Local Economic Development (LED) and Climate Change Mitigation

Local Economic Development as a means to promote mitigation projects with particular reference to the Clean Development Mechanism (CDM) – taking Namibia as an example

Dissertation

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Kurzdarstellung

In der vorliegenden Arbeit wurde untersucht, inwieweit durch lokale Wirtschaftsförderungsinitiativen in Namibia Projekte zur Minderung von Treibhausgasen angestoßen werden können. Dabei wurde insbesondere geprüft, ob der Clean Development Mechanism (CDM) des Kyotoprotokolls sinnvoll genutzt werden kann.

Dazu wurden zuerst die Faktoren (Potential für Minderungsprojekte, Geschäfts- und Investitionsklima, institutionelle Rahmenbedingungen, etc.), die die Initiierung von Projekten fördern oder behindern können, diskutiert. In einem weiteren Schritt wurde analysiert, welche Einstellung Klima- und Energieexperten und Personen, die im Bereich lokaler und regionaler Wirtschaftsförderung tätig sind, zur Forschungsfrage haben. Dazu wurden 229 Fragebögen, 28 individuelle Interviews und eine Fokusgruppendiskussion mit 20 Teilnehmern ausgewertet. Des Weiteren wurde die praktische Umsetzbarkeit entsprechender Maßnahmen mit Hilfe einer vom Autor initiierten „real life"-Fallstudie untersucht. Während der Entwicklung einer lokalen Wirtschaftsförderungsstrategie in der namibischen Region Otjozondjupa wurde auch das dortige Potential für Treibhausgasminderungsprojekte eingeschätzt, darauf basierend wurden Projektideen entwickelt und deren nachhaltige soziale und wirtschaftliche Auswirkungen beurteilt. Erfolg versprechende Projekte wurden anschließend in die Strategie zur Implementierung integriert.

Aufgrund verschiedener Faktoren wie beispielsweise der Komplexität von CDM, dem geringen Ausstoß von Treibhausgasen in Namibia, der schlechten Marktsituation für Emissionsrechte und unzureichender finanzieller Mittel hat die Initiierung von CDM-Projekten durch lokale Wirtschaftsförderung in Namibia den im Rahmen der vorliegenden durchgeführten Untersuchungen zufolge wenig Aussicht auf Erfolg. Jedoch besteht seitens der Akteure die grundsätzliche Bereitschaft, Minderungsprojekte in lokale Wirtschaftsförderung zu integrieren, wenn damit vorrangig die Ziele der Wirtschaftsförderung erreicht werden. Die Untersuchung zeigte, dass lokal initiierte Minderungsprojekte kaum zur Schaffung von Einkommensquellen oder Arbeitsplätzen beitragen. Stattdessen sollten eher nationale strategische Ziele verfolgt werden, wie z. B. eine flächendeckende Elektrizitätsversorgung oder die Verminderung der Abhängigkeit von Stromimporten. Dazu müsste bei lokaler Wirtschaftsförderung zukünftig auch der Energiesektor eine größere Rolle spielen, lokale Verwaltungen müssten die Verantwortung für die Initiierung von Energieprojekten übernehmen, nationale und lokale Behörden müssten effizienter zusammenarbeiten und die lokalen Rahmenbedingungen müssten so verbessert werden, dass der Privatsektor bereit ist, seine Rolle in der Wirtschaftsförderung zu übernehmen. Darüber hinaus sollten die Interessen der Bevölkerung berücksichtigt und alle Akteure frühzeitig in Entscheidungsprozesse eingebunden werden.

Abstract

This study explored the question whether greenhouse gas mitigation projects in Namibia could be initiated through local economic development programmes. In particular, research was done on whether the Clean Development Mechanism (CDM) of the Kyoto Protocol could play an essential role in the promotion of such mitigation projects.

In a first step supporting and inhibiting factors (potential for mitigation projects, business and investment climate, institutions, etc.) were discussed, which have a negative or positive influence on mitigation projects. In a second step the mind-set of climate and energy experts as well as of local economic development experts and practitioners was analysed with regard to the research questions. To this end, 229 questionnaires, 28 interviews and the output of a focus group discussion with 20 participants were evaluated. Additionally, the author conducted a real life case study to investigate the practicability of initiating greenhouse gas mitigation projects through local economic development efforts. Parallel to the development of an economic development strategy in the Namibian region of Otjozondjupa, the potential for greenhouse gas mitigation projects was explored. Based on the outcome of this investigation project ideas were developed and their potential socio-economic impact was evaluated. Promising projects were then included into the development strategy.

Due to various factors such as the complexity of CDM, low greenhouse gas emissions in Namibia, the low price of emission rights and insufficient financial means it is unlikely that CDM projects can be initiated through local economic development initiatives in Namibia. However, many stakeholders consider the idea of interlinking mitigation projects and local economic development initiatives favourably as long as such projects support the broader objectives of those initiatives. This research has shown that locally initiated mitigation projects do not contribute much to employment or income generation at the local level in Namibia. Thus, national strategic objectives should be considered, such as improving access to electricity to all strata of society or becoming less dependent on electricity imports. This requires, however, that local economic development strategies also cover the energy sector, that local governments are willing and capacitated to initiate mitigation projects, that national and local public institutions work together more closely, that national and local economic framework conditions are improved so as to attract private investments, and that the experiences and interests of the relevant stakeholders are considered throughout the project development process.

Erklärung

Hiermit erkläre ich, dass ich die eingereichte Dissertation selbstständig verfasst und alle von mir für die Arbeit benutzten Hilfsmittel in der Arbeit angegeben habe. Der Anteil beteiligter Mitarbeiter sowie anderer Autoren – sofern vorhanden – ist klar gekennzeichnet. Ich habe die Dissertation oder Teile hiervon nicht als Prüfungsarbeit für eine staatliche oder andere wissenschaftliche Prüfung eingereicht und die gleiche oder eine andere Abhandlung auch nicht in einem anderen Fachbereich oder an einer anderen wissenschaftlichen Hochschule als Dissertation eingereicht.

Windhoek, den 10.11.2013

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Writing a doctoral thesis besides one's work means that for years weekends and evenings are filled with literature research, analyses, and writing. Also, during the course of the project there have been ups and downs. Thus, special thanks go to my wife Petra Post who has patiently endured these difficult times and has always encouraged me when I felt frustrated.

I would like to particularly thank her and Erika von Wietersheim for their readiness to peruse the thesis and make it more legible and comprehensible. For any remaining errors I am entirely responsible.

The completion of this thesis would not have been possible without the willingness of Namibian LED stakeholders to spend their time with filling out questionnaires and sitting in interviews. I always found the discussions with them inspiring and fruitful for my research project. The data and information they provided constitute the backbone of this research project.

I would also like to thank the numerous unnamed people who were prepared to listen to me and who I used as a sounding board for the ideas and concepts I developed. I have always appreciated their remarks. This research project would not have materialized without the help of all these people.

Thank you!

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List of Abbreviations

Abbreviation	Description
AGRA	Agra Cooperative (agricultural cooperative in Namibia)
AIJ	Activities Implemented Jointly
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung
CAN	Climate Action Network
CBEND	Combating Bush Encroachment for Namibia's Development
CDM	Clean Development Mechanism
CEO	Chief Executive Officer (of a local authority)
CER	Certified Emission Reduction
CRO	Chief Regional Officer (CEO of a regional government office)
CFL	Compact Fluorescent Light
CH4	Methane
CO2	Carbon Dioxide
CO2e	Carbon Dioxide equivalent
COP	Conference of Parties
CPA	CDM Programme Activity
CRIAA SA-DC	Center for Research Information Action in Africa - Southern Africa Development and Consulting
DA	Data Augmentation algorithm
DAC	Development Assistance Committee
DNA	Designated National Authority
DOE	Designated Operational Entity
DRFN	Desert Research Foundation of Namibia
EB	Executive Board (of CDM)
ECB	Electricity Control Board (Namibia)
ECBP	Engineering Capacity Building Programme (Ethiopian GTZ programme)
EIA	Environmental Impact Assessment
EM	Expectation Maximum algorithm
EU	European Union
EU ETS	European Union Emission Trading Scheme
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
GEF	Global Environment Facility
Gg	Gigagram
GHG	Greenhouse Gas
GIZ	Gesellschaft für Internationale Zusammenarbeit
GRN	Government of the Republic of Namibia
Gt	Gigaton
GTZ	Gesellschaft für Technische Zusammenarbeit (since 2011 GIZ)
GW	Gigawatt
GWP	Global Warming Potential
HDI	Human Development Index
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
ILO	International Labour Organisation
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation (instrument of Kyoto protocol)
kW	Kilowatt
kWh	Kilowatt hours
LA	Local Authority
LDC	Least Developed Country
LED	Local Economic Development
LEDA	Local Economic Development Agency of Namibia

Abbreviation	Description
LNO	Letter of No Objection
LPG	Liquefied Petroleum Gas
LUCF	Land Use Change, Forestry
LULUCF	Land Use, Land Use Change, Forestry
MAR	Missing At Random
MAWF	Ministry of Agriculture, Water and Forestry (Namibia)
MCAR	Missing Completely At Random
MDG	Millennium Development Goals
MET	Ministry of Environment and Tourism (Namibia)
MLSW	Ministry of Labour and Social Welfare (Namibia)
MME	Ministry of Mines and Energy (Namibia)
MNAR	Missing Not At Random
MRLGHRD	Ministry of Regional and Local Government, Housing and Rural Development (Namibia)
MW	Megawatt
MWh	Megawatt hours
N2O	Nitrous Oxide
NCCC	National Climate Change Committee (Namibia)
NCCI	Namibia Chamber of Commerce and Industry
NGO	Non-Governmental Organisation
NPC	National Planning Commission (Namibia)
NSS	National Strategy Study
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
PDD	Project Design Document
PIN	Project Idea Note
PoA	Programme of Activities
PV	Photovoltaic
SADC	Southern African Development Community
SET	Solar Energy Technology
SME	Small and Medium Enterprises
SRES	Special Reports on Emission Scenarios (IPCC reports)
SRM	Solar Radiation Management
TE	Tree Equivalent
UN	United Nations
UNCDF	United Nations Capital Development Fund
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNHABITAT	United Nations Human Settlements Programme
UNIDO	United Nations Industrial Development Organisation
USAID	United States Agency for International Development
WHO	World Health Organisation

1 Introduction

1.1 Purpose

The aim of this chapter is to introduce the reader to the overall research project, its objectives, limitations, and structure.

1.2 Research project

1.2.1 Problem statement and purpose of study

Due to anthropogenic greenhouse gas emissions, average global temperatures have increased. This will have negative impacts on the socio-economic fabric of human society and the environment at large. Mitigation and adaptation are the two major strategies to deal with climate change. Mitigation strategies aim at reducing greenhouse gas emissions and thus slowing down the climate change process whereas adaptation strategies try to prepare humankind for the impact of a changing climate.

In the Kyoto protocol of 1998 certain countries (so called Annex-I-countries), committed to emission reduction targets. The Clean Development Mechanism (CDM) is an instrument of the Kyoto protocol. With CDM, Annex-I-countries are allowed to reduce greenhouse gases in developing countries. For every ton of emissions reduced they earn so-called Certified Emission Reductions (CERs) and can credit the reductions against their own reduction obligations. CDM pursues two main objectives. CDM allows Annex-I-countries to reduce emissions where it is most cost effective while at the same time the investments are expected to contribute to sustainable development in the CDM host countries.

In the Marrakesh Accords UNFCCC expressed “the need to promote equitable geographic distribution of clean development mechanism project activities at regional and subregional levels” (UNFCCC 2002, p. 20). However, especially Sub-Sahara Africa is extremely underrepresented. On the other hand, research shows that Sub-Sahara Africa has largely untapped potentials for greenhouse gas emission reduction projects. GOUVELLO et al. (2008, p. xx), for example, outlined that Africa has the potential of implementing more than 3,200 CDM projects. The AFRICAN DEVELOPMENT BANK (2008, p. iii) emphasised that only 4% of the commercially exploitable hydropower potential is being used and that Africa is endowed with 7,000 MW of geothermal energy of which only 130 MW are being exploited.

Steps have already been taken by bilateral and multilateral development organisations to initiate more CDM projects in Sub-Sahara Africa. During the 12th Conference of Parties in

Kenya in 2006, 5 UN agencies launched the Nairobi Framework, an initiative to support and catalyse the deployment of CDM in Africa. The initiative is to build capacity in CDM, build and enhance the capacity of Designated National Authorities (DNAs), promote CDM investment opportunities, improve information sharing and training, and enhance inter-agency coordination.

Additional measures have been taken by UNFCCC to support and facilitate underrepresented countries in developing CDM projects. UNFCCC (2010, p. 9) decided to defer the payment of registration fees for CDM projects for countries with less than 10 CDM projects until the first issuance of CERs. Furthermore it requested the Executive Board (EB) of CDM to provide loans to develop and validate project design documents and to verify reported emission reductions.

KILANI (2009, p. 5) reported that after the Nairobi Framework was signed in 2006, the number of registered projects in Africa had increased from 11 (2.6% of all registered CDM projects) in 2006 to 36 (1.9%) in 2009. According to FENHANN (2013), there were 145 (2.2%) registered projects in Africa in May 2013. Only 1.6% of all registered projects were located in Sub-Sahara Africa. Although the absolute number of African CDM projects increased the ratio between African CDM projects and CDM projects worldwide did not change. According to BYIGERO et al. (2010, p. 188), this is because the Nairobi Framework has focused primarily on training instead of addressing the ultimate causes for low CDM investments: inadequate investment climate, weak industrial base, and lack of CDM institutional capacity. Namibia largely failed to make use of the CDM. Although several Project Idea Notes (PIN) and Project Design Documents (PPD) have been developed over the years so far only two projects were registered.

Local economic development (LED) aims at improving the livelihood of people in a territory by generating employment and income opportunities. It is a widely used approach for sustainable development in Sub-Sahara Africa and many international organisations support LED activities. As a result of the fuel, food, and financial crisis between 2007 and 2009, UNEP urged governments worldwide to take steps to direct their economies to a greener and more sustainable development path. In particular, mitigation of greenhouse gas emissions is being seen as an integral part of the green economy model[1]. According to ELLIOT et al. (2008, p. 3), a green economy requires also actions on local level. UNEP (2008, p. 5 ff.) stated that worldwide more than 2.3 million jobs were created in the renewable energy supply sector and that about 4 million jobs were generated due energy efficiency measures.

[1] A “green economy is low carbon, resource efficient, and socially inclusive. In a green economy, growth in income and employment should be driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services” (UNEP 2011).

In particular, it highlighted that many local jobs and new business opportunities for local entrepreneurs were created in developing countries.

According to OLHOFF et al (s.t., p. 19,) the sustainable development objectives of CDM projects are to mirror national development goals but at the same time should consider sustainable development on local level. The South African DEPARTMENT OF MINERALS AND ENERGY (2004, p. 1 ff.) defined sustainable development objectives for CDM projects and explicitly refers to local development, e.g. the project are to be aligned with local development objectives or have a positive impact on local or regional biodiversity.

The research aims at finding out if LED and mitigation projects could be closer linked. The initial research focused on CDM only but due to developments in CDM during the last years (drop of price of CERs, CERs issued for projects registered after 2012 are only accepted by the EU Emission Trading Scheme if the projects are registered in Least Developed Countries) the likelihood of identifying viable CDM projects in Namibia diminished considerably. Thus, the scope of the research project was broadened.

1.2.2 Research objectives

The research is guided by the following main research question:

Can LED be an instrument to promote and initiate climate change mitigation projects – in particular CDM projects – in Namibia?

In order answer the question, the investigation needs to assess the framework conditions for mitigation projects, such as business climate, mitigation potential, institutional environment, etc. LED is largely influenced by the requirements, interests, knowledge, experiences, assumptions, objectives, and ideas of individual stakeholders involved. These aspects also determine whether mitigation projects are considered in LED initiatives and need to be studied as well. In addition, the author of this study initiated a real life case study. The main aim of it was to provide context data to the overall research and new explanations to discovered phenomena.

The author is not aware of any study in this specific field of research. Thus, the research is explorative in nature. Furthermore, the research is not purely academic but intends to provide LED practitioners with in-depth knowledge of how to interlink greenhouse gas reduction projects with LED - in particular against the background of green economic development strategies.

1.2.3 Research assumptions

The following assumptions apply to the thesis:

- There is a necessity of human action to mitigate greenhouse gas emissions. In this thesis, it is assumed that the climate change is the result of human activities and that the changing climate will have negative impacts on human development.
- Adaptation policies will not be part of the thesis. Climate change measures distinguish between methods of mitigation and instruments of adaptation. CDM refers almost exclusively to mitigation. Adaptation is only indirectly supported. UNFCCC (1998a, p. 19 ff.) requires that a share of the proceeds from CERs shall be used to support developing countries that are especially vulnerable to adapt to climate change impacts. This share is 2%. Both mitigation and adaptation are to support sustainable development. However, this thesis exclusively focuses on mitigation.
- Greenhouse gases reduced by CDM are real. There are controversial discussions about CDM achieving real greenhouse gas emission reductions. CDM is an offset mechanism that is greenhouse gas emitted in an Annex-I-country can be offset by reducing greenhouse gases in a Non-Annex-I-country. However, if the reductions achieved by CDM are not real, this will actually lead to an increase of emissions. The validity of this concern is not part of this thesis. This dissertation assumes that CDM emission reductions are factual.
- The research focuses solely on whether mitigation and CDM can be initiated through LED. It does not intend to compare the efficacy of different CDM promotion initiatives, like the Nairobi framework. Interlinking CDM and LED will be assumed to be a complementary promotional activity.
- CDM is not to be abused as an economic development tool. It has to be understood that CDM is a mechanism designed to reduce greenhouse gas emissions and not an economic development instrument. At no time does the thesis try to establish whether CDM could be turned into such an instrument.
- LED refers to LED programmes in developing countries. LED is not only practised in developing countries but has been used in countries all over the world. Numerous LED agencies in Europe and America are proof of that. According to ANDERSON/NACKER (2003, p. 2), almost all local authorities in Wisconsin/US with a population of more than 10,000 have organisations dealing with LED. However, within this thesis the term only refers to LED programmes which are initiated in developing countries.
- The framework conditions for mitigation and CDM projects in Namibia (mitigation potential, business climate, institutional environment) are purely assessed based on literature. It is beyond the scope of this research, for example, to calculate the CDM

potentials for every possible mitigation project in detail or to empirically research the business environment.

- All research will be conducted in Namibia. This thesis will be based on empirical research in Namibia.

