

Conceptualising Climate change Mitigation and Adaptation: A Review of Conceptual Challenges and the Prospects of a New Understanding

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Contribution statement

This paper is one of a series which examine a common data set of research materials, interview transcripts, pictures, documents and grey literature produced as part of the European Union-funded Programme to Support Pro-Poor Policy Development (PSPPD) Phase II in partnership with the Presidency of the Republic of South Africa, Department of Performance Management and Evaluation. The project was led by Professor Sarah Bracking, SARCHI Chair in Applied Poverty Reduction Assessment at the University of KwaZulu-Natal, with Dr Mvuselelo Ngcoya and Ms. Kathleen Diga as Co-Investigators and Dr Andrew Okem as Senior Researcher. The programme of research was also contributed by a number of research assistants: Mr Stephen Olivier (Co-ordinator), Siyabonga Ntombela, Phindile Ngubane, Mandy Lombo, Smanga Mkhwanazi, Ntando Ninela, Nokubonga Shezi, Ayanda Tshabalala and Bahle Mazeka. The overall methodology referred to here was collectively pursued and is thus also referred to in forthcoming papers.

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Conceptualising Climate change Mitigation and Adaptation: A Review of Conceptual Challenges and the Prospects of a New Understanding

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Abstract

In the past three decades, concerns about the impacts of climate change related disasters continue to gain global traction both in the academic and political spheres. Against the backdrop of the negative impacts of human activity on climate change, it is now widely recognised that there is an urgent need to redefine human relationships with the environment to reverse/reduce the pace of the current destructive unsustainable development path. In addition, it is now widely recognised that there is an urgent need to proactively devise and implement climate change adaptation strategies. To achieve the objectives of adaptation and mitigation, a substantial amount of funds have and continue to be expended on mitigation and adaption projects. This paper addresses some fundamental concerns in relation to current approaches to climate change mitigation and adaption. Firstly, I examine the conceptual ambiguity that muddles the terrain of climate change mitigation and adaptation and highlight their implications for climate-related projects in general and for the poor and vulnerable communities in particular. To further highlight these challenges, we draw from the eThekweni Municipality in South Africa, an example of a local action in addressing climate change. In the last section of the paper, we explore possible ways forward for climate change mitigation and adaptation and highlight some recommendations in addressing the current challenges. We propose a direction of future climate change mitigation and adaption projects while cautioning against the danger of the proposal being used as a Procrustean bed into which all mitigation and adaptation projects must fit.

1. Introduction

“When I use a word,” Humpty Dumpty said in rather a scornful tone, “it means just what I choose it to mean — neither more nor less.” “The question is,” said Alice, “whether you can make words mean so many different things.” “The question is,” said Humpty Dumpty, “which is to be master — that’s all.”

The above quote from the popular character of the primary school rhyme constitutes our point of departure in this review. We note that, like Humpty Dumpty, should climate change mitigation and adaption mean just what the user intends it to be or is there a universally (or at least to some degree) agreed understanding of these concepts and their applicability thereof? While it is theoretically improbable to achieve the latter, we argue that the former constitute a minefield where any project/programme can be construed as climate change adaptation and mitigation. Such a stance portends a grave danger for the success of climate change related projects especially in light of the recent emphasis on the poverty reduction co-benefits of climate change projects. This review is opportune given the growing interest in the field of climate change and contributes to the discourse on climate change financing and climate change accounting.

The review is organised into five sections. In section two of the paper, we unpack the meaning of climate change and identify the conceptual ambiguity that characterises the terrain of climate change mitigation and adaptation. The section also highlights the implications of the conceptual ambiguity for climate-related projects in general and for the poor and vulnerable communities in particular. This is followed by overviews of climate change mitigation in section three and climate change adaptation in section four. An example of a local action in addressing climate change in eThekweni Municipality, South Africa is presented in section five. The section also identifies challenges associated with accounting and the implications thereof for climate change spend. In the last section of the paper, we explore the possible way forward for climate change and highlight some recommendations in addressing these challenges.

2. A Review of the Meaning of Climate Change

Despite existing pockets of climate change sceptics, scientific knowledge has coalesced on the Anthropocene dimension of climate change. Scientific evidence point to the fact that the earth’s climate is in a constant flux (VijayaVenkataRaman, Iniyar, & Goic, 2012). This change is natural and characterised most of the earth’s history. The pre-Anthropocene era of climate change, referred to as the Holocene era, was when the earth maintained a natural balance in the face of a changing climate (Rockström et al., 2009). Compared to other historical epochs, changes in the earth’s climate in the last century have been quite rapid (Change, 2001, p. 1; Le Treut, Cubasch, & Allen, 2005). This current trend in climate change has been attributed to the increasing accumulation of Greenhouse Gas (GHG) in the earth’s atmosphere. The marked accumulation of GHG in the atmosphere has been correlated with the advent of the industrial revolution and the associated carbon-based development paradigm (Arrow, 2007; King, 2004; Mitchell, 1989; Oreskes, 2004; Rockström et al., 2009; Stern, 2006). In what is dubbed as the Anthropocene era, “human actions have become the main driver of global environmental change” (Rockström et al., 2009, p. 472). These actions cut across different sectors including agriculture, transportation, and settlements (Change, 2001).

Recognising the linkage between climate change and the current fossil-based development trajectory, it has been noted that the current fossil-based development path will cause an irreversible damage to the planet and by implication, endangers human life (Adger, Arnell, & Tompkins, 2005; VijayaVenkataRaman et al., 2012). Unlike the Holocene era, human-induced climate change degrades the ability of the ecosystem to maintain ecological balance (Parry, Canziani, Palutikof, van der Linden, & Hanson, 2007).

Although there is a growing global recognition of climate change, there is no consensus on its definition. The differing definitions, however, share the common view that climate change is a change in the earth's climatic conditions over an extended period (see Le Treut et al., 2005; UN Habitat, 2011). For instance, the UN Habitat (2011, p. 6) defines climate change as “a change in the state of the climate that can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer”. Although this definition notes that climate change occurs over an extended period of time, there is no causal attribution. Effectively, climate change, according to this view, encompasses a change of climate-mediated through natural process as well as human activities. VijayaVenkataRaman et al. (2012, p. 879) offer a similar definition of climate change without attributing responsibility. They note that “climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer)” (VijayaVenkataRaman et al., 2012, p. 879). The challenge associated with the above definitions is that without identifying the causal agents of climate change, it cannot be problematised. In the absence of the problematisation of climate change, advancing arguments for climate change mitigation and adaption becomes tenuous.

Contrary to the above conceptualisation of climate change, the Framework Convention on Climate Change construes climate change as changes in the climatic condition that are attributable (either directly or indirectly) to human activities (United Nations Environment Programme, 2015). The unique point about this definition is the attribution of causality. Once humans are identified as the cause of climate change, it then becomes justifiable to expect a human adaptation and mitigation response.

2.1. Implications of Climate Changes

Climate change presents a real existential threat to humanity. In the past three decades, concerns about the current and future impacts of climate change related disasters continue to gain global traction both in the academic and political spheres. The UN Habitat (2011) notes that climate change will impact multiple sectors including energy, water supply, transportation, the ecology and other infrastructures that are critical to the functioning of modern societies. The same report further observes that climate change “can disrupt local economies and strip populations of their assets and livelihoods, in some cases leading to mass migration” (UN Habitat, 2011, p. 65). Although the foregoing demonstrate that climate change portends a grave danger for different facets of human life, its impact is stated as a future possibility and fails to capture the present calamities that people face due to the changing climate.

Agriculture, which is one of the main livelihood strategies of poor communities, is a sector that is and will continue to bear the brunt of climate (VijayaVenkataRaman et al., 2012). In Sub-Saharan Africa, the impact of climate change on agriculture is expected to result in reduced output and about 12% average increase in food prices (The World Bank, 2015b). This reality will put additional “strain on poor households, who spend as much as 60 percent of their income on food” (The World Bank, 2015b). Undoubtedly, such a change will lead to an increase in the incidence of malnutrition and associated negative effects including a 23% increase in severe stunting.

The study the World Bank (2015b) paints a bleak picture of the impact of climate change on global poverty reduction efforts. According to the World Bank report, climate change could potentially render over 100 million people poor in the next one to two decades (The World Bank, 2015b). As people beyond the poverty lines are pushed back into poverty, global poverty is poised to increase as the incidence of climate change related disasters become frequent and more extensive (Fay et al., 2015). This stark reality is undermining the past and current poverty reduction efforts particularly in regions of the world such as Sub-Saharan Africa and South Asia that are already characterised by high levels of poverty. In addition, it might necessitate committing additional funds to combating poverty which is highly unlikely given the growing lethargy in the proportion of development aids that go towards poverty reduction initiatives.

