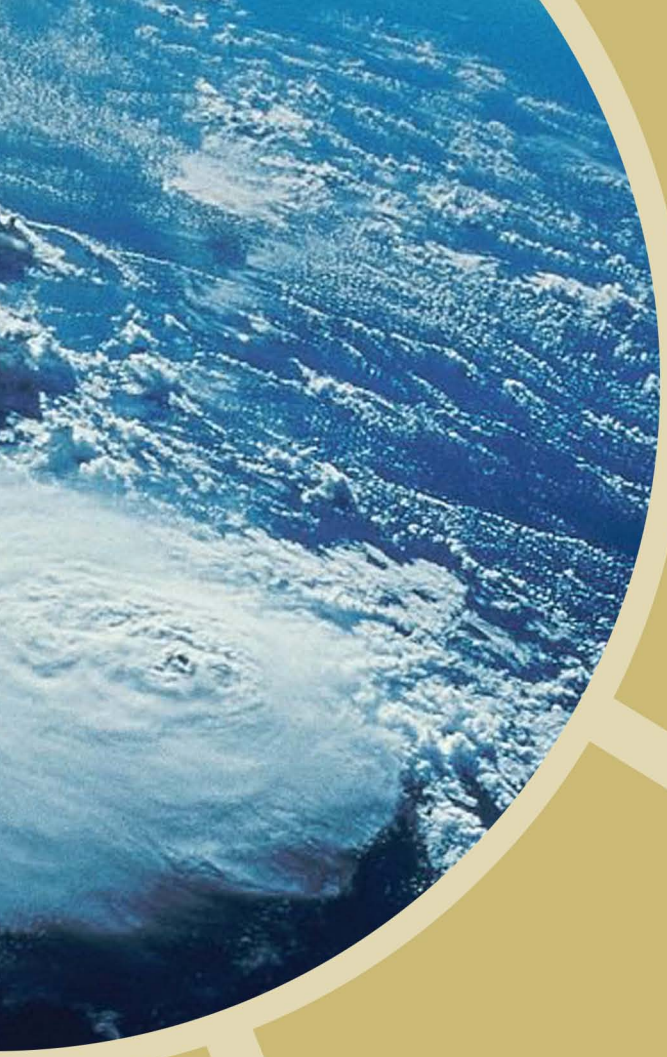

Synthesis Report:

Analysing Cities' Climate Change Resilience

Food security | Transport | Water

South African CitiesNetwork

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EXECUTIVE SUMMARY

This is a summary version of the synthesis report for a South African Cities Network (SACN) study on analysing cities' climate change resilience of food security, transportation and water provision. The project focused on case studies conducted at three municipalities namely: the City of Johannesburg (CoJ), Mangaung Metropolitan Municipality (MMM) and Ekurhuleni Metropolitan Municipality (EMM). This study links climate change issues at a municipal level to the daily operations of the cities with regards to service delivery and achieving the goals set out in these cities' planning documents.

The synthesis report provides a strategic overview of the project and method followed, as well as key summarised findings from the workshops' analysis and findings in the various city reports.

The study effectively contextualises the 'what happens', 'how does it happen' and 'what it means' questions around climate change. These questions are raised within the urban context of cities and the related municipal roles and functions through examining and defining city resilience.

A number of definitions were perused in this study pertaining to resilience in order to provide a holistic and clear notion as to what resilience really means on a strategic and operational level and how cities should adequately plan for resilience. Ultimately, the following components were identified as critical to city resilience: information; risk, vulnerability analysis and integration; as well as ongoing learning and capacity building.

Climate change is not just an environmental issue and more importantly it is not an issue that should be addressed in isolation. The varying parameters in which planning for impacts of climate change should occur could cut across all sectors and ultimately culminate in direct impacts on the city's ability to sustainably deliver services.

To date, there has been little emphasis on the impact of climate change on the day to day operation and municipal services of the cities. Climate change is seen as removed from the operational and implementation side of service delivery. Even within the strategic planning sphere, climate change, although recognised to some extent, is not addressed in terms of physical and direct impacts that will result from climate variables, thus impacting on service delivery.

During the course of the study, it became apparent that there is need to proactively, rather than reactively, plan for climate change and the impacts thereof, but that this planning should be contextualised within the Integrated Development Plan (IDP) objectives. This allowed for valuable discussions and input around actual impacts and the qualification of current climate change considerations.

Evaluating city resilience was linked specifically to whether or not cities have a system in place by which to address and plan for resilience and whether such a system was emerging or not developed. Based on an analysis done against an adequate resilient system, the following conclusions are made:

• The CoJ has an ***EMERGING*** resilience system. After reviewing CoJ's long-term planning documents, it is observed that reference is made to climate change in these documents, but it lacks integration and implementation. It is observed that the CoJ is becoming more proactive in its attempts to become climate change resilient. It is with this understanding that it can be concluded that CoJ's climate change resilience system is far advanced in moving towards a fully-fledged resilience planning platform, also taking into consideration the existing Adaptation Strategy that has been prepared and is scheduled for review.

