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eThekwini's green and ecological infrastructure policy landscape: research paradigms, theories and epistocrats

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Abstract

The purpose of this paper is to indicate how dominant research paradigms, social theories, and an epistocracy influence the governance of green and ecological infrastructures within a South African local government context. Paradigms and theories play an important constituting role that (local) government actors and institutions actively and subconsciously promote within the green and ecological infrastructure policy landscape. Research conducted by the author indicates that epistemic actors within the eThekwini Metropolitan Municipality, South Africa, use paradigms and theories to promote green and ecological infrastructures, as materialities, coupled with climate change adaptation and mitigation and water governance and security aspirations. I conclude that an epistocracy is active in the municipality and that it promotes the development and implementation of the infrastructure types through a positivist paradigm and accompanied theories. In this article, I will report on a two-year study that investigated eThekwini's green and ecological infrastructure policy landscape.

Keywords Research paradigms · Social theories · eThekwini · Ecological infrastructure · Green infrastructure

1 Introduction

What role does research paradigms, social theories, and epistocrats play in the governance of green and ecological infrastructure? In this article, I report on a two-year research project I conducted of the eThekwini Metropolitan Municipality's green and ecological infrastructure policy landscape. The municipality's Environmental Planning and Climate Protection Department (EPCPD), in partnership with various external actors, is the entity responsible for such infrastructure initiatives. The background knowledge for the article is research paradigms (hereafter worldviews or paradigms) and social theories (perspectives) and their role in the science-policy interface. Paradigms and theories play a role in how we view the world and develop and implement policies to advance the human condition. This

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implies that worldviews and perspectives manifest in human actions influencing the policy and political domains.

Research that I conducted over a two-year period indicates that research paradigms and social theories play a central role in the eThekwini Metropolitan Municipality's green and ecological infrastructure policies that, in turn, aspire to promote climate change adaptation and mitigation as well as water governance and security. Governance, broadly defined, is the result of interactive socio-economic and political forms of governing that result in problem solving and opportunity creation (Meissner, 2015a, 2015b; Rhodes, 1996; Rosenau, 2006). Politics shape governance (Tempelhoff et al., 2019) and security concerns. Politics, and the study thereof, furthermore, involve a critical engagement with the mechanisms and dynamics that produce and sustain power relations (Wilson et al., 2019). I argue that a symbiotic relationship exists between politics and governance and security issues with local government politics and policies infused with specific paradigms and theories that contribute to the political landscape and power relations. These interactions are also influenced by discourses emanating from the global governance environment (i.e. climate change).

Considering this, green and ecological infrastructure form part of the infrastructure and landscape ecology policy paradigm that is increasingly being promoted as the best design technique for dealing with the risk society. Discourses advocated by landscape and ecological urbanism promulgate a new and improved "post-carbon" and "post-Euclidian" infrastructure, which is juxtaposed in opposition to engineering as a discipline upsetting the natural balance (De Block, 2016: p. 367). From an ecocentric-policy advocacy perspective, the role of natural spaces and resources in the provisioning of services that support socio-economic development are not well integrated into the social development discourse and planning (Musango et al., 2017; O'Farrell et al., 2019). Further from this perspective, green and ecological infrastructure has a 'green' ideology (Warner et al., 2018) highlighting the role of 'natural' infrastructure in mitigating natural and human-induced risks. Within this wider policy discourse, green and ecological infrastructure considerations have typically been viewed as a reactive rather than proactive method for mitigating impacts such as biodiversity loss and climate change (Langton, 2015). From this, the policy prescriptions of the discourse are palpable, especially when viewed within the narrative of climate change as a global concern. Green and ecological infrastructures are some of the remedies to mitigate against the threat of a so-called climate apocalypse. Green and ecological infrastructure policy paradigms and perspectives are based on an empiricist epistemology, ontology, and methodology.

When discussing paradigms and theories, it is inevitable that normative elements, such as beliefs, culture, ideas, ideologies, and social values, enter the argument. Practitioners and researchers, alike, often ignore normativity, especially when addressing technical issues. Consequently, practitioners and researchers often develop policy programmes and strategies based on partial, or one-sided, understandings. The main momentum, relevance, and public awareness provided to ecology have arisen from its scientific support and proof, not from its moral or political attitude, which is a unique feature of ecologism as an ideology. Many ecologists have linked their own actions in their personal lives, from being vegetarians to scientists employed by a local government, to a global or universal problem (Vincent, 1995) such as anthropogenic climate change.

What we also need to consider is the context in which worldviews, perspectives, and policy developments evolve. Paradigms and theories as cognitive tools play a significant role in causal chains since concrete activities within policy processes are often not the causes in themselves but are the consequences of paradigms and theories that practitioners,

of all sorts, actively or subliminally advance in practice. To this end, Andreotti (2006: p. 7) states that 'Theory without practice is idle, practice without theory is blind'. Gay (1979: p. 178) cites Zais's (1976: p. 87) version of this statement: 'Theory without practice is idle speculation while practice without theory constitutes little more than blind or random groping'.

