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The Complex Task of Evaluating the Institutional Adaptive Capacity to Climate Change at Local Government Level: A Study of the Eastern Cape Province of South Africa

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ABSTRACT

Climate change impacts are wreaking havoc in South Africa, particularly in the Eastern Cape Province. Hence, adaptation strategies are essential tools in the Eastern Cape, as the province is among the most vulnerable regions to climate change impacts in South Africa. In response and to minimise the adverse impacts of climate change on socioeconomic factors and livelihoods, the post-apartheid South African government developed a policy framework for climate governance, with a focus on policy planning and adaptation. Although the policy sounds good and solution-driven, the implementation of the programme at local levels to achieve the desired goals remained a significant challenge due to institutional and capacity challenges. Using research methods inspired by the tradition of qualitative and quantitative research approach and existing literature, this article explored the complexities of evaluating and monitoring the adaptive capacity to climate change governance at a local government level in South Africa, focusing on the Eastern Cape Province. The findings of this article uncovered that the institutional and capacity challenges create an unconducive environment for an evaluation of institutional adaptive capacity to climate change at local government level in South Africa. The absence of a reliable system to assess the institutional adaptive capacity to climate change at local government level makes it difficult to compare the adaptive capacity of different institutions and allocate available resources in an adequate manner. The article recommends a broader discourse of the sustainable development goals, particularly goal number 13, which encourages the strengthening of resilience and adaptive capacity to climate change impacts.

1 | Introduction

Considering the complexities and threats associated with climate change, adaptation to varying climates is a critical necessity for developing countries (Kom et al. 2022). Nonetheless, Petzold et al. (2020) argue that adapting to climate change is a difficult task due to uncertainty of the future impacts. Subsequently, the developing countries are still struggling to adapt to climate

change, although much has been done in terms of awareness and education on climate change adaptation (Leal Filho et al. 2018). Governments, through their institutions, play a crucial role in addressing environmental challenges, such as climate change adaptation (Beunen and Patterson 2019). Additionally, climate change adaptation is regarded as a local task due to varying impacts and adaptation strategies from one geographical area to another (Mees et al. 2019; Rosendo, Celliers, and Mechisso 2018).

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Hence, scholars argue that the local government institutions are essential for climate change adaptation (Landauer, Juhola, and Klein 2019; Mees et al. 2019; Hosen et al. 2020; Lenhardt 2020), as they are at the forefront of combating climate change impacts (Birchall and Bonnett 2021). Similarly, Dale et al. (2020) disclosed that municipalities across the globe are adapting to climate change within their jurisdictions.

Regmi and Bhandari (2013) opined that there are still conflicting perceptions on the trajectory of climate change adaptation, particularly on how it should emerge and be measured. Nonetheless, the evaluation and monitoring of climate change responses is considered an essential phase in the progression and development of adaptation techniques and for informing adaptation and implementation priorities (Morecroft et al. 2019; Singh et al. 2022). On the contrary, other scholars indicate that there are no agreed-upon metrics, techniques, framework or indicators to measure climate change adaptation (Fu et al. 2012; Siders 2019; Simpson et al. 2021; Singh et al. 2022). There is also a lack of tools or framework to systematically evaluate the institutional adaptive capacity to climate change. Moreover, researchers indicate that evaluation of adaptive capacity to climate change is a very difficult task (Engle 2011; Patterson and Huitema 2019), due to a high variety of adaptation issues and the context-specific nature of adaptive capacity (Mikulewicz 2018; Siders 2019).

Nevertheless, climate change-related challenges are increasing daily at the South African local government level (Nhamo and Agyepong 2019). For example, Cape Town, in the Western Cape Province, experienced a water scarcity crisis due to severe drought in recent years (Bai et al. 2018; Dube, Nhamo, and Chikodzi 2022). In addition, eThekweni Metropolitan Municipality is considered one of the world's leading municipalities in institutional adaptation to climate change at local government level (Leck and Roberts 2015; Leck and Simon 2018; Rosendo, Celliers, and Mechisso 2018). However, this municipality has struggled to deal with recent heavy floods. Moreover, local government institutions in Eastern Cape Province are struggling to adapt to impacts of climate change (Santhia, Shackleton, and Pereira 2018), although the province has experienced severe droughts in recent years (Walz et al. 2020). Although the struggles of climate change adaptation at local level are well documented in South Africa, the government has prioritised the research for the design of a system to evaluate adaptation to climate change at national level (Ziervogel et al. 2014). In addition, similar to other countries, there is limited experience with climate change evaluation and monitoring in South Africa (Ziervogel et al. 2014). Thus, Averchenkova, Gannon, and Curran (2019) indicate that South Africa needs comprehensive reporting and evaluation frameworks with clear indicators to adequately address climate change challenges.

In light of these constraints, some policymakers and commentators, including Ofogebu et al. (2016), Mpandeli et al. (2019) and Nyide et al. (2023), investigated and evaluated the adaptive capacity to climate change in South Africa and proposed proactive coping strategies to meet climate change threats to livelihoods in South Africa. Nonetheless, what is missing in the literature is the complexities of evaluating the institutional adaptive capacity to climate change at a local government level. Considering these gaps, this article applied the adaptive capacity wheel (ACW) the-

oretical framework, which was developed by Gupta et al. (2010) and later extended by Grothman et al. (2013), to examine the mechanism that addresses issues of climate change adaptation governance at local level in the Eastern Cape and South Africa. This theory assesses and enhances the capacity of institutions to adapt to climate change. It identifies key dimensions and criteria that contribute to the overall adaptive capacity of governance system. The objectives of this article were derived from the ACW, which include (i) identifying and examining the existing systems for the evaluation of adaptive capacity to climate change in the Cape Province and South Africa; (ii) creating an inventory of determinants of institutional adaptive capacity to climate change at local government level in South Africa; and (iii) establishing the link between the determinants of institutional adaptive capacity and the institutional and capacity challenges to climate change in South Africa.