• Although participants at the EMM work sessions indicated that there are climate change impacts to be considered, these are not effectively integrated into overarching planning documents. The existing Climate Change Strategy has been taken into consideration, however, this document pertains predominantly to renewable energy and does not provide a holistic context of climate change in the metropolitan area. It is with this understanding that it can be concluded that Ekurhuleni's climate change resilience system is ***NOT DEVELOPED.***

• After reviewing MMM's long-term planning documents, it was observed that reference is made to climate change in a very isolated manner and that the concept is not adequately integrated into the overall strategic planning of the municipality. In addition, there is no supporting data management system in place to feed into proactive resilience planning, and this coupled with limited external partnerships does not provide sufficient support to effectively integrate climate change planning and strategies. It is with this understanding that it can be concluded that Mangaung's climate change resilience system is ***NOT DEVELOPED.*** It was found that climate change, and more importantly, the focused and structured planning for and management thereof, must be incorporated in all overarching city development strategies to ensure effective awareness, preparedness and integration across all disciplines and departments.

Linking the three sectors of focus for the study i.e. food security, water provision and transportation to the overall adequate resilience of the city as a system, the following emerged:

• The common sector facing high risk across all three cities is water provision. The highest climatic risk faced by the municipalities in this regard is the fact that increasing temperatures will have an impact on water provision, its usage and resultant available capacity within each city. Water and sustainable water provision is major issue for the MMM and the future projections regarding rainfall shows that MMM will have a decrease in rainfall. This is critical in terms of any future planning within the MMM. Interestingly, the MMM workshops indicated that water provision is a high risk, compared to the EMM which indicated this as an extreme risk, taking into consideration the varying degrees of potential rainfall change in these two cities.

• Flooding resulting from extreme rainfall is seen as a high risk for the transportation sector in both the CoJ and EMM as this affects service delivery and impacts on the public transport and sustainability of the transportation systems within each of these cities. Flooding also affects the road infrastructure, as intense flooding places great strain on the maintenance and development of road infrastructure. In addition, from a socio-economic perspective there are major concerns from both the CoJ as well as the EMM in terms of the economic impacts of increasing mobility disruptions due to increased rainfall.

• Food security is a moderate to low risk concern for CoJ perhaps attributed to the fact that development issues and emphasis in the metropolitan area are predominantly focussed on urban issues, which include insignificant angle on food security. Food security is seen as a local community development topic rather than acknowledging the major role of this industry in the resilience strategies of metropolitan municipalities. The CoJ has a number of programmes dealing with food security on a community level, rather than specific strategies addressing large scale food security and related potential on a regional and metropolitan level. EMM planning focuses a lot on agriculture and the need to make communities more food secure. The agricultural potential identified within EMM could however, due to increases in temperature and rainfall be impacted on as the sustainability of crop production is threatened. Food security is greatly dependent on water provision and transport sectors in order to ensure its own functionality and sustainability. In this regard, the fact that food security was not highlighted as a major risk shows that climate change is not yet seen from a holistic perspective, acknowledging the intricate inter-linkages between sectors.

City resilience is contextualised in terms of the development objectives of each city, taking the changing climatic variables and the direct and indirect impacts into consideration. The study found that although existing IDPs address approaches to urban resilience, the links and interdependent nature of climate change and its impacts are not adequately addressed and defined. This results in a lack of, or inefficient integration of climate change impacts in the development planning context of the city.

Recommendations in this regard are based on perusing a number of best practice examples as to how cities are addressing and integrating resilience planning. The building blocks for these recommendations relate to proactively creating awareness and facilitating appropriate platforms within cities to share and define resilience and climate change risks and opportunities. A vital component of the recommendations pertains to facilitating the necessary integration between departments and disciplines to challenge conventional ways of ‘just doing things’ and finding custom solutions to the climate change challenges that each city could face.

In addition, skills development, capacitation and a robust awareness strategy, pertaining to both internal and external city stakeholders including communities, are vital components to building a foundation for resilience planning in cities. This implies that strategic decisions around climate change and recognising the need to build resilience into service delivery objectives, should ultimately form part of practical operational functions.

The report is based on desk-top research, including international best practice, pertinent national and provincial policy and strategy as well as a variety of local government policy and strategy documents. In addition, the report and its analysis effectively integrate the various workshop findings and feedback to provide a practical perspective on the context of climate change and its impacts across the three cities.

1. CONTEXT OF CLIMATE CHANGE RESILIENCE AT LOCAL GOVERNMENT LEVEL

The following is a broad overview of the issue of climate change with specific reference to local government as well as the role and function of municipalities in addressing climate change impacts.

1.1 Climate change resilience in the context of local government and its impact on municipal roles and functions

A growing metropolitan population, pressured resources, under-utilised natural capital as well as the need for infrastructure development impact greatly on the strategic development of South African cities. Understanding, integrating and proactively managing city resilience is key to ensuring sustainability across the municipality. It is with this background that the study borrows the definition of 'resilience' from the Asian Cities Climate Change Resilience Network. The network defines resilience as the capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate impact circumstances while continuing to function at an acceptable level.