1.3 Research location

1.3.1 Namibia in a nutshell

Namibia, a country of about 2.1 million people that covers an area of 824,000 km^2 is located in the South West of Africa. It is bordered by Angola in the North, Botswana and Zambia in the East, South Africa in the South and South East and the Atlantic Ocean in the West. It is a democracy and has been independent from South Africa since 21. March 1990. When the research project started, the country was divided into 13 political regions. There were 54 local authorities (villages, towns, municipalities)[2].

With about 322,000 inhabitants Windhoek is Namibia largest city and its capital. The second largest town is Rundu with 61,900 inhabitants. However, most of the towns have a population of less than 20,000. In 2001 about 33% of the population lived in urban areas. The percentage increased to about 42% by 2011. About 40% of people live in the central northern region, consisting of the region of Oshana, Ohangwena, Oshikoto, and Omusati.

Namibia is a semi-arid country. Large proportions of the country are desert, e.g. most of the coastline. About 47% of the land is used for agriculture but only 1% is arable. Cattle farming is the predominant agricultural activity. According to MENDELSOHN et al. (2009, p. 70 ff.) most parts of the country receive in average more than 8 to 9 hrs/day of sunshine. The average solar radiation is between 5.8 to 6.4 kWh/m2/day. Except for the coast, average annual temperatures are above 18°C but temperatures vary a lot between summer and winter time[3]. Especially the southern and western regions receive in average less than 150-200 mm/year rainfall per year. The evaporation rate is high throughout the country and Namibia Wind is a predominant feature in the coastal areas. Average wind speed in Lüderitz is over 40 km/h during summer afternoons.

[2] The number of proclaimed local authorities and regions changes. As of August 2013 the number of regions increased to 14. The number of local authorities has also dropped to 52. To be consistent the study remains based on 13 regions and 54 local authorities.

[3] Average annual temperature is calculated as the average of the daily maximum and minimum temperature

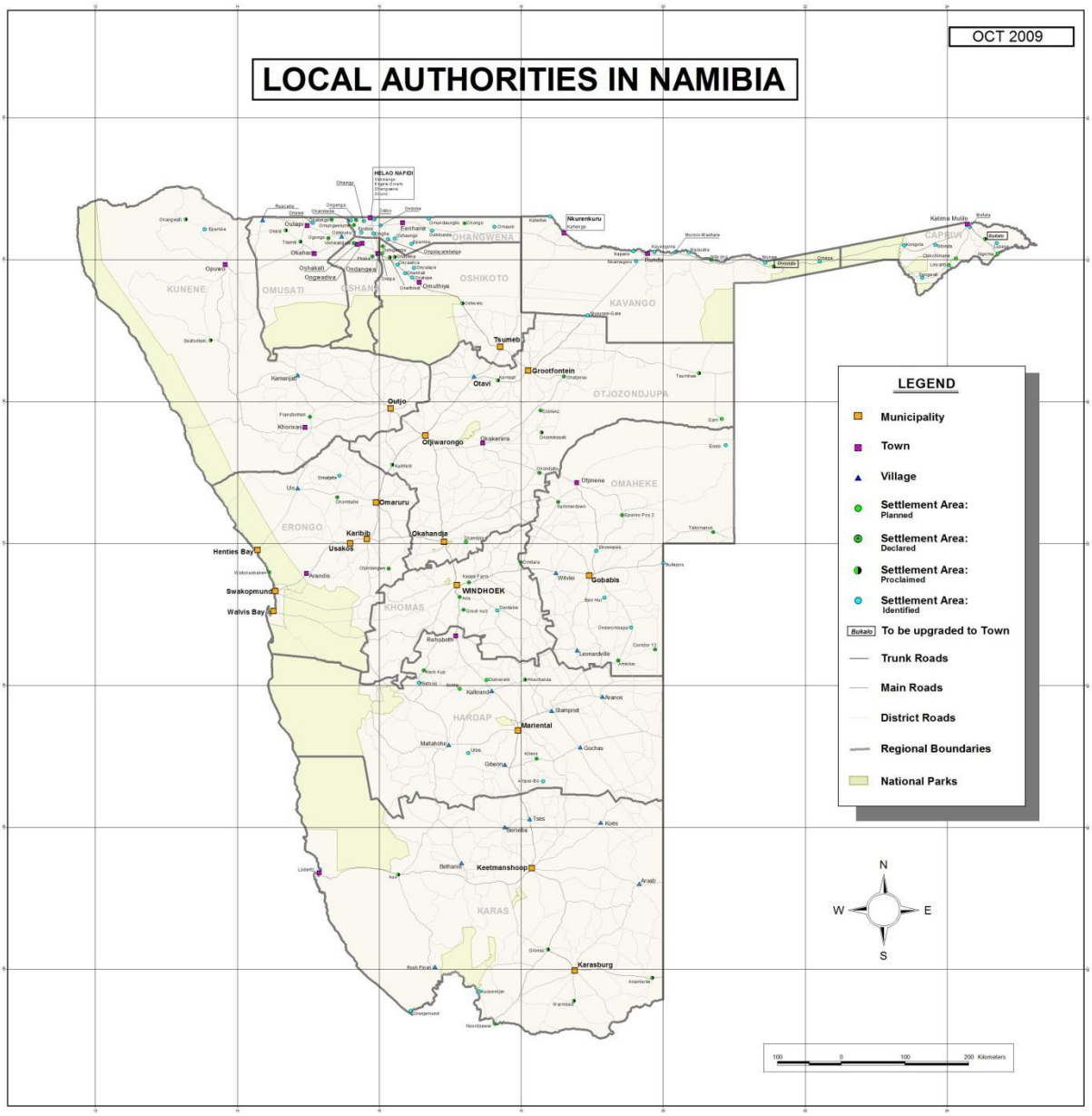

Figure 1 Local authorities and regions in Namibia
Source: MRLGHRD, 2009

According to WORLD BANK (2012a), GDP in Namibia grew about 56% between 2001 and 2011.The AFRICAN DEVELOPMENT BANK et al. (2012, p. 3 ff.) stated that the tertiary sector (e.g. government, real estate services, wholesale and retail sector, tourism sector) is the biggest contributor to GDP. In 2010, the sector contributed about 60% to GDP. Important industries in the primary sector are agriculture and forestry, fisheries, and mining. Their contribution was 17% in 2010. The secondary sector contributed 23% to GDP in 2010, with 15.8% coming from manufacturing. Main contributors to this sector are the meat and fish processing industries, the energy sector and the construction sector.

Because of the comparatively low degree of industrialisation Namibia does not emit much greenhouse gases. In its latest communication to UNFCCC Namibian Ministry of Environment and Tourism, MET (2011a, p. 37 f.), stated that 9,124 GgCO2e were emitted in

2000 whereas 10,566 GgCO2e were removed in the same year. Thus, Namibia is considered a sink country.

Since 2011 Namibia has been rated as an upper middle income country. On the surface, the standard of living in cities like Windhoek or Swakopmund seems to approximate European standards. However, outside the inner city boundaries the majority of people still live in shacks and the typical signs of developing countries are omnipresent: poverty and poverty related crime, missing infrastructure, no access to electricity and clean water, inadequate health care, high unemployment rate, etc. In terms of human development UN ranks Namibia 125 of 179 countries. The unemployment rate (broad definition) is over 50%. Additionally, the income disparity is one of the highest in the world. „The key challenge for Namibia is to sustain real economic growth rate, with a deliberate bias towards the poorest and the most vulnerable groups“ (OFFICE OF THE PRESIDENT/NPC, 2004, p. 5).

A summary of all figures can be found in Table 38 (see attachment I)

1.3.2 Rationale for selecting Namibia

In the following the rationale for selecting Namibia as the country for conducting the field study is outlined.

- Low potential for mitigation poses an additional challenge. Namibia does not emit much greenhouse gases at all. Thus, it might be difficult to find mitigation opportunities. If a country with such adverse and unfavourable conditions could initiate CDM projects through LED, other countries in Africa, where the environment for CDM projects is more conducive, could too.
- Institutional and individual LED capacity available. LED has been recognised as one of the key approaches for a sustainable and inclusive economic development in Namibia. People were trained in LED, local governments have assigned staff and allocated budgets for LED activities, support structures have been set up, and more and more consultants are providing services in LED to local governments.
- Authors` work experience. On behalf of the Gesellschaft für Internationale Zusammenarbeit (GIZ), the author has been supporting LED activities of local governments in Namibia for more than five years. Thus, he knows the different stakeholders, gets interview appointments more easily and has access to data.

1.4 Structure of the thesis

The document consists of nine main chapters. The research question, the objective of the research, its limitations and structure are outlined in chapter 1. The terms climate change, mitigation, CDM and LED are introduced in chapter 2. The research methodologies used and the approaches to treat the collected data are explained in chapter 3 and 4. In chapter 5 the factors which attract, support, or inhibit CDM projects are discussed for Namibia based on information captured in literature. Qualitative and quantitative research methodologies are used to study the opinion of LED stakeholders in Namibia with respect to the research question. This is described in chapter 6. A real life case study was conducted to obtain additional data for the research, in particular context data. The results of the case study are outlined in chapter 7. The main findings of the research are highlighted in chapter 8. The overall research is summarized in this chapter as well. Chapter 9 is a German translation of chapter 8.

2 Basics and definitions

2.1 Purpose

This chapter introduces the reader to the project based Kyoto mechanism CDM, its objectives, and also highlights some of the controversial issues around CDM. The second section of this chapter covers LED, its purpose and objectives, and discusses the impact of LED on sustainable development. It also highlights the role of LED in Sub-Sahara Africa in general and Namibia in particular.

2.2 The Clean Development Mechanism (CDM)

2.2.1 From climate change to CDM

2.2.1.1 Climate change

Climate change or global warming has become an important topic in scientific and political discussions. Polls showed that climate change is of high concern to the public at large (WORLD BANK, 2009a; DIRECTORATE GENERAL COMMUNICATION, 2009). The predicted impacts of climate change on global environment and human development are highlighted in newspaper articles and news broadcasts almost every day. It comes as no surprise that the term global warming was chosen by GLOBAL LANGUAGE MONITOR (2010) a company which documents, analyses and tracks trends in English language, as the top word for the first decade of 2010.

Yet, the term climate change is not universally defined. For the Intergovernmental Panel on Climate Change (IPCC), climate change is the “change in climate over time, whether due to natural variability or as a result of human activity” (IPCC 2007a, p. 30) whereas the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (UN, 1992, p. 3). Today, the term is commonly used to describe the rise of average temperature due to greenhouse gas emissions. Although there are still people who believe that climate change is not primarily caused by humankind, it is now widely accepted that the change in climate is human-induced[4].

[4] Due to many factors, such as data quality and scarcity, there are still many uncertainties when it comes to global warming and its impacts (e.g. effect on people and ecological and economic systems,

Compared to the 1980-1999 level, IPCC (2007b p. 13) forecasted that temperatures will likely increase between 1.1 to 6.4°C by the end of the century[5]. It also projects a warming of 0.2°C over the next two decades. With the current emissions, the WORLD BANK (2012b, p. xxi) predicted that the world is heading towards a temperature increase of 4°C by the end of the century.

According to IPCC (2007c p. 11 f.), climate change will have a negative impact on all facets of life, such as freshwater resources, ecosystems, food, fibre and forest products, coastal systems and low-lying areas, industry, settlements, and society and human health. The organisation further highlighted that freshwater resources will decrease by 10-30% and drought affected areas will increase worldwide, that crop production will globally decrease if temperatures increase beyond 3°C, that 20-30% of plant and animal species are at risk of extinction if temperature increases by 1.5 – 2.5°C and that people in developing countries will suffer most. "New studies confirm that Africa is one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity" (IPCC 2007c, p. 13). For ERIKSEN/O'BRIAN (2007, p. 346) climate change induced floods, droughts, heat waves, etc. threaten the income and the life of the poor, damage the infrastructure, bear the risk of increased diseases due to sanitary problems, hamper school attendance and interrupt water and energy supply. STERN (2006, p. x) admitted that long term economic forecasting is difficult and therefore cannot be very precise. Nevertheless, he amplified that an average temperature rise of 5-6°C might cause a loss of 5-10% of global GDP and developing countries might even suffer costs of excess of 10%[6]. Thus, climate change is rightly considered to be "the greatest and widest-ranging market failure ever seen" (STERN, 2006, p. i).

In order to reduce the negative effects and to make climate change impacts manageable, emissions have to be cut. The EU (1996) advocates to keep the global average temperature increase beneath 2°C above pre-industrial levels[7]. During the 15th session in Copenhagen,

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how much emissions need to be cut to keep the concentration of greenhouse gases below a certain level, projections of CO2 emissions, speed of global warming, etc.).

[5] IPCC considered different social and economic development scenarios in its calculations. There are six so called IPCC Special Reports on Emissions Scenarios (SRES). The scenarios take into account different demographic, economic, and technological forces to compute greenhouse gas emissions. For example one scenario assumes a very rapid economic growth with the global population to peak in the mid of the 21st century and a rapid introduction of more efficient technologies whereas another one is based on high population growth and on slow economic and technological development.

[6] Stern argues that because of the nature of climate change, economic forecasting has to consider long time spans of 50, 100 and 200 years respectively.

[7] Under the patronage of the UK, a conference on climate change in 2005 concluded that "limiting warming to 2°C above pre-industrial levels with a relatively high certainty requires the equivalent concentration of CO2 to stay below 400 ppm [whereas] if concentrations were to rise to 550ppm CO2 equivalent, then it is unlikely that the global mean temperature increase would stay below 2°C" (UK DEPARTMENT FOR ENVIRONMENT FOOD AND RURAL AFFAIRS, 2006, p. 3).

the UNFCCC Conference of Parties (COP) agreed that "deep cuts in global emissions are required [...] so as to hold the increase in global temperature below 2 degrees Celsius" (UNFCCC 2010, p. 5).[8] Such a target still translates into immense emission cuts. IPCC (2007a, p. 67) indicates that to achieve a 445 – 535 ppm CO_2e stabilisation level, emissions need to be reduced by 30-85% below the year 2000 level by 2050. Compared to pre-industrial levels, this would translate into a global mean temperature increase of 2-2.8°C. In addition, the emissions have to peak before 2020. To stay below 2°C the cuts would be even higher. The G8 SUMMIT (2007, p. 15 f.), held in Heiligendamm/Germany in 2007, declared to "seriously" consider to half the emission by 2050. However, the summit did not indicate a specific temperature target. At least there seems to be a political will to reduce emissions. However, emissions are on the rise globally. In its third emission gap report, UNEP (2012, p. 1 ff.) states, that in 2010 49 GtCO2e were emitted compared to 37 GtCO2e in 1990. With a "business as usual" scenario 58 GtCO2e will be emitted in 2020. In order to achieve the 2°C target, emissions are to peak before 2020 with an emission level of about 44 GtCO2e. The projected gap is 14 GtCO2e.

2.2.1.2 Mitigation

There are basically two options to deal with climate change: adaptation and mitigation. Adaptation is defined as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (McCARTHY et al. 2001, p. 982) and mitigation as "an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases" (McCARTHY et al. 2001, p. 990). Geo-engineering has become another strategy in the climate discussion. Geo-engineering "refers to a broad set of methods and technologies that aim to deliberately alter the climate system in order to alleviate the impacts of climate change" (IPCC 2011, p. 2). Geo-engineering aims at reducing solar radiation (e.g. by artificial injection of stratospheric aerosols and cloud brightening) and tries to extract carbon from the atmosphere by either increasing sinks naturally (e.g. afforestation) or by using chemical substances to increase sinks (e.g. iron fertilisation) or making use of technical processes to remove greenhouse gases (e.g. filter). As such, geo-engineering could be subsumed under mitigation.

Reducing emissions or extracting greenhouse gases from the atmosphere is the only option to keep the temperature increase below 2°C. OECD (2009, p. 58 ff.) proposes the following

[8] The Alliance of Small Island States, AOSIS (2009), which represents the interest of low lying countries and islands in the UNFCCC negotiations, strongly recommends aiming at a temperature increase below 1.5°C and 350 ppm CO2e.

instruments to reduce emissions: emission taxes, emission trading schemes, also referred to as cap-and-trade systems, technology and performance standards, also called command and control approaches, technology support policies, and voluntary agreements. Within the scope of this thesis the focus will be on a specific cap-and-trade[9] instrument: the Clean Development Mechanism (CDM).

2.2.1.3 The Kyoto protocol and CDM

During the United Nations Conference on Environment and Development in Rio de Janeiro/Brazil in 1992 the United Nations Framework Convention on Climate Change (UNFCCC) was negotiated and signed. In pursuit of Article 3[10] of the convention the Kyoto Protocol was debated and adopted by the COP in Kyoto/Japan in 1997. In the protocol, so called Annex-I-countries[11] agreed to reduce their combined greenhouse gas emissions by at least 5% below the 1990 emission level between 2008 and 2012. Individual quantified emission reduction targets have been defined in Annex B[12] of the protocol. In order for the Annex-I-countries to achieve their objectives the protocol permits the usage of so called flexible mechanisms[13]. CDM is one of them. In principle, CDM allows Annex-I-countries to invest in greenhouse gas reduction projects in Non-Annex-I-countries[14] which are almost all developing countries[15]. They can then "use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission

[9] For a cap-and-trade system to work a limit on greenhouse gas emissions is defined (cap) and emission rights are allocated to emitters. For the emitters to emit more greenhouse gases, the emitter has to buy emission rights from other parties (trade).

[10] Article 3 paragraph 1 of the convention cites „The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should take the lead in combating climate change and the adverse effects thereof" (UN, 1992, p. 4).

[11] Annex I countries are countries listed in Annex I of the framework convention on climate change. They have agreed to measures defined in article 4(2) of UNFCCC. For example, the measures are to implement policies to reduce greenhouse gas emissions and to protect and extend sinks for greenhouse gases. According to Article 12 of the Kyoto protocol these countries can use CDM to meet their emission obligations.

[12] Annex B of the Kyoto protocol lists all countries which have declared to reduce greenhouse gases with their respective emission reduction targets. According to Article 3 of the protocol the overall emissions of all countries should be at least 5% below the 1990 levels after the end of the first commitment period (2008 – 2012).

[13] The Kyoto protocol defines 3 mechanisms: Joint Implementation, Emission Trading and the Clean Development Mechanism. The Kyoto protocol also allows countries to form groups where the reduction objectives of every country will be added up and can then be redistributed again internally within the group. This is sometimes assumed the fourth mechanism and is accordingly called Bubble Policy or Bubble Mechanism.

[14] Non-Annex I countries have ratified the convention but are not included in Annex I.

[15] Countries like Saudi Arabia, Israel or Singapore are Non-Annex I countries but do not receive Official Development Assistance (ODA). "For the DAC [Development Assistant Committee of OECD], the term 'developing country' employed without qualification has generally been taken to mean a country eligible for ODA" (OECD 2010).

limitation and reductions commitments" (UNFCCC, 1998, p. 19). As such, CDM is an offset mechanism only. It does not lead to emission reductions beyond the agreed targets defined in the Kyoto protocol.