In terms of health, climate change is contributing to the spread of communicable and non-communicable diseases. For instance, a warmer climate is resulting in the spread of malaria to areas that were previously free of malaria-bearing mosquitoes. This reality puts the life of millions at risk of malaria infection (see Githeko, 2009; Hay et al., 2002; Mia, Begum, Er, Abidin, & Pereira, 2011; The World Bank, 2015b). Related to this is the current and projected increase in the incidence of diarrhoea as a consequence of water scarcity and the contamination of water bodies due to flooding (Hunter, 2003; Patz, Campbell-Lendrum, Holloway, & Foley, 2005; The World Bank, 2015b). Water scarcity and contamination will contribute to a spike in infant mortality. The World Bank (2015b) estimates that there will be about 48,000 additional under 15 deaths from diarrhoea-related illness by 2030.

The disruptions brought about by climate change has momentous economic and non-economic costs both in the short and long-term (Ackerman & Stanton, 2007; Bierbaum et al., 2013). About 20% of global GDP could be affected if actions are not taken to adapt to and mitigate the impacts of climate change (O'Brien, O'Keefe, Meena, Rose, & Wilson, 2008, p. 200). As noted earlier, climate change disrupts infrastructure resulting in the loss of economic activities. Similarly, bringing such back to optimum function status after a climate change related disaster requires significant financial investment and associated implications for the cost of production and economic development.

2.2. Global Response to Climate Change and Associated Difficulties

Scientific evidence points to the fact that the impacts of climate change are poised to worsen if the current level of GHG emissions is not abated (United Nations Environment Programme, 2014). This realisation underpinned the United Nations Framework Convention and Climate Change (UNFCCC) as the first global agreement on the need to take urgent steps to address the impacts of climate change (McLeman & Smit, 2006). In recent years, this has been actualised through various policy instruments and strategies including the recent push for a “development that is rapid, inclusive and climate-informed” (The World Bank, 2015b). Such an approach is underpinned by the view that climate change issues must be reflected in development policies and planning since both are intricately interconnected. The goal of this line of thinking is to drive development towards a low-carbon economy and to build societies that are resilient to the impacts of climate change (The World Bank, 2016).

While it has been widely accepted that climate change has negative implications for humans and the ecosystem, commitments to climate change mitigation and adaption have been a subject of the vagaries of complex international negotiations at the Conference of the Parties (COP). These negotiations are sometimes replete with controversies, shrouded in secrecy, and underhand dealings (Kravchenko, 2009; Lenssen et al., 2008). ‘Green’ civil societies have denounced such an approach and have called for more transparent and inclusive climate change negotiations (Fisher, 2010). Compounding the COP negotiations is the diametrically opposed views that have sometimes pitted the global North against the South (Caparros, Péreau, & Tazdaït, 2004; Sell, 1996). One of the sore points of climate change negotiations stems from the notion that developing countries contributed little to climate change but are the most impacted by climate change-related disasters. For instance, Sub-Saharan Africa contributes less than 4% to the global GHG emission but is simultaneously one of the regions that is the most affected by climate change (Lockwood, 2013). While the global South emphasises historical responsibility in any adaption or mitigation efforts, the North is intent on driving an agenda that encourages equal responsibilities in the climate change agenda (Ciplet, Roberts, & Khan, 2013).

In recent years, the BRICS group (Brazil, Russia, India, China and South Africa) has been instrumental in shaping climate change discourses as well as driving the agenda of the global South¹ (Hurrell &

Sengupta, 2012). The BRICS' central argument is buttressed by the notion of fairness in lieu of historic responsibilities. The argument is hinged on the view that countries that have contributed the most to climate change must take the ethical steps both in mitigating and adapting to the impacts of climate change (Wainwright & Mann, 2015).

Despite the political and ideological contestations that characterise international climate change negotiations, there has been growing commitment to addressing climate change related issues. Specifically, there has been a substantial increase in the financial commitments to climate change in recent years. At the 2015 COP21 in Paris, "more than 180 countries submitted their pledges – the Nationally Determined Contributions, or NDCs" that is expected to translate into "more than \$1 trillion per year over the next 15 years" (The World Bank, 2016). On its part, the World Bank has since 2011, "committed \$52 billion to more than 900 climate-related projects, an average of \$10.3 billion per year" (The World Bank, 2016). In the 2015 financial year, World Bank Group (2016) "made 188 climate-change related investments in 59 countries, ranging from helping farmers adapt to a changing climate with heat resistant seeds to new investments in renewable energy". The financial contributions of the World Bank to climate change related development initiatives is set to increase as demands for such projects increase. The World Bank notes its limitations in providing the required co-funding and argues that a big chunk of the required funds must come from the private sector (The World Bank, 2016). This is one of the underlying views that has led to an increasing participation of the private sector in climate finance.

The role of the private sector in climate finance is not unexpected since they contribute significantly to GHG emissions. However, the role of the private sector and the global climate finance industry has come under increasing criticisms in recent years particularly in relation to the financialisation of the climate change agenda. The financialisation of climate change and associated challenges has been noted elsewhere (Bracking, 2015a, 2015b; Johnson, 2013; Lohmann, 2005; Lombo, Ntombela, Okem, & Bracking, 2016; Wainwright, 2010). The critical argument here is that financialising the climate change agenda leaves a critical human survival issue to market forces. One of the implications of this approach is that private financiers will only invest in profitable ventures while ignoring those that are not profitable but are nonetheless critical responses to climate change. More so, such approach leaves climate change related issues in the hand the capitalist elite who are able to emit GHG as long as they offset their carbon footprint through the purchase of carbon credits in the carbon market. This approach could marginalise local communities and hinder their ability to utilise resources in their local context which are appropriated by big corporates to offset their GHG emission (Gupta, Lövbrand, Turnhout, & Vijge, 2012, p. (forthcoming); Okem, 2017). These contestations underscore climate change mitigation and adaption efforts around the world. In the next section of this review, we turn to exploring the meaning of climate change mitigation and other related issues.

3. An Overview of Climate Change Mitigation

Although climate change mitigation has been the central thrust of climate change for decades, there is no unified definition for the concept. According to the United Nations Environmental Protection Programme (2016), "climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases". The United Nations Environmental Protection Programme (2016) further states that "mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior". This is quite a broad definition of climate change mitigation and is replete with a number of issues. While the goal of climate change mitigation, according to the definition, is directly linked to reducing GHG emissions, the definition is, however, silent on whether these efforts can negatively contribute to environmental degradation. Similarly, there is no indication of the long-term implications of the emission reducing potential of the mitigation projects nor is there any mention of the implication of such activities for the livelihood strategies of local communities where climate change mitigation initiatives are implemented. Furthermore, the

definition is silent on the need to embed local needs in climate change mitigation initiatives and therefore could become the subject of elite capture.

The Private Infrastructure Development Group (2016, p. 6) offers a definition that is similar to that of the United Nations Environmental Protection Programme explored above. It sees mitigation as “either reduction in emissions of GHG into the atmosphere or absorption of them from the atmosphere” (Private Infrastructure Development Group, 2016, p. 6). As outlined in the definition, anything that contributes to reducing the amount of GHG in the atmosphere qualifies as climate change mitigation. This view, as noted above, is problematic for a number of reasons.

For Edenhofer et al. (2014, p. ix) “climate change mitigation can be framed as a risk management exercise”. Climate change is seen as a ‘risk management exercise’ precisely because of the complexity of the ecosystem and the attempt to bring about a balance to the ecological system. The mitigation approach, seen from this perspective, has for many years, been underpinned by the single scientific approach driven mainly by quantitative scientific modelling. This approach has been criticised for being too specialist/elitist resulting in the exclusive production of knowledge (Biesbroek, Swart, & Van der Knaap, 2009). As an approach that is driven by specialists, it does not leave room for the collation of knowledge from multiple sources and therefore becomes an exclusive club of the elite.

The Organisation for Economic Cooperation and Development (2011) provides a set of criteria that can be used to categorise an activity as a climate change mitigation activity. In doing this, it defines climate change mitigation as any activity that “contributes to the objective of stabilisation of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration” (Organisation for Economic Cooperation and Development, 2011, p. 4). This definition is akin to those above and is, therefore, subject to the same criticisms. Table 1 gives an overview of the definitions of climate change mitigation marker as well as the criteria for eligibility of climate change projects.