Climate change is inextricably linked to urbanisation as well as functions and operations of urban complexes. Urbanisation, as well as the increased connectivity and economic growth it brings, is, in the context of a developing economy such as South Africa, an important occurrence. Problems and opportunities facing metropolitan areas will grow in urgency and complexity and how local government responds to climate change will provide critical insight into responding to other complex issues over the next 40 years.

The study analyses the identified key focus areas of water provision, transportation and food security not only within the context of existing climate change work being done in the cities. The analysis undertaken for the study moved beyond the environmental and climate change policies to the guiding development policies and strategies such as the IDPs. This is done to truly understand and evaluate how the cities are faring in terms of resilience pertaining to the key urban functions and services that will be affected by the direct and indirect impacts of climate change.

Climate change is likely to have a significant impact on the ability of local government to finance and deliver services. In South Africa, municipalities finance their operating budgets through property rates income, service tariffs (e.g. water, electricity), fines and the 'equitable share', which is the allocation from national government. The latter depends largely on the number of low-income persons in the area, with rural municipalities usually receiving more. This typically only contributes a small portion of the operating budget. The capital budget is financed from the Municipal Infrastructure Grant (MIG) funding mechanism, as well as public/private partnerships, donations, internal and external loans.

Climate change is a serious environmental, security and socio-political challenge. Its impact is visible at community level within metropolitan municipalities. Tackling this challenge requires urgent action, with the proactive engagement of all city departments and where necessary local stakeholders and communities. In this regard, the following is important to note in terms of the context of climate change within the local government sphere:

- The need for a local response to climate change.
- The need for an integrated approach through engaged municipal departments and communities.
- The potential for a ripple effect through addressing climate change, which could effectively deal with a myriad of socio-economic and socio-political needs and concerns.

Metropolitan municipalities play an essential role in addressing and planning for climate change and its impacts, creating a vision for their jurisdiction, developing relevant strategies, implementing effective policies and rolling out actions. This confirms that climate change and its impacts do not stand in isolation and therefore, there is a vital need for integration across all sectors as the factors of vulnerability impact on the municipality as a whole.

1.2 Climate change resilience at city level

1.2.1 Key elements of climate change resilience at city level

The importance of cities to adaptation efforts has once again been highlighted in the Intergovernmental Panel on Climate Change's 2014 assessment report. It is noted that many of the key and emerging climate risks are concentrated in urban areas, and are linked to rapid urbanisation and associated with communities living in informal settlements.

South Africa's own National Climate Change Response (NCCR) White Paper (DEA, 2011) also recognises the urban climate change challenge. It specifically mentions the vulnerability of informal settlements to hazards such as floods, and the rapid growth of water demand in urban centres.

Building climate change resilience is an ongoing activity and therefore the focus of this work should be on:

- Strengthening systems to reduce their fragility in the face of climatic impacts and to reduce the risk of cascading failures.

- Building the capacity of social agents to anticipate and develop adaptive processes, to access and maintain supportive urban systems.

- Addressing the institutional factors that constrain effective climate responses to system fragility or undermine the ability of agents to take action.

The following elements are identified as critical to consider when determining what 'a climate change resilient city need to have in place from a systems perspective':

- Analysis of how weather and climate affects the delivery of the city's service delivery objectives.
- A continually updated view for the city of what the direct impacts of climate change are.

- The integration of climate change risk and vulnerability analysis into the development of service delivery objectives.

- A focussed approach to community capacity building in terms of climate change and encouraging localised resilience projects as part of community upliftment and social development strategies.

- A clear understanding exists of what the priority risks as related to climate change are, and in addition how they have been taken into implementation by being formally addressed in city plans.

- Staff capacity is being built on an ongoing basis to develop the city's capacity to analyse the implications of climate change.

- A register of extreme events is kept (and updated continually) with an associated evaluation of impacts and,

- Formal learning partnerships with other cities and local academic institutions are developed and maintained.

These elements were used in the analysis of the three cities in terms of the current status of their climate change resilience systems, with regards to the three focus areas of water provision, transportation and food security.

1.2.2 Food security and climate change resilience

The anticipated impacts of climate change on food security are expected to be wide ranging (IPCC 2014b). Food production systems around the world are already experiencing negative and positive impacts, with the negative ones being more common. The South African Long-Term Adaptation Scenarios (LTAS) Flagship Research Programme (DEA, 2013) identifies a number of agricultural sector impacts that have potential serious implications for food security. Such implications include spatial shifts in the optimum growing regions for many key crops such as wheat and climate change induced changes in plant and animal diseases.

Impacts on food security due to climate change include the following:

- Climate change lowers the agricultural production and yields due to the effects of increasing temperature, change in temperatures, change in precipitation patterns and frequent extreme events.

- Higher food prices as a result of climate change due to impacts on agricultural yields spirals into a range of socio-economic issues including, but not limited to child malnutrition.

At a city level food security not only relates to community and household resilience, but also to building the resilience of cities through economic diversification. However cities approach the issue in different ways, in some cases it relates to commercial agricultural bases, while in others there is a focus on assisting households in their food security efforts through the development of food gardens.

Food security is a prime example illustrating the interdependent links between inter alia transport and water provision, as indicated in Figure 1.

