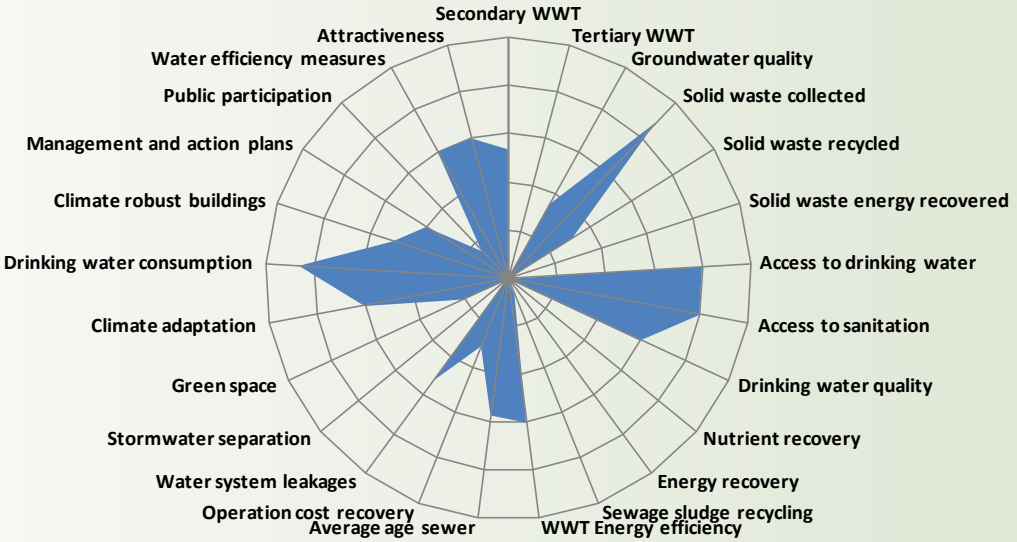

Figure 3: City Blueprint performance Framework (CBF) for the city of Ahmedabad, India. The city's overall Blue City Index (BCI) score is 3.01 points.

Conditions	Indicators	Water scarcity	Flood risk	Waste water treatment	Solid waste treatment	Urban heat islands
1. Awareness	1.1 Community knowledge	+	+	0	0	+
	1.2 Local sense of urgency	-	+	-	-	+
	1.3 Behavioural internalisation	-	0	0	0	+
2. Useful knowledge	2.1 Information availability	0	0	0	-	+
	2.2 Information transparency	-	0	-	+	0
	2.3 Knowledge cohesion	-	0	0	0	0
3. Continuous Learning	3.1 Smart monitoring	-	-	0	-	+
	3.2 Evaluation	-	-	-	-	+
	3.3 Cross-stakeholder learning	0	0	-	0	0
4. Stakeholder Engagement Process	4.1 Stakeholder inclusiveness	-	0	-	0	+
	4.2 Protection of core values	0	0	-	0	+
	4.3 Progress and variety of options	0	-	-	0	0
5. Management Ambition	5.1 Ambitious and realistic management	0	+	+	+	+
	5.2 Discourse embedding	-	-	0	-	++
	5.3 Management cohesion	0	0	0	0	0
6. Agents of Change	6.1 Entrepreneurial agents	-	-	-	0	+
	6.2 Collaborative agents	0	0	0	-	+
	6.3 Visionary agents	0	-	+	0	+
7. Multi-level Network Potential	7.1 Room to manoeuvre	0	0	-	0	0
	7.2 Clear division of responsibilities	0	0	0	0	+
	7.3 Authority	0	0	+	0	+
8. Financial Viability	8.1 Affordability	0	0	+	0	+
	8.2 Consumer willingness to pay	+	+	0	0	+
	8.3 Financial continuation	+	+	+	+	+
9. Implementing Capacity	9.1 Policy instruments	-	-	-	0	0
	9.2 Statutory compliance	-	-	-	-	+
	9.3 Preparedness	-	+	-	-	++

Table 2: Outcome of the water Governance Capacity Framework analysis of Ahmedabad for each water-related challenge (Aartsen et al. 2017). Scores for the water governance capacity range from very encouraging (++) to very limiting (––).

3.3 Next Steps

Further collaboration between Europe and India can be explored in the context of the Memorandum of Understanding (MOU) between the Republic of India and the European Union (EU) on water cooperation. The objective of this MOU is to strengthen the technological, scientific and management capabilities of India and the EU in the field of water management on the basis of equality, reciprocity and mutual benefit.The City Blueprint Approach developed at KWR Watercycle Research Institute, action group of EIP Water and part of the Watershare community, may be important in seizing these opportunities.The test case in Ahmedabad has been carried out together with Wetskills Foundation and Centre for Environmental Education (CEE) by applying an innovative concept named:WetsNext. This first initiative provides a good basis for further collaboration and exchange of knowledge and experiences between India and Europe.

The Wetskills Foundation and its global partners provide cases for talented students and young professionals from all over the world that are passionate to address water challenges. They form internationally mixed transdisciplinary teams that work for two weeks on case studies formulated by case owners, companies and organisations dedicated to address the water challenges. This Wetskills Water Challenge programme provides a floor to find innovative out-of-the-box solutions that enable integration between generations, water challenges, disciplines and cultures (Manea, Oost and Diels 2013; Jensen, Van der Meij-Kranendonkand Oost 2015; Oost and Diels 2015). At the moment, 23 challenges in 16 different countries have been organised since 2010. Building upon these activities, WetsNext projects dive deeper into the most promising cases by in-depth studies together with young professionals and local partners. Based on two Wetskills Water Challenge editions in India in December 2015 (Sarabhai and Goswami 2016) and January 2017, CEE, partners DuurzaamDoor (programme of RVO.nl), and Gujarat Pollution Control Board and Wetskills Foundation have agreed to maintain this cooperation till 2021. Based on the promising results of amongst others, the study of Ahmedabad, KWRWatercycle Research Institute, Utrecht University, CEE, and Wetskills Foundation strive to assess several Indian cities according to the City Blueprint Approach within the coming years. This will result in opportunities for city-to-city learning and can identify the main points for improvement that can help effective and efficient exchange of ideas, technologies and experiences between India and Europe. At present, the city of Amsterdam in the Netherlands is developing plans to apply this approach in an Indian city. This initiative is a good start and needs to be combined with capacity building and training programmes and follow-up projects with various public and private partners, in order to assist cities in developing long-term strategic plans and implementation schemes. As part of the Indian European Water Partnership, we are actively searching for cooperation to realise this aim.

4. CONCLUSION

Building Ahmedabad's governance capacity could provide much opportunity to enhance the city's ability to address its water challenges. The biggest barrier in solving India's diverse water challenges is presumably a lack of sufficient governance capacity. Smart Cities are cities that have water-wise governance. We would like to summarise this concept by introducing the Seven C's of Water-Wise Cities:

1. Citizen-centred: create adaptive, healthy and liveable cities for people
2. Children and grandchildren: focus on anticipatory long-term strategies
3. Collaboration: involve stakeholders right from the start
4. Comprehensive & coherent planning: integrate water and other sectoral agendas
5. Co-benefits or win-wins must be explored
6. This leads to cost-effective & cost-efficient solutions
7. Share them by collaborative learning: enhance city-to-city learning

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