Table 1: Definition of the Climate Change Mitigation Marker

DEFINITION An activity should be classified as climate-change mitigation related (score Principal or Significant) if:	It contributes to the objective of stabilisation of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system by promoting efforts to reduce or limit GHG emissions or to enhance GHG sequestration
CRITERIA FOR ELIGIBILITY	The activity contributes to a) the mitigation of climate change by limiting anthropogenic emissions of GHGs, including gases regulated by the Montreal Protocol; or b) the protection and/or enhancement of GHG sinks and reservoirs; or c) the integration of climate change concerns with the recipient countries' development objectives through institution building, capacity development, strengthening the regulatory and policy framework, or research; or d) developing countries' efforts to meet their obligations under the Convention. The activity will score "principal objective" if it directly and explicitly aims to achieve one or more of the above four criteria
EXAMPLES OF TYPICAL ACTIVITIES 1. Typical activities take place in the sectors of: Water and sanitation Transport Energy Agriculture Forestry Industry	<ul style="list-style-type: none"> - GHG emission reductions or stabilisation in the energy, transport, industry and agricultural sectors through application of new and renewable forms of energy, measures to improve the energy efficiency of existing generators, machines and equipment, or demand side management. - Methane emission reductions through waste management or sewage treatment. - Development, transfer and promotion of technologies and know-how as well as building of capacities that control, reduce or prevent anthropogenic emissions of GHGs, in particular in waste management, transport, energy, agriculture and industry. - Protection and enhancement of sinks and reservoirs of GHGs through sustainable forest management, afforestation and reforestation, rehabilitation of areas affected by drought and desertification.
2. Typical non-sector specific activities are: Environmental policy and administrative management Biosphere protection Biodiversity Env. education/training Environmental research	<ul style="list-style-type: none"> - Protection and enhancement of sinks and reservoirs through sustainable management and conservation of oceans and other marine and coastal ecosystems, wetlands, wilderness areas and other ecosystems. - Preparation of national inventories of greenhouse gases (emissions by sources and removals by sinks); climate change related policy and economic analysis and instruments, including national plans to mitigate climate change; development of climate-change-related legislation; climate technology needs surveys and assessments; institutional capacity building. - Education, training and public awareness related to climate change. - Climate-change-mitigation related research and monitoring. - Oceanographic and atmospheric research and monitoring.

(Organisation for Economic Cooperation and Development, 2011, p. 4)

Mitigation efforts are geared towards ensuring that global temperature is kept at 2°C above that which prevailed prior to the industrial revolution (Fay et al., 2015). Mitigation approaches include sequestration, fusion, fuel cells, reporting and verification (MRV), carbon capture and storage (CCS), renewable energy generation and reducing emissions from deforestation and forest degradation (REDD). The topic of REDD, a carbon sequestration strategy, currently occupies a prime position in the international climate change mitigation agenda. However, this approach has been criticised for focusing on forest mainly for the purposes of carbon capture while ignoring other uses of forests particularly as a livelihood strategy and for cultural and religious practices by local populations. Okereke and Dooley (2010, p. 83) note this point when they argue that “forests are not just about carbon but are central to so many processes—from regulating temperature and rainfall patterns to providing livelihoods, with an estimated 1.6 billion people reliant on tropical forests for their daily needs”.

As noted previously, carbon trading has become one of the key instruments of climate change mitigation. According to the The World Bank (2015c, p. 17), “placing an adequate price on GHG emissions helps mobilize the financial investments required to support diverse actions, such as fuel switching from coal to natural gas, renewable energy deployment, the adoption of energy efficiency measures and the use of low-carbon technologies in industry”. In another report, the World Bank (2015a) notes that

“putting a price on carbon is a key component of global efforts to address climate change. It should be an integral part of governments’ sustainable growth policies. Pricing carbon also offers a “triple dividend”: giving the private sector the certainty and predictability needed to make long-term decisions, driving investment in clean technologies, and improving the environment and people’s health through reduced GHG emissions”.

In the carbon market, carbon credits can be purchased to offset GHG emissions. Since its introduction, carbon pricing instruments has been on the increase with approximately 90% recorded increase since 2012 (The World Bank, 2015c, p. 20). But as noted previously, the financialisation of the climate change problem is not without its problems. For this reason, there are ongoing quests for alternative approaches to addressing the climate change mitigation question.

Although the notion of climate change mitigation has gained momentum over the years, the present reality of a changing climate means that mitigation efforts alone cannot constitute an adequate response (Eriksen et al., 2011). As Edenhofer et al. (2014, p. ix) argue, a “comprehensive exploration of the solution space in the field of climate change mitigation recognizes that mitigation itself will only be one objective among others for decision makers”. Similarly, Parry et al. (2007, p. 20) argue that “even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades, which makes adaptation essential, particularly in addressing near-term impacts”. In the long-term, unmitigated climate change can degrade the resilience of the ecosystem as well as the ability of people to adapt while in the short-term, the realities of climate change (as evidenced in climate related disasters) imply that communities will continue to suffer from these catastrophes regardless of the mitigation approach(es) taken. Consequently, mitigation and adaptation are considered as the two-pronged responses to climate change.

4. An Overview of Climate Change Adaptation

Climate change discourse and projects, as noted above, were for a long time dominated by the mitigation approach. This was largely due to the characterisation of climate change as an environmental problem which provided little justification for adaptation efforts (Eriksen et al., 2011). However, the realisation that climate change mitigation is inadequate in addressing the current and future impact of climate change has pushed for increased attention to climate change adaption. The key argument is that climate change

adaptation is critical to reducing vulnerabilities and helping communities adjust to the current and future impacts of climate change.

While there is a growing interest in climate change adaptation, there is no single universally accepted definition of climate change adaptation. However, the differing definitions are underpinned by the common view that climate change adaptation relates to adjustments in order to prepare for and cope with climate change-related disasters (Carmin, Anguelovski, & Roberts, 2012; Parry et al., 2007; Smit & Pilifosova, 2003; UN Habitat, 2011). In line with this thrust of argument, Carmin et al. (2012, p. 18) maintain that “adaptation refers to efforts that reduce vulnerability against current or expected impacts of climate change”. Going by this definition, climate change adaptation is seen as any project or activity that improves the preparedness of communities and the ecosystem for the negative impacts of climate change. Parry et al. (2007) offer a similar definition of climate adaptation stating that adaptation is mainly geared towards alleviating the dangers posed by climate change or harnessing the opportunities presented by climate change. The foregoing is underpinned by the view that “mitigation and adaptation can positively or negatively influence the achievement of other societal goals, such as those related to human health, food security, biodiversity, local environmental quality, energy access, livelihoods, and equitable sustainable development; and vice versa, policies toward other societal goals can influence the achievement of mitigation and adaptation objectives” (Edenhofer et al., 2014, p. 5).

For Smit and Pilifosova (2003, p. 879), climate change adaptation “refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts”. They further note that adaptation must be understood as a relative term that “involves an alteration in something (the system of interest, activity, sector, community, or region) to something (the climate-related stress or stimulus)” (Smit & Pilifosova, 2003, p. 879). Conceptualising climate change adaptation as a relative term is an important delimitation since the ecological and built environment differs across local contexts and the requisite adaptive responses will, therefore, need to be tailored in a manner that is responsive to the realities of each local context. To achieve such an outcome, the implementation of climate change adaptation requires providing answers to specific questions including the nature of what is to be adapted, the rationale for the adaptation as well as what is required in order for adaptation to occur. The United Nations Development Programme (n.d.) takes the definition a step further noting that “adaptation to climate change means climate-resilient economic development and sustainable livelihoods, especially for vulnerable populations – the poor, women, and indigenous peoples”. The definition bears in mind the differences in adaptive capacities of individuals and communities and the need to be cognisant of these in the design and implementation of climate change adaptation programmes.

According to the Private Infrastructure Development Group (2016, p. 6), “adaptation implies reduction in the vulnerability of human or natural systems to the impacts of climate change and climate variability related risks by maintaining or increasing adaptive capacity and resilience.” This definition encapsulates two important concepts (adaptive capacity and vulnerability) that are often associated with climate change. Lindner et al. (2010, p. 700) define climate change vulnerability “as the degree to which a system is susceptible to be affected by adverse effects of climate change”. They further note that “the vulnerability of a given system is a function of the climate variation to which this system is exposed (exposure), its sensitivity (together resulting in impacts on goods and services), and its adaptive capacity”. The UN Habitat (2011, p. 6) defines adaptive capacity as “the whole of capabilities, resources and institutions of a country or region to implement effective adaptation measures”. On their part, Smit and Pilifosova (2003, p. 881) define adaptive capacity as “the potential or ability of a system, region, or community to adapt to the effects or impacts of climate change” (Smit & Pilifosova, 2003, p. 881). Adaptive capacity, according to Smit and Pilifosova (2003), is determined by the following factors: Economic Resources, Technology, Infrastructure, Information and Skills, Institutions and Equity. Communities that are poorly resourced in these factors will have limited adaptive capacity and vice versa.