Figure 1: Multi-functional components of Food Security linking to transport and water provision

1.2.3 Transportation and climate change resilience

Transportation is a key service delivery objective for cities and the negative impacts that weather and climate can have on mobility are well known, for example as a result of flooding. The concerns around climate change impacts on transportation have led to action internationally, as a result of the loss of life and economic disruption associated with extreme weather events such as hurricanes, flooding and snow falls.

Climate change is projected to increase the frequency and intensity of extreme weather events. Specifically in the case of the three cities analysed, heat waves will likely be more severe, and storms will likely be more intense and frequent. These changes could increase the risk of delays, disruptions, damage, and failure across land-based and air transportation systems.

Higher temperatures can cause pavement to soften and expand. This can create rutting and potholes, particularly in high-traffic areas and can place stress on bridge joints. Heat waves can also limit construction activities, particularly in areas with high humidity. With these changes, it could become more costly to build and maintain roads and highways.

Climate change is projected to concentrate rainfall into more intense storms. Heavy rains may result in flooding, which could disrupt traffic, delay construction activities, and weaken or wash out the soil and culverts that support roads, tunnels, and bridges.

Image source: www.citizen.co.za

1.2.4 Water provision and climate change resilience

As the NCCR indicates South Africa is a water scarce country with a highly variable climate, a situation that is likely to be worsened by climate change (DEA, 2011). The key concern is that South Africa's water security could be compromised which will have knock-on impacts on those sectors that are heavily reliant on water such as agriculture and electricity generation.

The following in terms of water provision need to be taken into consideration regarding integrated municipal service delivery:

- Awareness should be centred around, not only at a municipal level but practical issues pertaining to water quality management and water conservation.
- Traditionally, water management is aimed at minimising risks and unnecessary costs to society, yet climate models do not address the issues, which are protruding public concern around climate change impacts such as droughts, floods, rainfall, extreme events and water quality.
- Disaster risk is not integral and centred around developmental planning. In addition, data collection including the type and format of data, is not sufficient to establish the required climate change impacts monitoring systems that will effectively feed into integrated planning processes.
- Adaptive water resource plans will require additional and various forms of storage for societies to adapt, which places economic strain on governments and city planners.

To address adaptation in this sector, 'financing' is therefore going to be of great importance. This includes adaptation strategies at a metropolitan level as well as effectively addressing and integrating local resilience approaches to water at a community level.

2. CONFIRMATION OF A CLIMATE CHANGE VIEW FOR EACH CITY

In this section, each of the cities are discussed in terms of the following elements, leading to an overall assessment of their climate change resilience. The elements are:

- Analysing the link between municipal service delivery objectives and climate change – this is done by assessing whether the city has in the first instance appreciated what the broader challenges to city resilience are, and then linked them to climate change;
- Identification of existing and proposed climate change adaptation and resilience related initiatives;
- Identification and assessment of the key climate change related risks for the three focus areas, as well as the identification of potential adaptation measures; and,
- Finally, the Climate Change Resilience Assessment.

2.1 Comparative analysis of climate overviews across the three cities

The table below provides a summary of the different climate overviews for each of the cities within this study. Classifying the different levels of risk helps to highlight how the municipality might be vulnerable to future climate change impacts. By incorporating scientific probability, the project team was able to estimate potential exposure and susceptibility to environmental climate change impacts. While the climate change scenarios are based on a basic interpretation of scientific study and analysis, the project team was still able to assess how the municipality might be vulnerable to future changes in climate.

Table 1: City climate overview comparison

CITY	CURRENT CLIMATIC CONDITIONS	FUTURE (2040) CONDITIONS
City of Johannesburg	The CoJ currently experiences an average annual temperature of 25°C (summer) and 17°C during winter. The current rainfall conditions for the regions indicate an annual average rainfall amount of 713mm. Humidity levels at present amount between 30-50%. The city is currently experiencing heat wave conditions during which the temperature is at 35°C.	An expected 2.3°C increase in average annual temperature is projected for the CoJ by 2040. Similarly there will also be an increase in annual average rainfall for the city of 841mm. Conditions of extreme rainfall are also expected for the city coupled with more flash floods. In addition the humidity levels will rise since the temperature will increase by 2°C. The heat wave temperatures will also increase by 2.1°C.
Mangaung Metropolitan Municipality	MMM experiences a much warmer, dryer climate with an annual average temperature of 32°C (summer) and 19°C (winter). Currently MMM receive between 200-600mm of rainfall on average annually.	By 2040 MMM is expected to have a 2.5°C increase in temperature. Similarly the seasonal temperatures will increase by 2°C. By 2040 there will be a decrease in rainfall of between 5-10%, which will add to the current water stress, which the city faces. Furthermore, significant occurrences of drought periods are envisaged for 2040.
Ekurhuleni Metropolitan Municipality	The EMM experiences an annual average temperature of 25°C in summer and 17°C in winter. The annual average rainfall is expected to increase across all 4 seasons. The trends are very similar to that of the CoJ due to the close geographical proximity of the municipality.	There is an expected 3°C increase in temperature envisaged for the EMM. Similarly to the CoJ, there will also be an increase in annual average rainfall for EMM. Heat waves will be more prominent for the city by 2040. There will also be an increase in rainfall intensity presenting occurrences of extreme events and flash floods.