2 | Assessing Adaptive Capacity to Climate Change in the Context of the Institutional Framework: A Synthesis of Literature From a Global Perspective

There is no agreement on the standard technique or framework to evaluate adaptive capacity to climate change (Simpson et al. 2021). Nonetheless, different indexes have been developed to assess the adaptive capacity to climate change of different regions globally, for instance, a scenario-driven model to assess European countries (Acosta et al. 2013), an indicator-based approach to assess Nordic countries (Juhola, Peltonen, and Niemi 2012), a capital index approach to assess China (Chen et al. 2015) and an indicator index to assess Sri Lanka (Thathsarani and Gunaratne 2018). In contrast, other researchers are of the view that adaptive capacity should be assessed at a local level (Juhola, Peltonen, and Niemi 2012; Amaru and Chhetri 2013). Correspondingly, local adaptive capacity (LAC) framework and indicator index were used to assess the levels of adaptive capacity to climate change at community and household levels in Ethiopia, Mozambique and Uganda (Jones, Ludi, and Jeans 2019; Mesfin et al. 2020). In addition, an indicator index has been used to evaluate the level of adaptive capacity to coastal hazards at some coastal regions of the Caribbean (Lam et al. 2014). Moreover, Araya-Muñoz et al. (2016) build on the scenario-driven model that was developed by Acosta et al. (2013) to assess the adaptive capacity to climate change of nine municipalities of the Concepción Metropolitan Area (CMA) of Chile. Furthermore, the evaluation of the adaptive capacity to climate change has been researched in different industries of different regions, for example, wine industry in Ontario, Canada (Pickering et al. 2015), horticultural industry in Ghana (Williams et al. 2019) and agricultural industry in the state of Chiapas, Mexico (Maldonado-Méndez, Romo-Lozano, and Monterroso-Rivas 2022).

Evaluation of adaptive capacity discipline is shifting from quantitative assessments at national level to qualitative assessments at local level (Grothmann et al. 2013). There are several studies that assessed institutional adaptive capacity to climate change (Pahl-Wostl 2009; Gupta et al. 2010; van den Brink et al. 2014; Grothmann et al. 2013; Fila, Fünfgeld, and Dahlmann 2024). Birchall and Bonnett (2021) argue that the ability of local government to successfully adapt to climate change is dependent on

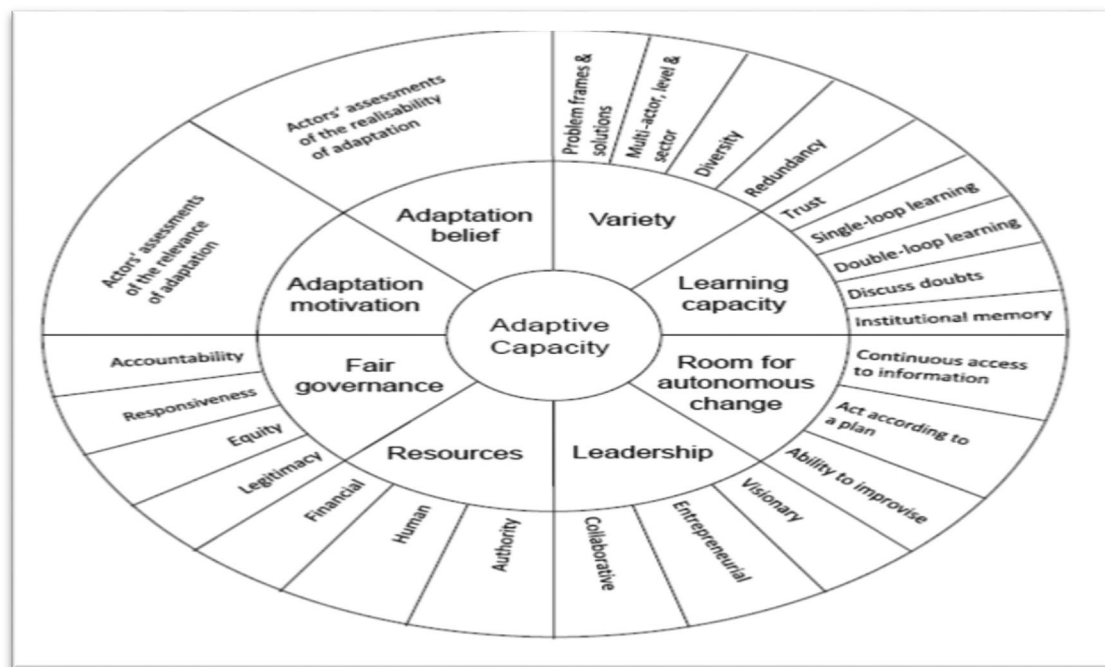


FIGURE 1 | Extended adaptive capacity wheel, including two psychological dimensions. Source: Grothmann et al. (2013).

the availability of personnel, knowledge and financial resources. Similarly, Jacobs et al. (2015) argue that the capacity to adapt to climate change involves the knowledge, skills and resources. According to Siders (2019), ACW is the most cited index in the literature. In addition, Grothmann et al. (2013) argue that the ACW by Gupta et al. (2010) is the only comprehensive and operationalised framework to evaluate the institutional adaptive capacity to climate change. Figure 1 demonstrates the determinants and the indicators of the institutional adaptive capacity.

ACW by Gupta et al. (2010) has six determinants of institutional adaptive capacity for climate change: resources, variety, fair governance, learning capacity, room for autonomous change, and leadership and 22 indicators (Gupta et al. 2010; Grothmann et al. 2013; Siders 2019). In an effort to improve the ACW, Grothmann et al. (2013) extended the number of determinants (and indicators) of the wheel by adding two psychological factors, adaptation motivation and adaptation belief, to the ACW, as illustrated in Figure 1. The dimensions are not independent of each other; they can influence each other, for example, adequate resources and fair governance (Gupta et al. 2010). In addition, the dimensions and criteria are dependent on the context; therefore, the application of the wheel is dependent on the specific problem. The results are produced by weighing and aggregating the indicators and determinants. In essence, the wheel is dependent on good interpretation and good judgement (Gupta et al. 2010).

Olazabal et al. (2019) indicate that the evaluation of adaptive capacity to climate change sheds light on factors required in enhancing capacity to future climate impacts. However, the current approaches for the assessment of adaptive capacity to climate change do not provide information on how adaptive capacity should be built. Birchall and Bonnett (2021) opined that support from higher level institutions is one of the factors

that enhances the adaptive capacity to climate change at local government level.