Based on the above, adaptive capacity can be seen to exist along a continuum with certain members of the society on one extreme as those with the most adaptive capacity (in terms of knowledge, institutions and resources) while those with the least are on the other end with others located at different points along the adaptive capacity continuum. Those with the least adaptive capacity are said to have adaptation deficit. The UN-Habitat (2011, p. 6) define adaptation deficit as “the lack of adaptive capacity to deal with the problems associated with climate variability”. The limited/poor infrastructure in many cities and communities around the world may reduce their adaptive capacity. In contexts where there is adaptation deficit, enhancing local adaptive capacities is critical to improving resilience to climate change. This consideration is particularly important when it is considered along with the discourse of sustainable development. Ironically, it is in “developing countries, where adaptation needs are anticipated to be the highest and adaptive capacity is often the lowest” (United Nations Environment Programme, 2014, p. 2).

Adapting to the impact of climate change is a critical component of sustainable development. The argument here is that adaptive strategies help vulnerable communities to become resilient to a changing climate (Laukkonen et al., 2009; O'Brien et al., 2008, p. 196). In doing this, adaptation provides new opportunities for local communities as new ways of addressing local challenges are identified and implemented. In addition, adaptation entails equipping local communities with capacities to respond to new demands/realities that emerge due to climate change (Adger et al., 2005). Adaptation action, in this way, constitute both private and public activities/decisions and comprises five components: “observation; assessment of climate impacts and vulnerability; planning; implementation; and monitoring and evaluation of adaptation actions” (United Nations Framework Convention on Climate Change, 2014). The foregoing takes cognisance of the fact that climate change degrades the ability of local communities to utilise their livelihood strategies.

The success of adaptation can be hindered by a number of barriers including “institutional constraints, lack of leadership, divergent risk perceptions, cultures, and values” (Bierbaum et al., 2013, p. 384). In assessing the success of adaptation, Adger et al. (2005) note that it is critical to take cognisance of both long-term and short-term success indicators of climate change adaptation since what might be successful in the short-term could turn out as a failure in the long term. For instance, climate change adaptation considered a success at the local level since it increases the resilience of local communities may exacerbate GHG emission (Eriksen et al., 2011, p. 16). In addition, the assessment of the success of adaptation projects must consider the sustainability of such projects since many adaptation activities are new in terms of scale and scope and evidence needs to be gathered to determine their effectiveness before they can be up-scaled.

There is a growing body of knowledge that recognises that not all adaptation are good for human beings and for the environment. Cognizant of this fact, Eriksen et al. (2011, p. 7) introduced the notion of ‘sustainable adaptation’. Eriksen et al. (2011, p. 8) define sustainable adaptation “as adaptation that contributes to socially and environmentally sustainable development pathways, including both social justice and environmental integrity”. Sustainable adaptation is not limited to the immediate effects of adaptation but the entire gamut of its effects in both the short and long-term. Sustainable adaptation incorporates both elements of social justice and environmental integrity (Klein et al., 2007). Against this backdrop, adaptation is therefore not construed merely as changing technologies to respond to new climatic realities but goes to the point of addressing approaches to development and addressing the inequalities and injustices that are inherent in such approaches. This argument recognises that general environmental challenges, besides those that directly relate to climate change, exacerbate poverty as they degrade people’s livelihood options. Consequently, it has been argued that “sustainable adaptation should (1) recognize the context of vulnerability, including multiple stressors, (2) acknowledge that different values and interests affect adaptation outcomes, (3) integrate local knowledge into adaptation

responses and (4) consider potential feedbacks between local and global processes” (Eriksen et al., 2011, p. 16).

Although improving the vulnerability of poor communities is often used as a justification for the implementation of climate change adaptation programmes, there is, however, little effort in assessing the pro-poor dimension of such programmes (Eriksen et al., 2011). When this occurs, poverty reduction agenda becomes an appendage to climate change adaptation programmes. Although not all adaptation programmes have the potential to reduce poverty, it is critical that conscious efforts are made in the design phase of adaptation programmes to explore if there are possible poverty reduction dimensions of such programmes as well as their potential to exacerbate vulnerabilities.

Adaptation to climate change requires significant financial commitments to capacitate local communities to become more resilient in the face of a changing climate. Schaeffer et al. (2013) estimate that adaptation will cost between USD 7-15 billion annually by 2020. Over the years, a range of funding instruments has been designed and implemented in that regard. These include “the Global Environment Facility Trust Fund, the Special Climate Change Fund, the Least Developed Countries Fund, and the Adaptation Fund” (Preston, Westaway, & Yuen, 2011, p. 408). While the funding has contributed to reducing the vulnerability of local communities, there have been concerns on how political consideration undermines the focus of the utilisation of these funds. This is particularly true for local municipalities where the issue of adaptation is still relatively new despite being the level of government that is the closest to the reality of climate change.

5. The Case of Climate in a Local Municipality in South Africa

In eThekweni Municipality, climate change presents a real danger to the Municipality’s ecosystem and infrastructure particularly those that support the livelihood of many of its residents (eThekweni Municipality Environmental Management Department, 2007). According to The World Bank (2015c, p. 11), the municipality is already experiencing multiple climate change related events including an “annual sea level rise of 2.7 mm that threatens coastal wetland and dune ecosystems”. Climate change is degrading the natural capital including terrestrial and aquatic assets of the Municipality. Ironically, Durban is one of the highest emitters of GHG in developing nations despite being highly vulnerable to climate change. This pattern is consistent with the national picture with South Africa producing more GHG than the rest of SSA (eThekweni Municipality Environmental Management Department, 2007). In 2013 alone, South Africa’s GHG emissions stood at 28,741,558t CO₂ (Roberts et al., 2016).

Both the social and physical contexts of eThekweni make the adaptation and mitigation of climate change key priorities (Roberts et al., 2016). This reality has prompted the implementation of proactive measures to both mitigate and adapt to the impacts of climate change at the municipal level. An outcome of this is the conscious effort geared towards aligning the Municipality’s development plans to the realities of climate change. eThekweni has committed to ensuring a low carbon future by reducing its carbon footprints. This includes transitioning to efficient utilisation of energy including retrofitting of buildings, enhancing a functioning ecosystem and obtaining energy from renewable sources (Environmental Planning and Climate Protection Department, 2012, p. 5).

The eThekweni municipality is working in a holistic framework which is underpinned by the ecosystem-based adaptation (EBA) and community-based adaptation (CBA). In implementing EBA, the Municipality creates various co-partnership projects which attempt to work with local communities in natural habitat restoration in local communities. Through such partnerships, the municipality seeks to design and implement climate change programmes that are responsive to local needs (Roberts *et al.*, 2012). Embedded in this approach is designing climate change programmes that are pro-poor and aim to reduce

poverty (eThekweni Municipality, 2011). This is a pragmatic approach that enables the Municipality to learn while implementing climate change mitigation and adaptation projects (Roberts et al., 2016).

The municipality recognises that both climate change mitigation and adaptation as critical responses to climate change. In the context of the Municipality, “mitigation refers to reducing the amount of GHGs entering the atmosphere from human activities” (eThekweni Municipality Environmental Management Department, 2007, p. 14). The municipality notes that mitigation includes “decreasing or eliminating fossil fuel use and other activities that produce GHGs” (eThekweni Municipality Environmental Management Department, 2007, p. 14). Mitigation activities in the Municipality are geared towards contributing to the global efforts of reducing GHG emission.

While mitigation is about reducing GHG, “adaptation refers to changing human activities and planning to take climate change into account and minimize the negative impacts it may have on quality of life” (eThekweni Municipality Environmental Management Department, 2007, p. 15). The Municipality’s definitions of adaptation and mitigation are aligned to those explored in the previous two sections and are plagued by the same weaknesses cited earlier. These includes the sustainability of mitigation and adaptation projects, and the short and long-term impacts of mitigation and adaptation projects on local communities and the ecosystem. Critically, questions need to be asked around whether what the municipality is implementing as climate change projects are not what it is already bound by law to implement. This is important in order to determine the climate spend of the municipality.