In the Kyoto protocol two main objectives are outlined for CDM. It allows Annex-I-countries to invest in mitigation projects in Non-Annex-I-countries to meet their greenhouse gas emission reduction targets cost effectively. Through such investments and the transfer of technology CDM is supposed to contribute to sustainable development in the CDM host countries.

At the UNFCCC conference in Doha/Qatar in 2012, the Kyoto protocol was extended till 2020. According to UNFCCC (2013 p. 3), Annex-I-countries are supposed to revisit their reduction targets for this second commitment period by 2014. The parties are supposed to reduce their emission by at least 25-40% below 1990 level by 2020. Canada withdrew from the Kyoto protocol and the Russian Federation and Japan will not take on any new obligations under the new commitment period.

2.2.2 Greenhouse gases covered by the Kyoto protocol

Anthropogenic greenhouse gases emissions contribute to global warming. Yet, not all greenhouse gases are covered by the Kyoto protocol. The Kyoto protocol does not include ozone depleting substances which are covered by the Montreal protocol of 1987 (halogenated hydrocarbons). The gases covered by the Kyoto protocol are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6). Nitrogen trifluoride (NF3) was added as an additional gas to the list for the second commitment period. Their global warming potentials differ. The Global Warming Potential (GWP)[16] defines the warming potential of a greenhouse gas compared to the warming potential of CO2. GWP is used to convert a gas into the equivalent of CO2. The converted unit is called carbon dioxide equivalent (CO2e).

[16] The Global Warming Potential (GWP) "defines the time-integrated warming effect due to an instantaneous release of unit mass (1 kg) of a given greenhouse gas in today's atmosphere, relative to that of carbon dioxide" (HOUGHTON et al. 1990, p. IX). The GWP used is calculated for a time span of 100 years for the Kyoto protocol.

Greenhouse Gas[17]	Global Warming Potential (100 years)[18]
Carbon dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous oxide (N_2O)	298
Hydrofluorocarbons (HFCs)	12-14,800
Perfluorocarbons (PFCs)	7,390-12,200
Sulphur hexafluoride (SF_6)	22,800
Nitrogen trifluoride (NF_3)	17,200

Table 1 Greenhouse gases and their global warming potential
Source: UNFCCC (2013), IPCC (2013)

2.2.3 Sustainable development objectives

Host countries of CDM projects have to confirm to UNFCCC that a project will contribute to their sustainable development objectives. Therefore, many countries like the Philippines, Malaysia or Brazil have developed catalogues with desired economic, social, and environmental sustainable development objectives for CDM. International organisations, NGOs, and scientists developed a plethora of objectives, too (see also attachment I Table 36).

2.2.4 CDM process

2.2.4.1 Project cycle

The project cycle begins with the development of the Project Design Document (PDD). In the PDD the project developer has to describe the project and the project boundary, outline the baseline methodology used, indicate the crediting period, demonstrate additionality of the project, prove that the project does not lead to the diversion of Official Development Assistance (ODA), describe the environmental impact of the project, summarise stakeholder comments, and explain the monitoring plan.

According to UNFCCC (2002, p. 36), CDM projects are additional if anthropogenic emissions are reduced below those which would have been generated without registered CDM project

[17] The list of greenhouse gases replaces the list of greenhouse gases in Annex A of the Kyoto protocol.
[18] The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol „decides that, for the second commitment period of the Kyoto Protocol, the global warming potentials used by Parties to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of the greenhouse gases listed in Annex A to the Kyoto Protocol shall be those listed in the column entitled 'Global Warming Potential for Given Time Horizon' in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon, taking into account the inherent and complicated uncertainties involved in global warming potential estimates" (UNFCCC 2012b, p. 24). Global warming potentials in the table were copied from this list.

activities. Additionality can be proven by either showing that the project is only financially viable with CDM, that barriers for mitigation projects exist which can only be removed with the support of CDM, or that the project activity is not a common practice in the country.

The so-called baseline is the amount of emissions observed or anticipated without CDM. UNFCCC (2002, p. 37) defined three different approaches for determining the baseline. The baseline can be calculated on existing or historical emissions, on emissions from technologies that represent an economically attractive course of action, or on the average emissions of similar activities. There are methodologies to calculate the baselines. A project developer can use existing and approved methodologies or can propose new methodologies. Methodologies need to be approved by the Executive Board (EB) of UNFCCC.

Potential project stakeholders have to be consulted by the project developer. “Stakeholders mean the public, including individuals, groups or communities affected, or likely to be affected, by the proposed CDM project activity or actions leading to the implementation of such an activity” (UNFCCC s.t., p. 27).

The project developer requires a letter of approval for the project from the Designated National Authority (DNA) of the host country. A country must have nominated a DNA to host a CDM project. The letter of approval confirms that the country has ratified the Kyoto protocol, that the host country voluntarily participates in the CDM, and the CDM project contributes to sustainable development in the host country.

The letter of approval together with the PDD is then submitted to an independent auditor, the Designated Operational Entity (DOE). DOEs have to be accredited by the EB. The DOE validates the documents and submits them together with the validation report to the EB for registration. After registration, the project can be implemented. Based on the monitoring plan, the emission reductions achieved by the project are calculated and verified by another DOE. For the verified emission reductions, the EB issues Certified Emission Reductions (CERs) for every ton of CO2e reduced. The CERs can be traded by the project developer. The value of CERs depends on demand and supply.

2.2.4.2 Costs and timeline

UNEP (2007, p. 12) estimated that it takes between 6.5 to 13.5 months from the beginning of a project for a CDM project to get registered.

UNDP (2006, p. 56) estimates CDM related costs for most projects (e.g. development of PPD, validation, registration, verification) to be between $US 60,000 and $US 130,000. For

most small-scale projects the costs might be 20-40% lower and range between $US 50,000 and $US 70,000. According to UNEP (2007, p. 55 f.), the costs ranged between US$ 38,500 and $US 610,000 for large-scale projects and US$ 18,500 and $US 117,000 for small-scale projects. Verification of emission reductions would periodically cause additional costs of U$5,000 to $US 30,000 for large-scale and $US 5,000 to $US15,000 for small-scale projects. These costs do not include the actual project development costs, such as building a power station.

2.2.4.3 Institutions

"For the Kyoto mechanisms to work smoothly, host and sponsor countries alike will need to develop their institutional capacity for the review, approval and registration of emission reduction projects" (FRANKHAUSER/LAVRIC, 2003, p. 9). Only CDM institutions of host countries are considered in the following.

UNFCCC (2002, p. 31 f.) required that participating countries need to designate a national authority for CDM, the Designated National Authority (DNA), to implement CDM projects. The DNA has to approve projects and make sure that the CDM projects contribute to the sustainable development objectives of the country. However, according to CURNOW/HODES (2009, p. 23), CDM rules do not restrict DNAs to this function. The host country can assign additional responsibilities to the DNA. DNAs could carry out a plethora of functions, like identification of CDM investment opportunities, capacity building for CDM, monitoring the sustainable development impact of CDM, disseminating relevant information to stakeholders, etc. JAHN et al. (2004, p. 44) believed, that proactive DNAs are necessary for local developed CDM projects. MICHAELOWA (2003, p. 218 f.) rightly points out that even with a high potential for CDM projects, the CDM instrument will not be used without an effective institutional environment. Furthermore, he argues that a CDM office should be independent, has full decision making power and is best operated by a private body or an NGO.

Although research on institutional CDM capacity refers foremost to DNAs the institutional environment for CDM is not confined to DNAs only. Other organisations are also essential, like capacitated consultants who are needed to prepare feasibility studies and PDDs or investment agencies which attract foreign CDM investors.

The term institution refers to more than just organisations. It also encompasses a system of rules, rights, and obligations which condition the social interaction between individuals, groups, organisations, etc. in order to make social actions predicable for others. "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints

that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic" (NORTH, 1990, p. 3). Thus, the institutional CDM capacity of a country refers to policies, legal framework and strategies, too.

To evaluate the institutional capacity of a country JUNG (2005, p. 6) assessed whether the country had ratified the Kyoto protocol, whether it had gained experience with Activities Implemented Jointly (AIJ)[19] projects, whether the DNA had been installed timely and whether a National Strategy Study (NSS)[20] had been completed. FRANKHAUSER/LAVRIC (2003, p. 9 ff.) assessed issues such as Joint Implementation (JI) policies, capacity of offices and staff, and prior experience (e.g. dedicated JI office, experience with AIJ projects, pilot projects, donor support).

2.2.5 Status of CDM implementations in Sub-Sahara Africa

Shortly after the Kyoto protocol was discussed, the potentials and requirements for CDM in Africa were discussed at a conference in Ghana in 1998. It was believed that "CDM can create significant technology and resource flows to developing countries including those of Africa" (DAVIDSON/SOKONA, 1999, p. 17). General CDM opportunities were highlighted, like in the transport sector (ZHOU, 1999) or energy sector (BREW-HAMMOND, 1999). Even concrete project proposals for CDM projects in Zambia were highlighted (YAMBA, 1999). However, several participants stressed that a conducive environment needs to be created to fully benefit from CDM, which also includes adequately addressing barriers for CDM implementations (e.g. DAVIDSON/SOKONA, 1999, p. 17 f.; AFFUL-KOOMSON/OPOKU-MENSAH, 1999, p. 36 ff; SPALDING-FECHER et al., 1999, p. 72 f.). That shows that the discussion on the importance of CDM for sustainable development in Sub-Sahara Africa, the potentials for greenhouse gas emission reduction projects and the challenges for CDM started already early in the first commitment period.

Yet, 12 years after the Kyoto conference FENHANN (2010) stated that about 80% of all CDM projects are carried out or planned in China, India, Brazil, Mexico, Malaysia and Thailand and only 2.5% (129 projects) of the projects which are already registered, seeking registration, or undergoing validation are located in Africa. About 2% (102) are located in Sub-Saharan African countries. In May 2013 FENHANN (2013) counted 268 CDM projects in Africa with

[19] At the 1st meeting the Conference of Parties to the UNFCCC in 1995 decided to start an initiative (AIJ) that Annex I countries can conduct projects in other countries to reduce greenhouse gases or to increase the capacity of sinks. The projects were voluntary and no carbon credits could be earned. The initiative was started to gather first experiences with joint projects.

[20] Switzerland and the World Bank started an initiative on National Strategy Studies on AIJ/JI and CDM in 1997. The initiative was to assist potential host countries to develop the expertise to enable them to make informed decisions on greenhouse gas emission offset mechanisms.

200 projects located in Sub-Sahara Africa. Within roughly three years, this is an increase of about 108% for Africa and about 96% for Sub-Sahara Africa. However, the ratio between Africa or Sub-Sahara Africa and the rest of the world had not changed much. Only 3.0% of all CDM projects are located in Africa and 2.2% in Sub-Sahara Africa. Except for Malaysia which was replaced by Vietnam, all the other leading CDM countries remain the same. They still account for 81% of all CDM projects in the CDM pipeline (see Figure 2). China (44.6%) and India (24.2%) alone host about 69% of CDM projects worldwide.

According to FENHANN (2010), only 22 out of 48 countries[21] which are subsumed under the term Sub-Sahara Africa participated in CDM by May 2010. FENHANN (2013) showed that this number increased to 29 in 2013. Yet again, 72% (143 projects) of the projects in Sub-Sahara Africa are located in four countries only: South Africa (81 projects), Kenya (30), Uganda (16) and Nigeria (16).

The situation is even bleaker if one considers only registered CDM projects. Sub-Sahara Africa hosts merely about 1.6% of all registered projects worldwide. Of the 145 registered projects in Africa 109 are located in Sub-Sahara Africa. About 71% (77 projects) of them are hosted by South Africa (43), Kenya (14), Uganda (12) and Nigeria (5) (see Figure 3).

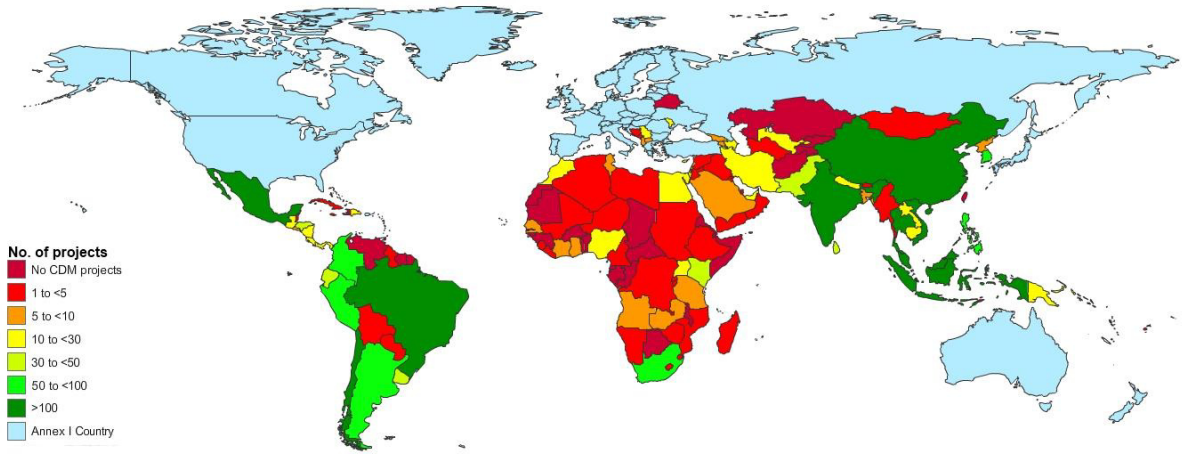


Figure 2 Number of all CDM projects (registered, seeking registration, under validation)
Source: Own illustration based on data from FENHANN (2013) and UNFCCC (1998a)

[21] The thesis subsumes 48 countries under Sub-Sahara Africa which includes also Mauritius. Some authors disregard Mauritius due to the ethnic composition of the population which is mostly of East-Indian, Chinese or French descent. Mayotte and Reunion which belong to France and St Helena which belongs to the UK are ignored. Countries which only partly belong to Sub-Sahara Africa, like Sudan, Mauretania, etc. are fully considered as Sub-Saharan African countries. South Sudan, a sovereign country since 2011, has not been considered.

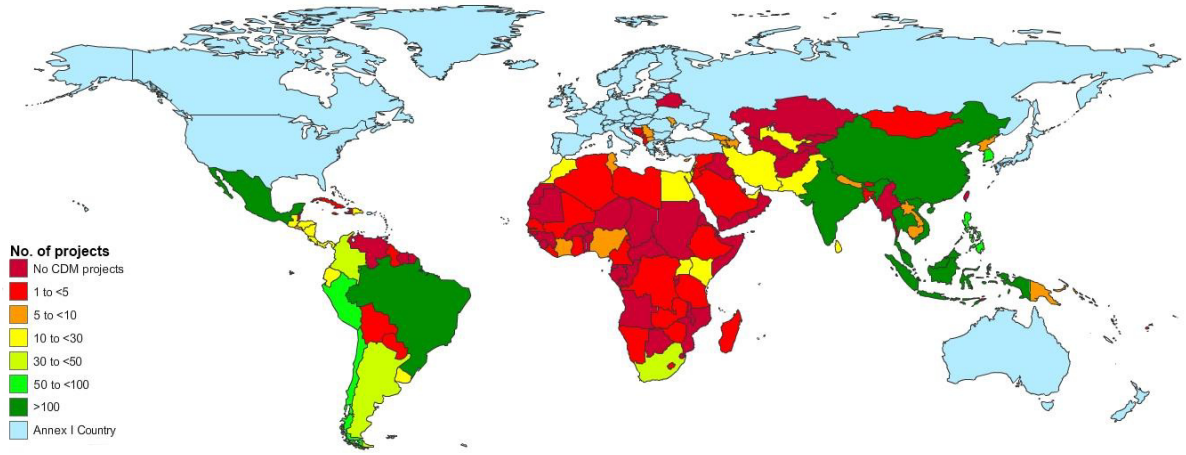


Figure 3 Number of only registered CDM projects
Source: Own illustration based on data from FENHANN (2013) and UNFCCC (1998a)

2.2.6 Determinants of CDM

FRANKHAUSER/LAVRIC (2003) stated that the attractiveness of a country for Joint Implementation (JI) investments depends on three dimensions: the mitigation potential, the capacity of institutions and the business environment. In a cluster analysis JUNG (2005) used the dimensions to classify 114 potential CDM host countries with respect to their attractiveness for non-sink CDM investments (see Figure 4). According to her, the overwhelming majority of African countries included in the study are rated as very unattractive whereas Argentina, Brazil, India, Mexico, South Africa, Thailand, China and Indonesia are considered very attractive. ZHU (2012, p. 4) also highlighted that the performance of a CDM host country mainly depends on the domestic economy and the investment climate. Song concluded in his doctoral thesis on factors determining CDM investments that "the attractiveness of CDM projects to potential developers is heavily influenced by the environmental, political, and technical environments of host countries including their emission reduction potential, domestic policy support, and general investment environments" (SONG, 2010, p. 131).

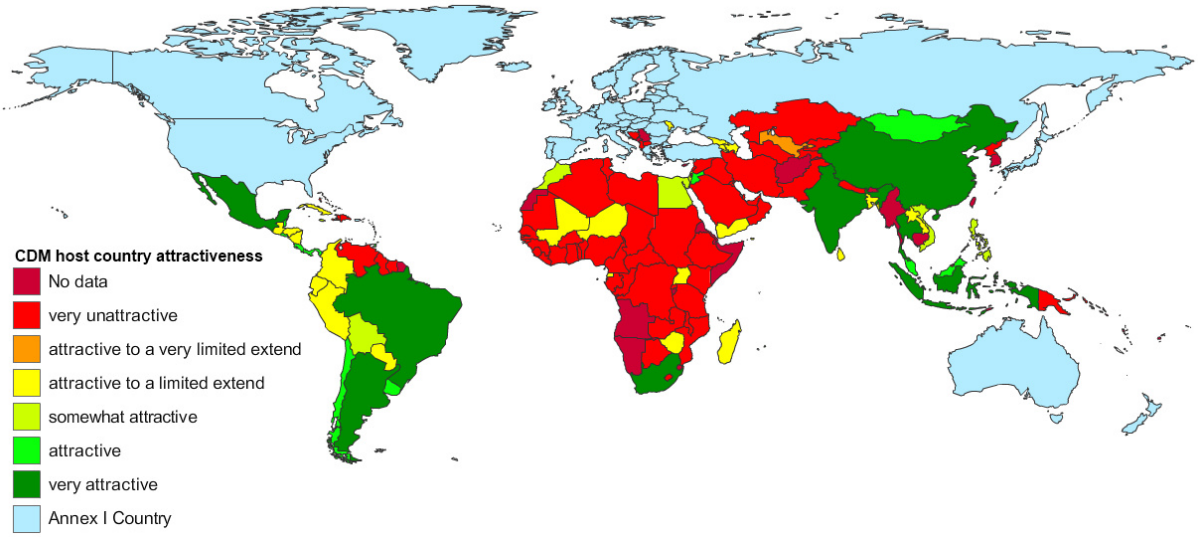


Figure 4 Attractiveness of 114 CDM host countries for non sink CDM investments
Source: Based on JUNG (2005) and UNFCCC (1998a)

Research has also identified and categorised an abundance of potential inhibiting factors for CDM implementation. For example ELLIS/KAMEL (2007, p. 17 ff.) distinguished between national barriers, CDM related barriers, international framework barriers, international project related barriers and barriers caused by the uncertainty of the post Kyoto regime. One of the desired outcomes of CDM is the transfer of environmentally sound technologies to developing countries. PAINULY/FENHANN (2002, p. 6) identified institutional barriers, market barriers, barriers due to low awareness, financial barriers, economic barriers, technical barriers, capacity barriers, social barriers, environmental barriers, and barriers due to policies and regulations. A senior level round table discussion was held during the 9th COP meeting in Milan/Italy in 2003 to talk about requirements for transferring technologies. The participants came to the conclusion that "barriers exist at every stage of the technology transfer process – technical, economic, political, cultural, social, behavioural and institutional" (UNFCCC, 2004, p. 5).

