Climate Change Vulnerability Assessment and Adaptation: A Comparative Analysis of Reports Produced for Local Governments in South Africa and South East Queensland, Australia

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Abstract

Climate change is dominating social, political and economic agendas. Because of the salience of the issue, scientists, researchers and consultants have developed a plethora of climate adaptation strategies. In this article I analyse two such strategies: *Adapting South African Cities and Towns: A Local Government Guide to Climate Change Adaptation Planning* by Ziervogel and Methner; and *Climate Change Vulnerability in South East Queensland: A Spatial and Sectoral Assessment* by Choy et al. For this analysis I utilised the PULSE^3 analytical framework. My analysis indicated that the two adaptation strategies were predominantly positivist in scientific orientation. Other paradigms and theories are also applicable in explaining the issue of climate change and how to adapt to it.

Keywords: climate change; adaptation; paradigm; theory; leadership; policy

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Introduction

Climate change has come to dominate social, political and economic agendas worldwide. It is almost unthinkable to have a conversation about the environment without discussing climate change, its causes and impacts on the natural environment and human society. Due to its salience, societies at all levels—from individual to communal and governmental—have started giving serious consideration to climate change. Adapting to and mitigating the consequences of climate change have spawned numerous technical and societal efforts, reports, plans, programmes and treaties. How people produce research on climate change, the impact of climate change, and people's responses to it, are the focus points of discussion in this article. The central problem that is highlighted is that research is produced using positivism as the main paradigmatic foundation and that the recommendations made to practitioners in the private and public sectors are based on this particular paradigm. Basing research on positivism alone is not incorrect; however, it begs the question which other paradigms could be utilised as legitimate forms of knowledge generation to inform practitioners about climate change and about adaptation to this global threat. Other paradigms that are as legitimate as positivism are postpositivism, interpretivism/constructivism, critical theories, and the participatory paradigm (Lincoln, Lynham, and Guba 2011, 2018; Meissner 2017, 2021).

To investigate the matter, I analyse two documents: *Adapting South African Cities and Towns: A Local Government Guide to Climate Change Adaptation Planning* by Ziervogel and Methner (2009), and *Climate Change Vulnerability in South East Queensland: A Spatial and Sectoral Assessment* by Choy et al. (2010). The assessment reported on in this article was part of research that the Council for Scientific and Industrial Research (CSIR) conducted for a South African metropolitan municipality. The purpose of the research project was to develop a climate change adaptation plan for the relevant municipality. To get a sense of what such an adaptation plan would entail, the CSIR researchers investigated similar research conducted in a South African and an international context. The Australian report by Choy et al. (2010) was selected to gain insight from an international perspective. There was a remarkable resemblance between the report by Ziervogel and Methner (2009) and the terms of reference of the commissioned research for the metropolitan municipality. The research project manager subsequently requested an analysis of the Ziervogel and Methner (2009) report and the municipality's terms of reference. The purpose of this analysis was to investigate the way in which knowledge around the issue of climate change and adaptation was generated and how recommendations were put forward. It was believed that an analysis of this nature would give important clues about how to develop the adaptation plan for the metropolitan municipality.

In a similar analysis I did of a CSIR project titled *Linking Climate Change and Water Resources to Mitigate Impacts and Promote Adaptation in Support of Social and Economic Development* (Claassen 2014), I investigated the potential of mitigating the

impacts of climate change on water resources in the South African context and promoting adaptation to climate change. As part of the project, I investigated the paradigms and theories that my fellow researchers utilised to design recommendations that would be more eclectic in orientation, and I established that the research team had employed the positivist paradigm and theories. In their recommendations for the development of mitigation and adaptation strategies they focused on the South African government or its entities. Other societal actors could then use the structural requirements proposed to change their behaviour accordingly.

Adaptation through institutional mechanisms or structures at different scales will be a challenging future endeavour (Adger, Arnell, and Tompkins 2005). The challenge to adapt to climate change is compounded by existing climate change complexities and uncertainties. In this regard, researchers from other institutions are focusing on developing adaptation plans for government entities (e.g. Serrao-Neumann, Harman, and Choy 2013) or on the way that governments can facilitate adaptation planning (e.g. Bauer and Scholz 2010; Ziervogel et al. 2014). Be that as it may, an important element in adaptation planning is to reduce the so-called "adaptation deficit." This deficit refers to the exposure and sensitivity of observed climate change and climate variability (Ziervogel et al. 2014).

Climate change adaptation links to the ideas of sustainable development, climate resilience, governance and risk management regarding responses to current and future climate impacts. Whatever the meaning of climate change adaptation, it will not only be achieved through changes in governmental structures such as South Africa's *National Climate Change Response White Paper* (RSA 2011). Bringing about change through such structures is important, but this is not the only means through which climate change adaptation can be achieved.