The article will unfold as follows. In the first section, I will briefly outline and discuss water management at local government level, which is important since an interdependent relationship exist between water resources and green and ecological infrastructures. I then examine the link between green and ecological infrastructures and water governance within eThekwini. I follow this with an appraisal of the research paradigms and social theories used by the epistocracy operational within eThekwini, and its external research partners, and how it governs green and ecological infrastructures. In the penultimate section, I discuss the epistocracy within the policy landscape and how it promotes certain political interactions at the expense of the wider public interest. I end with a discussion and conclusion.

2 Water management and South African local government

South African local governments enjoy considerable independence when deciding what to do and how to do it within constitutional confines. The South African Constitution (RSA, 1996) is the framework that divides the functions and powers between the three spheres of government: municipal, provincial, and national (de Visser, 2005). Municipalities, as the sphere of government closest to its citizens (Songer, 1984; Zybrands, 2011; Meissner et al., 2019), implement policies, initiatives, regulations, or decisions that can have a direct bearing on people's lives, for better or for worse (Meissner et al., 2018). It is for this reason that the Constitution (RSA 1996), the Water Services Act (No. 108 of 1998) (RSA, 1998) and the Municipal Systems Act (No. 32 of 2000) (RSA, 2000; Weaver et al., 2017) specify that water service provisioning and management are the responsibility of municipalities.

The Municipal Systems Act (No. 32 of 2000) enables municipalities to progressively uplift local communities socially and economically. According to this Act, local governments must provide the central principles to ensure universal access to essential services that are affordable for all (RSA, 2000).

Du Plessis (2010: p. 265) argues that 'Local government is no longer [particularly after the constitutional transformation of 1996] regarded as mere functionary or an agent of national and provincial government and its constitutional mandate centres, in the main, on the idea of "developmental local government". Local governments, therefore, do not only have considerable autonomy. They also play a developmental role that is expressed by means of inclusive service delivery to all their residents. It is within the scope of autonomy and inclusive service delivery that I investigated eThekwini's green and ecological infrastructure policy landscape and its linkages to water governance and water security.

Although South African local governments have considerable autonomy, they are not immune to the politics of the ruling African National Congress (ANC). Government and political culture are still extremely hierarchical and, to a certain extent, authoritarian,[1] and centralised. One of the reasons for this can be attributed to the ideology of the ruling ANC that also controls the eThekwini Municipal Council. This ideology informs a

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[1] I would like to thank one of the anonymous reviewers for this idea.

command-and-control style of governance at all tiers. The clash between government administration and politics causes an ANC-in-government to become caught in a web of interconnected political pressures (Booysen, 2015). 'The protection of political superiors rules supreme and the misbehaving troops (those aligned to a dominant faction and certain that they have licence to make money in the state) are either untouchable or guaranteed to be treated softly' (Booysen, 2015: p. 95). In 2019, the former Mayor of eThekwini and close political ally of former President Jacob Zuma, Councillor Zandile Gumede,[2] resigned as mayor due to charges of attempting to influence the award of a tender of about R208 million for a Durban solid waste contract, but remained on as an ordinary councillor[3] (Meissner, 2021a).

Due to a culture of ANC cadre deployment associated with systemic corruption (state capture), most local governments, especially those that are supposed to service the rural areas, have lost their administrative and governance capacity. Water and sanitation service delivery by municipalities is one of the most pervasive indications of this diminishing capacity. During the tenure of former President Zuma, an important element responsible for this diminishing statehood is the ANC's national democratic revolution ideology. The purpose of which is to bring the economy, society, and the state under party control (Meissner, 2021b). That said, politics and governance in most policy issue areas are not strange bedfellows, particularly not in a state dominated by a single political party.

3 Ethekwini

The eThekwini Metropolitan Municipality is the local authority that governs the city of Durban, which is situated on the east coast of South Africa in the KwaZulu-Natal Province (Meissner, 2018, 2019). In terms of the South African economy, Durban is an important port city (Corbella & Stretch, 2012), with a large shipping container terminal enabling container shipping into and out of the port of Durban (Mutombo, 2014).

Apart from playing a key role in the South African economy, Durban is also a popular tourist destination and is, by far, the most-visited place in KwaZulu-Natal by domestic and foreign visitors (Schalkwijk et al., 2017). The area in which the municipality is located supports a wide variety of terrestrial and aquatic ecosystems. The water that flows from the 17 catchments, such as the Isipingo, oHlanga, Palmiet, Umhlangane, Umhlatazana, Umlazi, uMngeni, and Umkomazi Rivers, influences Durban's water quality and quantity (eMM, 2007; Meissner et al., 2019) and, in effect, tourism. The uMngeni, with its source near the Drakensberg Mountains, is the largest of these rivers and a rapidly developing river catchment (Namugize et al., 2018) plagued by water quality problems.

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[2] At the time of my research in 2018, Gumede as the Vice President of C40, a global network of the world's mega-cities that is closely linked to matters pertaining to climate change. C40's mandate is to support cities to collaborate, share knowledge and drive action on climate change (C40, 2020).