At the municipal level, the implementation of climate change related projects began in 2007. The inclusion of the climate change agenda in the municipality was prompted by exogenous factors. However, its sustainability is largely attributed to local champions who continue to drive the climate change agenda within the Municipality. In addition, the hosting of the 2010 World Cup and the Conference of Party of the United Nations Framework Convention on Climate Change COP17/CMP7 were also instrumental in institutionalising the climate change agenda across the municipality (eThekweni Municipality, 2013; Roberts et al., 2016). These events facilitated the implementation of a number of climate change-related projects including the creation of local awareness around issues of climate change as well as “reforestation projects with mitigation, adaptation and social upliftment co-benefits, as well as urban greening initiatives” (eThekweni Municipality, 2013, p. 3).

Over the years, the municipality has made strides in developing its portfolio of climate change resulting in Durban becoming one of the first cities in the global South to develop a climate change adaptation strategy (Carmin et al., 2012). In its climate change adaptation strategy, the municipality notes the disproportionate focus on mitigation in developed countries and argues that for less developed countries that are characterised by negative adaptive capacities, addressing current adaptation needs are critical. This is particularly true in improving the adaptation of the ecosystem since many depend on the system for their livelihood. The Municipality, therefore, calls for the prioritisation of an EBA model of climate protection (eThekweni Municipality, 2013, p. 3). This argument is evident in the predominance of EBA projects in the Municipality’s portfolio of climate change projects.

5.1. Determining Climate Spend in eThekweni Municipality

eThekweni Municipality has committed financial and human resources to climate change-related activities. However, there is no existing accounting system for its commitment to climate change. This lacuna makes it difficult to clearly establish the Municipality’s climate change spend. This is reality is not only peculiar to eThekweni but is also a challenge experienced at the international level. To close this gap, the Municipality commissioned Cartwright, Blignaut, McKenzie, and Mander (2015) to establish the Municipality’s climate change spend. The study aimed to establish:

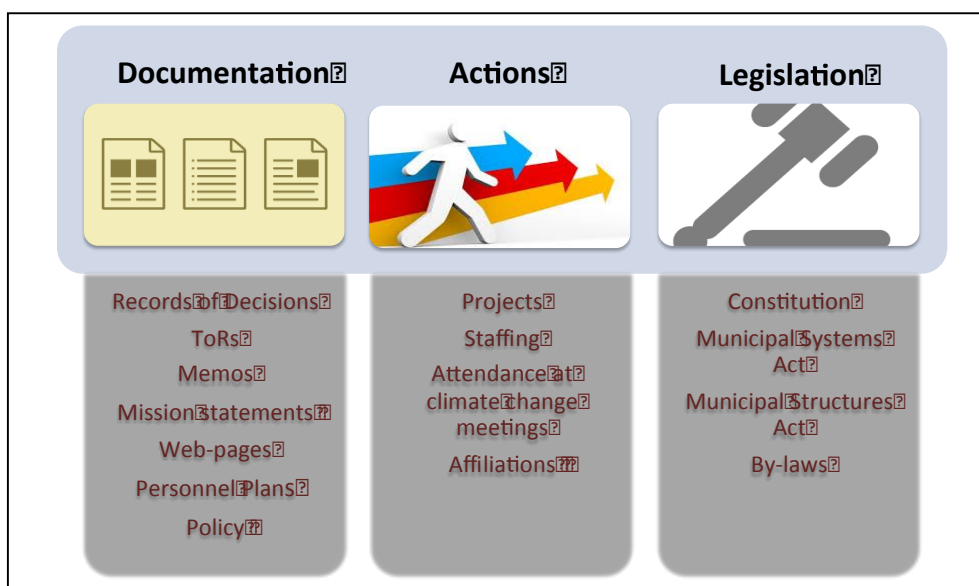
- A template for estimating the extent of money that is already being spent on climate change adaptation and mitigation. This is necessary to ascertain the funding deficit relative to what is required.
- Local priorities targeted by existing climate change budget allocations and the scope for complementarity between municipal budget allocations and international climate finance.
- A process for defining what constitutes climate change spend and what constitutes “business as usual” budget allocations (Cartwright et al., 2015, p. 5)

The analysis also sought to provide critical lessons that could be replicated elsewhere so as to guide the channelling of climate change funds for maximum impacts. In doing this, the study developed a framework for assessing climate change spend and a protocol for collecting climate change data that fits into the framework. Achieving these goals required in-depth engagement with municipal personnel to determine past and current climate change activities and the funds committed to such activities (Cartwright et al., 2015). In implementing the study, Cartwright et al. (2015) identified a number of methodological difficulties one of which relates to the attribution of climate finance. To obviate this challenge, they adopted the UNFCCC definition of “additionality” and applied it to unpacking climate finance. However, applying the concept of additionality at the Municipal level is riddled with challenges including the fact that

“...in eThekweni Municipality, it is extremely difficult to discern additionality in anything more than an “in principle” sense. Some of the best climate protection projects are those that conflate existing expenditure with a climate risk reduction mandate so as to deliver multiple benefits (climate related and otherwise) at the same time. In this sense, it is legitimate to suggest that a local municipality’s entire budget should demonstrate an awareness of climate change risks. This, however, does not enable a tracking of how much money is being specifically directed at climate change, nor how effectively this money is being spent. More crucially, it is not how most financial officers operating at the local level account for their expenditure. Such officers tend to allocate their fiscus to specific departments each with a discrete mandate and budget line items, and not to systemic risks or programmes. Discarding this approach would not only make for lax fiscal accounting, but could undermine the case for investing new resources to counter climate change risks by leading to a simple re-branding of funds. (Cartwright et al., 2015, p. 8).

In light of the above difficulties, the study developed a three-phased approach to understanding climate change spend (see Figure 1). The first step entails an in-depth analysis of municipal documents to establish evidence of climate spend. This includes assessing records of decision, terms of reference, memos, mission statements, web pages, personal plans and policies of the Municipality. The second phase comprises analysing actions of the Municipality including looking at its projects, staffing, engagement in climate change meetings as well as affiliations with climate-related organisations. The third phase involves an analysis of the Municipality’s legislations and by-laws to establish their alignment to climate change.

Figure 1: Evidence Applied in Discerning the Extent of Spend that is Specific to Climate Change



Source: (Cartwright et al., 2015, p. 9).

In documenting the actual climate spend, the study proposed three categories of additionality outlined in table 2 below. The rationale for this categorisation stems from the earlier note that determining additionality is often complicated when there is no accurate record of climate change spend. This approach is, therefore, an attempt to give order to what is considered a chaotic field of climate spend analysis.

Table 2: Criteria for Quantifying Climate Spend

% of costs counted as either climate change adaptation or mitigation	Explanation
100	A R1 million project in this category will be counted as R1 million of climate change “spend” in terms of the spend analysis. This is the easiest category to discern.
30	A R1 million project in this category will be counted as R300,000 of “spend” in terms of the spend analysis
5	A R1 million project in this category will be counted as R50,000 of “spend” in terms of the spend analysis

Source: extracts from Cartwright et al. (2015, pp. 9-10)

Another challenge associated with climate change spend analysis relates to collating relevant climate spend data. The challenges include the fact that climate change is not considered when drafting Municipal budget. In addition, officials of the Municipality seldom have a comprehensive understanding of the budget of their respective unit which makes it difficult for them to identify climate change spend (Cartwright et al., 2015). This challenge is not unexpected since climate change finance is an emerging phenomenon and there is no established accounting procedure within government bureaucracy where the focus is often on the performance of projects with little attention given to climate change.

Data collection in the study comprised a two-pronged approach “of top-down and bottom-up analysis” (Cartwright et al., 2015, p. 11). While the study noted that the bottom-up approach in which climate

change-related data are clearly delineated and presented is ideal, this was not possible for a number of reasons including “staff turn-over and the resultant lack of familiarity of incumbent staff with historical budget allocations, changed ledger entries used to describe a particular project, missing data and data not being recorded in a manner that made it attributable to specific climate change activities, all confounded a bottom up approach” (Cartwright et al., 2015, p. 12). Against the backdrop of these challenges, Cartwright et al. (2015, p. 12) relied “on aggregated budgets kept by the municipal treasury, for which historical records were much better, and applied these to estimate the proportion of spend on climate change”. Table 3 presents an overview of the different Units in the Municipality and their climate change spend. The noted difference in climate change spend across the different departments is not unexpected since the mandate of some units is more directly linked to climate change than others. Table 4 presents a weighted “Additional’ Climate Change Operating Cost Spent for the period 2007/08 – 2013/14 while Table 5 presents Weighted “Additional” Climate Change Capital Cost Spent, for the period 2007/08-2013/14. The costs in both tables are presented in 2014 Values.