2.1 | Appraisal of Climate Change Adaptation Strategies in South Africa

South Africa is extremely vulnerable to climate change impacts, such as rising temperatures, destructive storms and a decrease in rainfall trends (Mugambiwa and Tirivangisi 2017; Wale, Nkoana, and Mkuna 2022). Considering these threats, the government developed and published the National Climate Change Response White Paper of 2011 and the National Climate Change Adaptation Strategy of 2020. Similarly, Leck and Simon (2018) revealed that attention given to climate change has increased in South Africa. Averchenkova, Gannon, and Curran (2019) further uncovered that South Africa has established one of the most intricate and inclusive climate change governance systems among the developing countries. Moreover, South Africa is considered to have the most advanced research, observation and climate modelling in Africa (Ziervogel et al. 2014).

The country has three constitutional spheres of government: national, provincial and local (Leck and Simon 2018; Nhamo and Agyapong 2019). Each province of South Africa is mandated by the White Paper to develop its climate change strategy based on their climatic conditions, threats and implications (Gods-mark et al. 2019). Nonetheless, Montmasson-Clair and Zwane (2016) argue that the provincial institutions are at different stages of climate change adaption; for example, only Western Cape, Gauteng, Eastern Cape, KwaZulu Natal and Limpopo have developed climate change response strategies. Table 1 illustrates the provincial climate change response strategies in South Africa.

TABLE 1 | Provincial climate change response plans/strategies in South Africa.

Provinces with climate change response plan	Provinces with no climate change response plan	Budget allocated	Dedicated institutional arrangements
✓ Western Cape climate change response framework for agricultural sector ✓ Gauteng climate change response strategy ✓ Eastern Cape climate change response strategy ✓ KZN climate adaptation plan ✓ Limpopo Green Economy Plan	✓ Free State ✓ North West ✓ Mpumalanga ✓ Northern Cape	✓ Western Cape (minimal dedicated budget) ✓ KwaZulu-Natal (minimal dedicated budget)	✓ Western Cape ✓ KwaZulu-Natal

Source: Montmasson-Clair and Zwane (2016).

Table 1 illustrates that almost half of South African provinces do not have a climate change response plan. In addition, only two provinces have the budget and the institutional departments/units responsible for climate change activities. In essence, most of the provinces that have climate change plan in place, including the Eastern Cape, lack the institutional and financial capacity to implement the plan. Inevitably, the Eastern Cape Climate Change Response Strategy (ECCCRS) goal of including multi-sectoral planning for climate change at all levels has not been achieved (Santhia, Shackleton, and Pereira 2018).

The South African local government comprises metropolitan, district and local municipalities. It must be noted that a South African district municipality is subdivided into several local municipalities (Leck and Simon 2018). Leck and Simon (2018) argue that most metropolitan municipalities have commenced tailor-made and progressive climate change initiatives, but the district and local municipalities lag behind. Additionally, all the district municipalities of South Africa, with the help of the South African Local Government Association (SALGA), have developed their climate change policy. However, numerous authors such as Ziervogel et al. (2014) revealed that achieving medium-to-long-term goal of adaptation is restricted by inadequate climate change modelling techniques. As a result, some researchers, including Singh et al. (2022), are convinced that the adaptation and monitoring approaches are challenged by the uncertainty about timing, intensity and magnitude of climate change impacts (Hosen et al. 2020; Petzold et al. 2020; Singh et al. 2022). Similarly, Averchenkova, Gannon, and Curran (2019) disclosed that South Africa's climate change adaptation programmes are constrained by the lack of comprehensive reporting and evaluation frameworks with clear indicators to adequately address climate change challenges.

Moreover, there are very limited climate change adaptation actions at the local municipalities in South Africa (Nkhonjera, 2017). Ziervogel et al. (2014) and Montmasson-Clair and Zwane (2016) revealed that local government institutions are struggling to adapt to climate change in South Africa. It has been argued that there are numerous climate change adaptation challenges at South African municipal level, such as the lack

of political will (Pasquini and Shearing 2014; Leck and Simon 2018), insignificant contribution towards the overall performance (Pasquini, Cowling, and Ziervogel 2013), lack of financial resources (Rosendo, Celliers, and Mechisso 2018; Averchenkova, Gannon, and Curran 2019), lack of human capacity (Rosendo, Celliers, and Mechisso 2018; Averchenkova, Gannon, and Curran 2019), limited skills and expertise (Ziervogel et al. 2014), insufficient knowledge and information (Rosendo, Celliers, and Mechisso 2018; Popoola, Yusuf, and Monde 2020), positioning of climate change within the municipality (Santhia, Shackleton, and Pereira 2018) and lack of coordination (Ziervogel et al. 2014; Montmasson-Clair and Zwane 2016; Santhia, Shackleton, and Pereira 2018; Averchenkova, Gannon, and Curran 2019; Godsmark et al. 2019).

2.2 | Adaptive Capacity of Climate Change Governance and Implementation Challenges in the Eastern Cape Province of South Africa

The Eastern Cape government, led by the Eastern Cape Provincial Department of Economic Development and Environmental Affairs (DEDEA), developed and published the ECCCRS in 2011 (DEDEA 2011). The ECCCRS is in line with the national White Paper, which serves as a guideline for what is expected from government institutions and also outlines what is needed by all provinces and municipalities to achieve the goals it intends to attain (Ziervogel et al. 2014; Montmasson-Clair and Zwane 2016). Adaptive responses to increase resilience to climate change impacts are vital for the Eastern Cape Province (Ziervogel et al. 2014), due to the high vulnerability of the region to climate change (Mugambiwa and Tirivangasi 2017). Similarly, Santhia, Shackleton, and Pereira (2018) point out that it is essential for local government institutions to adapt to climate change and increase their adaptive capacity due to the vulnerability of this province to climate change impacts. Fortunately, the government of South Africa developed the Climate Change Let's Respond Toolkit as a guide for municipalities to integrate climate change risk and opportunities into municipal planning (DEA 2012).

TABLE 2 | Challenges of implementation of municipal climate change strategy.