[3] In May 2021, Gumede agreed to step down in accordance with the ANC's 'step-aside resolution'. This means that she could not act in any ANC leadership position but could remain in the KwaZulu-Natal legislature after her ousting from the municipality (Harper, 2021; Kotzé, 2021).

4 Green and ecological infrastructures

Green and ecological infrastructure conceptualisation and provisioning differs in built-up and rural areas, since the former have distinguishable biophysical characteristics, compared to rural areas, due to altered surface cover (Gill et al., 2007) such as paved roads and sidewalks. These features manifest, for instance, in altered energy exchanges creating heat islands and hydrology alterations generating increased water runoff (Gill et al., 2007). Because of these characteristics, green infrastructures are more applicable to metropolitan environments than ecological infrastructures, which are prominent in rural locations. The place and purpose of both infrastructure types depends on the nature and extent of civil engineering development, or its absence. Even so, eThekwini is not exclusively reliant on green infrastructures to mitigate flooding and pollution but also on ecological infrastructures, since large parts of the municipality are peri urban and/or rural (Meissner et al.,). The municipality relies on the uMngeni River, which has its source in rural KwaZulu-Natal, for sustaining its economy and population.

In their definitions of an ecological infrastructure, Pringle et al. (2015) and Jewitt et al. (2015) observed it in relation to the ecosystem. They view it as 'a naturally-functioning ecosystem that produces and delivers valuable services to people' and that it is 'the nature-based equivalent of a built infrastructure'. Their definition was borrowed from the South African National Biodiversity Institute (SANBI), which notes that an '[e]cological infrastructure refers to a naturally-functioning ecosystem that delivers valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction. It is the nature-based equivalent of a built or hard infrastructure and can be just as important for providing services and under-pinning socio-economic development' (SANBI, 2019). This means that these definitions, elevate an ecological infrastructure to the same status, and with the identical function, as technological infrastructures.

The research of Pringle et al. (2015) and Jewitt et al. (2015) focused on the ecological infrastructures of the uMngeni River Catchment. According to Kotzé (2013), the uMngeni provides ecosystem services in the form of water, climate regulation, soil formation, and disaster risk reduction. Since large parts of this catchment are rural, Kotzé (2013) argued that such areas contain the vital ecological infrastructure for maintaining and restoring the river. These essentials, including indigenous forests and wetlands, contribute directly to rural livelihoods.

To bring this notion closer to the subject at hand, in a press release, dated 28 February 2013, after a workshop to establish the uMngeni Ecological Infrastructure Partnership (UEIP), officials from eThekwini's Water and Sanitation Department and EPCPD defined ecological infrastructures as follows: 'Ecological (or natural) infrastructures refer to functioning ecosystems that produce and deliver services that are of value to society, such as fresh water, climate regulation, soil formation, and disaster risk reduction' (eMM, 2013). This definition is very similar to that of the SANBI description. In fact, SANBI played a major role in the formation of the UEIP (Pringle, 2020; Stuart-Hill, 2020) indicating an interdependent link between science informing public policies and programmes.

eThekwini convened the workshop 'to catalyse a new partnership initiative that was aimed at unlocking the potential of natural ecosystems in the water security equation' (eMM, 2013). During the workshop, eThekwini officials indicated that an ecological infrastructure has a dual function, namely, to improve the quality of the uMngeni's water resources and to create jobs by restoring and maintaining it. In the light of the establishment of this partnership, Neil McCleod, the former head of eThekwini's Water and

Sanitation Department, said that the engineering solutions for securing water for Durban had not worked and that a 'novel approach is needed for improving the quality and the quantity of water in the uMngeni through the restoration and maintenance of the catchment's [sic.] natural infrastructure, i.e. its ecosystems' (eMM, 2013). This 'novel' approach did not develop from a transdisciplinary scientific agenda, with the social sciences playing almost no role, despite the sociopolitical nature of environmental concerns.

This is exemplified by eThekwini's definition of ecological infrastructure as the water security improvements that are linked to water quality and quantity, both quantitative matrices at home within the natural sciences and engineering disciplines. Considering this, eThekwini juxtaposes two ontologies (realities), namely, an ecological and a grey infrastructure, with the ecological infrastructure supplementing the grey infrastructure.

Globally, researchers emphasise the ecosystem service functioning capabilities of an ecological infrastructure, while, in the case of eThekwini, this infrastructure has a closer relationship with climate change adaptation and mitigation and water governance and security, where the latter is defined in terms of water quality and quantity. Green and ecological infrastructures are, in eThekwini's case, part and parcel of local governance initiatives, and more specifically environmental governance when considering the role of both infrastructures in alleviating climate- and water-related problems such unavailability and pollution.

5 Green and ecological infrastructure policy landscape: positivism dominates

5.1 Data collection

In 2018, I interviewed 16 municipal officials and some of their external research partners from several research institutions (e.g. the University of KwaZulu-Natal (UKZN), the Council for Scientific and Industrial Research (CSIR), the Oceanographic Research Institute (ORI)) and environmental non-governmental organisations (the Wildlife and Environment Society of Southern Africa (WESSA)) and an interest group, the Palmiet River Watch. Together with the municipality, these partners are responsible for developing and implementing green and ecological infrastructure initiatives.