Paradigms and theories have an impact on scientists' view of reality, their focus of analysis and how they develop recommendations (Wendt 1999). For instance, by focusing on governmental processes instead of on the behaviour of actors it is possible to recommend changes, in particular structures. Paradigms such as positivism with its assumptions that objective reality exists beyond the human mind (Weber 2004; Lincoln et al. 2011, 2018; Meissner 2017, 2021), and its hierarchical top-down focus on governments, great powers and international regimes (Hobson and Seabrooke 2007; Meissner 2017, 2021), influence scientists' actions and research focus.

In this article I analyse two adaptation strategies as described in two research documents: *Adapting South African Cities and Towns: A Local Government Guide to Climate Change Adaptation Planning* by Ziervogel and Methner (2009); and *Climate Change Vulnerability in South East Queensland: A Spatial and Sectoral Assessment* by Choy et al. (2010). For this analysis I use the PULSE[3] analytical framework in order to identify the paradigm within which the researchers have nested their work. This analysis provides insight into what other paradigms have not been incorporated or have been

utilised to a limited extent. Through the use of PULSE^3 I am also able to investigate and identify the type of paradigm and theories used at other stages of the policy process (Meissner 2014, 2016, 2017, 2018, 2021).

The aim of this article is to investigate which paradigms and theories have influenced the two adaptation documents. The article consists of two main parts. In the first section, I discuss climate change assessment and adaptation, sketching the background against which the rest of the article unfolds. This section documents the analyses of the two documents. In the second part I carefully consider the findings of the analysis and their implications, based on which I reach a conclusion.

Climate Change Assessment and Adaptation

An assessment of climate change involves investigating the risks and vulnerabilities that society faces considering the potential effects of climate change. It is important to assess vulnerabilities since it assists in establishing the scale of a threat. With a vulnerability assessment one can also start determining the (effective) means of "promoting remedial action to limit impacts by supporting coping strategies and facilitating adaptation" (Kelly and Adger 2000, 325). An assessment thus involves the mobilisation of resources to deal with potential threats at different scales. Adaptation does not only have a physical or ecological dimension. There is a human dimension too where people must adjust the availability of resources (in whatever form) and the consideration of risks at various spatial, societal (Adger, Arnell, and Tompkins 2005) and temporal scales. Over almost three decades, scientific knowledge has played a significant role in the formulation and implementation of policies to curb climate change impacts (Füssel and Klein 2006). That said, and since humans are an integral part of vulnerability assessments and adaptation plans, it also follows that the way in which we generate scientific knowledge influences policy adaptation plans and the way we implement such plans. The type of paradigm from which knowledge is generated, and the agency it constitutes, can be central in how the problem is conceptualised and the way in which recommendations are implemented. In this section, I apply PULSE^3 to two climate change assessment and adaptation plans: one for South African local governments and the other for the government of Queensland in Australia.

Adapting South African Cities and Towns

The report titled *Adapting South African Cities and Towns: A Local Government Guide to Climate Change Adaptation Planning* by Ziervogel and Methner (2009) outlines six steps municipalities should take to adapt to climate change: (1) Create a coordinating adaptation committee. (2) Assess current climate trends and future projections for the municipality. (3) Undertake a climate vulnerability assessment. (4) Undertake an assessment of adaptation options. (5) Develop a municipal adaptation plan. (6) Monitor, evaluate and adjust the interventions on an ongoing basis.

The outline of these steps is preceded by an explanation that the practical guide is necessary to promote robust adaptation to climate change in the context of sustainable development. Ziervogel and Methner (2009, 3) note that: "An adaptation strategy should be a systematic, proactive and coordinated response to enhanced climate variability and projected climate change. [The adaptation strategy] refers to the overall process that guides […] [the municipality's] planning and decision making for a sustainable future."

Figure 1 represents the paradigm assessment of the guide[1]. As indicated in the diagram, the dominant paradigm is positivism. There are also elements of postpositivism, interpretivism, critical theories and the participatory paradigm. An assessment of the background of the guide's authors could explain why this is the case. Ziervogel scores high on the positivism and postpositivism paradigm, whereas Methner's training profile shows a mix of positivism, postpositivism, interpretivism and the participatory paradigm. None of these authors adopts the critical theories paradigm. Also, the topic the guide deals with is of a positivist and possibly postpositivist nature. Here I would like to pause and provide an example of how I score the text of the document. Consider the following excerpt from Ziervogel and Methner (2009, 3):

> Municipalities are well placed to develop and implement effective adaptation strategies. They are the site of government closest to people, local knowledge and experience – all important attributes in designing strategies that must address the specific vulnerabilities of local areas, communities, socio-economic activities and ecosystems in the context of climate change. This important role is recognised in national strategy, such as the draft National Climate Change Response Strategy and National Framework on Sustainable Development.