The above table shows the difference in conditions of all three cities in terms of their current and future weather and climate. All three cities are faced with possible annual average temperature increases. Whilst CoJ and EMM will have rainfall increase in the next 3 decades, this is not the case for MMM. The MMM will experience a decrease in rainfall patterns across all seasons. The above table also sets the tone for the associated risks that the city experiences.

Table 2: Summary of climate change related events across the three cities

	CLIMATE CHANGE EVENT		
City	Increased Temperatures	Increased Intensity of Rainfall	Reduced Amount of Rainfall
City of Johannesburg	✓	✓	
Ekurhuleni Metropolitan Municipality	✓	✓	
Mangaung Metropolitan Municipality	✓		✓

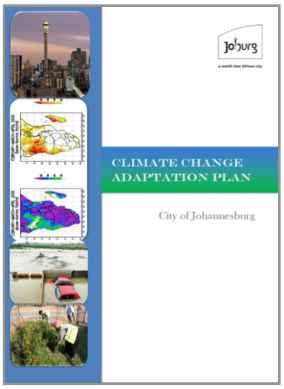
Table 2 provides an overview of the major anticipated climate change events that will impacts on the ability of the three case study municipalities to sustainably and continuously deliver on service provision objectives:

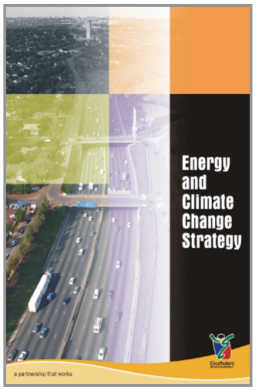
2.2 Existing climate change policies in the three case study cities

The CoJ developed a Climate Change Adaptation Plan in 2009, aimed at addressing the adaptation requirements for the municipality and its residents. Guided by international polices such the UNFCCC and the National Climate Change Response Strategy, the CoJ has effectively taken necessary actions to address climate change. The CoJ is also involved in climate change adaptation projects, such as the sustainable human settlements project, which addresses the issue of food security and promotion of self-reliant communities. The CoJ also uses a multi-pronged approach, which actively supports and provides incentives for small-scale farmers to supply fresh produce from urban food systems.

Mangaung has not yet adopted a climate change adaptation strategy. There is currently very little link between climate change and planning within the MMM. However between 2008 and 2012 the Department of Water Affairs, Bloemwater, the municipality and all other relevant stakeholders developed a Bloemwater Reconciliation Strategy, which serves to develop a sustainable balance between future water availability and current water requirements in the metro. The strategy also focuses on water usage and availability and takes cognisance of the impact climate change has on water availability.

Ekurhuleni developed its Energy and Climate Change Strategy in 2007 based on its existing State of the Energy report. The aim of the strategy is to integrate and entrench sustainable energy practices and approaches at the local level. The main thrust of the strategy is on energy efficiency and the potential of the city to reduce energy usage and focus toward more renewable energy sources. Based on the future climatic projections for the municipality and the impacts of climate change, there is need for a revised strategy to address these problems and plan for the long-term climate change impacts.





3. ASSESSING RISK AND VULNERABILITY IN THE THREE CITIES

This section presents the risks faced by the cities with regards to current weather patterns and climate change that cities are experiencing. It is a combination of the practical data gathered through workshops and meetings as well as the research team's analysis and intepretation of this data.

3.1 Key findings from work sessions

The focus of the workshops was to establish how cities are experiencing, considering and managing the direct impacts of climate change on their service delivery objectives and programmes.

Table 3: Overview of city risk ratings in comparison

		IMPACTED SECTOR		
		FOOD SECURITY	WATER PROVISION	TRANSPORTATION
MANGAUNG METROPOLITAN MUNICIPALITY				
RISK RATINGS	LOW RISK			
	MODERATE RISK	✓		✓
	HIGH RISK		✓	
	EXTREME RISK			
EKURHULENI METROPOLITAN MUNICIPALITY				
RISK RATINGS	LOW RISK	✓		
	MODERATE RISK	✓	✓	
	HIGH RISK	✓	✓	
	EXTREME RISK			✓
CITY OF JOHANNESBURG				
RISK RATINGS	LOW RISK	✓		
	MODERATE RISK	✓	✓	
	HIGH RISK		✓	✓
	EXTREME RISK			

Table 3 presents a summary of the key findings regarding the climate risk ratings for each sector across all three cities. These risks are based a result of the climate change issues faced in each of the cities.

The common sector facing high risk across all three cities is water provision. The highest climatic risk faced by the municipalities in this regard is the fact that increasing temperatures will have an impact on water provision and water usage and resultant available capacity within each city. An increased temperature in this regard implies increased water demands and this places increased pressure on existing water reserves within each city.