I employed a participatory and iterative data collection strategy that incorporated a snowball technique for respondent participation identification. I administered a structured open-ended questionnaire during face-to-face interviews. I was unable to meet with two of the respondents face-to-face and therefor conducted the interviews either telephonically or via Skype. I interviewed the respondents about their understanding of the concept of a "green infrastructure". A follow-up question from this was whether they viewed green and ecological infrastructures as two different elements of the same phenomenon. I also asked them about their knowledge their knowledge of municipal policies, plans, bylaws, or standards for implementing green and ecological infrastructures that are directly related to water security. Furthermore, I questioned them about specific green and ecological infrastructure initiatives that are being implemented by eThekwini to improve water security. I then asked them to evaluate them to evaluate the content, implementation, and the financial and social costs and benefits of the operations. The final question was about which stakeholders the municipality collaborates with to implement such water improvement projects. I also conducted site visits to the Buffelsdraai Landfill, part of the Palmiet Rivert catchment, the River Horse wetland, eThekwini's green roof initiative in Durban's inner city and
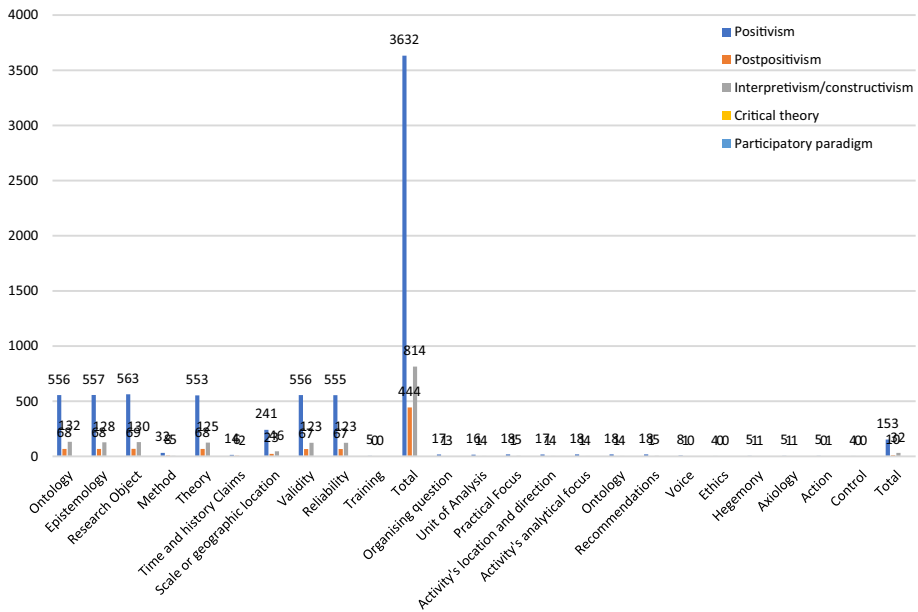
Fig. 1 Paradigm assessment result

the Durban Botanical Gardens. These visits afforded me the opportunity to get a first-hand view of some of the initiatives in and around the city and to photograph them. Photographs provides a visual discourse for understanding the subject matter. I utilised photographs that I had taken on previous field visits to Durban, as well as photographs from some of the stakeholders that depict certain incidents, such as the municipal waste pollution on the beaches after the 2019 rainstorm (Meissner, 2021a, 2021b).

5.2 Data coding and analysis

After conducting the interviews, I transcribed them and saved them in a Portable Document Format (PDF). I emphasised the sections that I wished to analyse by using the PDF highlighter function. Using the PULSE^3 digital version developed by Dr. Marc Pienaar, I uploaded each interview into the programme. The digital version recognises the tinted text, which enables the analyst to evaluate it by using the PULSE^3 analysis selection capability, which consists of a drop-down menu of its components: paradigms, perspectives (theories), causal mechanisms and critical problem-solving theories. With these available options, the analyst can analyse the highlighted text in terms of the dominant paradigms, theories, causal mechanisms as well as critical and problem-solving theories, that are contained in the transcribed interviews (see Meissner, 2014, 2016, 2017, 2019, 2021a).

I developed PULSE3 specifically to analyse the presence or absence of scientific paradigms and social theories. The framework, furthermore, is a tool that identifies scientific paradigms and social theories that influence policies and strategies, as well as their remedial action (Meissner, 2016). The differentiation between positivism, postpositivism, interpretivism/constructivism, critical theories, and the participatory paradigm profiles research inherent in policies, programmes, and plans. PULSE3

determines the paradigmatic and theoretical profiles of policies, programmes, and plans by quantifying the extent of such initiatives' conformity to the five paradigms. The assessment tool considers the way knowledge and policy recommendations are generated by scientists and practitioners (Meissner, 2017).

My PULSE[3] analysis indicates that the respondents generated the knowledge and recommendations contained in their interview responses from a positivist worldview. The interpretivism/constructivism paradigm followed, trailed by postpositivism (see Fig. 1).

Several explanations exist for this. The first relates to the subject at hand. Green and ecological infrastructures fit neatly within the natural sciences, especially considering the central notions of biodiversity and climate change. In short, eThekwini's main motive for implementing green and ecological infrastructures is climate change adaptation and mitigation with biodiversity the main driver of these actions.