In this text the researchers note that municipalities are the government bodies closest to communities (Zybrands 2011). This statement is an indication of an objective reality that exists beyond the human mind. In other words, the statement is in the form of the positivist ontology, indicating the nature of the relationship between the researcher and the thing (municipality) being researched (Lincoln, Lynham, and Guba 2011, 2018; Meissner 2016, 2017, 2018, 2021). The statement that the municipalities *must* utilise

1 There is a major difference in the scoring between the two documents that I analyse. The reason for this is that I assess *Adapting South African Cities and Towns: A Local Government Guide to Climate Change Adaptation Planning* as a whole whereas I only assess the executive summary of *Climate Change Vulnerability in South East Queensland: A Spatial and Sectoral Assessment*. The length of text one assesses has an impact on the scoring of the text; the more text is assessed the higher the scores and *vice versa*. As mentioned by one of the anonymous reviewers, this difference in the scoring of the two documents could impact on the level of confidence in the scoring. Since the summary of the Australian report is quite comprehensive, I am confident that the scores might have differed when adding the totals, but it would not have shown that another paradigm was dominant. Also, I have done the scoring myself using the paradigm assessment matrix mentioned earlier. I am not sure how that would influence reliability. Since this is a new framework of analysis, I have not trained anybody else in using it. It would be interesting to see how different scientists will score texts according to the matrix.

their position of being close to "people, local knowledge and experience" indicates that the researchers are acting on the research they have conducted and that the law-like statements they make influence the decision-makers. The latter is the axiological metatheoretical attribute of positivism. Axiology refers to the actions of researchers based on their research (Lincoln, Lynham, and Guba 2011). Said differently, Ziervogel and Methner (2009) view their role as "prescribers" to decision-makers based on their observation that municipalities are the closest to the population they supply services to. The sentences of the passage are therefore positivist in their paradigmatic foundation because no other paradigm is present. Because of this, the positivist sentences all score a 1 on positivism whereas the other paradigms do not get a score because they are absent.

Scientists talk about "[t]he science of climate change" (Doulton and Brown 2009, 191) "[d]espite the overwhelming scientific consensus that humans are influencing the planet's climate" (Ladle, Jepson, and Whittaker 2005, 231), and the study by Jarraud and Steiner (2007) claims to be "the first major global assessment of climate change science in six years." These quotes indicate that, in discursive writing, climate change is linked to scientific methods of study. It can also be argued that the exploration of climate change has become synonymous with the use of the scientific method, which, in turn is infused with positivism. This is seen in Ziervogel and Methner's (2009) guide where the generation of knowledge follows the principles of positivism. The metatheoretical assumption in respect of the method they use scores the highest (14) of all the categories under knowledge generation. The other scores are as follows: the research object (11); ontology, epistemology, theory of truth and validity (10); and training (6). Reliability receives the lowest score (3). This does not indicate that the study or the method used is unreliable. The publication is a guide and not an assessment of vulnerabilities; hence reliability's low score. The guide's authors use their positivist knowledge of climate change to inform municipal officials. Another aspect regarding the authors' training needs to be mentioned. "People remember what they want in the circumstances in which they do the remembering; they always select and often invent their memories" (Service 2004, 598). It is possible that Ziervogel and Methner relied on the training they had received to guide their memories in developing the guide. People, including Ziervogel and Methner, do not operate independently of their training; their training has an influence on the way they analyse the matter at hand. Here, Lebow (2014, 5) makes a useful observation: "The social world is the product of our conceptions as well as our practices." It is not impossible that these conceptions and practices are instilled when researchers receive their training.

Ziervogel and Methner (2009) follow a specific method in presenting their six steps for adapting to climate change. The steps are outlined in a seemingly logical dyadic order. Ziervogel and Methner are also clear about their views on adaptive municipalities. For instance, they note that: "An 'adaptive' municipality takes proactive steps towards reducing the vulnerabilities and risks associated with climate variability and climate change" (Ziervogel and Methner 2009, 4). They go on to say that adaptive municipalities follow "a coordinated and integrated approach," which is based on the

latest climate information (Ziervogel and Methner 2009, 4). Such municipalities also monitor their strategies on a constant basis. The authors' statements are very specific and to the point, indicating exactly what is meant by adaptation within a local government. In terms of agency, their statements indicate that they control the research process without any inputs from municipal participants (Guba and Lincoln 2005; Lincoln, Lynham, and Guba 2011, 2018; Meissner 2016, 2017, 2018, 2021). The voice of the scientists is therefore dominant, and policy-makers are informed by the scientists (Lincoln, Lynham, and Guba 2011, 2018; Meissner 2016, 2017, 2018, 2021).

In terms of voice and recommendations, the guide scores the highest (20) and second highest (19) in the paradigm assessment. Other scores are as follows: unit of analysis, prime empirical focus, locus of agency and ontology (15); organising question (14); level of analysis (12); and the hegemony or the researchers' influence (11). Agency therefore resides with the authors in a top-down manner; they have adopted the scientific method of giving directions to municipal officials about implementing climate change adaptation strategies.

The recommendations they make are also predominantly positivist. For instance, they list several essential lessons to be learnt from municipalities that have developed adaptation strategies. The actors involved in the implementation of these lessons were political leaders or champions within the municipality, local research institutions, coordinating adaptation committees and lastly stakeholders (Ziervogel and Methner 2009). The locus of agency is therefore top-down, and the level of analysis by Ziervogel and Methner (2009) is systemic. For Ziervogel and Methner, municipal officials and top political leaders are the most important actors that should actively govern to benefit citizens. They also do not ignore ideational entrepreneurs such as researchers and climate change scientists. According to them, a direct and cooperative link should be created and sustained between those who govern and those with the necessary skills and knowledge regarding climate change.