Flooding resulting from extreme rainfall is seen as a high risk for the transportation sector in both the CoJ and EMM as this affects service delivery and impacts on the public transport and sustainability of the transportation systems within each of these cities. Flooding also affects the road infrastructure, as intense places great strain on the maintenance and development of road infrastructure. In addition, from a socio-economic perspective there are major concerns from both the CoJ as well as the EMM in terms of the economic impacts of increasing mobility disruptions due to increased rainfall.

Food security is a moderate to low risk concern for the CoJ, perhaps attributed to the fact that development issues and emphasis in the metropolitan area are predominantly focused on urban issues. Food security is seen as a local community development topic rather than acknowledging the major role of this industry in the resilience strategies of metropolitan municipalities. The CoJ has a number of programmes dealing with food security on a community level, rather than specific strategies addressing large scale food security and related potential on a regional and metropolitan level. EMM planning focuses a lot on agriculture and the need to make communities more food secure. The agricultural potential identified within the EMM could however, due to increases in temperature and rainfall be impacted on as the sustainability of crop production is threatened.

With regards to the above assessment the following observations are made:

- Cities are at different points in their system development.
- Water related risks are a consistent, integrating theme across all three cities.
- Transportation related risks have the potential for severe economic impacts.
- The recognition that climate change is having an impact now than somewhere in the future.
- Climate change does have the potential to impact negatively on the city's infrastructure.
- How to implement interventions is still a challenge.

3.2 City resilience assessment against an adequate resilient system

In order to realistically evaluate the resilience of the cities for the purposes of the study, the project team embarked on defining what would be required from 'a system perspective' for cities to have in place in order to proactiovely plan for, integrate and address resilience. Notably, it is crucial to assess the city as a system and how resilient the system is to the impacts of climate change. The following are the climate change resilience system requirements as well as the extent to which the three cities have these requirements in place:

Information

The first system resilience requirement on information is an analysis by cities of how weather and climate affect the delivery of the specific service delivery objectives as well as supply chain. The study observed that none of the cities have a system in place to analyse how weather and climate change impacts affect the city's delivery of specific service delivery objectives.

Secondly, the information must be regularly updated to provide a view for the city of what the direct impacts of climate change will be. It was observed that while CoJ does not have a system in place to monitor the direct impacts of climate change, the city has started planning their climate change adaptation agenda. On the other hand, while MMM and EMM workshop participants had a general understanding of the impacts of climate change, the two cities do not have systems in place to monitor the direct or indirect impacts of climate change.

Risk, Vulnerability Analysis and Integration

The system resilience requirement on risk, vulnerability analysis and integration is the integration of climate change risk and vulnerability analysis into the development of the specific service delivery objectives. It was observed that in the CoJ and EMM, while there is reference to climate change and the impacts thereof in the cities' IDPs and Growth and Development Strategy (GDS), there is very little integration of climate change vulnerability and risk analysis into specific service delivery objectives. In MMM, there is very little integration of climate change vulnerability and risk analysis specific to service delivery objectives.

Furthermore, there is need for an understanding of the nature of priority risks that need to be addressed. The CoJ workshop participants had an informed understanding of what the priority risks are, while EMM and MMM participants had a basic understanding of what the priority risks are.

The last system resilience requirement under this section is whether climate change risks have been formally addressed in city plans. The CoJ is in the process of revising its climate change adaptation plan for Johannesburg. In

Ongoing Learning and Capacity Building

The first system resilience requirement for cities in ongoing learning and capacity building is continuous building of staff capacity to analyse the implications of climate change. For the three municipalities, there was no indication that the respondents have built an ongoing process to analyse the impacts of climate change. However, the CoJ has established a climate change unit to work on issues related to climate change and MMM has a disaster management team.

The second resilient indicator is maintenance of an ongoing register of extreme events with an associated evaluation of their impacts. All three municipalities do not have a formalised system where they record experiences and details of extreme events.

The third system resilience requirement is the existence of formal learning partnerships with other cities and local academic institutions developed and maintained. The CoJ has some partnerships with local academic institutions regarding the issue of climate change, however, these parties do not work together to any real extent. In EMM and MMM there are no partnerships with other cities regarding the issue of climate change. Participants in EMM and MMM however acknowledged the good work that the SACN is doing towards climate change and how these type of projects kick-start the development of new partnerships and enhance team work intercity.

Based on the above analysis on a system's requirements and using the definition of the three categories of a 'system' as defined below, a view on the status of each city's system is made. The three categories are:

- System not developed - the majority of system resilience requirements discussed above are not present based on the research analysis of each city in terms of both the literature review as well as feedback from the various work sessions and interviews.

- System emerging- implies that there are elements of resilience planning present within the city that could be used to more effectively integrate climate change planning across the municipal sectors.

- System is developed - implies that one could tick all the boxes as per the system resilience requirements discussed above and that the city has a robust and defined approach to not only the integration of climate change but also the effective planning for resilience from the top down.