2.2.7 Controversial issues

Research on CDM more or less started immediately after CDM had been defined as one of the mechanisms of the Kyoto Protocol and there is literature on almost every facets of CDM available. Considerable research has focused on the efficacy of CDM with respect to economic, social and environmental sustainable development (SCHNEIDER 2007; NAGLE 2009; SIROHI 2007) and on criteria to appraise and measure sustainable development impacts (THORNE/LA ROVERE 1999; COSBEY et al. 2006; HUQ 2002; SUTTER/PARREÑO 2007; UMAMAHESWARAN/MICHAELOWA 2006). The transfer and

spread of environmentally friendly technologies to developing countries by CDM has been a central topic of extensive research as well (FLAMOS 2009; SERES/HAITES 2008; DECHEZLEPRETRE et al. 2007; HAGEM 2007). Furthermore, research has focused on the effectiveness of CDM projects to reduce greenhouse gas emissions (SCHNEIDER 2007; ROSENDAHL/STRAND 2009; RAHMAN et al. 2010; FIGUERES/BOSI 2006). The following two sections highlight a few of the issues exemplarily.

2.2.7.1 CDM and emission reductions

FENHANN (2013) expected that 11,639,525 ktCO2e of greenhouse gas emission will have been offset through CDM by end of 2020. Only about 11% (1,307,785 ktCO2e) of the emissions had been certified by May 2013. Yet, are the emission reductions real?.

SCHNEIDER (2007, p. 40) doubted that all projects meet the additionality requirements. He estimated that most of HFC-23, N_2O destruction, and flaring of landfill gas projects, about 70% of power generation from landfill gas or biogas projects, and about 50% of small-scale projects such as energy efficiency initiatives in industry, usage of alternative fuels in the cement industry are additional. For POTTINGER (2008, p. 2) the fact that three quarters of the hydropower projects were already operational at the time they were approved by CDM indicates strongly that they are not additional. If CDM had been essential for a project, it would not have been implemented in the first place.

UNFCCC (2002, p. 37) pointed out that project developers should chose the most appropriate methodology to determine the baseline. However, if inflated baselines are used the emission reductions will not be “real”. International Rivers and CDM Watch reviewed CDM proposals for hydropower projects and found out that “the baselines assume that they will displace electricity production from fossil fuel combustion, often coal. Even the project proposals from Uganda and Peru – countries which generate almost all of their electricity from hydropower – used fossil fuels as their assumed baselines.” (INTERNATIONAL RIVERS/CDM WATCH, 2002, p. 6). SEPIBUS (2009, p. 6) stressed that after the CDM project is implemented, the baseline describes a situation which will never exist and thus is very hypothetical.

PEARSON/KILL (2005, p. 18) highlighted that revenues from CER sales from methane avoidance projects in coal mines in China and oil production in Vietnam directly subsidize the oil and coal sector. Clean coal technologies (CCT), which are allowed under CDM, have been equally criticised. An Indian energy policy expert pointed out that because of the new

technology, India - which is on its way to become the third largest CO_2 emitter in the world - has no incentive to de-carbonised its energy policy.

Furthermore, emission reduction projects can have off-site effects. They are referred to as leakages. Although UNFCCC (2002, p. 37) made provision for technical leakages and requires that the reductions should be adjusted accordingly, leakages are difficult to foresee. Moreover, there is the risk that emission reductions are not permanent. If CDM sink projects are not managed in a sustainable manner, the captured carbon might be released again in the future.

2.2.7.2 CDM and sustainable development

SATHAYE et al (2007, p. 726 f.) identified sustainable development synergies in the energy supply and use sector, the forestry sector, the bio energy sector, the agricultural sector as well as the waste management sector. They stated that improving productivity of resource use will have a positive impact on all three dimensions of sustainable development. COSBEY et al. (2006, p. 17 ff.) pointed out that relative to their emission reductions small-scale projects tend to contribute more to sustainable development than large-scale developments. However, they also acknowledged that in absolute terms the sustainable development contribution of large scale projects might be higher than of small scale projects. Nevertheless, they cautioned against generalising too much because the absolute benefits depends on many factors, such as employment, balance of payment, reduction of local pollution. They added that large-scale CDM projects might provide the financial means to subsidize additional sustainable development projects, such as China`s 65% levy on HFC-derived CDM income.

Yet, there is no consensus on the actual contribution of CDM to sustainable development. The WORLD BANK (2004, p. 127) stated that projects that achieve long-term, real and measurable greenhouse gas emission reductions in China might not necessarily contribute to sustainable development. COSBEY et al. (2006, p. 17 ff.) highlighted that only 3 % of registered projects scored high in an evaluation of sustainable development impacts of CDM (6 out of 222 projects analysed). As there are no financial incentives for sustainable development achievements, CERs are the only economic motivation for project investors. OLSEN (2005, p. 13) pointed out that many CDM projects are only attractive due to their low-cost emission reduction perspectives, like landfill or industrial projects. CDM is a voluntary market mechanism and thus is submitted to market forces. Therefore, it comes without surprise that “low-hanging fruits [...] are exploited first” (OLSEN, 2005, p. 15).

SIROHI (2007, p 104 f.) stressed that certain types of projects, like industrial energy efficiency projects have no or only little impact on sustainability. SCHNEIDER (2007, p. 48 ff.) pointed out that HFC-23 or N2O destruction projects do not contribute to sustainable development at all because the destruction facilities do not generate additional employment, the technologies are mostly already available in the host countries and the deployment of the technology has no impact on long-term energy consumption and production patterns.

SIROHI (2007, p. 104 f.) doubted that CDM activities effectively benefit the poor in India. Projects such improving the energy efficiency in industries or the destruction of HFC-23 would only benefit companies. But even sustainable development benefits of renewable energy projects, such as supplementary income from farm and non-farm activities, better access to energy resources might not materialise for those living below the poverty line. They are often landless, small subsistence farmers or lack the skills to fully make use of the opportunities offered by CDM projects, like supplying raw material for biomass energy installations or wage employment. Because of their limited purchasing power, they will not get access to the electrical grid either. The author pointed out that the reasons for poverty in rural areas in India can be found in the distribution of landholdings, the productivity of land, the quality of labour force, etc. Yet, these issues are “beyond the development focus of CDM projects” (SIROHI, 2007, p. 105).

Some projects might even do more harm than good. INTERNATIONAL RIVERS/CDM WATCH (2008, p. 3) called some of the hydro projects “dirty CDM hydros”. For example, 1,000 people were forced to leave their homes for a 222 MW dam in Panama. This was enforced by threats, illegal destruction of crop or arbitrary detention. According to FAO (2008, p. 8), there are also trade-offs when it comes to mitigation in the agricultural and forestry sector. Mitigation measures which aim at reducing deforestation might threaten land rights and the livelihoods of rural people and undercut development efforts to improve food security.

2.3 Local Economic Development (LED)

2.3.1 Definition

There is no standard definition of LED. Development organisations, scientists, and LED practitioner have come up with a variety of definitions which differ only slightly and have all certain key characteristics in common (ILO, 2013; WORLD BANK, 2009b; UNHABITAT, 2005; RUECKER/TRAH, 2007). “LED means more than just economic growth. It is promoting participation and local dialogue, connecting people and their resources for better

employment and a higher quality of life for both men and women."(ILO 2013). The World Bank defines LED as a process to "build up the economic capacity of a local area to improve its economic future and the quality of life for all" (WORLD BANK, 2009b). LED is a participatory, bottom up approach which requires the input of all stakeholders in a locality. Furthermore, it is based on the competitive and comparative advantages of a locality. Economic development should lead to economic growth which results in employment opportunities and income for the people and ultimately improves their quality of life. The focus is more on development than on economic growth. Sustainable development is hardly ever mentioned in the definitions but is nevertheless an implicit part of LED.

LED offers a variety of tools, methods, and approaches. It encompasses initiatives, such as the development of LED strategies which, for example, provide a clear guidance for economic development, the building of necessary local capacity to initiate and maintain economic development, the development of needed infrastructure, the support of small and medium sized companies, and the reduction of bureaucracy. LED initiatives might differ from locality to locality as they depend on comparative and competitive advantages of the respective locality. As local economic conditions constantly change, LED is more of an on-going process than a project with a finite deadline. According to ROGERSON (2009, p. 73), it is essential that quick-win activities are identified and implemented in order to keep people interested and to build trust between the different stakeholders.

2.3.2 Sustainable development in LED

2.3.2.1 Sustainable development objectives

As opposed to CDM, which is project based and has a well-defined regulatory framework, LED is very often intangible, amorphous in scope and encompasses a multitude of different approaches and strategies. As wide as the spectrum of different LED activities as extensive is the range of individual sustainable development targets. Yet, the focus is clearly on social and economic development (see also attachment I Table 37).

2.3.2.2 Controversial issues

The efficiency and effectiveness of LED initiatives are controversially discussed. MEYER-STAMER (2003, p. 2) did not find many successful initiatives - neither in developing nor in OECD countries. Yet, in an evaluation of the "Empowerment Zone Program" of the US government, BUSSO/KLINE (2008, p. 29 f.) highlighted that subsidies and tax reliefs had a

positive impact on employment and housing markets. However, they were not sure if the effects remained after the end of the programme. In an investigation of pro-poor LED in South Africa, NEL (2005, p. 16) concluded that there was evidence of successful LED initiatives in Cape Town and Johannesburg. For example, 1,000 additional jobs were created in Johannesburg's fashion district. However, he also pointed out that some of the jobs were temporary and the sustainability of the LED programmes still needed to be proven. SCHEDBAUER (2005, p. 71 f.) highlighted that through systematic LED the number of legally employed people had increased by 25,000 within 28 years in the district of Cham/Germany and DALLMANN (2005, p. 81) emphasised that the number of employed people had risen by 16.4 % since the inauguration of the LED agency in 1987 in Freiburg/Germany. However, DALLMANN also stressed that a correlation between the activities of the agency and the economic development impact was not always evident.

In general, literature is very vague about concrete results of LED. Studies often highlight the objectives of programmes, emphasise on the involvement of stakeholders and institutional arrangements or focus on strategies. Reliable figures about job creation or poverty reduction are hardly available. As NEL (2005, p. 17) outlined for South Africa, the monitoring and evaluation of programmes was weak in principle. Yet, it was difficult to measure sustainable development impacts for LED initiatives because it was often very difficult to attribute an improvement of the business environment unambiguously to LED initiatives.

Nevertheless, in an assessment of the LED approach for the development of Sub-Saharan Africa RODRIGUEZ-POSE/TIJMSTRA (2007, p 62 f.) argued that LED strategies are especially apt to support sustainable development. Firstly, because advancing urbanisation and globalisation have added environmental, economic, and social pressure on individual sub-national geographic structures like municipalities or regions. Secondly, because the different dimensions of sustainable development require trade-offs and a participatory approach like LED, with all community groups involved is best suited to achieve a compromise. Thirdly through the participatory approach itself, formerly excluded groups of a community are now partaking in policy making processes which will foster a sustainable social system.

2.3.3 LED in Sub-Sahara Africa and Namibia

"Top down national development policies are designed to fit the needs of the entire country and therefore run the risk of not being able to respond to the needs and priorities of individual localities well" (RODRÍGUEZ-POSE/TIJMSTRA, 2007, p. 527). Thus, LED has also become a prominent tool for development organisations in the last decades in Africa. HELMSING

(2005, p. 19 ff.) believed that there were several forces which led to the emergence of LED in Africa. The first set of changes, which he called fundamental changes in development policy, refers to market liberalisation and decentralisation, aid fatigue and the resulting decline of Official Development Assistance (ODA)[22], and the disintegration of the Soviet empire and the disenchantment of its state-led economy development strategies. The second group of forces refers to globalisation and includes new space-reducing developments in transport and communication, the increasing mobility of people, capital and firms, and the changes in production of goods and services, such as the establishment of clusters of vertically integrated companies or technological innovations. It was against this backdrop that regional and local authorities were forced to actively develop their respective economies which finally let to the dawn of LED in Africa.

LED programs have been initiated in many countries of Sub-Sahara Africa. The majority of them are supported by a multitude of non-governmental organisations (NGOs) and national or multinational development organisations. GIZ supports LED in South Africa, Namibia, Zambia, Ethiopia, Nigeria, Ghana, etc. UNCDF together with UNDP run a program to strengthen local governments to promote LED in Uganda. UNHABITAT, ILO, FAO, UNIDO together with some other development organisations run the Lake Victoria Local Economic Development Initiative in Kenya, Tanzania and Uganda. Cities Alliances started City Development Strategy projects which also include LED in many towns in Africa, among them Dakar/Senegal, Douala/Cameroon or Dar Es Salaam/Tanzania. The Swedish International Development Cooperation SIDA and the EU finance LED projects through the program Partnership Participation Progress (P3) in South Africa, Namibia and Botswana.

The concept of LED is not new to Namibia either. According to MRLGHRD (2008, p. 5) LED emerged right after independence in 1990. In particular the Local Authorities Act and the Regional Councils Act, both of 1992, and their amendments and the Decentralisation Act of 2002 and its amendments provide the framework for local governments to engage in economic development initiatives. However, LED gained only momentum when the White Paper on LED was adopted by cabinet in 2010 and the Local Economic Development Agency (LEDA) was established in 2011. Since then all major local authorities and regional councils are seriously engaged in LED initiatives.

[22] According to KHARAS (2007, p. 7), development aid had risen about 4% annually between 1974 and 1991 due to the Cold War. After the fall of the Soviet Empire, aid dropped by 22% by 1997.

2.3.4 LED and the mitigation of greenhouse gases

As mentioned previously, LED is many-faceted and depends on a plethora of different factors. There is no “one size fits all” approach. On the contrary, individual and innovative concepts are required to fully utilise the comparative and competitive advantages of a locality. Against this background greenhouse gas emission reduction in general and CDM in particular might offer new opportunities for LED. Some initiatives already link LED programs with greenhouse gas reduction projects. For example, the Oregon House Bill 3161 of 2009 required the Oregon Department of Administrative Services to prepare a report about the establishment of a US$ 10 million greenhouse gas reduction and economic development pilot program for the construction sector. One of the objectives of the pilot programme is to identify “local economic development programs that may be enhanced through involvement with the project” (OREGON STATE LEGISLATURE, 2009, p.2). According to the CITIES FOR CLIMATE PROTECTION (2009) program, synergies between greenhouse gas reduction and LED were explored in 11 cities in Australia. In Melbourne, for example, the tenants of large buildings were introduced to “green” lighting technology. In the City of Greater Bendigo the generation of bio energy from chicken litter was proposed, which could save up to 77% of the greenhouse gas emissions caused by the poultry farm.

Several economic development programmes of GIZ have links to climate change. For example, the Engineering Capacity Building Program (ecbp) of Ethiopia supported a wind energy project and a bamboo afforestation project which promoted the use of bamboo as an alternative to firewood and wood charcoal. In South Africa a rural development programme in the province of Mpumalanga looks into the possibility of supporting a private initiative which intends to produce briquettes out of wood waste, thereby replacing the use of fossil fuels. However, these projects were just ad-hoc projects because there was an opportunity. They were not based on a systematic investigation of financially and technically viable adaptation and mitigation opportunities.

Whereas some national and regional government organisations in Sub-Sahara Africa might know about CDM, the majority of administrations on regional and local level are unaware of the instrument. For example, UNDP (2010) stated that Ethiopia had considerable CDM potential but highlighted at the same time that “many potential eligible CDM project concepts are currently unknown to factory owners, communities, NGOs and state utilities” (UNDP, 2010). According to a staff member of UNDP in Ethiopia, there is currently no link between CDM and LED programmes of UNDP in Ethiopia either. The LED unit of UNDP in Ethiopia discussed biogas projects and energy efficiency projects with local authorities and

communities. Yet, the activities were not known to or coordinated with the CDM programme unit[23].

[23] Both units are located on the same floor of the UN building in Addis Abeba.

3 Methodology

3.1 Purpose

During the course of this research, attracting, supporting, and inhibiting factors for mitigation and CDM projects were discussed based on data obtained from literature research. LED stakeholders` perceptions and knowledge concerning climate change projects were investigated with qualitative and quantitative research techniques while a real life case was studied to provide context data. Methodological and data triangulation was used to increase the credibility of concepts worked out during the research. In this chapter the reader is introduced to these approaches in detail.

3.2 Units of study

One unit of analysis of the empirical study were stakeholders as they are the main actors in LED initiatives. They were grouped into five clusters: town and regional chief executives, economic planners, LED consultants, councillors, and other stakeholders. Another unit were conditions and forces which determine if mitigation and CDM projects can be initiated by LED, such as potentials for emission reduction projects, economic conditions, etc.

LED is one of the mandates of local governments. In Namibia, local authorities and regional administrations are in charge of LED. To this end regional councils and local authorities employ economic development planners, who are tasked to propose, plan, and implement LED initiatives. Depending on many factors such as the size of the locality, the socio-economic development level or the availability of public budget, some localities have designated economic development officers whereas in other locations this task was assigned to existing staff from corporate services, town planning, marketing, etc. In this thesis, they were all referred to as economic planners. A local authority or region is run by a chief executive officer (CEO) or a chief regional officer (CRO) respectively. CEOs and CROs were categorized as chief executives in this thesis. They are instrumental in obtaining the approval and the public budget for LED initiatives from local councils. Consultants play an essential role as well. In most cases local and regional authorities resort to them because of their LED knowledge and planning and implementation skills. The term “other stakeholders” subsumes staff from national ministries, community organisations, traditional authorities, business support organisations, associations, unions, vocational training centres, schools, etc. which also play an essential role in LED initiatives. Private companies are one of the most important stakeholders in LED. They were not considered as the focus of the research

project was on initiating mitigation and CDM projects through LED and LED initiatives in Namibia a predominantly started by staff from the public sector.