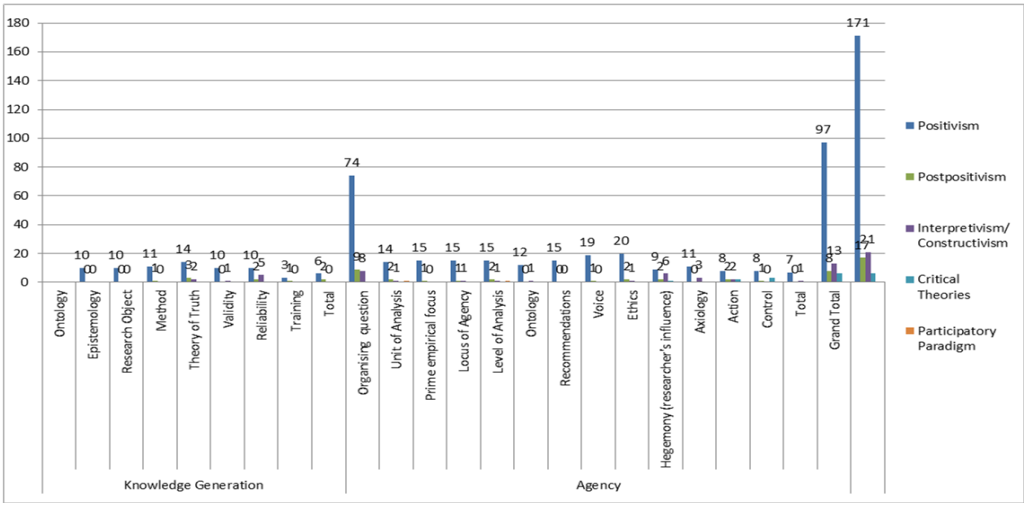

Figure 1: Paradigm assessment of the South African cities and towns report compiled by Ziervogel and Methner (2009)

Climate Change Vulnerability in South East Queensland

Choy et al. (2010) conducted their assessment titled *Climate Change Vulnerability in South East Queensland: A Spatial and Sectoral Assessment* as part of the South East Queensland climate adaptation research initiative. Partners in this initiative were the governments of Queensland and Australia, the Griffith University, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the University of the Sunshine Coast, and the University of Queensland. The aim of the initiative was to provide research knowledge to permit the Queensland region to prepare for and adapt to climate change impacts. From this initiative, adaptation strategies were developed to assist decision-makers in industry, government and the community (Choy et al. 2010). The report by Choy et al. (2010), which concluded the first phase of the initiative, contained a regional assessment of human settlement vulnerability to climate change at spatial and sectoral levels.

I analyse only the executive summary of the report since it is an excellent summary of the entire report. According to my analysis, the paradigm that is central throughout the report is positivism (see Figure 2). Positivism is dominant in both the knowledge generation and agency portions of the executive summary. Interpretivist/constructivist elements and the participatory paradigm are also present. Regarding knowledge generation, the scientists use an integrated framework which include external (or exposure) and internal (or sensitivity) and adaptive capacity dimensions of vulnerability. Choy at al. (2010) note that they have chosen this approach because it is the most common approach used in global environmental change and climate change research.

In terms of the method utilised, Choy et al. (2010) assess the region's vulnerability to three impacts: extreme heat, extreme rainfall and coastal hazards. They base these variables on a set of indicators. For them, the research object and the associated ontology and epistemology are positivist because the Queensland region has inherent qualities that exist independently of the researchers. The impact of the region and climate change on Queensland can thus be investigated from a distance and in an objective manner through gathering empirical data and analysing the data through statistical analyses or computer modelling.

With respect to theory of truth and validity, I have established that interpretivist/constructivist elements are present, but only in the presentation of the results of the climate change assessment. For instance, the scientists state that: "In SEQ [South East Queensland], climate change is *projected* to lead to an increase in average annual temperatures, a change in average rainfall and sea-level rise. In addition, more extreme weather events are *projected*, with an increase in rainfall events" (emphasis added) (Choy et al. 2010, i). They also note that: "Of particular concern are a number

of areas within the Sunshine Coast and Gold Coast jurisdictions that *appear* extremely vulnerable to extreme rainfall" (emphasis added) (Choy et al. 2010, i). That the scientists use the words "projected" and "appear" is an indication of the uncertainty inherent in climate change modelling and the effects of climate change on the environment. Climate change scientists are aware of this uncertainty—it is part of their lived experience, leading to their defensible knowledge claims and their construction of validity through consensus (Lincoln, Lynham, and Guba 2011, 2018).