Therefore, the view on each city's system status is as follows:

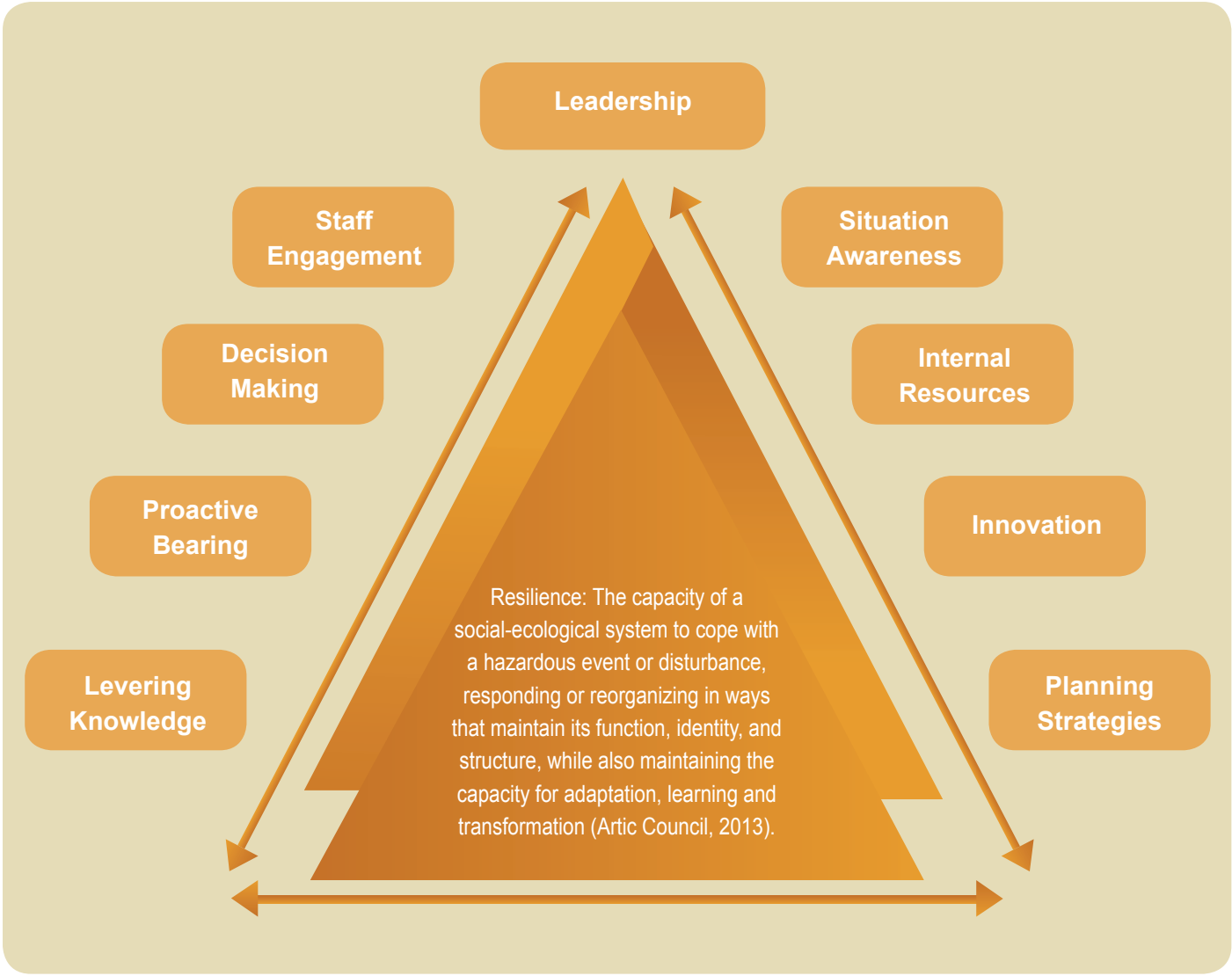
- The CoJ has an ***EMERGING*** resilience system. CoJ's climate change resilience system is far advanced in moving towards a fully-fledged resilience planning platform.
- Ekurhuleni's climate change resilience system is ***NOT DEVELOPED.***
- Mangaung's climate change resilience system is ***NOT DEVELOPED***.

4. MOVING TOWARDS BUILDING A RESILIENT SYSTEM FOR CITIES

Part of the envisoines conclusions of this project was to develop recommendations for addresing climate change related planning activities through local planning to enhance city resilience. A lack of suffiient awareness, support tools and interactive integration of climate change issues are reducing the capacity of municipalities to effectively deal with climatic extremes and resultant risks and vulnerabilities.

In this regard, Figure 2 provides an overview of basic building blocks which should be present and developed to move towards a DEVELOPED resilient system.

Figure 4: Proposed municipal resilience system building blocks



The study has shown that the following indicators are needed as building blocks to more resilient cities:

- Strong leadership to ensure effective decision making.
- Situation awareness through training, development as well as knowledge sharing amongst staff.
- Innovation through finding new ways of mitigating climate change.
- Planning strategies to include resilience as a key factor in all spheres of planning.
- Levering knowledge for integration between the various municipal departments.
- Proactive bearing in effective disaster risk planning.
- Filtering of decision-making from strategic to operational level.
- Staff engagement on understanding their municipalities' resilience plans.
- Mobilisation of internal resources towards climate change issues.

5. KEY THEMES

There are a number of key themes that emerge from the city climate change resilience assessments undertaken that could be considered by other municipalities when taking forward their climate change programmes.