3.3 Literature research

3.3.1 Overview and rationale

Literature research provides the theoretical background and allows the perusal of existing data. It was felt that the review of literature was in particular necessary because:

- the specific field of research was new. The review of literature allowed to formulate the final research questions and to establish the overall research framework (e.g. limitations, timeframe, costs).
- the preparation of stakeholder interviews and questionnaire required extensive information on the topic.
- an empirical study on certain aspects such as the potential for mitigation projects was outside the scope of this thesis. In this case, the discussion had to be purely based on literature.
- results of the empirical research could be cross-checked with information obtained from literature

3.3.2 Sources

The secondary research, that is the analysis and interpretation of available information, was based on electronic sources and on printed material, such as books, scientific magazines, newspapers, grey literature, etc. The number of sources on CDM and LED was too overwhelming to allow a detailed evaluation of every article. Yet, literature on the actual research topic was virtually non-existent.

With respect to English references, for example, the Internet revealed about 660.000 websites on the Clean Development Mechanism and about 564.000 on LED. However, a combined search of Local Economic Development and Clean Development Mechanism resulted in only 3.960 hits. Restricting the search to scientific literature resulted in only 185 hits[24].

General literature on LED and CDM was obtained from the following sources:

[24] The Internet search was carried out on Aug. 26, 2010. Google and Google Scholar were used to search for literature.

- Deutsche Bibliothek, Frankfurt
- Bilateral development organisations like the Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- UN organisations and agencies, like UNFCCC, UNEP, UNDP, ILO, etc.
- World Bank, International Monetary Fund, African Development Bank, etc.
- Internet sources, like the Tyndall Center for Climate Change Research, the Social Science Research Network, or the Forum: Qualitative Sozialforschung.
- Namibian ministries (see below for a list of ministries) and ministries of other countries being in charge of economic development or climate change issues
- Scientific journals and magazines
- Own resources (library)

Literature with respect to CDM or LED in Namibia was obtained from several Namibian and international organisations. There were no scientific papers available. The studies found were often very superficial and shallow. Many studies were desktop studies compiling information from previous reports and investigations. The following sources were used to obtain information on Namibia:

- Ministry of Environment and Tourism (MET)
- Ministry of Mines and Energy (MME)
- Ministry of Agriculture, Water and Forestry (MWAF)
- Ministry of Trade and Industry (MTI)
- NamPower (Namibian power supplier)
- Consultancy companies in Namibia with special focus on energy or economic development
- Non-governmental organisations (NGOs) with focus on energy and sustainable development
- Research institutions, like the Desert Research Institute, Polytechnic, University of Namibia
- Other institutions, e.g. the Renewable Energy and Energy Efficiency Institute (REEEI)
- UN organisations, such as UNFCCC and UNDP
- Bilateral development organisations active in Namibia
- World Bank

3.4 Quantitative research

3.4.1 Overview and rationale

According to HUG/POSCHESCHNIK (2010, p. 112), quantitative research is the systematic, objective and standardised measurement of real and empiric facts, the deployment of standard procedures to test hypotheses, the measurement of quantifiable facts and the analysis by statistical instruments are typical for quantitative research methods. It normally requires larger sample sizes.

Quantitative data can be captured in numerous ways, such as measuring physical characteristics and counting observations. In order to assess the perceptions and knowledge of LED stakeholders with regard to climate change mitigation initiatives and LED, a survey among stakeholders was conducted.

The quantitative research methods were applied because:

- the research aimed at obtaining answers to “who”, “what”, “where”, “how many”, “how much” – questions, such as “who is responsible for climate change mitigation initiatives?” or “what are the main challenges climate change mitigation initiatives face?”.
- quantifiable data were needed to test if stakeholders` opinion and knowledge differ.
- quantifiable data were required to support and complement the findings of the literature research, qualitative research and case study.

3.4.2 Survey

3.4.2.1 Design of survey and tests

To design the survey, LED and climate change experts were consulted and literature research was conducted. The first draft of the questionnaire was perused by people who were not involved in any kind of climate change activities. Based on their comments the questionnaire was then revised (see attachment III for final questionnaire). The reason for asking non-experts was to make sure that ordinary people understood the questions. In a test, it was measured how long it took to fill out the questionnaire. Ideally, this should not take longer than about 20 minutes. The questionnaire was to be distributed and filled out during conferences and trainings which normally have a tight schedule. It was also taken into account that people start to lose patience with long questionnaires and then tend to provide unqualified answers. In a pilot the questionnaire was handed out during a LED conference in

2011 and answered by about 120 people. Based on this experience the questionnaire was again revised and finally used in LED trainings and LED conferences in 2012/13.

The questionnaire was designed in a way which forced the respondents to provide answers. Non-committal answers such as “do not know” were only accepted in two cases. It was assumed that “do not know” options provide an easy answering option and might therefore be ticked too often.

In several cases stakeholders were asked to rate certain aspects such as the economic development potential of mitigation projects on a 10 point scale. In a study, DAWES (2008, p. 9) found out that a 5 or 7 point scale produces a higher mean than a 10 point score. The difference of 0.3 was statistically significant on a 5% level. There was no significant difference for the standard deviation, kurtosis, and skewness. It was concluded that the “scales are all comparable for analytical tools” (DAWES, 2008, p. 9) and that there are no disadvantages in using a 10 point scale.

In addition, it was anticipated that a 10 point scale would result in a more differentiated picture. It was also assumed that respondents tend to choose the value in the middle of a scale. This mid-point value would be more clearly defined in a scale with odd numbers of categories. This was avoided by using a 10 point scale.

The questionnaire was not anonymous. Although people might not feel comfortable stating their true opinion this risk was taken because of the following reasons:

- Contact details of participants allow follow up enquiries. Stakeholders consulted prior to the survey stated that the risk to receive wrong or missing answers due to personal data would be minimal
- Certain data were needed to group stakeholders and conduct statistical analyses, such as function, location, etc. and this information would already allow the identification of the respondent (e.g. CEO of a town)

3.4.2.2 The sampling

On several occasions such as LED trainings, LED conferences, LED sensitization workshops, participants were asked to fill out the questionnaire. Taking into account that most people are tired after a lecture, the questionnaires were always distributed after breaks. It was assumed that only people with a certain interest in LED attended the events. On other occasions, where questionnaires were sent out by mail or email the response rate was low. Thus, distributing the questionnaire during the above mentioned events guaranteed a higher response rate. The more so as the questionnaire was filled out under instruction and

questions of clarification could be asked. During the trial phase in 2011 it was recognized that people struggled to understand some of the questions. Thus, filling out the questionnaire under the instruction would result in a higher quality and credibility of the answers and less missing data. Considering the size of Namibia and the distances between towns, individual visits to local authorities and regional councils were not an option. The disadvantage of the above approach was that some stakeholder groups might be underrepresented in the overall sample. For example, councillors do not normally participate in more technical oriented conferences, trainings and workshops. Thus, the sample size of councillors was expected to be low in relation to the population size (all councillors). All in all, the selected approach was considered to be the most cost effective and efficient one.

3.4.2.3 Determination of the population size

As there are 54 local authorities and 13 political regions in Namibia[25] and as every local authority or region has one CEO or one CRO respectively, there is a population size of 67 chief executives. The number of economic development planners could only be estimated because there were no precise data available. After talking to some LED officers and staff of the national LED agency, it was assumed that every local authority and regional council has approximately two staff whose responsibility includes economic planning. This makes a total of 134 economic development planners in local governments. The number of LED consultants was equally difficult to obtain. Based on the number of consultants who have a proven record of working with local governments in the field of LED, who are known to the author of this thesis or with whom the author worked on LED related topics in the past, is was assumed that there are no more than 30 of them in Namibia. According to GRN (2012), the 13 Namibian regions are subdivided into 107 constituencies. Every constituency elects a regional councillor who represents the constituency in the regional council. Local authorities are ruled by local councils. According to the last local election in 2010, there are 329 local authority councillors in Namibia. Thus, the number of councillors added up to 436[26]. The number of “other LED stakeholders” in Namibia could not be estimated at all (see also Table 2).

[25] As of August 2013 the number of regions increased to 14. In November 2013 the number of local authorities stands at 52.

[26] According to the Namibian constitution (article 106), every region has between six and 12 constituencies. According to the local authority act, village councils have five councilors and municipalities and towns between seven and 15.

3.4.2.4 Calculation of the sample size and the desired accuracy

Because the survey captured only ordinal and nominal data the sample sizes were calculated for proportions. The required sample sizes for the different stakeholder groups were calculated for a 95% confidence level and a 5% margin of error. When the population was known or could be estimated the calculation was carried out based on a finite population size otherwise the calculation was computed based on an infinite population size. The following formula was used to calculate the sample size for an infinite population:

$$n = p * (1 - p) * \frac{z^2}{c^2}$$

The following formula was used to calculate the sample size for a finite population:

$$n = \frac{p * (1 - p) * \frac{z^2}{c^2}}{1 + \frac{p * (1 - p) * \frac{z^2}{c^2} - 1}{N}}$$

where p = parameter representing a population proportion (point estimator), z = standard score (critical value) for 95% confidence level (two-tailed, here 1.96), c = required margin of error (here 0.05), and N = the population size as indicated in Table 2

Because the probabilities of the proportions were not known, the sample sizes were calculated based on a worst case scenario for the sample size, which assumes a probability of 0.5. This resulted in a maximum sample size.

In such a case 75% of all economic planners, 85% of all chief executives, 93% of LED consultants and 47% of all councillors had to fill out the questionnaire. To achieve the required sample size in an efficient way, questionnaires would have to be mailed and people would have to send them back. Based on previous experience, the probability of getting enough questionnaires back would be low.

		Overall	Chief executives	Economic Planners	Consultants	Councillors	Others
Population size		infinite	67	134	30	436	infinite
Sample size	for a finite population	n/a	57	100	28	204	n/a
	for an infinite population	384	n/a	n/a	n/a	n/a	384
	% of population	n/a	85%	75%	93%	47%	n/a

Table 2 Required sample size for a 95% confidence level and a margin of error of 5%

To compute tests for the overall population of LED stakeholders, the sample had to reflect the actual composition of the population. Because of the reasons mentioned above and the

fact that for only two different stakeholder groups the population size was definitely known this might be impossible to achieve.

As the results of the research were based on data from qualitative and quantitative research, a case study, and literature research, smaller sample sizes with a higher margin of error were accepted.

3.4.3 Statistical methods used to analyse the survey data

3.4.3.1 Tests

3.4.3.1.1 Significance level

Statistical hypothesis tests require the definition of a significance level (α-level). If the tests yield a value of less than the α-level, the hypothesis should be rejected. The definition of the α-level is up to the researcher and "reflects how cautious the researcher wants to be" (AGRESTI/FINLAY, 1997, p. 173). The smaller the α-level the more difficult it is to reject the hypothesis. Rejecting the null hypothesis might have serious implications (e.g. test of the hypothesis that the effectiveness of new drugs to currently prescribed ones are the same). In these cases one should prefer a small α-level. The α-level for the test is identical with the accepted Type I error of statistical tests. The Type I error determines the probability of rejecting the hypothesis even though the hypothesis is true. The Type II error defines the probability of not rejecting the hypothesis even though the hypothesis is wrong. The two types of errors are related. The smaller the Type I error the higher is the probability of a Type II. This fact has to be taken into account before deciding on a predefined significance level. AGRESTI/FINLAY (1997, p. 176) highlighted that for exploratory research an α-level of even 10% might be appropriate. YIN (2009, p. 34) stressed that in social sciences an α-level of 5% is normally used in hypothesis testing. The tests carried out in this thesis compare the opinion and knowledge of stakeholders. A 5% α-level was used in all tests, because:

- the results of the tests do not have serious implications on critical social issues (e.g. health, security, etc.).
- a balance between Type I and Type II errors needs to be struck.
- the research is exploratory in nature and thus tests should highlight potential differences. However, a lower α-level (e.g. 1%) will makes it more difficult to reject the null hypotheses (e.g. that there are no differences among stakeholder groups).

3.4.3.1.2 Pearson´s Chi-squared

The chi-squared test can be used as a test of goodness of fit in order to establish if the distribution of observed data differ significantly from a theoretical predefined distribution. In this thesis, it was used to test if the frequency distribution of a variable is consistent with the normal distribution. It can be applied for categorical data. In order to conduct the test, the observations for a variable are grouped into categories. Based on a presumed distribution of the variable, the number of expected observations per category is calculated.

The test statistic is then calculated with

$$\chi^2 = \sum_{i=1}^{m} \frac{(N_i - E_i)^2}{E_i}$$

where χ^2 = Pearson`s cumulative test statistic, N_i = actual number of observations in category i, E_i = expected number of observations in category i, m = number of categories, and i ϵ{1..m}.

If in a test of goodness of fit the distribution parameters are not known, they have to be estimated based on the sample. This has consequences on the degree of freedom. For every parameter estimated (e.g. mean value, standard deviation) the degree of freedom is reduced by 1. The degree of freedom is calculated with n-1-w where n = number of categories and w = number of estimated parameters, which is, for example, 2 for the normal distribution.

With the degree of freedom and a predetermined level of significance, the calculated test statistic is then compared with the values of the chi-squared distribution. If the calculated chi-squared value is above the value of the chi-squared distribution, the hypothesis that the observed variable follows a presumed distribution (e.g. normal distribution) cannot be rejected. In case the value is below the value of the chi-squared distribution, the hypothesis is rejected.

3.4.3.1.3 Mann Whitney U test

To test hypotheses, the Mann Whitney U Test was used for ordinal non-binary variables. The test does not require a normal distribution of the variables. With the test two independent samples can be compared. For every test the size of the samples was denoted with n_1 and n_2 where n_1 is the sample with the least number of elements.

The data of the two samples were sorted in ascending order and ranked. If two or more observations were the same (ties), they all were assigned the average rank of the ranks they would have gotten, if they had been different from each other. The ranks per sample were then added up.

To consider ties, the standard deviation σ_{Ucorr} for the Mann Whitney U Test was calculated as:

$$\sigma_{Ucorr} = \sqrt[2]{\frac{n_1 * n_2}{N * (N-1)}} * \sqrt[2]{\frac{N^3 - N - \sum_{i=1}^{k} t_i^3 - t_i}{12}}$$

where $N = n_1+n_2$, t_i = number of tied observations for rank i, k = number of ranks.

According to SIEGEL (1976, p. 122), if $n_2>20$ the significance level of the test can be approximated by computing the standard score (z value). This level can then compared with the predefined significance level (α-level).

The standard score z was calculated using the following formula:

$$z = \frac{|U - \mu_U|}{\sigma_{Ucorr}}$$

where $U = \min(U_1,U_2)$ and

$$U_1 = n_1 * n_2 + \frac{n_1 * (n_1 + 1)}{2} - R_1$$

$$U_2 = n_1 * n_2 + \frac{n_2 * (n_2 + 1)}{2} - R_2$$

$$\mu_U = \frac{n_1 * n_2}{2}$$

where R_1 = the sum of the ranks assigned to the first sample and R_2 = the sum of the ranks assigned to the second sample.

3.4.3.2 Clopper Pearson confidence interval

The Clopper Pearson interval method was used to calculate the confidence interval for proportion estimates. This interval was used because it avoids normal theory approximation and provides a conservative confidence interval, which means the true coverage probability is usually greater than or equal to the nominal coverage probability (confidence level). Normal approximation works best, if the point estimator is close to 0.5. However, it was

assumed that the proportions (e.g. ratio of people who feel that climate change threatens the development of their locality) would be closer to 0 or 1. In such a case, the Clopper Perarson interval provides more accurate intervals.

The confidence intervals were computed based on a 95% confidence level (confidence coefficient). The Clopper Pearson interval is determined by the following formula:

$$p_l = \frac{k}{k + (n - k + 1) * F_1}$$

$$p_u = \frac{(k + 1) * F_2}{n - k + (k + 1) * F_2}$$

where p_l,/p_u = lower bound/upper bound, F_1 = Fisher distribution ($F_{1-\alpha/2}$ quantile with 2n-2k+2, 2k degrees of freedom), F_2 = Fisher distribution ($F_{1-\alpha/2}$ quantile with 2k+2, 2n-2k degrees of freedom), n = sample size, k = number of successes (e.g. yes answers), 1-α = nominal coverage probability and 0<k<n.

3.4.3.3 k-combinations

The number of tests for a specific aspect, which were required in the analyses, was calculated with the formula for k-combinations. The formula for k-combinations is:

$$\binom{n}{k} = \frac{n!}{k! * (n - k)!}.$$

where n = number of elements in a set, k = number of elements to be taken out of the set.

3.5 Qualitative research

3.5.1 Overview and rationale

The quantitative research provided data with regard to how stakeholders perceive issues concerning climate change mitigation initiatives. Qualitative research techniques were used to obtain subjective data which allows to interpret the captured quantitative data and to discover additional phenomena.

Qualitative research is characterised by a non-representative, small sample size which means that meaningful statistical analyses are not possible. The methodology is used to

support the development of new hypothesis. The main focus is on subjective factors, which are not measured but interpreted. An open and flexible approach is deployed without standardised procedures. For WEITZ (1994, p. 14) qualitative research is not submitted to pre-defined theoretical opinions, aims at the discovery of unknown facts and their linkages, attempts to come to terms with very specific problems by studying a single or a few cases, does not apply standardised research methods and does not need a structured research situation.

Qualitative research techniques were applied because:

- they complemented the findings of the survey with qualitative data. At the start of the research, they were also used to capture enough data to design the survey.
- it was expected that the statistical tests would not be based on a representative and large enough sample size. Thus, the qualitative research would add credibility to the results of the statistical tests.
- the survey would limit the findings of the thesis to the aspects covered by the survey. The qualitative research could lead to the discovery of new phenomena.

3.5.2 Grounded Theory

3.5.2.1 Overview and rationale

In the thesis it was attempted to discover new concepts and develop new hypotheses. To do so, the Grounded Theory was used. As mentioned before, no study could be found which deals with the specific subject of this research. Thus, it was assumed that this field of research was new, that no theories or hypotheses were developed yet and that the research would be exploratory in nature.

The Grounded Theory developed by GLASER/STRAUSS (2012) in the sixties is a methodology to develop theories purely based on data collected. While Glaser favoured the original approach Anselm Strauss together with Juliet Corbin developed a more pragmatic one[27]. The following description of the Grounded Theory is mainly based on Corbin and Strauss` book “Basics of Qualitative Research”.