5.2.1 Biodiversity

Considering biodiversity, one of the respondents, an engineer working for eThekwini, coined his understanding of the concept 'green infrastructure' using biodiversity and its function in retaining flood water. He remarked that: 'There [in the retention ponds] you have all your various grasses. This is what the environmental people like and there is lots of biodiversity, but it also functions as a storage place for the storm flow.' Another interviewee, a lecturer at the University of Kwazulu-Natal (UKZN) who works closely with eThekwini on green infrastructure matters said the following: 'eThekwini is very good in understanding the difference between biodiversity, ecosystem services and ecological infrastructure. Biodiversity is part of that [ecological infrastructure], but it is also different from it.' Another municipal official indicated that she worked within the 'biodiversity department', and that 'the department has the function to protect biodiversity and, for me, that biodiversity is our [ecological infrastructure]'. A researcher from the Institute for Natural Resources (INR) in Pietermaritzburg, who also worked closely with eThekwini opined that: 'I think the intention [with green and ecological infrastructure policies] is around biodiversity conservation…in terms of their mandate under Sect. 24 of the Constitution, where people have the right to a clean environment'.

Considering the concept 'biodiversity', Slootweg (2005: p. 37) noted that scientists treat it as an 'uncomplicated concept' and as 'a visible reality that surrounds and supports us.' This stands in contrast with the concepts 'green and ecological infrastructure' with their multiple meanings. The 'uncomplicated' nature of 'biodiversity' relates directly to positivism's theory of truth, where there is a one-to-one mapping between research statements and reality, or one truth or reality (Lincoln et al., 2011, 2018; Meissner, 2017; Weber, 2004) when considering biodiversity and how it is conceptualised and characterised. Biodiversity's characteristics are also measurable, expressed as a loss or gain (e.g. Possingham & Wilson, 2005; Scholes & Biggs, 2005) with data truly measuring reality (Meissner, 2017; Weber, 2004), another positivist characteristic. This is what Lincoln et al. (2018) call 'raw realism', or the pretended 'hard science', where the researcher and reality are separate, and the purpose of research is to control and predict (logical deduction) nature and its influence on people. This type of science is steeped in empiricism, with objectivism being the central feature. It is within this ontology that the respondents frame eThekwini's green or ecological infrastructure initiatives.

5.2.2 Interpretivism/constructivism

When contemplating the results of the PULSE3 paradigm assessment (Fig. 1), it is important to note the prominence of interpretivism/constructivism. This indicates that the respondents are not only defining the concept of green and ecological infrastructures within the frame of a 'raw realism', but they also view the concept in relativistic terms, as defined by the local and specifically constructed and co-constructed realities (Lincoln et al., 2018). Even so, these framings fall within the structural and measurable epistemology and ontology of biodiversity, climate change science, and, as such, is epistemologically and ontologically subordinate to the raw realism of biodiversity's and climate change's empiricism. This means that they construct and co-construct the concepts within an overarching raw realism framing.

One of the interviewees, a senior researcher at the Council for Scientific and Industrial Research (CSIR) said that a green infrastructure is '[e]ssentially…investment and development in projects in the green economy space'. When I asked him if there is a difference between green and ecological infrastructures, he answered by saying: 'In theory… there should be a difference. An ecological infrastructure, to me, is more about things like floating wetlands, which are very specific projects, technologies or infrastructures that are developed to assist with ecological aspects, like water functioning… A green infrastructure is something like a green building, or it could be a roof top garden, or solar panels on the roof… It is at a higher level and talks to the whole idea of the sustainable development debate.'

For some of the respondents, the answer to the question 'What is your understanding of the concept "green infrastructure?"' was not straightforward, which is a further indication of the interpretivism/constructivism paradigm. The lecturer from UKZN, answered in the following way: 'When you say, "green infrastructure", it is always a bit difficult, because I think that people use these terms interchangeably. Sometimes, green infrastructure is used…more in the policy or applied fields. However, I tend to use ecological infrastructure more.'

5.2.3 Recommendations

When the respondents spoke about recommended actions to improve water security, they also framed these in positivist terms. For instance, a municipal official said that the municipality plans to set up a water fund, in collaboration with The Nature Conservancy (TNC), a transnational interest group. According to the TNC, it uses science for the advancement of policies that address the problems faced by the environment and people (TNC, 2019a). The official argued that before one can establish such a fund, one needs to look at the feasibility thereof, in terms of the sources of revenue, and whether the municipality will be able to motivate downstream water users and beneficiaries to contribute financial resources to the fund.

This indicates that the municipality conceptualises water security in a specific way, in that it relates only to water quality and quantity. What is also noteworthy is that a water fund is a positivist, instrumental and technocratic way of improving water security. A water fund is a financial mechanism that is used to address the water quantity and quality problems faced by local governments and the private sector. Water users can invest in five strategies to reduce pollution and improve water security, namely, forest

protection, reforestation, agricultural best management practices, riparian restoration, and forest fuel reduction (TNC, 2019b); these are all forms of green and/or ecological infrastructure practices.