I have found that positivism is also dominant in the treatment of agency. The only metatheoretical assumptions where other paradigmatic elements are present are in the organising question, voice and ethics. Choy et al. (2010, i) report on local authorities that have been proactive in "developing policies geared toward climate change strategies in the last few years despite the fact that there was no statutory obligation to do so." This assertion is an indication that the local authorities are not in an absolute top-down relationship with the central government and that they have autonomy to construct their own policies, irrespective of the latter's involvement or not. The local authorities' actions are portrayed as interpretivist/constructivist since they act independently of the regulatory environment; they do not wait for legislation to tell them what to do. The scientists bring their voice to bear on the planning practices. Here they say that: "the analysis of the current planning schemes illustrates that adjustments will need to be made in order to improve planning practices" (Choy et al. 2010, i–ii). The scientists adopt an activist role, calling for the improvement of planning processes. They put forward adaptive management "to deal with uncertainties and evolving climate science, better cross-scalar and cross-sectoral integration in the policy delivery process" (Choy et al. 2010, ii). While applying their voice in an interpretivist/constructivist manner, the scientists advocate the application of adaptive management, a positivist theory, so as to advance policy planning and scientific knowledge. From an ethical point of view, it can be said that the research process aims to reveal the special problems that human settlements face in regard to climate change. This notion is the only element representing the participatory paradigm. The reason for this could be that the report was a product of a participatory initiative between scientists and policy-makers.

The scientists report on three sectors where climate change will have impacts: coastal management, health, and emergency management. The scientists make explicit recommendations to the three sectors, and they repeatedly use the word "will." A few examples are: to reduce "vulnerability in coastal areas *will* need to consider the identification of sustainable options"; "[n]ew concepts *will* need to be integrated into local planning schemes"; and "successfully addressing the challenges posed by climate change *will* require an understanding of the complexity of stressors and external drivers on human health." The scientists further note that: "Climate change […] *will* bring new challenges to the emergency management sector" (emphasis added) (Choy et al. 2010, ii). In this regard, the scientists make their voices heard by informing policy-makers of the consequences of not giving effect to specific elements timeously. The prime empirical focus is to assist the political leadership of the Queensland government to

bring order and create and maximise welfare (Hobson and Seabrooke 2007). Therefore, the scientists give directions to policy-makers through predictions.

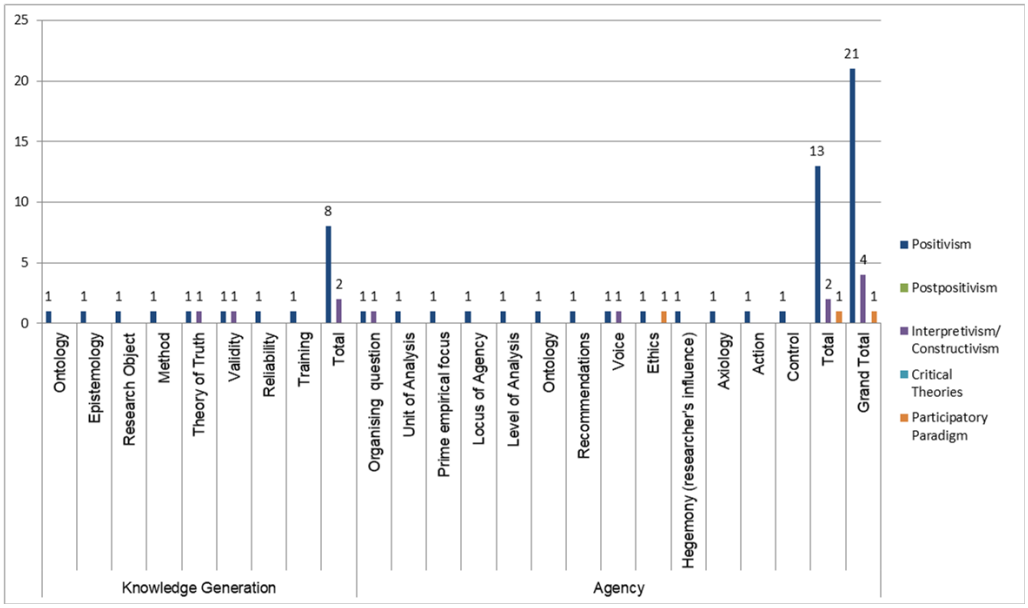

Figure 2: Paradigm assessment of the executive summary of the South East Queensland report compiled by Choy et al. (2010)

Discussion and Conclusion

My assessments raise a critical question. Are those people who have the necessary scientific knowledge and skills about climate change automatically the ones who can inform municipal officials about the implementation of adaptation strategies? More specifically, is the positivist paradigm suitable for such an endeavour? Considering that the local government, in the case of South Africa, is the sphere of government closest to citizens (Zybrands 2011), it would appear that a combination of paradigms might be more suitable. The human element or agency is central in the relationship between local government and communities. The ethos of analytic eclecticism (Meissner 2017, 2021; Sil and Katzenstein 2010) might provide guidance in this matter, especially with respect to what more is needed to inform practitioners. The two studies (see Table 1 for a detailed comparative analysis of the two studies) can be commended for highlighting the issue of climate change, how it could impact on different government sectors and what to do about such impacts. What they omit though are the acknowledgement and integration of other paradigms. A possible reason for this is that the authors of the reports are not aware of alternative paradigms and that their omission could therefore be a case of "out of sight, out of mind." In the next few paragraphs I apply the ethos of analytic eclecticism (Meissner 2017, 2021; Sil and Katzenstein 2010) and the repertoire

of theories to better understand how knowledge can be deepened and how agency can be influenced and better understood at local government level.