- The importance of building internal capacity.
- Are we thinking enough about supply chains?
- The need for climate and weather information management.
- The role of integrated planning.
- Climate change is not just an environmental issue.
- The need to include stakeholders outside of local government.

6. CONCLUSION

Rising energy prices, the rapid depletion of natural resources, carbon constraints, increasing urban populations and aging service delivery infrastructure contribute to the manner and the capacity of municipalities to proactively and effectively address sustainability. Cities in particular, face a myriad of potential future shocks – sudden major breakdowns and stresses as well as slow, insidious cracks. These shocks are, or can be, exacerbated by the impacts of climate change.

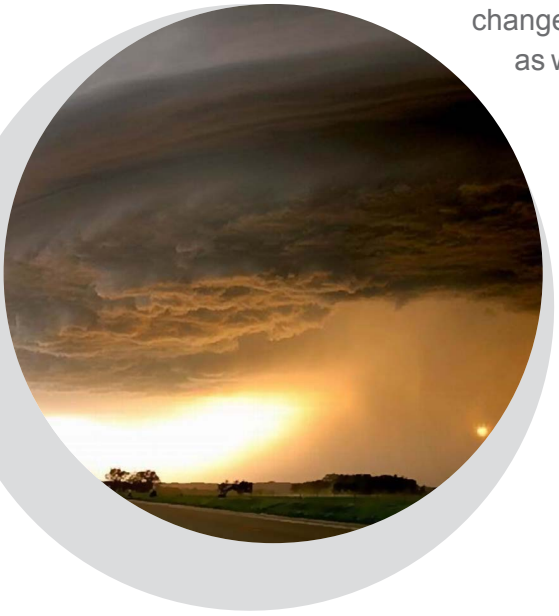
Climate change is not a concept still too distant to plan for. It poses immediate and long-term challenges across a spectrum of development sectors, influencing the city functioning and resultantly influences the liveability of cities. Climate change is not a concept or issue that can be adequately addressed in isolation by individual city departments; it must rather be addressed in an integrated, holistic manner. For cities to meet all of the challenges which climate change present, cities must become more resilient.

This study has highlighted a number of interesting considerations:

- Climate change is not an isolated or a green concept. The direct and indirect impacts of climate change require a focussed integrated approach to practically and strategically address these impacts on the ground.

- Challenges to urban resilience and the approaches in this regard, are closely aligned to existing urban spatial and development strategies to maximise development potential and increase service delivery capacity. However, these approaches are not further defined within the context of climate change and its impacts.

- In order to ensure cities become more climate resilient, a dedicated system in this regard is required to effectively address and manage the impacts of climate change. This system comprises inter alia dedicated skills transfer in relation specifically to climate change; data support services and management as well as continuous communication and awareness creation.



It is clear that in order to ensure climate change resilience in the form of proactive plans and strategies which are practical, strategic planning for these impacts becomes vital. In this regard, the IDPs and the GDS of each municipality must speak to climate change more directly.

The analysis of the three cities indicate that the operational context of the policies and planning objectives lack appropriate consideration of, and reference to, climate change variables. The strategic planning documents do not adequately link and address the impacts climate change could have on the three focus areas of this analysis i.e. food security, transport and water provision. Nor have the interdependencies in terms of addressing the issues of climate change across all development sectors been linked throughout the relevant planning documents. Due to this, planning for solutions to improve city resilience will most likely be reactive and isolated as opposed to pro-active and integrated. This is supported by findings of the work sessions held on risk and vulnerability in the various cities. It is with this understanding that it can be concluded that the City of Joburg's climate change resilient system is **emerging**, while those of both Ekurhuleni and Mangaung Municipalities **are not developed**. This finding incorporates the resilience of the three sectors that were a particular focus for the study.

All three cities have however made great strides in addressing a number of challenges to resilience at a municipal level. Planning for climate change is also reflected in all respective IDPs, albeit just as a theoretical note. An integrated approach is key and will ensure that the holistic nature of climate change impacts is addressed in practical and applicable responses, within both the urban and rural contexts that contribute to the sustainability of the cities.

All the cities raised the question in the discussions as to whether there could be further workshops on this issue, and the need for knowledge sharing on how diferent cities are addressing the concerns identified. In general the issues to be addressed are similar and there would be a significant benefit from sharing effective and low-cost solutions. Case studies illustrating actual climate change resilience projects and their impact would be a useful product of such co-operation.

Finally, the study illustrates that although there is an emerging awareness of the direct impacts of climate change, there is still a need for effective capacity-building of the city as a 'system'. All three cities in the study are aware of this and are intending to take the issue forward. The formation of networks, both informal or formal, to assist in these efforts would be a useful next step.

Some of the images used in this report are courtesy of the City of Johannesburg, Ekurhuleni Metropolitan Municipality and Mangaung Metropolitan Municipality.

South African CitiesNetwork

Joburg Metro Building, P.O Box 32160 Braamfontein, 2017

Tel: +27 (0)11-407-6471 | Fax: +27 (0)11-403-5230
Email: info@sacities.net | Web: www.sacities.net