Table 3: eThekweni Municipality Departments and their Respective Contribution to Climate Change

Department	Considerations When Deciding On Proportion Of Budget Allocated To “Climate Spend” In Terms Of The “Mandate”, “Participation” And “Documentation” Criteria Outlined Above	Proportion Of Budget Allocated To “Climate Spend”
Energy Office	The Energy office keeps detailed data. EThekweni Municipality’s Energy Office was established in 2008 in the wake of rolling black outs, in an attempt to secure demand cuts from intensive users. The initial purpose of the office was energy security and not climate change related. In 2011/12 the office’s mandate changed to focus specifically on renewable energy and local demand side management. From the 2011/12 financial year the office’s entire (100%) budget is included as an allocation towards GHG mitigation.	Entire budget since 2011/2012 financial year is included as climate spend.
EPCPD	Good data available. There is no legal requirement on local governments in South Africa to establish a climate protection office, and in this sense the EPCPD is additional. The Department’s title and mandate is focused on climate change protection, they have been active in a range of local and international climate change fora. In 2007/8 the department successfully converted its initial mandate of biodiversity protection into a form of ecosystem based climate adaptation through the initiation of large-scale reforestation projects. 100% of the department’s budget will be considered ‘climate spend’ as of 2007/2008. Since 2000 the EPCPD has received USAID funds earmarked for climate protection and these funds have been included under donor budgets.	100% of budget included from 2007/2008, 50% of the departmental budget between 2000 and 2006/7 included on the grounds that it was this departmental budget that created the institutional capacity for subsequent work.
Water	Climate change forecasts for South Africa’s east coast suggest the potential for more intensive rain and greater flooding. The Department has only been an occasional participant at climate change events. The Department has implemented a range of energy saving innovations, but this has been motivated by cost savings and energy security and not greenhouse gas emission reductions or flooding scenarios.	Water department’s budget not included in the spend analysis.
Disaster Management	Local municipalities in South Africa are required to have a disaster risk reduction unit. EThekweni Municipality’s disaster risk reduction department has been an active participant in the municipality’s climate change programme and identifies strongly with it. They have pursued a gradual shift from reactionary interventions towards more preventative measures, and have actively considered the impact of climate change on the frequency and intensity of disasters.	5% of the Department’s budget is included as ‘climate spend’

	It was agreed to count 5% of this budget since the department identifies with climate change. Some of the disasters that they are planning for are specifically climate change related.	
Waste	<p>Local authorities are legally mandated to manage solid waste and would do this whether the climate was changing or not. However, eThekwin Municipality's approach at a number of its landfill sites went beyond this mandate and converted landfill gas to electricity. For some time eThekwin Municipality's landfills constituted the municipality's flagship climate change programmes.</p> <p>In addition, a private consultant working with the municipal team has implemented a number of rehabilitation projects at eThekwin Municipality's landfill sites. It was agreed to allocate this budget to climate change spend on account that it was "additional" to what was required in terms of national waste legislation and has had a significant impact on ecosystem based climate change adaptation.</p>	100% of the budget for the landfill gas to energy projects was included, although it was not clear that the gathered data represented the full spend.
Department of Transport	No data were available at time of analysis. Durban has initiated the process of developing an integrated transport system aimed at easing congestion and emissions. The system is in the very early stages of establishment. The system is not a legal requirement and as such is not part of business as usual. The Department has been actively involved in the municipal climate change programme.	It was agreed that 5% of the IRPTN budget would be counted as climate change spend once data were available.
Engineering: Drainage and Coastal Engineering.	This programme includes two components. Firstly storm-water management. Staff dealing with storm-water management have a long history of participation in eThekwin Municipality's climate change programme and have spent considerable time and budget understanding and responding to the heightened threat of flooding as a result of climate change. This has included the re-setting of flood lines based on climate change projections. The second component is coastal engineering. Coastal engineering has been strongly associated with the municipality's climate change programme and is largely organized around the threat of climate change and mitigation of storm surge damage through the promulgation of a coastal set-back line. The Department did exist, however, before these became concerns and has more conventional responsibilities managing Durban's beaches and estuaries.	30% of department's budgets considered to be "climate spend".
Smart Metering	Whilst this programme has reduced emissions from coal-fired electricity, its efforts have been motivated by energy security and not climate change. As such they are part of "business as usual" under rising electricity prices and nationally constrained supply.	Excluded from the spend analysis, but included as a table item to indicate that it came under consideration and could be included in the future.

Umgeni Green Hub	The hub was constructed with funds aimed at greening the 2010 World Cup and showcases green energy and resource efficiency. 100% of the spend on this building is to be allocated since it was part of profiling climate protection measures during the soccer world cup.	100% of the off-set budget for the green hub is included in the spend analysis.
Green Corridor	This programme forms part of eThekweni Municipality's ecosystem based climate adaptation. A portion of this programme was funded by Bremen with a specific climate change adaptation goal in mind. The balance was integrated into the biodiversity protection programme and supported ecosystem based adaptation.	Bremen funds were counted at 100%. The balance of funding for the green corridor was assumed to be 30% allocated towards climate change.
Use-It	A local recycling and up-cycling programme. However the National Waste Act requires local authorities to reduce-reuse-recycle and this programme is merely in compliance with the Act. Use-it is motivated more by resource efficiency than climate change.	Excluded from this spend analysis but kept in the model to illustrate that it came under consideration and in case its contribution to climate change is altered.
Environmental Health	The department has been a long-standing participant of the Municipality's climate change programme and has changed some of its activities in light of climate change. There is a legal requirement on municipalities in South Africa to ensure safe and healthy environments in South Africa, but the existence of a bespoke Environmental Health Department is unusual in the country's metros.	5% of the Environmental Health's budget is included in the spend analysis.
Parks and Recreation	The mandate for this department's work makes no mention of climate change, and the department has not been actively engaged in eThekweni Municipality's ecosystem based adaptation programme.	Not included in spend analysis, but included as an item for future consideration.
Urban Food Security	Many urban food security programmes take their mandate from climate change concerns. In Durban, however, the food security programme is very small and makes no specific link with climate change.	Not included in spend analysis, but included as an item for future consideration.
Densification strategy/urban planning	In theory urban densification should play a major role in supporting cohesive urban living and reducing emissions. Durban's strategy is insignificant and not linked to climate change.	Not included in spend analysis, but included as an item for future consideration.

(Cartwright et al., 2015, pp. 13-15)

Table 4: Weighted “Additional” Climate Change Operating Cost Spent, 2007/08 – 2013/14 in 2014 Values

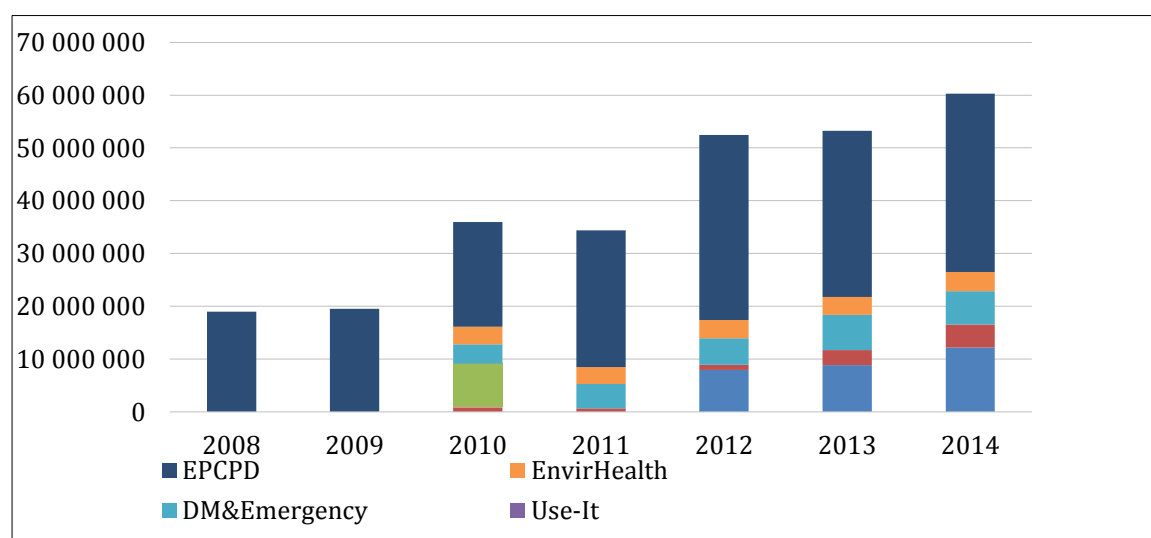
DEPARTMENT	Before 2008	2008	2009	2010	2011	2012	2013	2014
Energy office		-	-	-	-	7 948 611	8 893 276	12 228 059
Durban green Corridor		-	-	510 488	425 864	598 950	1 685 600	2 587 800
Umgeni Green Hub		-	-	8 342 761	-	-	-	-
DM & Emergency		-	-	3 587 604	4 584 174	4 994 799	6 657 439	6 344 325
Environ Health		-	-	3 341 541	3 237 453	3 450 172	3 409 464	3 607 433
EPCPD		18 976 666	19 559 673	19 854 043	25 863 105	35 084 569	31 448 083	33 784 858
Donor funds		1 750 576	6 206 005	4 125 565	7 568 417	-	-	-
Drainage and coastal management		28 773 845	23 191 043	40 202 434	38 756 332	37 839 171	38 087 798	37 463 684
Total additional climate spend for the year		49 501 087	48 956 721	79 964 436	80 435 345	89 916 271	90 181 660	96 016 159
Cumulative additional climate spend for the year	2 340 406	51 841 492	100 798 214	180 762 650	261 197 996	351 114 267	441 295 926	537 312 085