Challenges	References in the Eastern Cape Province	Other references in South Africa
Mainstreaming of climate change in the municipal IDP is weak	Santhia, Shackleton, and Pereira (2018)	Ziervogel et al. (2014)
Lack of climate change coordination between government institutions	Santhia, Shackleton, and Pereira (2018)	Ziervogel et al. (2014); Montmasson-Clair and Zwane (2016); Averchenkova, Gannon, and Curran (2019); Godsmark et al. (2019)
Climate change is isolated in the environmental department	Santhia, Shackleton, and Pereira (2018)	Ziervogel et al. (2014)

However, Santhia, Shackleton, and Pereira (2018) disclosed that the mainstreaming of climate change into the municipal Integrated Development Plan (IDP) in the Eastern Cape is weak, as it is only mentioned in the environmental sections of the IDPs. Additionally, there is a lack of effort to ensure that there is climate change coordination between district and local level municipalities in the Eastern Cape (Santhia, Shackleton, and Pereira 2018). This is not unique to the Eastern Cape Province; climate change adaptation governance is also fragmented among government institutions in other parts of the country (Ziervogel et al. 2014; Montmasson-Clair and Zwane 2016; Averchenkova, Gannon, and Curran 2019; Godsmark et al. 2019). Climate change is further isolated in the environmental department within the municipality of the Eastern Cape Province (Santhia, Shackleton, and Pereira 2018) and South Africa (Ziervogel et al. 2014). Table 2 demonstrates challenges of implementing climate change strategies in the Eastern Cape Province.

Table 2 illustrates that the documented challenges of implementing climate change strategies at local level in the Eastern Cape Province are similar to the challenges documented in other parts of South Africa.

3 | Methodological Considerations

3.1 | The Study Area

The Eastern Cape Province is one of the nine provinces of South Africa, and it is situated in the southern coastal area of South Africa (Walz et al. 2020). This province consists of 2 metropolitan municipalities and 6 district municipalities, which are further subdivided into 29 local municipalities (Santhia, Shackleton, and Pereira 2018) (see Figure 2).

The Eastern Cape is arguably the poorest province in South Africa (Santhia, Shackleton, and Pereira 2018), has a high ratio of households that are dependent on agriculture (Walz et al. 2020) and has high levels of poverty and illiteracy (Popoola, Yusuf, and Monde 2020). All the aforementioned features are associated with vulnerability to climate change (Bernauer and Scaffer 2010). Thus, this province is regarded as one of the most vulnerable regions to climate change impacts in South Africa (Mugambiwa and Tirivangasi 2017; Santhia, Shackleton, and Pereira 2018). In addition, the Eastern Cape is prone to numerous climate change impacts, particularly droughts (Walz et al. 2020). Moreover, the

municipalities of the province are under-resourced with very limited skills and capacity to adapt to climate change (DEA 2012).

3.2 | Research Design

This study applied a mixed method approach of qualitative and quantitative data collection techniques to explore climate change governance in South Africa. The method incorporated the advantages of both qualitative and quantitative methods, permitting researchers to gain a broad understanding of the research problem and offer a richer and more robust data analysis. Similarly, the method provided a rounded and distinct understanding of the complex research questions, allowing researchers to address both the extent and complexity of climate change governance in the Eastern Cape Province. Additionally, the mixed method approach further gave the researchers valuable knowledge on what is needed to improve the climate change governance in the province and beyond. Specifically, the study employed the qualitative method to obtain data involving the institutional and capacity challenges for climate change governance, whereas the quantitative technique was used to obtain data for the evaluation of the institutional adaptive capacity to climate change.

3.3 | Sampling Procedures and Sampling Size

The data for the study were collected in 2021 and 2022 in the Eastern Cape Province (see Figure 2). The selected institutions are either local municipalities in the province or are deemed influential in climate change adaptation at local government in South Africa. A total of five ($n = 5$) participants from five different institutions were interviewed in this study. In addition, a total of 15 ($n = 15$) participants from 8 different institutions were requested to complete questionnaires for this study. On the basis of the research questions, the researchers applied judgemental criteria to engage in online interviews and questionnaires with the 20 respondents from both government and private organisations. The researchers ensured that all the types of municipalities (metropolitan, district and local) were well represented in the research. The participation of 20 experts was deemed sufficient for the study. The breakdown of the sampling respondents includes the following: the Department of Forestry, Fisheries and the Environment (DFFE) ($n = 2$), SALGA ($n = 1$) and different municipalities of the Eastern Cape Province (Nelson Mandela Metropolitan) ($n = 1$), Buffalo City Metropolitan ($n = 1$),