The feasibility study, mentioned by the official, is in the form of a cost–benefit analysis, which utilises empirical data and constitutes positivist planning (Meissner, 2015a, 2015b) or development. It is not only positivist, but also technocratic. Technocratic governance goes hand in glove with expert knowledge. Technocrats are experts who formulate and implement economic and development policies to achieve a set of targets. They are usually civil servants or professionals with special training (Khalid & Abidin, 2014). Green infrastructure is the purview of ecologists and engineers. Considering engineers' role, they design and implement such systems by utilising technocratic decision-making processes for the protection of urban properties and for investment opportunities, by complying with regulations, as well as by stimulating and promoting urban development (Finewood et al., 2019: p. 910). This form of technocratic governance has political and power relations implications for fixing "wicked problems", such as climate change, that are inherently political (Warner et al., 2018). Through exploration of the natural world, the natural scientists (e.g. ecologists and botanists) work closely together with the engineers that apply this knowledge to design, build and maintain green infrastructure. What is also noteworthy is that the feasibility study encapsulates economic technocracy in the relationship with the TNC. In this regard, market and economic rationality is at the forefront of the feasibility study and the relationship between the EPCPD and the TNC.

Even so, and although this argument indicates the potential of economic knowledge to play a role in implementing green and ecological infrastructure, a more inclusive social scientific agenda is also necessary. In this regard, local governments should be more epistemically inclusive and take onboard a deeper transdisciplinary attitude towards city planning.

Structurally, the respondents, furthermore, framed their recommendations within a positivist manner and specifically through the lens of 'Who governs and who benefits?' (Hobson & Seabrooke, 2007, 2009, as cited in Meissner, 2017). This analytical organising question assumes that there is a hierarchical order manifesting in the municipal-society structure. This grading consists of the state actors, who govern at the top, and the non-state entities or individuals who benefit (Hobson & Seabrooke, 2007) at the bottom. We see this manifesting in the responses of several municipal officials and their research partners. One official said that the eThekwini Municipality should do more to educate people and communities about alien vegetation clearing and rainwater harvesting, as this would benefit the people and communities. The senior research from the CSIR recommended more studies by the municipality into the benefits of green and ecological infrastructures for the wider public. Another municipal official mentioned the feasibility of the water fund, while an interviewee from a local interest group, the Palmiet River Watch (PRW), noted that the municipality should govern more for the benefit of everybody in the uMngeni River basin, and yet another municipal official argued that the municipality should invest more in 'capex projects' that will, by implication, benefit Durban's residents.

Now that I have established that positivism dominates, not only in terms of knowledge generation and recommendations, but also in political structural terms, I will discuss the epistocracy operating within the municipality. The central government structure in this regard is the EPCPD and the officials attached to this and other departments working with the EPCPD.

6 Ethekwini's epistocracy

The term 'epistocracy' means 'the rule of experts' (Min, 2015; Tremmel, 2018) or 'the rule of knowers' (Moraro, 2018). Wissenburg (2019) sketched a more elaborate conceptualisation when he wrote that an epistocracy is rule that is exercised by individuals in society who have a superior knowledge of politics. In this regard, according to Lucky (2019), epistocrats claim that they can improve the outcomes of instrumental policy, since they possess a superior knowledge that informs governance (Lucky, 2019; Min, 2015) and politics. Even so, in certain instances, epistocrats may not have a superior knowledge of politics but they could wield political power in a specific political arena, since they possess the relevant knowledge to make good policies (Mulligan, 2015) concerning specific issues. This indicates that epistocracies are not only connected to the wider political context, but also to specific issues like green and ecological infrastructures, climate change adaptation and mitigation and water security.

From my research, I observed that the municipality's EPCPD consists of numerous experts who focus on biodiversity and climate change adaptation and mitigation as the foundations underpinning the green and ecological infrastructure policy.

These officials not only play the role of local government administrators, but also of scientists. This would be the case for several eThekwini officials who I interviewed. I identify numerous officials who have published books, book chapters and peer-reviewed articles (e.g. Mather, 2008; Roberts et al., 2012; Roberts & O'Donnoghue, 2013; Douwes et al., 2008; Douwes, 2018; Douwes et al., 2018). Roberts is the most prolific producer of scientific literature among the officials mentioned. She was responsible for establishing the Durban Metropolitan Open Space System (D'MOSS) and the EPCPD. This Department oversees the development and implementation of eThekwini's Municipal Climate Protection Programme, which includes the development and implementation of appropriate climate change adaptation and mitigation strategies, like the Durban Climate Change Strategy (DCCS). Since the late1980s these officials have produced 90 scientific publications either as lead or co-authors. Some of these include chapters in the Intergovernmental Panel on Climate Change's (IPCC) assessment reports (e.g. Revi et al., 2014).

How does the notion of an epistocracy fit in with eThekwini's green and ecological policy landscape? As a local government, eThekwini is a political organ that has been established by the South African Constitution. It also means that the eThekwini Council needs to approve the implementation of green and ecological infrastructure projects, such as the water fund, should it come to fruition. Municipal Council approval involves a political function. Based on this argument, the link between politics and eThekwini's green and ecological policy arena is not difficult to comprehend in that the experts operate within this local political environment.