THOMAS/JAMES (2006, p. 768) highlighted that in qualitative research researchers are often stuck after having captured the data and do not know how to proceed. The Grounded Theory provides a set of procedures to capture and analyse data and build theories.

[27] Corbin and Strauss proposed tools to extract information out of the data, such as the coding paradigm or axial coding. Glaser argued that this forces categories on data. According to him, the categories should be developed based on data only (theoretical coding). The categories should purely emerge from data.

Basically, the Grounded Theory consists of three processes, the theoretical sampling, coding and creating memos and diagrams, and theory building. They are parallel processes which feed each other.

The Grounded Theory was chosen because:

- the research is exploratory and aims at discovering new concepts and phenomena. CORBIN/STRAUSS (2008, p. 53 ff.) highlighted that theory building is not the only objective of qualitative research. The research could also aim at describing people, events, etc. or at the discovery of concepts.
- according to TUSCHKAT et al. (2005), the Grounded Theory has become a standard in empirical qualitative research.

3.5.2.2 Theoretical sampling

CORBIN/STRAUSS (2008, p. 45 ff.) defined theoretical sampling as a process that develops concepts based on data collected. Concepts are defined as “groups or classes of objects, events, and actions that share some major common properties” (CORBIN/STRAUSS, 2008, p. 45). The researcher prepares a set of initial questions to start off the research. In contrast to traditional research methods the researcher does not wait with the analysis until all data are captured but starts the analysis process immediately after the first data are available. The analysis will raise further questions which will again lead to further data capturing. “The research process feeds on itself” (CORBIN/STRAUSS, 2008, p.144). As such, it is an iterative algorithm, which will continue its question-and-analysis cycle until a level of saturation is achieved. Saturation means that additional data do not add new value to the developed concepts or lead to new concepts. In a mathematical sense, the algorithm converges. This approach also allows collecting and analysing data right up to the end of the research. The research is not strictly divided into a data capturing and a data analysis phase.

3.5.2.3 Coding and creating memos and diagrams

Coding is the process of analysing data and developing concepts. Concepts are interpretations of data that means coding goes beyond a simple description of the data. According to CORBIN/STRAUSS (2008, p. 66), coding is more than just defining concepts. It is a process where concepts and data interact, where data are compared and where the analysis of data leads to new questions. Against this background the Grounded Theory distinguishes between two levels of coding. According to CORBIN/STRAUSS (2008, p. 195

ff.), open coding or substantive coding describes the process where raw data are analysed word by word and line by line. Open coding results in the formulation of concepts. During the coding properties (e.g. stakeholder group) and dimensions (e.g. chief executives, economic planners, etc.) assigned to concepts. Axial coding refers to the identification of relationships between concepts and tries to find out how concepts can be linked with each other.

Data are analysed in terms of concepts, context and process. Concepts are “words that stand for ideas contained in the data” (CORBIN/STRAUSS, 2008, p. 159) and context describes a “set of conditions that give rise to problems or circumstances to which individuals respond by means of action/interaction/emotions” (CORBIN/STRAUSS, 2008, p. 229). According to CORBIN/STRAUSS (2008, p. 261), processes are described by phases, steps, progress, sequence but also day-to-day activities.

As mentioned before, the analysis process starts immediately after the first data were collected. The thoughts and ideas which are developed during the analysis are stored in memos and diagrams. Memos are “written records of analysis [whereas diagrams] are visual devices that depict relationships between analytical concepts” (CORBIN/STRAUSS, 2008, p. 117). CORBIN/STRAUSS (2008, p. 118) also stressed that memos and diagrams are as essential as the data capturing process as they move the theory building process forward. In order to detect contexts and relationships between contexts and processes the authors proposed to look at data from three different angles: condition, inter/action and emotions, and consequences. CORBIN/STRAUSS (2008, p. 88) called this the coding paradigm.

3.5.2.4 Theory building

Based on the concepts discovered, more abstract higher level categories can be developed. Categories are groups of concepts closely linked to each other. Yet, CORBIN/STRAUSS (2008, p. 103 ff.) outlined that the description of concepts and categories is not enough to constitute a theory. Theory is the “overall unifying explanatory scheme that raises findings to the level of theory” (CORBIN/STRAUSS, 2008, p. 104). A theory has to explain the data and not only describe them. The central category has to be identified to develop a theory. It must be abstract, appear frequently in the data, is logical and consistent with the data collected, it should grow in depth and explanatory power and other categories must be linked or related to it. In Grounded Theory the process of linking categories to a core category is called integration.

3.5.3 Interviews

To collect qualitative data, semi-structured interviews with open ended questions were conducted with LED stakeholders, LED experts and people involved in climate change related issues. An interview guideline was developed which contained questions for the first interviews. Yet, as described above, in Grounded Theory the data collected are immediately analysed. Thus, the analysis of the interviews constantly led to new questions. Depending on the course of the interview itself questions were added, dropped or changed. According to KING/HORROCKS (2010, p. 27), this is not uncommon in qualitative research.

The interviewees were informed before the interview about the topic of the research and the purpose of the interview. Individual interviews were taped. The interviews were transcribed verbatim and uploaded to the MAXQDA system for analysis. On the rare occasions when interviewees did not want to have their remarks recorded, notes were taken. On one occasion, a group interview was conducted during one of the LED workshops. Group interviews are conducted because they "reveal the social and cultural context of people`s understanding and beliefs [and] encourage recall and stimulate opinion elaboration" (KING/HORROCKS, 2010, p. 61 f.). The group interview was conducted in the form of a focus group discussion. A day before the focus group discussion the participants of the focus group filled out the questionnaire developed for the quantitative research. The results were presented to the focus group and then discussed.

TRUSCHKAT et al. (2005) emphasized not to continue conducting interviews if the obtained data do not add new information to the research. Yet, they also stressed that the number of interviews depends on the knowledge of the interview partners. It can be assumed that experts provide more information in a higher quality than non-experts. Thus, the research might require a higher number of interviews if the interviews are conducted with non-experts.

3.6 Case study research

3.6.1 Overview and rationale

The case study approach was used to observe and study what happens when an LED initiative tries to consider mitigation and CDM projects.

According to KITTEL-WEGNER/MEYER (2002, p. 13), case studies are basically qualitative research strategies but may also include quantitative analyses. Because of this, the case study approach was not subsumed under qualitative or quantitative research methods but treated as a separate research method.

For YIN a “case study is [also] an empirical inquiry that investigates a contemporary phenomenon […] within its real-life context” (YIN, 2009, p. 18). He pointed out that “surveys can try to deal with phenomenon and context, but their ability to investigate the context is extremely limited” (YIN, 2008, p. 18). A case study could focus on entities like individual persons, group of persons, organisations, interventions, etc. It is important to mention that case studies are multi-dimensional as different aspects are observed, described and analysed in parallel over a period of time. “A qualitative case study is an approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources. This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple facets of the phenomenon to be revealed and understood” (BAXTER/JACK, 2008, p. 544). Those facets might not be known beforehand and might only be worked out or discovered during the course of the case study. KOMREY (2000, p. 507) highlighted that case studies are used to describe a reality and subsequently to develop theoretical concepts or hypotheses which are based on empirical research. YIN (2009, p. 19 f.) pointed out four different applications for case studies: to explain links between real-life interventions, to describe interventions within their contexts, to describe topics within an evaluation, and to evaluate interventions which do not have a clear and single outcome.

Case studies can be conducted on a single case or on multiple cases. According to KITTEL-WEGNER/MEYER (2002, p. 20 ff.), single case studies are in particular suitable for an exploratory study. Multiple case studies are, in principle, better suited to confirm hypotheses and theories. Multiple case studies also allow the generalisation of findings. Furthermore, the authors distinguished between exploratory-descriptive and exploratory-explanatory studies. Exploratory-descriptive studies are to discover first facts and circumstances of the research subjects. The questions used to discover concepts and phenomena are “what”- and “how”-questions. The gain in knowledge is to serve as a basis for further studies. Exploratory-explanatory studies try to answer “why”-questions and aim at creating first ad-hoc hypotheses and theories. For YIN (2009, P. 8) the major questions answered by case studies are “how”- and “why”-questions. The author stressed that case studies should be applied if circumstances cannot be controlled and the focus is on contemporary events rather than on historical ones.

The real life case study was important for this research because:

- the research project was to provide a first insight to the subject of the research. Thus, the study was to be exploratory-descriptive as well as exploratory-explanatory. Exploratory research typically tries to answer “how”-, “what”- and “why”- questions. A case study is one of the methodologies to provide answers to these questions.

- case studies could provide context data to the quantitative and qualitative research.
- it supports the generalisation of research results. Provided that the initial conditions are the same, the same outcome could be expected in other cases. However, a converse line of reasoning is not valid. If a case study does not show the expected results it does not necessarily mean that it would not work in a different environment.
- a case study is suited if complex and linked circumstances are being investigated – which is the case in this research.

3.6.2 Short description of the case study

The case study was planned as a single case study. In 2010, the political region of Otjozondjupa in Namibia intended to develop an LED strategy for the region. The author of this thesis convinced the regional council to include a study on the economic development potential for greenhouse gas mitigation in the region, in particular CDM. The results of the study should then be considered in the LED strategy development process. The region was supported in getting the respective finances and human resources (experts in LED and CDM). The LED strategy development process as well as the study on mitigation and CDM potentials was only influenced by the author in cases when the process slowed down or additional resources were needed.

3.6.3 Design of the case study

YIN (2009, p. 25 ff.) defined five components for a case study design: questions, proposition, units of analysis, logic how data are linked to propositions, and criteria to interpret data. He emphasised that exploratory case studies do not need theoretical propositions. As mentioned before, this case study was exploratory which means there was no need to define and state propositions beforehand. However, YIN also stressed that a case study should have a well-defined purpose. The purpose of this case study was to explore in practice if mitigation and CDM projects could be considered as part of an LED strategy.

The region of Otjozondjupa was chosen because:

- it was assumed that a large region would have more potential for mitigation projects than a smaller locality.

- an initial assessment showed some potential for feasible and economically sensible mitigation projects.
- the regional government was willing to invest in the research project.

The study focused on processes and stakeholder groups. The data were analysed by qualitative techniques only. The principles of the Grounded Theory were used to analyse the data.

3.6.4 Collection of data

YIN (2009, p. 99) listed six sources of case study data: documentation**,** archival records, interviews, direct observations, participant observations, and physical artefacts. For this case study the final LED strategy document, the study on the potential of CDM in Otjozondjupa, workshop reports, participant lists, and minutes of meetings were analysed. Interviews were conducted with the members of the project teams (LED strategy development, assessment of CDM potential) and the stakeholders. The data were complemented by field notes and observations made during workshops (e.g. what role did mitigation projects play during LED stakeholder forums, how qualified were the contributions by stakeholders, who participated in the discussions, how were the mitigation projects identified, etc.). After the strategy had been finalised and adopted by the regional council, the progress of the actual strategy implementation was monitored.

KROMREY (2009, p. 328 f.) distinguished between 16 different observation methods. An observer could observe his or her subject of research in an artificial, laboratory kind of environment or in a natural environment. The observations could be systematic or unsystematic. An observer could participate in the observed event or not and the observed people could be aware of the observation or not. In this thesis a mostly non-participatory observation method was used. People were not aware of the research project and did not know that they were being observed for a particular purpose. The observations took place in real-life situations (project meetings, workshops, etc.) and were systematic in a sense that some the observation categories were identified beforehand. However, based on the observations, the research approach allowed for enough flexibility to drop categories or add new ones. The following categories were predefined:

- approach
- identification of potentials
- prioritisation of potentials
- participation

- objectives
- mandates
- cooperation
- knowledge and awareness

The case study data were collected between 2010 and 2013.

3.6.5 Analysis of the case study

YIN (2009, p. 136 ff.) pointed out five analytical techniques for case studies: pattern matching, explanation building, time series analysis, logic model, and cross case synthesis. For an exploratory case study only explanation building is a relevant technique. “The goal is to analyse the case study data by building an explanation about the case” (YIN, 2009, p. 141). YIN outlined that the explanation building process is iterative. Initial propositions are compared with the findings of the case study. The propositions are then refined and again compared to the findings. If more cases are investigated the propositions are compared with the findings of all cases. The process resembles the Grounded Theory approach. Thus, processes of the Grounded Theory were used to analyse the data, like theoretical sampling and open coding.

3.7 Triangulation

3.7.1 Overview and rationale

According to BYRMAN (2003, p. 1142 f.), triangulation is carried out in all instances where the phenomenon is observed from more than one point of view. The objective is to enhance the confidence in the outcome of a research project. DENZIN (2009, p. 301 ff.) distinguished between data, investigator, methodology and theory triangulation. Data triangulation is performed if data is collected in different locations, at different times, or from different groups of persons (e.g. students, teachers). According to YIN (2009, p. 116 f.) data triangulation means that data are collected from multiple sources of evidence, like documents, archival records, interviews, or observations. Investigator triangulation means that different scientists research the same phenomenon. Theoretical triangulation uses more than one theoretical point of view or hypothesis to interpret data. Methodological triangulation applies different research methods, such as focus group interviews, individual interviews, and observations to increase confidence in the research results.

Triangulation was applied because:

- it increases the credibility of the research results.
- the individual research methods applied might not provide enough data to formulate concepts or hypotheses.

3.7.2 Application

Triangulation was applied in respect to data and methodological triangulation. Data from five clearly distinguishable groups of major players involved in LED were collected: local and regional government chief executives, economic planners, consultants, councillors and other stakeholders. The methodological triangulation used qualitative research techniques (Grounded Theory), quantitative research techniques (e.g survey, statistical tests), literature research, and the case study approach (real life experience). Theoretical triangulation was not feasible as the field of research was new and not propositions existed. Furthermore, there was only one investigator involved in the project. Therefore, investigator triangulation was not applicable either.

3.8 Sequence of research approaches

The research approaches were not strictly applied sequentially. They were supposed to cross-fertilize each other. For example, the outcome of the first interviews was used to design the survey and the results of the survey were used to structure additional interviews. The case study was started as soon as the financial means were provided by the project partners. Some of the findings from the case study were used for the design of the questionnaire and the interview guidelines. Literature research was continuously conducted during course of the whole study.

3.9 Data capturing period

The survey data were captured during LED conferences, LED workshops, and LED trainings conducted between April 2012 and April 2013. The case study was observed and data were captured over a period of three years between 2010 and 2013. Interviews were held over the whole research period from 2010 to 2013.

3.10 Summary

In this chapter the quantitative and qualitative research methodologies, literature research, and the case study approach which were used during the research are introduced and their deployment justified.

To summarize:

(1) The field of research was new and thus the research was exploratory in nature.

(2) Exploratory research requires that the subject of research should be looked at from various angles.

(3) Therefore, it was necessary to use different research approaches and sources of evidence. This approach also increased the reliability of the research results.

(4) The different research approaches were to cross-fertilize each other. Thus, the different researches approaches were largely deployed in parallel.

(5) Literature research was conducted to establish the theoretical background and to discuss attracting, supporting and inhibiting factors for CDM projects in Namibia.

(6) The study focused on stakeholders` opinion and knowledge and on conditions and forces which determine the successful integration of mitigation and CDM projects into LED

(7) Five groups of LED stakeholders were defined and were considered in the research project: chief executives, economic planners, LED consultants, councillors and other stakeholders. Process is the sequence of steps which need to be taken to initiate mitigation projects as part of LED.

(8) A survey was developed to collect quantitative data and statistical tools were selected to analyse the captured data.

(9) Semi-structured interviews with open ended questions were used to capture qualitative data. They were analysed with instruments of the Grounded Theory.

(10) A case study in the political region of Otjozondjupa was selected to gain insights into a real life situation. The regional council of that region decided to develop an LED strategy. Parallel to the strategy development the potential for mitigation projects in the region – in particular CDM – was assessed. The results of the assessment were fed into the LED strategy development process.

(11) The survey data were captured during LED conferences, LED workshops, and LED trainings conducted between April 2012 and April 2013. The case study was observed and

data captured over a period of 3 years between 2010 and 2013. Interviews were held over the whole research period from 2010 to 2013.

4 Sample data and data treatment

4.1 Purpose

In this chapter, it is outlined how the captured data were treated and structured. Additionally, first basic analyses were computed, such as geographic coverage of data, margins of error, etc.

4.2 Quantitative research

4.2.1 Sample size and accuracy

229 people filled out the questionnaire: 26 chief executives, 58 economic planners, 18 LED consultants, 69 councillors (of local authorities and regions), and 58 other LED stakeholders.

85 (37.1%) out of 229 respondents returned a completed questionnaire. Cases with too many missing data were identified with the help of a frequency table (see attachment I Table 39). All cases with more than 40% of missing data were deleted. It was assumed that data augmentation would be used to impute missing data later. Data augmentation is robust against violations of the normality requirement if missing data do not exceed 50%. This reduced the sample size by 5 cases (about 2% of all cases) and increased the margin of error only slightly: for executives by around 0.5 percent points, for economic planners by approximately 0.2% percent points, for consultants by circa 1.1 percent points and for councillors and other stakeholders by around 0.1 percent points. For all stakeholders combined the margin of error increased by about 0.1 percent points (see Table 3).

After having deleted cases with too many missing data, 224 questionnaires were considered in the analysis. 25 questionnaires were filled out by chief executives, 57 by economic planners, 17 by LED consultants, 68 by councillors (of local authorities and regions), and 57 by other LED stakeholders.

		Chief executives	Economic planners	Consultants	Councillors	Other stakeholders	All stakeholders
Population		67	134	30	436	infinite	infinite
Original sample size	No. of respondents	26	58	18	69	58	229
	Margin of error (%)	15.15	9.73	14.86	10.84	12.87	6.48
Cleansed sample size	No. of respondents	25	57	17	68	57	224
	Margin of error (%)	15.64	9.88	15.91	10.93	12.98	6.55

Table 3 Margin of errors for sample sizes

For an infinite population size the margin of error was calculated with

$$MoE = z * \sqrt[2]{\frac{p * (1-p)}{n}}$$

and for a finite population size with

$$MoE = z * \sqrt[2]{\frac{p * (1-p)}{n}} * \sqrt[2]{\frac{N-n}{N-1}}$$

where MoE = margin of error (radius of confidence interval), p = parameter representing a population proportion (point estimator), z = standard score (critical value) for 95% confidence level (two tailed, here 1.96), and N = the population size as indicated in Table 2.

4.2.2 Representativeness

4.2.2.1 Representativeness of stakeholders

The overall sample was found not to be representative. For example, economic planners are overrepresented whereas councillors are underrepresented (see Table 4).