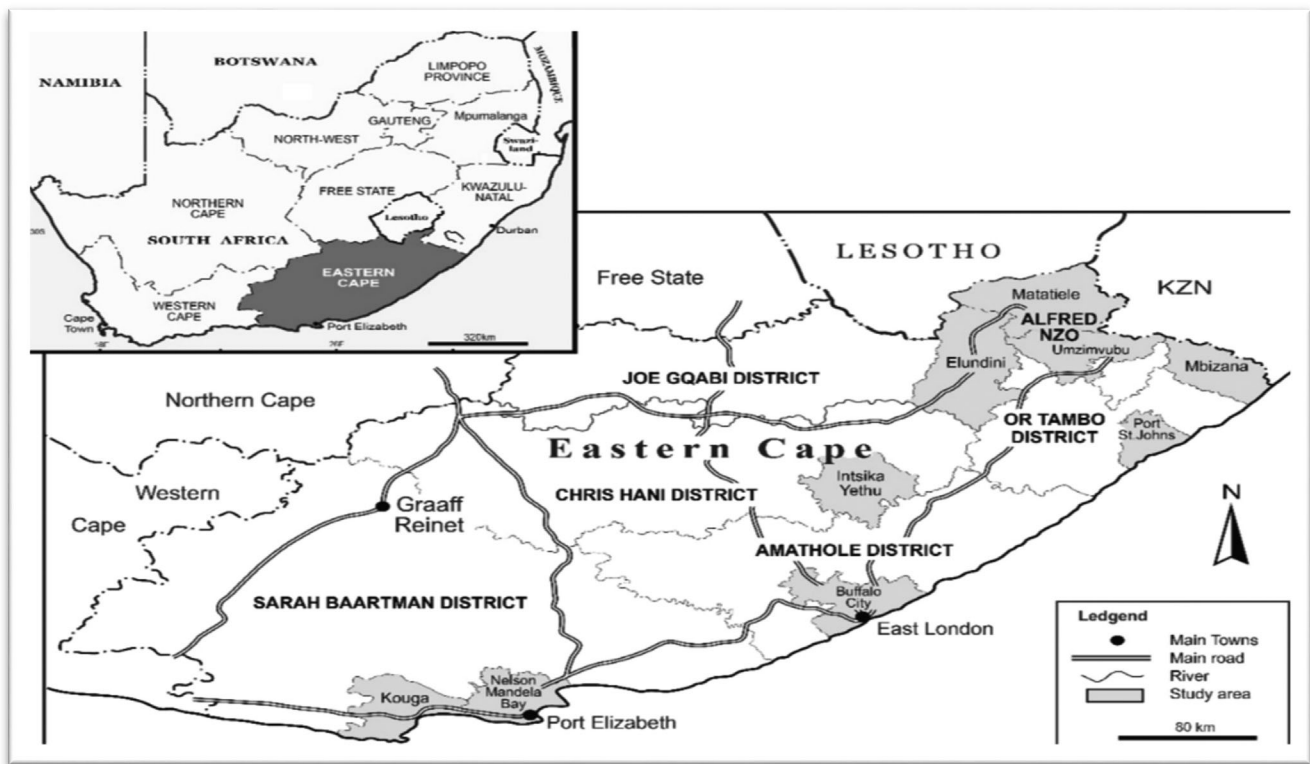


FIGURE 2 | Study sites in the Eastern Cape Province, South Africa. *Source:* Cartography Unit, University of the Witwatersrand (2022).

Amathole District ($n = 1$), Chris Hani District ($n = 2$), Mbizana Local ($n = 2$), Elundini Local ($n = 2$), Intsika Yethu Local ($n = 1$), Matatiele Local ($n = 2$), Port St Johns ($n = 1$), Mzimvubu ($n = 2$) and Kouga Local Municipality ($n = 2$).

3.4 | Data Collection Method

Interviews and questionnaire techniques were used to collect primary data. All the engagements were carried out virtually due to COVID-19 human restrictions at the time of data collection. The research team adopted a flexible approach of semi-structured, in-depth and open-ended discussions to uncover capacity and institutional weaknesses to climate change adaptation in the province. The questionnaires consisted of closed-ended question to capture statistical data about the process of evaluation of the institutional adaptive capacity to climate change. The primary data were complimented by the secondary data in the form of government gazettes, reports and archives. The secondary information was useful in identifying the existing policy frameworks for climate change adaptation, discovering the challenges and barriers of climate change adaptation and providing an insight into the evaluation processes of adaptive capacity at local government level.

3.5 | Data Analysis

The primary data obtained from the interviews were digitally recorded and transcribed from audio to text. Thematic analysis was used to analyse the qualitative data obtained. Kiger and Varpio (2020) defined thematic analysis as a method for qualitative

data that entails searching across a data set to identify, analyse and report repeated patterns using inductive approach. The thematic analysis for this study provided a framework that enabled the transcripts of the interviews to be organised into themes of similarities. Descriptive statistical analysis was used to analyse the data obtained from the questionnaires. This data analysis method is useful to display data in a brief and concise manner (Nick 2007). The data obtained from the secondary sources were analysed using critical discourse analysis and comparative analysis approach. These methods assisted data to be interrogated on 'what, why and how' on issues related to climate change governance at local government level.

4 | Empirical Evidence

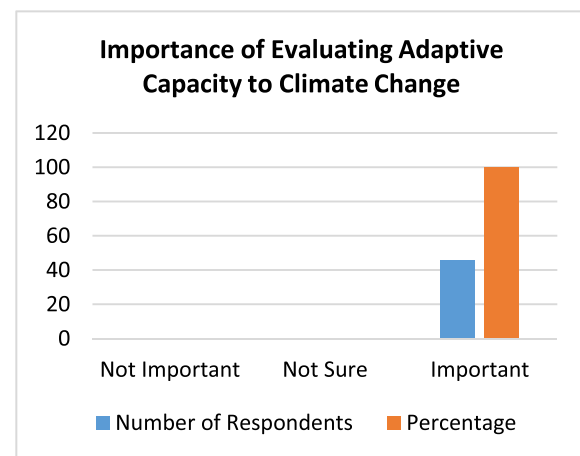
4.1 | Existing Systems for Evaluation of Adaptive Capacity to Climate Change

This article explored the evaluation of the institutional adaptive capacity to climate change in South Africa, with particular focus on the Eastern Cape Province. To begin with, it was important to understand the importance of evaluating the institutional adaptive capacity to climate change. The respondents were questioned about the subject, and the results are presented in Table 3 and Graph 1.

The results indicate that evaluation of institutional adaptive capacity is considered essential at local government level. In support of the above results, the respondent's comments are presented as follows.

TABLE 3 | Importance of evaluating the institutional adaptive capacity to climate change ($N = 20$).

Choices	Number of respondents	Percentage
Important	20	100
Not sure	0	0
Not important	0	0
Total	20	100

**Graph 1**

Source: Based on field notes (2021–2023).

Names of institutions	Respondent's comments
SALGA	“There is no structured process or framework that exist that can be used to evaluate or compare adaptive capacities of different municipalities according to certain indices in SA. There is a degree of adaptive capacity evaluation (e.g., of climate risks) during vulnerability and resilient assessment. It is essential to develop one, however, a system is as good as its input and output” (personal communication, 2021a).
DFFE	“There is a need for a system that measure or evaluate institutional adaptive capacity to climate change, but it should not be standard” (personal communication, 2021b).

Abbreviations: DFFE, Department of Forestry, Fisheries and the Environment; SALGA, South African Local Government Association.

In addition, the respondents were asked to indicate systems or frameworks used to assess the institutional adaptive capacity to climate change at local government level. The results are presented in Table 4, Graph 2 and Graph 3.

The results in Table 4 and Graph 3 uncovered that there are few municipalities at the study site that have systems in place for evaluation of institutional adaptive capacity. In addition, Table 4 and Graph 3 uncovered that most government institutions at local level do not evaluate their adaptive capacity and, subsequently,

their overall capacity to respond to varying climates is unknown. The results further uncovered that although there are claims that some systems are used to evaluate adaptive capacity, there is a lack of evidence in terms of the results of the assessment.

4.2 | Determinants of Institutional Adaptive to Climate Change

The article also examined the selection of the determinants of the institutional adaptive capacity in South Africa. The relevant climate change documents were reviewed, and the respondents were interrogated about the selection of determinants. The results are presented in Table 5.

The results in Table 5 uncovered that the respondents, systems and the report have selected identical, similar and different determinants to evaluate the coping ability of the institution. In addition, the results indicate that the number of determinants ranges from four to six in all different data sources.

The hierarchy of determinant's selection is presented in Figure 3.