Table 1: A comparison of the paradigms used in the two relevant reports

Meta-theoretical assumption	**South African cities and towns report**	**South East Queensland report**
Ontology	Positivist	Positivist
Epistemology	Positivist	Positivist
Research object	Positivist	Positivist
Method	Positivist/Postpositivist/Interpretivist/Constructivist	Positivist
Theory of truth	Positivist/Interpretivist/Constructivist	Positivist/Interpretivist/ Constructivist
Validity	Positivist/Postpositivist/Interpretivist/Constructivist	Positivist/Interpretivist/ Constructivist
Reliability	Positivist/Postpositivist	Positivist
Training	Positivist/Postpositivist	Positivist
Organising question	Positivist/Postpositivist/Interpretivist/Constructivist/Participatory	Positivist/Interpretivist/ Constructivist
Unit of analysis	Positivist/Postpositivist	Positivist
Prime empirical focus	Positivist/Postpositivist/Interpretivist/Constructivist	Positivist
Locus of agency	Positivist/Postpositivist/Interpretivist/Constructivist/Participatory	Positivist
Level of analysis	Positivist/Interpretivist/Constructivist	Positivist
Ontology	Positivist	Positivist
Recommendations	Positivist/Postpositivist	Positivist
Voice	Positivist/Postpositivist/Interpretivist/Constructivist	Positivist/Interpretivist/ Constructivist
Ethics	Positivist/Postpositivist/Interpretivist/Constructivist/Critical Theory	Positivist/Participatory
Hegemony of the researcher's influence	Positivist/Interpretivist/Constructivist	Positivist
Axiology	Positivist/Postpositivist/Interpretivist/Constructivist/Critical Theory	Positivist
Action	Positivist/Postpositivist/Critical Theory	Positivist
Control	Positivist/Interpretivist/Constructivist	Positivist

Although the two reports have different paradigm profiles, the figures and comparative table show that positivism is the predominant paradigm used in both reports. The question that arises is what we can do to better inform government officials. I will start with the subject matter, namely, climate change. To the casual eye it would appear that climate change is a straightforward, rational or even postpositivist topic. Many scientists who are involved in climate change research, work in the field of the natural sciences and will approach the subject of their research from the perspective of the scientific method. Even so, if we consider the postpositivist premise that a single reality can never be fully understood (Guba and Lincoln 2005; Lincoln, Lynham, and Guba 2011, 2018; Meissner 2014, 2016, 2017, 2018, 2021), it opens the possibility for the application of the interpretivist/constructivist and participatory paradigms.

Viewed from an interpretivist perspective, if researchers were to acknowledge the existence of multiple realities that are cognitively constructed, it might motivate them

to investigate how practitioners view climate change. They might be surprised that practitioners hold the same views as scientists do (because climate change is such a common topic on the social agenda and thoughts about it are converging). Alternatively, researchers might realise that they are dealing with so-called climate change optimists and pessimists. The views held by practitioners will influence the way that researchers might want to approach them during their research. Since a mix between optimists (i.e. people who believe that climate change is caused by human activities and that climate change is real) and pessimists (i.e. people who do not believe that the global climate is changing) is a possibility, researchers engaging in climate research will come into contact with people who hold subjective and objective views about the realities of climate change. These realities are co-created by the human mind and the surrounding environment (Guba and Lincoln 2005; Lincoln, Lynham, and Guba 2011, 2018; Meissner 2017, 2021). This environment includes large volumes of information from a variety of sources, which may include scientific journals, television documentaries or sources of information that can treat information in a topical manner (media outlets and electronic media come to mind). However, practitioners might not have the objective reality of human-induced climate change at heart. They are free from the scientific objectivity (Heshusius 1994; Lincoln, Lynham, and Guba 2011, 2018) that could put the objective scientist at odds with the practitioner who possesses no "objective truth" about the subject matter. In such a situation, scientists usually fall back on their rational science to convince the practitioner of the realities of anthropogenic climate change. This creates a power relationship, where influence starts to play a significant role in the interpersonal relationship between the scientist and the practitioner. Such a situation is akin to two political parties trying to convince each other that their respective pathways to corrective action are correct, and to win over supporters of their actions. In other words, a knowledge tug-of-war ensues, which can be a fruitless endeavour with both science and practice suffering; no longer is it about science and practice—it is about the psychological convictions of the parties and their endeavours to exercise influence.