Table 5: Weighted “Additional” Climate Change Capital Cost Spent, 2007/08-2013/14 in 2014 Values

DEPARTMENT	2008	2009	2010	2011	2012	2013	2014
Energy office	-	-	-	-	144 509	30 622 995	65 953
Durban green Corridor	-	-	410 738	977 015	554 583	316 248	775 000
Gas to electricity	133 163 396	-	32 872 644	4 756 854	4 148 024	3 152 888	5 392 462
Water loss	-	1 710 063	3 885 861	234 862 813	31 668 613	-	3 834 886
Total additional climate spend for the year	133 163 396	1 710 063	37 169 242	240 596 682	36 515 729	34 092 131	10 068 301
Cumulative additional climate spend for the year	133 163 396	134 873 459	172 042 702	412 639 383	449 155 112	483 247 243	493 315 544

The methodology employed in the study, according to Cartwright et al. (2015), was able to capture about 90% of climate spend. The study found that the Municipality spent a total “of R1.03 billion on climate change in the period 2004/05 - 2013/14 (in 2014 values) as outlined in graph 2. This comprised “R535 million in operating expenses and R493 million in capital expenses (all adjusted to 2013/14 prices)” (Cartwright et al., 2015, p. 16). The amount is, however, small when examined from the broader municipal budget. The Municipality spent only 0.2% and 1% of its budget on climate change between 2008 and 2014. Despite this, it is important to point out that climate change spend has witnessed a marked increase since 2008. This could be linked to the international focus on South Africa in the build-up to hosting the 2010 World Cup and the COP17.

Figure 2: Annual operational “climate spend” by departments in eThekweni Municipality 2007/8-2013/14



(Cartwright et al., 2015, p. 17).

Although the study developed a methodology for assessing climate change spend in eThekweni, it did not judge the quality of such spend. In other words, the study did not attempt to assess whether what the Municipality has committed to climate change is yielding the expected outcomes. This is because the methodology

“...assumed that mistakes will be made in the implementation of local adaptation and mitigation projects, but that over time these mistakes will be identified and corrected with a reallocation of the resources. This is the norm for climate change interventions at the local scale. Accordingly, all money that is deemed to be allocated for climate change is counted, whether it has the desired impact or not” (Cartwright et al., 2015, p. 11).

While the assumption behind the decision not to assess the quality of climate change spend is appealing, it can be argued that assuming that mistakes will be automatically identified and addressed is insufficient particularly in contexts where there is no strong interest to implement such corrective measures. In essence, such assumptions leave much room for lack of transparency and could be a harbinger of corruption in the implementation of climate change projects.

6. Climate Change Mitigation and Adaption: Which Way Forward?

In the previous sub-sections, we explored the meaning and characteristics of climate change mitigation and adaptation. In those sections, our review focused on the rationale that underpinned both approaches and the limitations thereof. This was followed by an examination of the approaches to climate change in

eThekwini Municipality. The goal of that section was to present the progress made by the Municipality in implementing climate change projects and expound on challenges particularly in terms of accounting for climate change spend. In this last section of the review, we will map out the way forward for climate change based on the challenges identified in the previous parts of this review. While we do not aim to be rigidly prescriptive, it is important that there should be some degree of criteria that projects must meet for them to be considered as climate change mitigation and adaptation. The goal, as noted earlier, is to avoid a scenario whereby anything can be construed as a climate change project with the implication of the diversion of funds from other critically important climate change projects. Given the ongoing recognition that there is limited time to address the devastating impacts of a changing of the climate (VijayaVenkataRaman et al., 2012), all climate change resources must be efficiently and effectively committed to both climate change mitigation and adaptation projects.

One of the emerging issues from the review is the linkage between climate change and sustainable development. The linkage recognises the need to explore alternative development pathways that do not exacerbate climate change while simultaneously meeting the livelihood needs of communities (Eriksen et al., 2011). For this to happen, it is pertinent to be cognisant of both the long and short-term impacts of climate change mitigation and adaptation projects. The aim here is to ensure that projects that might have short-term benefits do not turn out to have long-term negative impacts both on the environment and by implication, the vulnerability of communities that such projects were designed to assist in the first place. It is, therefore, important to plan and discount for the negative consequences of mitigation and adaptation projects.

By linking sustainable development with climate change initiatives, the goal is to ensure that climate change funds do not go towards projects that worsen people's vulnerability or contribute to increased GHG emission (Eriksen et al., 2011). Both adaptation and mitigation should, therefore, be underpinned by the logic of providing the most benefit to vulnerable groups (Grasso, 2010). Climate change projects must, therefore, seek to promote development that is not inimical to the environment or the socio-economic wellbeing of human beings since the two are not mutually exclusive. Against this backdrop, climate change projects should promote developments "such as transitions to low-carbon economies, organic agriculture and horticulture, agroforestry, ecological sanitation, water harvesting, water purification by the use of solar energy, alternative modes of transport, decentralized renewable energy supply, recycling or participatory plant breeding" (Eriksen et al., 2011, p. 10). The World Bank (2015b) defines such development as 'smart development' which comprises scaling up of social protection, universal health coverage, development and implementation of early warning systems and climate-resistant crops.

Related to the foregoing is the critical significance of proactively linking climate change to poverty reduction. This is important for two reasons. Firstly, the poor are the most affected by the climate change but have the least adaptive capacity. Secondly, climate change has the potential to worsen global poverty as its impact could result in millions who are already out of poverty sliding back into poverty. In light of the above, climate change activities must consciously include elements of poverty reduction. As Fay et al. (2015) argue, ending global poverty will continue to be an eluding reality if the link between climate change and poverty reduction is left unacknowledged.

Added to the foregoing is the importance of fair participation in climate change issues given the disparity between the global North and South in terms of adaptation resources (Grasso, 2010). This is linked to the view that both adaptation and mitigation efforts must not only be geared towards addressing poverty but must address the underlying issues that contribute to poverty in a changing climate (Lockwood, 2013). The foregoing is underpinned by the view of ethical adaptation which "involve the distribution of the costs

and benefits of prevention measures and adaptation activities, compensation for residual damages, and participation in the related decision processes” (Grasso, 2010, p. 74).

The provision, utilisation and accounting of climate funds is an emerging issue that continues to gain attention. As the impacts of climate change become more nuanced, development partners/organisations will be forced to contribute more financial resources to both mitigation and adaptation projects. Already, it is estimated that an additional US\$40 trillion will be required in the next 34 years for the world to transition to a low carbon energy (The World Bank, 2015c, p. 16). This is substantially below the current annual global funds of US\$343–385 million for both mitigation and adaptation projects majority of which go towards climate change mitigation (The World Bank, 2015c, p. 16). The unevenness of climate change spend between mitigation and adaption is evident with nearly 95% of climate finance going towards mitigation efforts (Intergovernmental Panel on Climate Change, 2014, p. 104). The focus on return on investment, perhaps, accounts for why a significant portion of global climate change spend goes towards mitigation while a meagre proportion is dedicated to adaptation projects.

The review of the approach to climate change in eThekweni Municipality highlights the challenges associated with accounting for climate change spend. While estimating climate spend (as is the case in eThekweni) seems an ideal option given the present realities of the Municipal accounting system, it must be noted that this is not a sufficient approach as it leaves a lot of grey issues that can undermine mitigation and adaptation efforts.