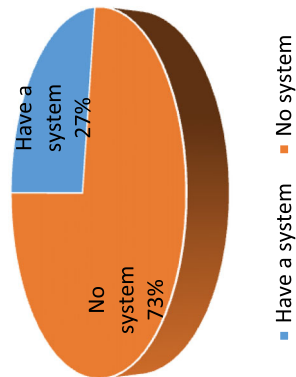
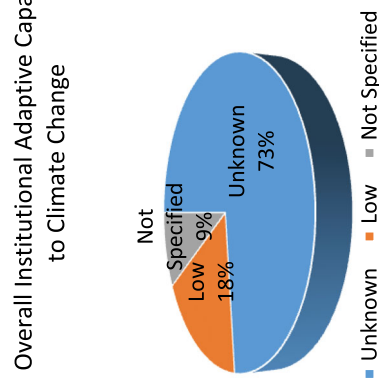
The results in Table 6 and Figure 3 indicate that there is a high variation in the selection of determinants for evaluation of institutional adaptive capacity among different government sources.

4.3 | Institutional and Capacity Challenges of Climate Change Adaptation

The article further examined the challenges hindering climate change adaptation in the province. Respondents were asked to mention or identify some of the constraints hindering the implementation of this strategy. Table 7 depicts the answers of respondents.

TABLE 4 | Systems for evaluation and monitoring of institutional adaptive capacity.

Name of municipalities	Name of the systems				Overall Adaptive Capacity
	No system	System	Let's Respond Toolkit (LRT)	Integrated Development Plan (IDP)	Climate Change Vulnerability Assessment and Response Framework (CCVARF)
Nelson Mandela Bay	✓				Unknown
Buffalo City	✓				Unknown
Amathole		✓	✓	✓	-Low (LRT) -Not specified (IDP)
Chris Hani		✓	✓		-Not specified (CCVARF)
Elundini	✓				-Low (LRT)
Mbizana		✓	✓		Unknown
Matatiele	✓				-Not specified (IDP)
Port St. Johns	✓				Unknown
Kouga	✓				Unknown
Ntsika Yethu	✓				Unknown
Mzimvubu	✓				Unknown
Total = 11	8	3			
Percentage = 100%	73%	27%			

Graph 2
Existence of a system to evaluate institutional adaptive capacity**Graph 3**
Overall Institutional Adaptive Capacity to Climate Change

Note: The (✓) indicates that the system is used by the municipality.
Source: Field-based notes (2021 and 2022).

TABLE 5 | Determinants of institutional adaptive capacity to climate change.

South African 1st Annual Climate Change Report	Climate Change Let's Respond Toolkit	Climate Change Vulnerability Assessment and Response Framework (CCVARF)	Participant's response
Policy, planning and mainstreaming	Policy	Awareness and planning	Policy
Institutional capacity	Institutional support	Institutional capacity	Human
Research	Research	Technical capacity	Research
Coordination structure	Finance	Financial capacity	Finance
Tools/Guidelines	Community		Political support
Prioritisation of climate change adaptation measures/actions			

Source: Based on field notes (2021–2023).

TABLE 6 | Determinant's selection frequency by relevant sources.

Determinants of institutional adaptive capacity	Total number of sources	Number of times the determinant is selected	Selection percentage
Policy	4	3	75
Planning	4	2	50
Mainstreaming	4	1	25
Awareness	4	1	25
Institutional capacity	4	2	50
Institutional support	4	1	25
Human capacity	4	1	25
Financial capacity	4	3	75
Political support	4	1	25
Technical capacity	4	1	25
Research	4	3	75
Coordination structure	4	1	25
Tools/Guidelines	4	1	25
Prioritisation of climate change adaptation measures/actions	4	1	25
Community	4	1	25

Source: Field-based notes (2021 and 2022).

The results in Table 7 illustrate that the same challenges were mentioned in an irregular manner by respondents from different institutions. In addition, table results uncovered that challenges of climate change adaptations are linked to different types of capacity. The results further uncovered that all primary challenges were connected to the institutional setting, and none of them was linked to the policy issues at local government level at the study site.

5 | Analysis and Discussion

The discussion of this article is structured and sequenced to establish a holistic understanding of climate change adaptation governance in the Eastern Cape Province and the rest of South Africa under three main objectives which include existing

systems for evaluation of institutional adaptive capacity to climate change, selection of determinants of institutional adaptive capacity to climate change, institutional and capacity challenges of climate change governance at a local government level in the province. The findings of Tables 4 and 5 uncovered that there is no consensus on the evaluation framework, terminology of determinants and the standard determinants of institutional adaptive capacity to climate change at local government level in South Africa. Similar findings were made by Baudoin and Ziervogel (2017) that there is no consensus on an evaluation framework or determinants to evaluate the adaptive capacity to climate change of government institutions in South Africa. Grothmann et al. (2013) concur by stating that even if faced by the same climate change impacts, different institutions may have different determinants of adaptive capacity, barriers and drivers of adaptation. However, it is interesting that the findings

TABLE 7 | Institutional and capacity challenges to climate governance.^a

Primary challenges	Number of times the challenge is selected by the participants (20)	Percentage	Identification of the challenge frequency rate	Research	Policy	Financial	Human	Institutional setting
No legislation for climate change	16	80	High					✓
Lack of political will/support	17	85	High					✓
Insignificant contribution towards the overall performance	13	65	Medium					✓
Unfunded mandate	14	70	High			✓		✓
Lack of financial resources	19	95	High			✓		✓
Lack of human capacity	17	85	High				✓	✓
Lack of knowledge and information	14	70	High	✓			✓	✓
Absence of climate change champion	11	55	Medium				✓	✓
Positioning of climate change within the local government institutions.	5	25	Low					✓

Note: The (✓) indicates capacity types that are linked to the challenge. The frequency rate is categorised into three, where “low” is percentage less than 33.3%, “medium” is 33.3%–66.6% and “high” is more than 66.6%.
Source: Field-based notes (2021 and 2022).