This way of influencing is seen in the step-by-step way that Ziervogel and Methner (2009) wrote their guide. The guide puts science at the top, giving instructions on how to implement practice and policy to be more sustainable. Similarly, the Choy et al. (2010) report on climate change in South East Queensland puts science in the service of practice and public policy. In this report the top-down relationship manifests in several explicit directives. For instance, the report notes that: "an improvement in disaster risk assessments and the prevention, preparedness, response and recovery phases of disaster management will be necessary in order to deal with the expanding and changing risks caused by climate change" (Choy et al. 2010, ii).

Getting around the situation described above, calls for the incorporation of methods from the interpretivist/constructivist, critical theories and participatory paradigms. Methods involving interviews, focus groups, deconstruction of text and language, face-to-face learning and the analysis of power structures could produce much needed information on how practitioners view climate change. These methods could place the

researcher in an emancipatory environment. The views of practitioners can be likened to windows on the environment they operate in. For instance, all tiers of government are influenced by the ideology of the day. How government practitioners view climate change is not only a matter of personal conviction but also of organisational functionalism. An understanding of current ideological undertones in government can help researchers in developing effective recommendations that are likely to have an influence. There is no hard and fast rule to apply in this regard, but sensing the type of ideology is likely to create a better understanding of the undercurrents in government and of the ways to interact with practitioners. Governments have limited financial and human resources at their disposal to execute policies. These restraints can place an enormous strain on government officials to deliver services. The day-to-day functioning of officials is also affected by the multiple tasks they need to carry out to implement programmes within a specific time frame. An understanding of how government officials operate could help in fostering higher levels of empathy in scientists, which could influence the recommendations they make. A scientist who takes realities into consideration might think twice about a specific set of recommendations and might opt for more realistic recommendations.

It is also telling that both reports rely to a varying extent on a single theory to interpret and direct matters for the practitioner. In the case of the South African guide, Ziervogel and Methner (2009) implicitly refer to adaptive management, especially when they outline the criteria of an "adaptive" municipality and talk about adaptive capacity and resilience. Choy et al. (2010, ii) refer to adaptive management explicitly when they call for "planning processes through adaptive management in order to deal with uncertainties and evolving climate science." A repertoire of theories can assist in breaking from this mono-theoretical mould. To reiterate, it is not wrong to describe things based on one theory. Yet, there is a price to pay. Adaptive management is very much in vogue to plan for and implement practices to make communities, governments and companies more resilient. Yet, rarely do one-size-fits-all solutions deliver on their promises; moreover, they can have a debilitating impact on practitioners as they get demoralised (e.g. Miller, Hartwick, and Breton-Miller 2004) when implementing the principles of adaptive management and see that change is happening slowly or not at all. It can also have an impact on scientists in the long run. As practitioners see that the recommendations put forward by scientists have a minimal effect or no effect at all, they could start losing faith in the ability of scientists to deliver sound recommendations for the problems facing the human condition. This view by practitioners can erode the legitimacy of science and scientists, as well as the methods they employ to generate knowledge and ultimately knowledge itself. As mentioned earlier, using a repertoire of theories can aid in avoiding this. There are a variety of social theories. Lemert (2013), for instance, discusses the thinking of over 100 social theorists. It is possible that climate change and its impact on local and provincial governments can be made more understandable by approaching the issue from the perspectives of a variety of theories or an endless integration of theories. This integration is particularly useful in the case of climate change that involves a variety of sources and global impacts.

How can researchers and practitioners approach such integration? Firstly, it might be possible to look at the predominant theory in vogue and question its applicability. For all involved in the policy-making process there is wise council from Miller and Spoolman (2011, 2): "Be sceptical […]. Do not believe everything you hear and read including the content of this [paper] without evaluating the information you receive. Seek other sources and opinions." According to them, doing that will sufficiently arm practitioners and scientists to become "good baloney[2] detector[s]." Sometimes we forget to "question everything and everybody" as we become embroiled in our views of reality. This questioning attitude was not lost on Einstein (cited in Uhlenbrook 2006, 3581) who said that: "The important thing is not to stop questioning." Questioning the applicability of one dominant theory will bring to light alternative theories to highlight issues. Questioning does not mean that adaptive management should be discarded entirely. Yet, a questioning attitude could force one to consider alternative views of reality and, by implication, theories that explain reality. As already mentioned, not one theory will always explain everything happening in the world (Albert and Buzan 2013; Aron 1967). What is more, one theory will not come up with solutions to all the problems facing the world.