While funding is important for the success of climate change mitigation and adaption, it is critical to note that the financialisation of the climate change agenda is not without its limitations one of which is the inability/unwillingness of the market to address the climate change question when it is not immediately beneficial for them to do so. This approach also creates a problem where those who can afford the cost of tradable carbon continue to pollute as long as they can offset their GHG emissions by purchasing carbon credits in the carbon market (Lohmann, 2005; Wainwright & Mann, 2015).

In the review of climate change, we noted that the changing climate presents a number of challenges to the human system. Consequently, cities and communities must explore creative ways to leverage global climate change adaption and mitigation funds. Such approach must consciously incorporate a pro-poor dimension when and wherever possible. In the context of eThekweni Municipality, we noted that the adoption of EBA and CBA approaches were informed by the goal of maximising pro-poor benefits in the implementation of climate change mitigation and adaptation projects. This approach provides good lessons that could be applied in other contexts.

In reviewing the definitions of climate change mitigation and adaption, we noted that the definitions were plagued by a number of challenges. As observed in sections 1 and 2, conceptual clarity is critical to the success of climate change mitigation and adaptation since such clarity will ensure that only projects that contribute towards meeting mitigation and adaptation needs are funded. In light of the weaknesses identified in previous definitions, we define climate change mitigation as any project that is designed and implemented with the goal of reducing carbon emission, does not harbour any negative consequences for the ecosystem and improve the livelihood conditions of local communities both in the short and long-term. Similarly, we define climate change adaptation as any project that is designed and implemented with the goal of helping communities adapt to the negative impacts of climate change. Such projects should not harbour negative consequences for the ecosystem or livelihood strategies of local communities both in the short and long-term. These definitions encompass the three pillars of sustainable development. In addition, the definitions incorporate the value of considering long-term impacts of climate change adaptation and mitigation projects. This entails the implementation of a forward-mapping approach that attempts to forecast possible future negative implications of climate change projects. This

is in recognition of the potential future negative outcomes of climate change projects that might have short-term benefits. Furthermore, the definitions embody the notion of intentionality as a qualifying criterion for climate change mitigation or adaption. The notion of intentionality here implies that for a project to be considered a climate change project, it must explicitly set out to contribute towards climate change mitigation or adaptation.

Our definitions of adaptation and mitigation also include elements of climate change co-benefits. The definitions require that the implementation of climate change projects must bring about improvements in the livelihood conditions of communities. Such improvement includes capacity enhancement, job creation, income-generating opportunities, access to natural and social capital and skills acquisition. In addition, it is critical that climate change projects build local capacities and is inclusive of local views and knowledge in the design, implementation as well as monitoring and evaluation of the project. The goal here is to include local communities as key stakeholders in such projects. Besides capacitating local communities, such approach is also critical to getting local communities to accept such projects.

Based on the definitions, we proposed a checklist for assessing climate change mitigation and adaption projects (see table 6). We assume that each attribute has equal weight and therefore ascribed a score of either 1 or 0 to each item in table 6. Going by this, a project can have a possible total score of 12 points on the dimension of poverty reduction co-benefits and 9 on the dimension of successful attributes.

This approach aims to discount for scenarios where the side effects of mitigation/adaption outweigh the benefits of implementing such a project (Ürge-Vorsatz, Herrero, Dubash, & Lecocq, 2014). Understanding the cost/benefits of mitigation programmes is critical to the holistic success of such programmes. It also discounts against focusing on the current benefits of climate change at the expense of future negative impacts. In arguing for the consideration of co-benefits, it must be explicitly stated that current co-benefits do not produce negative outcomes in the future. As Ürge-Vorsatz et al. (2014) argue, co-benefits, because they produce local benefits, tend to elicit the attention of decision-makers and deliberately ignore future negative outcomes. We, therefore, caution against the undue emphasis on co-benefits that does not account for long-term implications.

Table 6: Attributes of Climate Change Mitigation and Adaptation Projects

Poverty Reduction co-benefits attributes		Mitigation	Adaptation
1	The project has overt climate change objective		
2	The project aims to contribute to income/ financial wealth of local communities		
3	The project aims to create jobs at local communities		
4	The project improves access to public utilities for poor communities		
5	The project improves the education/ skills of local communities		
6	The project improves access to health for poor communities		
7	The project enhances assets acquisition		
8	The project leads to improvements and/or access to natural capital for the poor		
9	The project leads to improvements and/or access to social capital for the poor		
10	The project does not have the potential for long-term negative impacts on the ecosystem		
11	The project does not have the potential for long-term negative impacts on the livelihood of local communities		
12	The project does not have the potential for long-term negative impacts on the adaptive capacity of local communities		
Successful project attributes			
1	The project identifies the needs of affected communities		
2	The project has effective means or seek to build communication with communities		
3	The project accepts local community as stakeholders and equal partners		
4	The project seeks to identify, use or adapt local knowledge, tools and methodologies to meet the broader development needs		
5	The project creates strategic intelligence with the local community		
6	The project has a plan for sustainability after the project ends		
7	The project takes gender issues into consideration		
8	The project has mechanisms of transparent public inclusivity and/or multi-stakeholder participation throughout the period		
9	Governments/business are not mandated by law to implement such projects		

Conclusion

One of the biggest existential threats to humanity today is the changing climate. Over the years, addressing the negative impacts of climate change as well as reducing the pace of climate change has gained traction in the international community. Despite the global attention on climate change, the reality is that discourses on climate change have been beleaguered by inconsistencies in the understanding of key terminologies and the resultant design and implementation of climate change projects. Cognizant of this reality, this review took as its point of departure, the question on whether climate change mitigation and adaption should mean what the user intends it to be or if there should be a universally (or at least to some degree) agreed understanding of these concepts and their applicability thereof. To answer these questions, we began by examining the meaning of climate change in general and climate change mitigation and adaption in particular. In the review, we highlighted the need for conceptual clarity in the field of climate change and noted the dangers associated with the lack of conceptual clarity. More

importantly, we argue that the absence of conceptual clarity can result in climate change becoming the subject of elite capture with the implication that vulnerable communities that should be at the forefront of climate change issues fall through the cracks.

To address the challenges in relation to climate change mitigation and adaption, we provided a definition that attempts to address the problems that characterise current definitions. In addition, we provided a checklist for assessing the pro-poor dimensions and sustainability of climate change mitigation and adaptation projects. In doing this, we caution that this should not be construed as a Procreation bed into which all climate change projects must fit. Rather, the checklist constitutes a guide against which to assess climate change mitigation and adaptation projects.

The review of climate change in eThekweni Municipality provided critical insights into local attempts in the design, implementation and accountability in the area of climate change. The example of eThekweni Municipality provides an interesting case study on how the climate change agenda can become embedded in municipal planning. However, the lack of adequate accounting on climate change spend (which is currently a global challenge) continues to be a key issue in the implementation of the climate change agenda in the Municipality. Although a framework has been developed and deployed to determine climate spend in eThekweni Municipality, we note that ignoring to incorporate elements of success/failure in such a tool is a major weakness since it leaves room for corruption and maladministration in the implementation of climate change projects. We propose that going forward, climate spend accounting must incorporate elements of efficiency, effectiveness as well as the sustainability of such projects.

For climate change to gain momentum, it is critical that climate change decision-making is not limited purely to the domain of natural scientists. Climate change adaption decision making that is limited to the realm of bureaucracy will fail to capture the multiple contextual factors and perspectives that need to be factored into decision making. Such an approach runs the risks of construing successful adaption and mitigation as a purely technical exercises and will, therefore, focus on the development of technical skills which, in itself, will fail to address local issues. This approach ignores the role of institutions as well as individual citizens in the design and implementation of climate change related programmes. Climate change decisions must be open to engaging the views of other stakeholders. This approach is important for reformulating the discourse on climate change disaster and the requisite adaptation needs that is cognisant of the already dire conditions that people find themselves. In arguing for the inclusion of co-benefits in climate change projects, we note that an approach must scan both the short-term and long-term benefits of climate change so as to avoid transferring negative consequences to future generations.

The current prevalent phrasing of climate change related challenges as a future term runs the risk of obfuscating the present challenges and thus undermine the need to urgently address them. This is to avoid a scenario described by Wainwright and Mann (2015, p. 314) in which climate change mitigation “would be tacitly abandoned . . . in favour of accelerated investment in selective adaptation for Earth’s first-class passengers”.

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