In general, epistocrats desire a certain shape of society and, typically, long for ends, rather than means (Wissenburg, 2019). Tremmel (2018) and Wissenburg (2019) argue that we should make a distinction between an epistocracy and a technocracy. A technocracy is the rule of those that are most skilled in a practice, or those who use a means. That said, we cannot completely ignore the concept 'technocracy', since it is tied explicitly to the recommendations made by the interview respondents mentioned earlier. Whatever the case may be, positivism dominates the technocratic process (means) as well as the aspired outcomes (ends) of the green and ecological infrastructure initiatives and as such also has a political function as the main paradigm guiding green and ecological infrastructure policies.

What are the advantages of an epistocracy? Modern societies are large and complex, with the result that political problems, such as climate change, are multifaceted. According to Min (2015), it is for this reason that society should appeal to experts for policy development and evaluations. Efficient instrumental policy development happens through cost–benefit analyses that are based on positivism, since scientists exclude any reasonable doubt from the process (Wissenburg, 2019). The numbers and equations speak for themselves. Estlund (2003) argued that certain political outcomes or policy consequences yield better results than others. If experts have a better knowledge than the public for forecasting the outcomes of a specific issue, then an epistocracy could produce better results in governing certain policy processes. What makes an epistocracy valuable is not so much the efficiency of the decision-making process, but more the scientific and professional knowledge of the epistocrats (Holst, 2012). If this is the case, the efficiency of policy decisions will increase, and the benefits for the rest of society will accrue.

Epistocracies play a compensatory role by correcting the relative unreliability of arguments, or the agential shortcomings, of authority actors (Viehoff, 2016). Because of this, Pederson (2014) claimed that improving the use and impact of science-based policies and practices at various levels can enrich the quality and legitimacy of democratic governance systems.

On drawbacks, in most forms of an epistocracy, it is possible that the more advantaged demographic groups, who have a superior education, would have more political representation than those that are less advantaged and educated. This is the demographic objection which argues, firstly, that such a form of representation is unjust and unfair. Secondly, it holds that some people will have more power than others, since epistocracies have the tendency to help the advantaged and harm the disadvantaged (Brennan, 2018). Based on this notion, epistocracies could suffer from several problems: lack of popular acceptance and actual, or perceived, illegitimacy, which may lead to instability and resistance, since citizens will likely be sceptical of any form of selection criteria or competence that determine political participation (Brennan, 2019).

Since experts are not epistemically privileged, they do not always know how their policies will affect individuals; only individuals know how the policies will directly or indirectly influence them. It is for this reason that deliberation is necessary to construct a more complete picture of the political problems and their solutions. Political problems are complex, which is reason enough for them to be framed from all the relevant perspectives, because what one person knows is often unknown to others (Meissner et al.,).

Judging by the number of publications by the eThekwini officials in the EPCPD and other departments, we can argue that these individuals are experts in their respective fields. I would not say that they have a superior knowledge of the politics that is practised at a societal level, but they certainly do have an expert knowledge on public governance in the municipality. They are employees of the municipality, as a local government legislative and political structure, and because of this, they possess an inherent knowledge of this political arena. Therefore, they wield political power in this institution.

About the green and ecological infrastructure projects, the EPCPD works towards improving the municipal policies by improving the biodiversity in the city, as well as climate change adaptation and mitigation. Their impressive list of publications shows that they utilise their knowledge to inform governance and politics in this arena. This means that we are not dealing with a technocracy, although the officials are skilled in numerous practices, such as catchment management and climate change adaptation and mitigation.

Based on my analysis, we are dealing here with a limited epistocracy that concentrates on perceived non-political issues that are politically relevant. It is limited to the eThekwini

municipal structure and geographical boundary, although it has a network beyond these boundaries. That said, the epistocracy's influence is predominantly limited to the eThekwini Metropolitan municipality. Considering political relevancy, I would argue that the issue did not automatically become political, but that it became politically pertinent through the work of Debra Roberts and her colleagues over time. Said differently, this limited epistocracy turned green and ecological infrastructures from a perceived non-political issue into a political matter, by the expert-infused practices in the local government arena. However, it appears that they are treating the green and ecological infrastructure issues as apolitical in that they involve only a limited number of experts in the execution of green and ecological infrastructure policies.

As already mentioned, it is also worth noting that municipal officials collaborate with experts from research institutions situated within, and outside of, eThekwini's geographical boundaries. The network of collaboration also includes NGOs, such as the Duzi uMngeni Conservation Trust (DUCT) and the Wildlife and Environment Society of Southern Africa (WESSA). The individuals who work for these organisations are experts in various fields of natural science. Since this collaborative network exists, we can also say that there is not only an internal eThekwini epistocracy, but one that extends beyond the municipality's governance and geographic boundaries, even into the IPCC. This is an indication that limited epistocracies operate not only within their direct structural sphere of influence (i.e. a municipality), but that they are also capable of playing a transnational and global governance role.