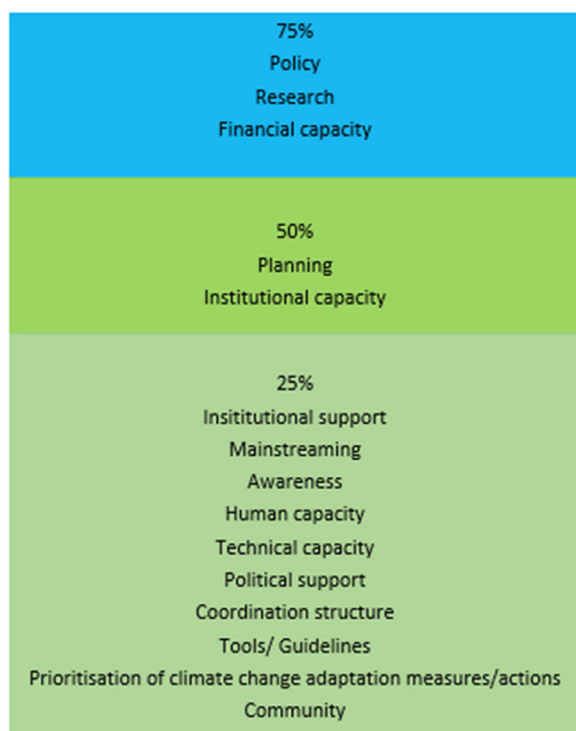


FIGURE 3 | Based on Table 6. *Source:* Field-based notes (2021 and 2022).

of this article revealed that the selection of determinants differs from different government gazettes and technocrats of the same government. In addition, the findings of Table 5 and Section 2 uncovered that there is a vast difference in the selection of dimensions and determinants of institutional adaptive capacity to climate change. The differences in dimensions of the Climate Change Let's Respond Toolkit of the South African government and the ACW are demonstrated in Figure 4.

The differences in the selection of determinants of the institutional adaptive capacity are demonstrated in Figure 5.

The findings of Figures 4 and 5 uncovered that there is minimal cross-referencing in the selection of dimensions and determinants of the institutional adaptive capacity across government institutions and with academic literature. A similar finding was

made by Siders (2019) that there is an insufficiency of collaboration and improvement of techniques in the evaluation of the climate coping mechanism discipline. It is understandable that adaptation is a localised activity, and the scenarios are different from different regions and institutions; however, it is easier and more valuable to use (or, if need be, derive your methods, dimensions and determinants from) the existing methods, dimensions and determinants to shift towards standardising and advancing evaluation of institutional adaptive capacity to climate change and the field of climate change adaptation in general.

The findings of Table 7 revealed that there are interlinkages between the primary challenges of climate change adaptation and the determinants of institutional adaptive capacity at municipal level. The relationship between barriers to climate change and determinants of adaptive capacity complicates the evaluation process of adaptive capacity to varying climates. This finding correlates with the finding of Santhia, Shackleton, and Pereira (2018) that South Africa should prioritise innovate approaches at subnational institutions to create an enabling environment to build adaptive capacity to climate change. Any results or outputs of a system or tool are as good and reliable as the inputs of a system. Therefore, the municipalities of South Africa need to address the barriers of climate change governance to adequately assess the institutional adaptive capacity to varying climates. The underlying finding of Tables 6 and 7, which is the relationship between the primary challenges of climate change adaptation and the determinants of institutional adaptive capacity at municipal level is simplified in Figure 6.

Findings of Figure 6 demonstrate that adequate building and evaluation of institutional adaptive capacity to climate change is almost impossible without addressing the challenges of climate governance first. Therefore, it can be argued that the current environment at local government level is not conducive to satisfactory evaluation and monitoring of the institutional adaptive capacity to climate change.

6 | Conclusions and Recommendations

Challenges of climate change governance at local government level complicate the evaluation process of adaptation responses and adaptive capacity in developing countries, and this article proves that South African municipalities are no exception. The

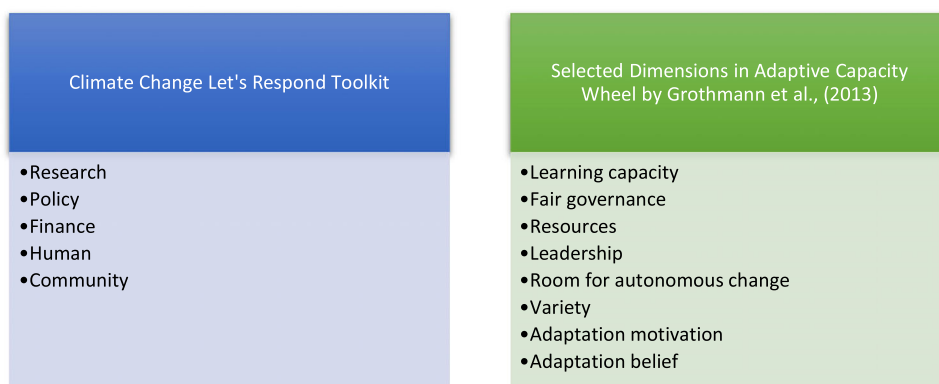


FIGURE 4 | Dimensions of adaptive capacity in Let's Respond Toolkit and in Adaptive Capacity Wheel Framework. *Source:* Research Team (2023).