Secondly, one should consider theories that seem likely candidates for being a close fit to explain a phenomenon and the opportunities and problems it could possibly create for the stakeholders involved. A glance at PULSE[3]'s list of theories (Meissner 2017, 2021) indicates that there is a theory that could be of potential value to government officials, namely, the ambiguity theory of leadership by Alvesson and Spicer (2011). The central premise of this theory is that leadership is a perception and not a practical scientific conception. Leadership varies in time and space—it is not the same thing in all contexts and times. This multi-dimensional meaning of leadership brings forth the ambiguous interpretations, understandings and experiences that people attach to leadership. Ambiguity is something leaders must cope with; they do not always know what their roles are. The concept "leadership" is used to achieve certain things. In other words, the utility of the concept serves as a lever to create certain things, especially in making us believe that leadership can do wonders, which is not the case, according to Alvesson and Spicer (2011). This silver-bullet attitude towards something is also applicable in the case of other concepts such as adaptive management, sustainability, and resilience. Combine these with the ambiguity theory of leadership (Alvesson and Spicer 2011), and one starts to see that leadership, adaptive management, sustainability and resilience are not always noble and good objectives. They are created to serve other things as well. For instance, leadership means nothing without followers, and followers usually interpret leadership and their expectations of leaders in a certain way (Alvesson and Spicer 2011). Cast the scientist in the role of the leader with specialised knowledge, and this interpretation of leadership becomes apparent. Society expects scientists to provide sound scientific knowledge, make recommendations about and have answers to

2 In the United States, "baloney" is slang for nonsense (Oxford Advanced Learner's Dictionary 2005).

the myriad of problems facing humanity. It becomes clear that scientists need to deal with ambiguity like any leader. However, positivism is not good at dealing with ambiguity; there is, after all, a one-to-one mapping between research statements and reality (Weber 2004; Meissner 2021) or only one truth or reality (Lincoln, Lynham, and Guba 2011) embedded in positivism.

Considering the above arguments, it is possible to integrate adaptive management with the ambiguity theory of leadership. Insight into adaptive management will give practitioners a better understanding of the viable options for the future through planning and experimentation. It focuses on processes. Knowledge of the ambiguity theory of leadership will help practitioners understand the ambiguity of their leadership roles, the roles of followers, what is expected of them, and the fact that there are different contexts and histories that could impact on their sense of reality. The ambiguity theory of leadership is a close-fit candidate to take into consideration when dealing with adaptive management because of its focus on a specific role (Meissner 2017) within an organisation, be it a large corporation, government entity (e.g. municipality or a provincial or national government department or a federal state department), civil society organisation or science council. This theory, therefore, takes the human element in adaptive management processes into consideration.

Theories other than adaptive management and the ambiguity theory of leadership are also applicable to the issue of climate change and its varying impacts on society. A few of these theories that come to mind are: (1) the interactive governance theory that states that governance, often not harmonious, depends on the interaction of a variety of actors and their interactions (Kooiman and Bavinck 2013); (2) the modernity theory that notes that the era of modernity arose due to the advent of the industrial revolution (Adams 1993) and is described by Giddens (1990) as a juggernaut or a runaway engine that has enormous power that humans can control to some extent but that can also get out of hand; and (3) the theory of risk society that gives credence to the notion that modernity has created a number of risks or large negative impacts on environmental and social systems (Björkman 1987; Ritzer 2000). The link between these theories and climate change is recognisable. Climate change, a result of the burning of fossil fuels that has reached unprecedented levels since the industrial revolution started, has created risks not only for the environment but also for society at a variety of levels. The amelioration of these risks is in the form of interaction among a variety of actors in an interconnected and often non-harmonious fashion. Because of this and since it is a global phenomenon, climate change will remain at the top of the international agenda for the next few decades to come.

Addressing the problem of climate change will not only find credence within the natural sciences because of its centrality to the investigation of the phenomenon. Social science and social scientific theory also have a role to play. After all, the problem emanates from society, and what better way to investigate the sources and societal vulnerabilities of climate change than through a social scientific and alternative paradigmatic and

theoretical lens. On a paradigmatic level there is one fundamental difference between the natural and social sciences: agency (Lebow 2014). Agency is an important element in the development of adaptation plans. Nevertheless, it would appear that the scientists who developed the two reports analysed in this article did not adequately address agency. In this regard, an interdisciplinary approach would be able to ameliorate the situation. What I mean by this is that, contrary to the two reports I have analysed, adaptation plans should not rely solely on natural scientists. The foundation of both these studies is a predominantly positivist paradigm. To be truly interdisciplinary, scientific teams should ask to what extent they are using different paradigms in their ontology and epistemology, and how they can integrate alternative paradigms and theories for a deeper understanding. One way of achieving a deeper understanding is to ask questions differently. I am in agreement with Cornut (2014) who posits that one should not only ask "why x?" to get a better understanding of a problem or issue. One should also ask "why x rather than y?" In other words, instead of asking why we should use adaptive management as the basis for climate change adaptation policies, we should ask why adaptive management rather than the ambiguity theory of leadership, or the theory of interactive governance, or modernity or risk society should be used as the basis for developing climate change adaptation policies. By asking questions in this way we juxtapose theories from different paradigms and bring about a deeper understanding of problems. Doing that also assists in the creation of opportunities because researchers will be able to view the role of actors (i.e. scientists and practitioners) as well as contexts in a different light through the integration of metatheoretical assumptions and different theories. If one uses the answers to these questions as a starting point, one can take a step in the direction of conducting an interdisciplinary investigation in order to gain a deeper understanding of complex problems like climate change.

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