		Chief executives	Economic planners	Councillors	Consultants	Total
Population	No. of potential respondents	67	134	436	30	667
	%	10.0	20.1	68.4	4.5	100
Sample size	No. of respondents	24	57	68	17	167
	%	15.0	34.1	40.7	10.2	100%

Table 4 Comparison of sample size with representative sample proportions

4.2.2.2 Geographic representativeness

The survey was filled out by LED stakeholders from all 13 regions of Namibia[28] (see Table 5). About 10 to 20 questionnaires were returned per region. Because of two well attended events, the LED conference in Khomas and the LED sensitization workshop in Caprivi, many more questionnaires were received from stakeholders from these regions. From the region of Omaheke und Oshikoto only a handful of stakeholders took part in the survey. This was to some extent expected as there are not many towns located in these regions.

[28] since August 2013 Namibia has 14 political regions

Stakeholder group	Caprivi	Erongo	Hardap	Karas	Kavango	Khomas	Kunene	Ohangwena	Omaheke	Omusati	Oshana	Oshikoto	Otjozondjupa	Total
Chief executives	1	1	5	4	1	0	3	0	1	3	2	2	2	**25**
Economic planners	7	8	7	4	2	3	3	4	2	5	3	1	8	**57**
Consultants	0	0	0	0	0	17	0	0	0	0	0	0	0	**17**
Councillors	0	5	4	4	14	1	1	12	2	12	10	2	1	**68**
Other stakeholders	39	3	0	3	0	7	3	0	0	0	0	1	1	**57**
Total	**47**	**17**	**16**	**15**	**17**	**28**	**10**	**16**	**5**	**20**	**15**	**6**	**12**	**224**

Table 5 Geographic coverage of survey

4.2.2.3 Representativeness of local governments

The questionnaire was answered by representatives of 44 (81%) of the 54 local authorities[29] (see attachment Table 40) and 10 (77%) of the13 regional administrations in Namibia (see Table 6).

Category	Caprivi	Erongo	Hardap	Karas	Kavango	Khomas	Kunene	Ohangwena	Omaheke	Omusati	Oshana	Oshikoto	Otjozondjupa	Total
Chief executives	1	0	0	0	0	0	1	0	0	0	0	0	0	**2**
Economic planners	4	1	2	0	1	1	0	2	2	0	0	0	2	**15**
Councillors	0	0	0	0	7	1	0	9	0	0	5	0	0	**22**
Total	**5**	**1**	**2**	**0**	**8**	**2**	**1**	**11**	**2**	**0**	**5**	**0**	**2**	**39**

Table 6 Respondents from regional councils

4.2.3 Data treatment

4.2.3.1 Data cleansing

After having deleted all cases with too many missing data, the remaining questionnaires were manually searched for unlikely data, logical discrepancies and outliers. The following strategy was applied for cleansing inconsistent data (see also attachment III for final questionnaire):

- Name, organisation, functions, etc.: All respondents provided data. No data treatment was necessary.
- Questions 1 and 2: In question 1 stakeholders were asked to indicate if they felt that the development of their locality is threatened by climate change. In question 2 they were required to rate the threat with respect to economic, social and environmental sustainability on a 10 point scale (10 = high threat). If respondents answered question 1 in the negative, they were not supposed to rate the threat in question 2. If

[29] Because the Namibian government downgraded two local authorities, there are now only 52 in Namibia.

in such a case an answer was given, it was marked zero. If the answer to question 1 was “do not know”, the rating in question 2 was set to 5 (value in between 0 and 10). Omitted data in question 1 and 2 were considered missing values.

- Question 3 and 4: In question 3 people were asked to indicate if they believe that mitigation or adaptation have the potential to contribute to economic development. In question 4 people were asked to rate the potential on a 10 point scale (10 = high potential). If respondents answered question 3 in the negative they were not supposed to rate the potential in question 4. If in such a case an answer was given, it was marked zero. If the answer to question 3 was “do not know”, the rating in question 4 was set to 5 (value in between 0 and 10). Omitted data in question 3 and 4 were considered missing values.
- Questions 5 and 6: Out of a selection of 25 sustainable development objectives for LED (question 5) and 25 objectives for climate change mitigation initiatives (question 6) people were supposed to tick five which they feel most important. In cases when people ticked less or more than five options, the cases were deleted and not considered during the analysis (casewise deletion). Missing data were not imputed.
- Question 7: People were supposed to rate the economic development potential of 15 different mitigation initiatives on a 10 point scale (10 = high potential). If they did not have an opinion on a proposed mitigation initiative, they did not have to provide an answer. Non-committal answers were not considered in the analysis. Only one participant ticked none of the 15 options. This case was rated as “really” missing and the missing data were imputed.
- Questions 8 and 9: Out of a selection of 25 challenges for LED (question 8) and 25 challenges for climate change mitigation initiatives (question 9) people were asked to tick five which they feel most challenging. In cases where people ticked less or more than five options, the cases were deleted and not considered during the analysis (casewise deletion). Missing data were not imputed.
- Question 10: The participants had to rate their knowledge on different climate change instruments and policies. “Do not know”-answers were not considered as it was a self-assessment. If they did not know the instrument they were asked to tick 1 (= very poor). Omitted values were supposed missing values.
- Question 11: Participants were required to indicate the main drivers of climate change initiatives in towns and regions. They were provided with a selection of potential drivers from which they could choose. More than one answer was possible but “do not know”-answers were not allowed. Ticked options were recoded to 1, unticked options to 0. If a question was not answered at all, the answer was considered missing.

- Question 12: Participants were requested to indicate what functions (promoting, financing, implementing, operating) the drivers of climate change initiatives should assume with respect to mitigation. “Do not know”-answers were not allowed. Ticked options were recoded to 1, unticked options to 0. If no answer was given, it was assumed to be a missing answer.
- Question 13: Participants were supposed to rate on a scale from 1 to 10 (= fully agree) if mitigation initiatives should be included in LED strategies and if the Local Economic Development Agency of Namibia should encompass advice on climate change mitigation in its service portfolio. It was assumed that all stakeholders were familiar with LED and the agency. Thus, “do not know”-answers were not accepted and missing values were imputed.
- Question 14: Participants were asked whether they had ever been involved in climate change activities. If the answer was yes, they were supposed to name or describe the initiative. If it was found that the initiative was not related to climate change or no initiative was named, the answer was recoded to no. If the answer was missing but a real climate change initiative was mentioned, the answer was re-coded to yes.
- Question 15: Participants were provided with a list of organisations dealing with climate change issues in Namibia. They were asked if they had ever been approached by or had ever approached one of them. If no answer was given, the answer was recoded as “I have never approached or have never been approached by any of the organisations”.
- Question 16: Participants were asked if they agree that climate change mitigation projects could be initiated by a typical bottom up, participatory LED approach. They had to rate the agreement on a 10 point scale (10 = highly agree). Omitted values were considered missing and imputed
- Question 17: Participants were supposed to assess their own knowledge about climate change mitigation and climate change adaptation on a 10 point scale (10=very knowledgeable). If no answer was given, it was considered a missing value and imputed.

4.2.3.2 Missing data imputation

4.2.3.2.1 Variables

The variables used in the data imputation process are described in Table 41 (see attachment I). The variables correspond with the questions in the questionnaire. In cases where a question allowed more than one answer, sub-variables were defined.

4.2.3.2.2 Magnitude of missing data

Surveys often face the challenge that questionnaires are incompletely filled out. “Missing data are ubiquitous through the social, behavioural, and medical sciences” (ENDERS, 2010, p. 1). Books on missing data and survey design always stress that it is more effective to try to avoid missing data (e.g. ENDERS 2010; REISINGER et al., 2012) than to deal with incomplete data. Yet, there are many reasons why missing data occur. For example, people might be unwilling to disclose their ignorance about a certain subject or they might omit an answer out of pure negligence.

In order to minimise missing data and to allow questions of clarification, ideally, the interviewer should be around when an interviewee fills out the questionnaire. Thus, it was decided to have the questionnaires filled out during workshops and conferences but under the authors’ instruction.

Overall, 5.1% of answers (526 of 10,304 data) were missing. In particular, data from councillors (6.8% missing data) and other stakeholder (6.1%) were missing. The percentage of missing data from all other groups was between 3.1 and 3.7% (see attachment I Table 42).

For question no. 5, 6, 8, and 9 imputation was not feasible. It they are not considered, the overall missing rate drops to 4.1% (389 out of 9,408 data). The missing data rate from the group of councillors and other stakeholders dropped to 6.4% and 5.1% respectively. The missing data rate for all other stakeholder groups was between 1.8 and 2.4% (see attachment I Table 42).

Ignoring all the cases with missing data would reduce the already low sample size. Thus, it was decided to treat missing data as non-ignorable and consequently to impute missing values.

4.2.3.2.3 Missing data mechanism and missing data pattern

In order to select an imputation method, the missing data mechanism and the missing data pattern have to be known.

Three different missing data mechanisms are distinguished. According to ENDERS (2010, p. 2), a missing data mechanism outlines the relationship between measured variables and the probability of missing data. Data can be missing completely at random (MCAR), which

means they are not related to other data in the data set. They can be missing at random (MAR), which means there is a relationship between the probability of missing data on a variable and other variables of the data set. However, the probability must not depend on the variable itself. They can also be missing not at random (MNAR), which means that the probability of missing data on a variable depends mainly on the values of the variable itself. “MCAR is the only missing data mechanism that yields testable propositions” (ENDERS, 2010, p. 17). MAR and MNAR cannot be tested.

According to ENDERS (2010, p. 2 ff.), the missing data pattern describes the location of missing data in a data set. Enders mentioned several data pattern, such as univariate, monotone or general. In order to decide on the missing data pattern, the data of all questionnaires were transferred into a table (rows = data records, columns = variables). The variables were then sorted in descending order by number of missing data per variable while the cases were sorted in ascending order by number of missing data per case. Missing data were marked in red. A graphical representation of the table shows an unspecific random pattern (see attachment II Figure 10). However, ENDERS (2010, p. 4 f.) highlighted that in such a case there could still be a relationship between the variables as the pattern only show the location of the missing data but do not disclose why the data are missing.

To further define the missing data pattern and the missing data mechanism, an indicator matrix was created for all variables with missing data. For every variable in the table a corresponding indicator variable was generated. The table was then processed data record by data record. Depending on the value of the original variable, the indicator variable was assigned the value 1 (= observed data) or 0 (= missing data). IGL (2004) highlighted that substantial correlations among indicator variables point to a systematic missing data pattern. In such a case, the randomness of missing data cannot be assumed. In order to define the relationships between the indicator variables, the correlation coefficients were calculated and entered into a correlation matrix (see attachment I Table 43).

If a question of the questionnaire consisted of sub-questions, it was assumed that there is a high probability that if one of the sub-questions is not answered, the others will not be answered either. Therefore, a high correlation among sub-variables was expected. Yet, there were no noticeable correlations among the main variables.

On the other hand, the high percentage of missing data for councillors and other stakeholders might suggest that there is a relationship between stakeholder groups and missing values. This means that MCAR could not be assumed for the entire collection of variables. Thus, it was concluded that the missing data are MAR. The missing data pattern seemed to be unspecific and general.

4.2.3.2.4 Data augmentation algorithm

The data augmentation algorithm is a stochastic two step iterative process to impute missing data. It was used to generate single imputations for missing data.

The first step in the data augmentation algorithm is the Imputation (I)-step in which the missing values are imputed. The values for the missing data are estimated based on stochastic regression procedures using the observed data to determine the regression equations. A stochastic element will be added to the equations by drawing a random residual from a normal distribution with a mean value of zero and a variance equal to the variance of the residuals. The I-step results in a complete dataset.

The subsequent Posterior (P)-step is based on Bayesian estimation which considers the parameter estimates not as a set of fixed estimates but as random variables with a distribution. Based on the complete dataset obtained by the I-step, the P-step determines a new set of parameter estimates which define the posterior distribution. Data augmentation uses the Markow Chain Monte Carlo method to randomly draw a new set of parameters from this posterior distribution. They are used again in the subsequent I-Step to impute new values for the missing data.

The data augmentation algorithm converges when the distribution becomes stationary (equilibrium distribution), that is subsequent distributions of parameters do not differ significantly between iterations. The final values are randomly drawn from that distribution to impute the missing data. This method can be used with monotone as well as unspecific missing data pattern and gives unbiased parameter estimates under the MAR missing data mechanism.

4.2.3.2.5 Application of data augmentation

The missing values were imputed with the software NORM. According to SCHAFER (1999, p. 25), the NORM model assumes each variable to have a normal distribution but SCHAFER (1997, p. 267) also argued that if there are less than 50% of missing data, data augmentation seems to be robust against violations of the normality requirement.

Based on the 1st quartile, median, and 3rd quartile of non-binary variables, it could be assumed that most of them were either left or right skewed (see attachment I Table 44). Additionally, the Chi-squared test was used to test if the observed variables are normally distributed (test of goodness of fit). A significance level of 5% was assumed. Based on the

scales used for the questions, the number of categories was either set to 10 or 11 (e.g. question 2 and 4). The mean value and standard deviation of every variable were calculated. Based on them and the assumption that the variable is normally distributed, the expected frequencies of every category were calculated. After that the Chi-squared test statistic and the degree of freedom were computed. By taking into account the degree of freedom, the probability of obtaining the test statistic if the null hypothesis (variable is normally distributed) was true was taken from the Chi-squared distribution.

The test of goodness of fit resulted in a probability of nearly 0% for every variable. Thus the null hypothesis that the variable is normally distributed could be rejected for all variables.

The power transformation technique was used to reduce the asymmetry of the distributions. The power transformation requires positive data. As some of the variables contain zero values, the data had to be shifted. Power transformation uses the following formula:

$$y` = \begin{cases} ((y+c)^{\lambda} - 1)/\lambda & for\ \lambda \neq 0 \\ \log(y+c) & for\ \lambda = 0 \end{cases}$$

where y` = power transformed value, y = original value, c = shift parameter where the c is large enough to ensure that (y+c)>0, and λ = exponent of the power transformation (transformation value).

Box-Cox Transformation was used to determine the most suitable transformation value λ for categorical variables. The Box-Cox approach uses different λ-values to power transform the data. For every transformed data set regression equations are developed. The residuals of the regression equations are then calculated. The smaller the residuals the more symmetrically are the distributions. MedCalc was used to determine the λ-value with the Box-Cox transformation algorithm. The system also proposes shift parameters for variables with values smaller than 1.

The variables were then transformed. After the transformation the new variables were again tested for normality. The probability obtained from the Chi-squared test was again nearly 0% for all variables tested. Data should, however, only be transformed if the transformation improves the data augmentation process. Thus, non-binary variables were not transformed and the original values were used in the data augmentation algorithm.

Using binary data (1/0, Yes/No, agree/do not agree) in the regression method applied in data augmentation might result in values which are outside the range of the binary variable (e.g. <0 or >1). To deal with this challenge the range restrictions have to be removed first. This is done with the logit-transformation, which calculates the natural logarithm of the odds ratio.

$$p` = \ln(\frac{p}{1-p})$$

where p = probability of observing an event (e.g. 0 or 1) and -∞<p`<+∞. The range is symmetrical around 0.

The transformed data are then used in the imputation algorithm. Because the final data need to be binary, after the final imputation step they have to be retransformed with the expit-function.

$$p = \frac{\exp(p`)}{1-\exp(p`)}$$

where 0<p<1 and -∞<p`<+∞.

The calculated p value is then rounded to the next observed integer value which is either 0 or 1.

The data were imported into the NORM system. As outlined above, non-binary variables were left untransformed whereas the logit-function was used to transform binary variables. Missing values were indicated with -99.

The Expectation Maximum (EM) algorithm was then used to create a first set of maximum likelihood distribution parameter values (means, variances, co-variances) for the data augmentation algorithm. The EM optimization algorithm is a two-step iterative procedure and can be used to calculate maximum likelihood estimations for samples with missing data.

Based on the initial mean vector and the covariance matrix of the original data, the so called E-Step develops regression equations. The equations are used to impute the missing values. In the so called M-Step, the algorithm uses the complete data set to calculate a new mean vector and a covariance matrix which will again be used in the following E-Step. The algorithm continues its cycles until it converges, that is until the change in successive estimates is below the convergence criterion. The algorithm converged after 58 iterations. The convergence criterion was defined as 10^{-4}. SCHAFER (1999, p. 26) provided two reasons why EM should be used prior to data augmentation. “The parameter estimates produced by EM provide excellent starting values [for data augmentation and helps] to predict the likely convergence behaviour of DA” (SCHAFER, 1999, p. 26).

The final parameters obtained from the EM-algorithm were taken to start off the data augmentation algorithm. In order to get an imputed data set that is independent from the dataset used in the EM algorithm, a certain number of iterations (I-P Steps) in the data augmentation algorithm need to be carried out. SCHAFER (1999, p. 29) recommended to carry out at least as many iterations as were needed for the EM algorithm to converge. This

will ensure that successive complete data sets are independent from each other. The number of iterations in the data augmentation was set very conservatively at 1,000. The random seed – the number that starts the random number processor for the Markow chain – was set at 10,000. The imputed values after 1,000 iterations were transformed back and rounded to the next observed value.

4.2.3.2.6 Rationale

The rationale for using data augmentation was:

- Deletion methods reduce the sample size either through listwise or pairwise deletion. They should only be used if the data are MCAR which they were not. As the sample sizes for some of the stakeholder groups was comparatively low, it was important not to further reduce them by deleting cases.
- Many imputation methods require that the distributions of variables are multivariate normal distributions, that the variables are measured on an interval scale, that a monotonous missing data pattern can be observed, or that the data are MCAR. It was assumed that the variables were not normally distributed but skewed. SCHAFER (1997, p. 267) stated that in case there are less than 50% missing data, data augmentation seems to be robust against violations of the normality requirement. The data from the survey were all nominal or ordinal but data augmentation may also be applied for these kinds of data. “For the dichotomous and ordinal variables, we will impute under an assumption of normality and round off the continuous imputes to the nearest category.” (SCHAFER, 1997, p. 256). The observed missing pattern was not monotonous. Thus, imputation methods which require a monotonous missing data pattern are not applicable. Data augmentation does not require monotonous missing data pattern. Data augmentation requires the data to be at least MAR. Yet, SCHAFER (1997, p. 38 ff.) stated that even if MAR is unrealistic, procedures which are based on an observed data likelihood or an observed posterior, such as data augmentation, work better than other single ad hoc imputation procedures.
- The data augmentation algorithm is stochastic and produces less biased values for missing data. For example, unlike the expectation maximisation algorithm which is deterministic the data augmentation algorithm is stochastic. “DA bears a strong resemblance to the EM algorithm, and may be regarded as a stochastic version of EM” (SCHAFER, 1999, p. 28).
- Multiple imputation which has become increasingly popular “will produce parameter estimates with less bias and greater power” (ENDERS, 2010, p.1). It produces

multiple copies of complete data sets and the parameter estimates for every dataset are calculated. The individual parameter estimates are then combined into a single set of results. According to REISINGER et al. (2012, p. 151), a sample size of more than 100 is a precondition for multiple imputation. The sample size of the survey was 224. Yet, the data set encompassed data from different stakeholder groups (chief executives, economic planners, etc.). In order to avoid average parameter estimates, multiple imputation had to be carried out for each stakeholder group separately. However, if the data set are divided based on the stakeholder group, the sample size will be below 100 for all groups. Thus, multiple imputation was not applicable.