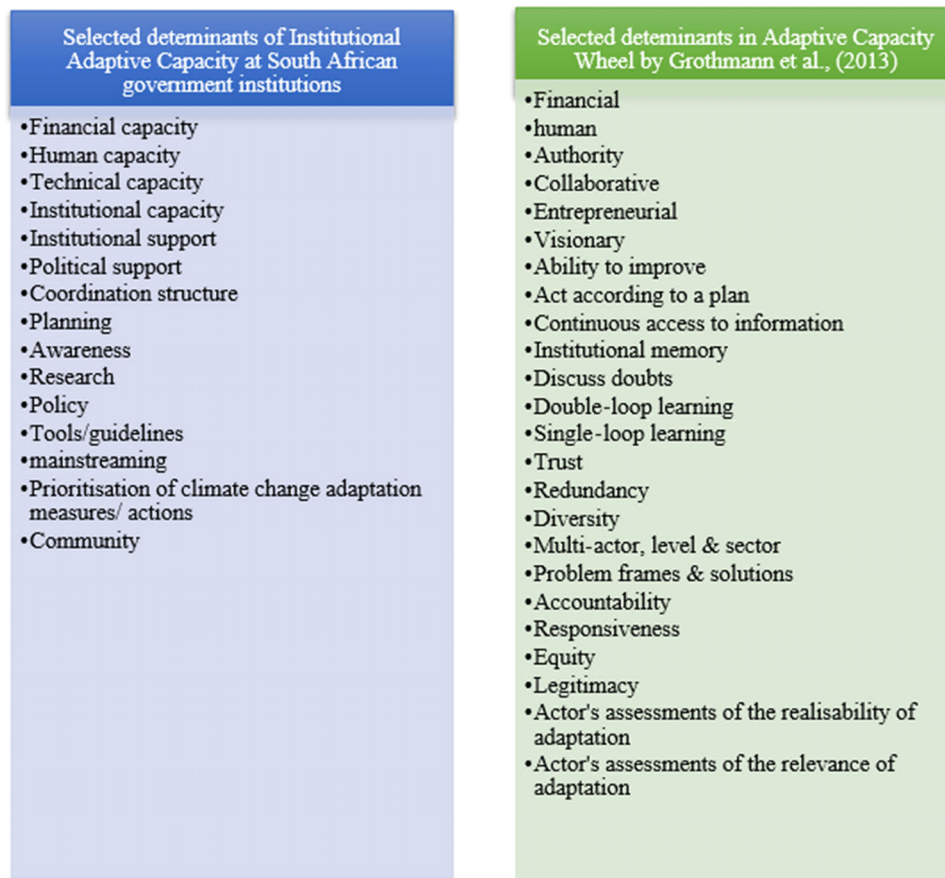


FIGURE 5 | Difference between the selected determinants of institutional adaptive capacity by South African government institutions and Adaptive Capacity Wheel Framework by Grothmann and others (2013). *Source:* Research Team (2023).

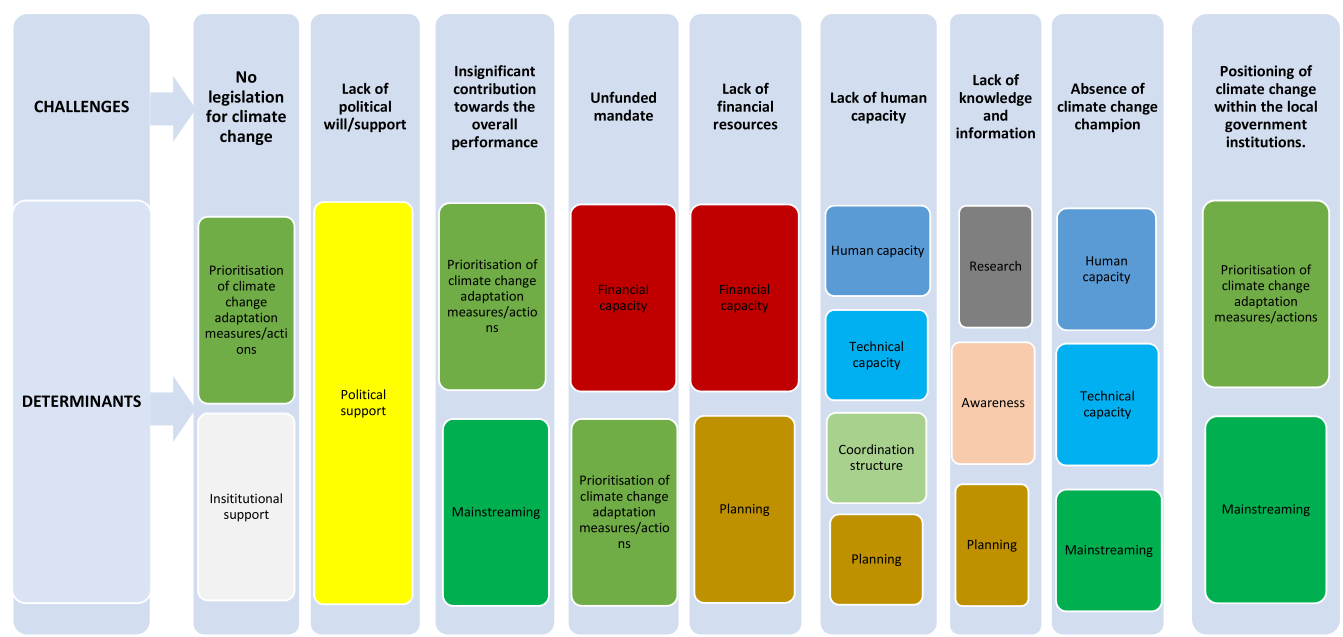


FIGURE 6 | The relationship between the determinants for the evaluation of the adaptive capacity to climate change and the primary challenges of climate change adaptation at local government level. *Source:* Research Team (2023).

primary challenges of climate change governance are linked to the determinants of the institutional adaptive capacity to climate change at municipal level. As a result, it is almost impossible to adequately evaluate the institutional adaptive capacity without addressing the challenges of climate change adaptation at local government level first. Therefore, the article findings reveal that the challenges of climate change adaptation and the determinants of the institutional adaptive capacity are intertwined. In addition, the article uncovered that there is no consistency in the terminology and the selection of the determinants of institutional adaptive capacity to climate change within the South African government institutions. Moreover, the article highlights the absence of a reliable system for evaluation of institutional adaptive capacity to climate change. As a result, it is difficult to compare the capacity of different institutions, understand which institution needs assistance the most, and adequately allocate resources. The study recommends the introduction of institutional reforms with the sole purpose of minimising and eventually eliminating the challenges of climate change governance at municipal level. Moreover, the study recommends the development of a system with standard dimensions and indicators that can evaluate and monitor the institutional adaptive capacity of local government institutions. The system should be able to track the progress of adaptation responses, compare the adaptive capacity of municipalities and assist in the allocation of resources.

This study is subjected to numerous limitations. First, the study focused on the institutional framework for climate change with minimal consideration of social, economic and political factors. In addition, the study focused on local government institutions; therefore, mostly government officials that were engaged are involved in climate change adaptation at local government level. Future studies could investigate the same subject in other South African government institutions, maybe at different spheres, for example, water and agricultural departments. Other future studies could examine the possibility of developing a system/tool that can assess and monitor (dashboard) the institutional adaptive capacity of government and private institutions in South Africa.

Author Contributions

Siyaxola Ernest Gadu: conceptualisation (lead), data curation (lead), formal analysis (lead), investigation (lead), methodology (lead), project administration (lead), validation (lead), visualisation (lead), writing—original draft (lead), writing—review and editing (equal). **Richard Kwame Adom:** formal analysis (equal), methodology (equal), supervision (supporting), writing—original draft (supporting), writing—review and editing (supporting). **Mulala Danny Simatele:** conceptualisation (supporting), methodology (supporting), supervision (lead), writing—review and editing (supporting).

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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