7 Discussion and conclusion

From a governance and politics perspective, the epistocracy interacts with internal and external actors that result in problem solving (e.g. increase biodiversity, climate change adaptation and mitigation and water insecurity improvement) and opportunity creation (e.g. the water fund and UEIP) within the municipality. By utilising positivist-informed ontologies, epistemologies, and recommendations, leads to a situation where the epistocracy relies on an oversupply of communication and interaction with like-minded external experts and networks to implement green and ecological infrastructure initiatives. In this regard, Solecki et al. (2021), state that:

'Promoting effective scientist-policymaker-practitioner collaboration on climate change at the city level is a recurring challenge and will need continual dialog and engagement. Many points of potential tension and misunderstanding exist and as a result those involved need to constantly communicate not only about the content of the conversation but also its context and their own positionality and power. Most important is transparency regarding whose voices are heard or not heard, and who has the capacity to control the dialog and process, and the creation of space for other less-heard voices'.

It is not impossible that positivist thinking instils a notion that the natural science-informed problem (climate change) is ameliorated by the same epistemological assumptions (e.g. empiricism) that, in turn, informs a top-down political structure. The limited epistocracy communicates with an elaborate network of 'like-minded' stakeholders. This could be reinforced by the ANC's top-down political culture. The party not only controls the eThekwini Municipal Council but also the South African state, which could further exacerbate the silencing of dissenting voices in the green and ecological policy landscape.

According to Van Klaveren (2018), where communities are involved, they are 'utilised' as a 'labour reserve'. One of the counter arguments is that the municipality's green and ecological infrastructure initiatives create much needed employment opportunities in a country where the official unemployment rate is a staggering 32,5% (StatsSA, 2021). This resonates with the developmental local government idea. Even so, do the municipal officials have the necessary expertise to stimulate economic activity and employment through green and ecological infrastructures? Their expertise lies within the natural sciences and engineering and not economics and it is, therefore, quite possible that they would not have such expertise. Since green and ecological infrastructures are rooted in the natural sciences and engineering, with the aim of solving environmental problems, the epistocrats would automatically view these infrastructures as opportunities to solve a wide range of problems, not only biodiversity, climate change, and future water insecurities. In this regard, this relationship between the epistocrats and community members who labours in the initiatives can be regarded as instrumentalised participation.

According to Van Klaveren (2018: p. 1), 'The state [eThekwini Municipality] and cooperative civil groups form and in-group, who embody expertise and a collective mandate, resulting in top-down expert-run projects.' This indicates limited 'open decision-making processes' where the epistocrats 'consult' with an 'in-group' of like-minded scholars. That said, multiple interests are recognised in so far as access to the in-group's epistemology is concerned. The boundary of the in-group's epistemology is that of positivism, interpretivism/constructivism and postpositivism (Fig. 1), with positivism dominating. This leads to group-think, with political implications when the in-group members play an important role in buttressing the policy landscape through their respective research endeavours. This could constitute the hegemony of the in-group, which could perceive itself to be immune against criticism and calls for better communication with Durban residents. That said, in theory, a consequence of such a group-think is bad decisions, along with cognitive inconsistency, improper assimilation of new data and information linked to old epistemological beliefs, a reliance on heuristics due to cognitive limitations and the framing of information (Mercer, 2005) in a systematic manner. The wellspring of this could be the objective and rational framing if the green and ecological infrastructure concepts, and how these inform and promote the policies and programmes around such enterprises. This is evident from the criticism levelled against the EPCPD by the Palmiet River Watch and the recommendation made by the CSIR researcher that the municipality should communicate more with residents and communities about their green and ecological infrastructure plans. What is also hegemonic is an objective and rational epistemology that is akin to a grey infrastructure epistemology.

Lastly, the epistocracy does govern the green and ecological infrastructure policy landscape but not in a wider participatory manner, but network governance, based on consensus and reciprocity (Kjær, 2004; Van de Meene et al., 2011), a form of governance that acknowledges the public, private and civil society participation that is necessary for effective public policy development and implementation (Van de Meene et al., 2011). One of the drawbacks of network governance, combined with objectivity and rationality is that it exhibits self-governing tendencies, which can impede democratic processes. These leanings can resist external influences and exclude traditionally marginalised groups, such as those living in informal settlements and traditionally governed areas. The consequence of self-governing is that accountability could become problematic. This is case with the eThekwini's epistocracy particularly when considering how South Africa's Constitution grants local governments considerable autonomy within a command and control dominated party political ideology. With a symbiotic relationship existing between governance and

politics, paradigms and theories inform a possible hegemonic in-group network governance structure in solving climate change as a global governance issue (Meissner, 2021a, 2021b). Finally, further research should be conducted with a specific focus in answering the following questions: Is a hegemonic in-group, consisting of natural scientists and engineers operating within eThekwini? If so, what are the potential implications for policies within the ambit of a developmental local government? What do these outcomes mean for eThekwini and its role in the uMngeni Catchment? What do these conclusions mean for other local governments in South Africa and the rest of the world? What are the lessons to be learnt from this regarding government engagement in innovations and the science-policy interface conceptually?

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