4.3 Interviews

During this doctoral thesis 18 Namibian LED stakeholders and international LED experts, and 10 national and international CDM and climate change experts were individually interviewed while 20 LED stakeholders of the Caprivi region[30] participated in a focus group discussion. (see Table 7).

	Individual interviews			Focus group discussion
	National LED stakeholders and international experts	International/national CDM/climate change practitioners	Total	LED stakeholders of one Namibian region
Absolute	18	10	**28**	20
%	64	36	**100**	

Table 7 Number of interviewees

Most of the interviews were taped and subsequently verbatim transcribed. The software MAXQDA was used to analyse the interview data.

4.4 Summary

In this chapter it was outlined how the captured data were treated and structured. First basic analyses of qualitative and quantitative data were carried out.

To summarize:

(1) The questionnaire was filled out by 229 LED stakeholders

(2) After having deleted cases with too many missing data (>40%), 224 questionnaires were further processed. 25 questionnaires were filled out by chief executives, 57 by economic

[30] The Caprivi region was renamed to Zambezi region on August 9, 2013.

planners, 17 by LED consultants, 68 by councillors (of local authorities and regions), and 57 by other LED stakeholders.

(3) Stakeholders from all 13 regions in Namibia submitted questionnaires. The questionnaire was answered by representatives from 44 (82%) of the 54 local authorities and from 10 (77%) of the 13 regional councils in Namibia.

(4) Due to time and budget limitations, it was concluded that sample sizes with a 95% confidence level and a margin of error of 5% would be impossible to achieve. As the results of the research were to be based on data from qualitative and quantitative research, a case study, and literature research, smaller sample sizes and consequently higher margins of errors were accepted. The new margins of error ranged from about 10% to 16%, depending on the stakeholder group.

(5) The data were cleansed before the analysis, that means illogical answers and outliers were edited.

(6) Because of the comparatively low sample size, it was decided to impute missing data instead of deleting incomplete cases.

(7) 5.1% of the answers (526 out of 10,304 data) were missing. The missing data rate dropped to 4.1% (389 out of 9,408 data) if questions 5, 6, 8 and 9 were not considered. Missing data imputation was not planned for these questions (see also chapter 3).

(8) Data augmentation was used to impute missing values. The software used was NORM. Multiple imputation was not possible as the sample sizes of individual stakeholder groups were below 100.

(9) 28 open ended semi structured interviews with LED stakeholders (18) and climate change mitigation practitioners (10) were held. In addition, one focus group discussion with 20 people was conducted.

(10) The interviews were verbatim transcribed and analysed with the software MAXQDA.

5 Factors attracting, supporting, and inhibiting CDM

5.1 Purpose

As outlined in chapter 2, the success of CDM depends on the general business environment, the potential for CDM projects, the institutional environment, and the barriers which hamper potential CDM implementations. This chapter investigates these factors with respect to the Namibian situation. An empirical study of all factors, however, would be beyond the scope of this study. For example, to establish the feasibility of a CDM project the expected amount of emission reductions needs to be calculated, the baseline has to be established, the additionality of the project has to be proven, the transaction costs and the initial investments have to be figured out, the risks have to be assessed, the sources for funding have to be investigated, the sustainable development impacts need to be worked out, and a profound implementation plan has to be drafted. Thus, the investigation of the factors is purely based on literature research.

5.2 General business environment in Namibia

Even two decades after the liberation struggle ended and Namibia became independent the society is still divided into a better off (mostly white) and a poorer stratum (mostly black). According to UNDP (2013, p. 154), the Gini coefficient (0.639) is one of the highest in the world. MLSW (2010, p. 2) stated that the unemployment rate in Namibia is 51.2% using the broad definition of unemployment and 37.6% considering the strict definition[31]. An unskilled workforce is mentioned by the WORLD ECONOMIC FORUM (2011, p. 270) and NCCI et al. (2011, p. 6 ff.) as the most problematic factors for doing business in Namibia. Subsistence and informal sector activities are also key features of the economic situation in Namibia. Due to the small size of the population large areas of the country are deserted and distances between areas of economic activities are huge.

According to UNCTAD (2011, p. 187 f.), Namibia ranks tenth in terms of foreign investments in Sub-Sahara Africa[32]. Yet, with only 3,214 million US$ foreign investments Namibia received only a fraction of that of Nigeria (33,983 million US$), Angola (57,044) or South Africa (21,095).

[31] "The broad measures of unemployment regards all those without jobs, who are available for work [whereas] the strict measure of unemployment considers those without jobs, who are available for work and actively looking for work" (MLSW, 2010, p. 38).
[32] Measured over the period 2006 to 2010.

However, many indicators also hint that Namibia fares very well compared to other Sub-Saharan African countries and the framework conditions are relatively good. With respect to sovereign credit rating the country fares better than most African countries (Moody's: Baa3, Fitch: BBB-)[33]. According to TRANSPARENCY INTERNATIONAL (2013, p. 5), Namibia is the second least corrupt country in Africa. It ranks 58th out of 174 countries worldwide and only Botswana (32) is less corrupt. The country has already been labelled by the WORLD BANK (2012c) as upper middle income country, a status which only five other countries have in Sub-Sahara Africa: Botswana, Gabon, Mauritius, Seychelles, and South Africa[34].

According to the WORLD BANK (2012a), the Namibian economy grew by 56% between 2001 and 2011. According to the Global Competitiveness Index of the WORLD ECONOMIC FORUM (2013, p. 15), in Sub-Sahara Africa only South Africa (Rank 52 out of 144 countries worldwide), Mauritius (54), Rwanda (63), Seychelles (76) and Botswana (79) are more competitive than Namibia. In its Doing Business Report the WORLD BANK (2013, p. 3) saw Namibia on position 87 out of 185 countries. For the whole of the African continent only Mauritius (19), South Africa (39), Rwanda (52), Botswana (59), Ghana (64), and Seychelles (74) achieve a higher rating.

Compared to other Sub-Saharan states, the indicators point towards a rather conducive Namibian business environment. Yet, other countries with a worse business environment seemed to attract more CDM projects, like Kenya (with 30 projects in the CDM pipeline[35]), Uganda (16) or Tanzania (6). Taking into account only the business environment Namibia should fare much better in CDM and should be in a position to attract more CDM investments. If CDM is to follow foreign direct investments, compared to other Sub-Saharan countries Namibia should also be better off in terms of CDM projects. This suggests that other factors might be more influential. It seems that the national business environment does not constitute a major stumbling block for CDM investments in Namibia.

5.3 Greenhouse gas reduction potentials in Namibia

5.3.1 Introduction

The mitigation and CDM opportunities of Namibia are discussed in this sub-chapter. Because of the financial implications and the complexity large scale projects like hydropower plants or wind parks were not considered. Neither were projects where it is obvious that they do not

[33] The credit ratings were obtained from CHARTSBIN.COM (2012).
[34] Mayotte is also classified as upper middle income country but is not included as a Sub-Saharan African country in this study.
[35] see FENHANN (2013)

contribute much to the sustainable development of a locality, such as fugitive gas projects or energy efficiency projects in the industry. Except for Jatropha, carbon sequestration projects were not discussed either, such as reforestation and afforestation. Data from similar existing CDM projects in other countries or from reports and studies were used to get a very first impression on the feasibility of potential projects. Yet, the viability of a CDM project depends on many factors.

5.3.2 Greenhouse gas emissions and removals

In its Second Communication to UNFCCC the MET (2011a, p. 37 f.) pointed out that Namibia's greenhouse gas emissions amounted to 9,118 GgCO2e the removals to 10,560 GgCO2 in 2000 (see Table 8). Thus, Namibia considers itself "a net sink of GHG emissions, sequestering more on annual basis than the nation emits" (MET 2011a, p. 91). The inventory provided in the First Communication by MET (2002, p. 22 f.) showed only 5,686 GgCO2e for emissions and 5,716 GgCO2 for removals for 1994. This would mean that emissions and removals would have doubled within six years. The difference of removals for instance was explained by the underestimation of the bush encroachment in the calculation for the First Communication.

Considering Namibia's economic structure and development the growth of emission is quite unlikely and the difference seems to be rather an indication of data inaccuracy, lack of data, wrong assumptions, and insufficient data management. According to WORLD BANK (2012a), the Namibian economy grew by about 24% between 1994 and 2000. Based on the growth rate, the low level of industrialisation, the low population number, a small agricultural sector, and the expanse of grass- shrub- and woodland MET (2011a, p. 91 f.) assumed that the net emission rate of greenhouse gases is negligible or negative. All the more as 50-70% of Namibia's electricity is imported from South Africa and the greenhouse gases emitted to produce that electricity is not included in Namibia's greenhouse gas inventory[36].

[36] "For imports from connected electricity systems located in another host country(ies), the emission factor is 0 tons CO2 per MWh" (UNFCCC 2009a, p. 4). This rule was change to „For imports from connected electricity systems located in Annex-I-country(ies), the emission factor is 0 tons CO2 per MWh" (UNFCCC 2012c, p. 8) and entered into force on November 23, 2012.

Category		CO2				CH4		N2O		CO2e		
		Emissions		Removals		Emissions		Emissions		Emissions	Removals	Total
		Gg	%	Gg	%	Gg	%	Gg	%	Gg	Gg	Gg
Energy	Energy industries	239.0	11.81	0.00	0.00	0.0	0.00	0.0	0.00	239.0	0.0	239.0
	Manufacturing/ Construction	99.0	4.89	0.0	0.00	0.0	0.00	0.0	0.00	99.0	0.0	99.0
	Transport	1,025.0	50.64	0.0	0.00	0.2	0.06	0.0	0.00	1029.0	0.0	1,029.0
	Mining	558.0	27.57	0.0	0.00	0.0	0.00	0.0	0.00	558.0	0.0	558.0
	Others	97.0	4.79	0.0	0.00	5.5	1.71	0.2	18.18	275.0	0.0	275.0
	Total Energy	2,018.0	99.70	0.0	0.00	5.7	1.77	0.2	18.18	2,200.0	0.0	2,200.0
Industrial processes		0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.0	0.0
Solvents												- Not calculated -
Agriculture		0.0	0.00	0.0	0.00	310.5	96.49	0.7	63.64	6,738.0	0.0	6,738.0
LUCF		6.0	0.30	10,566.0	100.00	0.0	0.00	0.0	0.00	6.0	10,566.0	-10,560.0
Waste		0.0	0.00	0.0	0.00	5.6	1.74	0.2	18.18	180.0	0.0	180.0
Total		**2,024.0**	**100.00**	**10,566.0**	**100.00**	**321.8**	**100.00**	**1.1**	**100.00**	**9,124.0**	**10,566.0**	**-1,442.0**

Table 8 Greenhouse gas emissions and removal in Namibia – Inventory of year 2000
Source: Adapted from MET (2011)

The highest emitter of CO2 was the transport sector with about 1,025 GgCO2 (51% of overall CO2 emissions) and the mining sector with around 558 GgCO2 (28%). As expected agriculture was the highest emitter of methane and nitrous oxides, contributing with about 310.5 Gg CH4 (96%) to the overall methane emissions and with 0.7 GgN2O (64% of overall CH4 emissions) to the overall nitrous oxide emissions[37]. According to MET (2008, p.2-2 ff.), methane emissions were largely due to enteric fermentation (250 GgCH4) and prescribed burning of savannahs (60 GgCH4). Emissions from manure management were negligible. 2 GgCH4 of the methane emissions in the waste sector were caused by commercial and domestic waste water and 4 GgCH4 by solid waste disposals on land. Emissions from combustion of fuel wood were not included in the inventory because it was assumed that the emissions are removed during the re-growth of the biomass[38]. Emissions from firewood were 1,330 GgCO2.

Compared to other countries like South Africa greenhouse gas emissions seemed to be negligible in Namibia[39]. Even if Namibia was to stop emitting greenhouse gases it would not make much difference to climate change. Thus, a Namibian climate change consultant believed that the "top priority for Namibia must be adaptation".

Nevertheless, the Namibian government sees mitigation as an essential element of its climate change policy. Although the draft version of the policy which was presented in September 2010 still focused more on adaptation - "the Namibia Climate Change Policy shall primarily focus on Climate Change Adaptation measures while necessary attention will be given to mitigation" (MET, 2010, p. 16) – in the final version of 2011 the focus was shifted in favour of mitigation. Mitigation became the second of the five policy objectives which requires

[37] The CO2 equivalent factors used are 21 for methane and 310 for nitrous oxide.
[38] In accordance with IPCC 1996 Revised Guidelines.
[39] According to the South African DEPARTMENT OF ENVIRONMENTAL AFFAIRS (2011, p. 29), the greenhouse gas emissions in South Africa were 461,178.5 GgCO2e in 2000 and the removals were 20,751 GgCO2e.

"the development and implementation of renewable energy and energy use efficiency, Clean Development Mechanism (CDM) and enhanced carbon sinks" (MET, 2011b, p. 8). MET (2011a, p. 97 f.) explicitly pointed out that Namibia's first priority is to follow a sustainable energy and low carbon development path. It is to improve the efficiency of energy production, promote renewable energy, reduce emissions from agriculture, LULUCF, and the industrial sector, enhance sinks, and manage urban and rural waste. As the transport sector is a main contributor to emissions in Namibia it has been identified as the second priority area, which encompasses, for example, the diversification of transport energy resources, the improvement of vehicle fuel efficiency, and the promotion of public transport.

5.3.3 Existing and potential initiatives

5.3.3.1 Wooden biomass

5.3.3.1.1 Jatropha

Jatropha (*Jatropha curcas*) was mentioned in almost every study on Namibian mitigation potentials. A study by HERRMANN/BRÜNTRUP concluded that "bioenergy production could contribute to rural development and food security in Namibia (HERRMANN/BRÜNTRUP 2010, p. 1470). GOUVELLO et al. (2008, p. 25 ff.) identified 30 potential Jatropha projects for Namibia. MET/UNDP (2007, p. 76) also believed that the plantation of oil crops like Jatropha would increase Namibia's carbon sink and as such could be considered a potential source to earn carbon credits. However, a "Strategic Environment Assessment (SEA) for biofuels production in the Caprivi and Kavango regions of Namibia" concluded that the "Namibian Government should exercise extreme caution when it comes to supporting and/or facilitating the establishment of a Jatropha based biofuel industry in the Kavango and Caprivi Regions, and the associated allocation of communal land." (ZYL/BARBOUR, 2010, p. 110) whereupon the Namibian Cabinet recommended that large-scale Jatropha plantation should not be allowed in the Caprivi and Kavango region. Due to the water requirements of these plantations other regions in Namibia are not as suitable. According to the assessment, there were too many open questions, such as what impact do plantations have on the living conditions of the rural population (lack of control of land, crazing area for cattle, etc.) or what to do with the toxic oil seed cakes after the refinery.

Moreover, the "lack of success with gaining credits from biofuel projects in other countries is telling" (ZYL/BARBOUR, 2010, p. iv). FENHANN (2013), for example, listed only one registered Jatropha plantation project in Senegal in his database. It is to provide biomass to

replace coal in the cement industry. Several others are listed as rejected, withdrawn or validation stopped.

WAHL et al. concluded in a study on Jatropha plantations in Tanzania that Jatropha is "unlikely to substantially increase employment and income in rural areas" (WAHL et al., 2009, p. 43). However, the authors also highlighted that the results cannot be transferred to other areas as the yield of plantations might be higher under better soil and climatic conditions.

Because of the reasons mentioned above, Jatropha will not be considered further in this study.

5.3.3.1.2 Bush encroachment

Because of the abundance of bush, the negative impact of bush on water resources or land productivity, and the growing interest in biofuels OERTZEN (2009a, p. 20) pointed out that there are many opportunities for bush-to-energy, charcoal or biochar projects in Namibia. According to KLERK (2004, p. xi ff.), bush has encroached[40] on about 26 million ha of woodland savannas which resulted in a loss of land productivity by 100%. The main encroacher species are: False Umbrella Thorn (*Acacia reficiens*), Black Thorn (*Acacia mellifera*), Sickle Bush (*Dichrostachys cinerea*), Purple-pod Terminalia (*Terminalia prunioides*), and Yellowwood (*Terminalia sericea*). A study by the consulting company COLIN CHRISTIAN & ASSOCIATES (2010a, p ii f.) stressed that bush encroachment has reduced Namibia's beef production by 50-80% compared to 1950. The bush encroachment species have also an impact on groundwater resources. According to the study, the loss of water through encroacher species results in 12 million m^3 for a 5,000 ha farm. If bush is thinned out to the optimum density[41] about 6 million m^3 of groundwater could be saved[42]. Due to its negative impacts bush encroachment is seen as an undesirable development.

[40] "Bush encroachment is the invasion and/or thickening of aggressive undesired woody species, resulting in an imbalance of the grass:bush ratio, a decrease in biodiversity, a decrease in carrying capacity and concomitant economic losses" (KLERK, 2004, p. 2)

[41] KLERK (2004, p. xiv) uses tree equivalents (TE) to determine the optimum level. A TE is a bush/tree of 1.5 m height. The number of TE per hectare should not exceed twice the long term average rainfall. As TE is difficult to determine COLIN CHRISTIAN & ASSOCIATES (2010b, p. xi) proposed in an EIA on the usage of bush as fuel in a cement factory to keep all large and protected trees and 50% of the bush.

[42] Three different methods were used to calculate the loss of water: annual growth of biomass and respective water consumption (12.45 million m^3), transpiration rate of tree equivalent (11.98), and foliage coverage (11.72). Example: growth of biomass was estimated to be 1660 kg/ha (only wood, no grass). Water consumption was estimated to be 1500 l/kg biomass. There were no exact data on water consumption for the bush species. Thus, the study used data from the *Prosopis* trees which

However, instead of considering bush encroachment to be a liability it could also be regarded as a comparative advantage. Several private and public small scale initiatives which use the bush as raw material have already been started in the bush encroached regions, such as Otjozondjupa and Kunene.

Two companies use the bush to produce wood briquettes. Together, they employ about 50 people for harvesting, chipping, and processing the bush. However, as the actual debushing is heavily mechanised, it does not provide many employment opportunities.

As According to DIECKMANN/MUDOWA (2010, p. 1), about 50-60,000 t of charcoal are produced annually. The Namibian charcoal industry is a growing sector and was worth 75-100 million N$ in 2004. It is labour intensive and provides job opportunities to unskilled labourers but because the industry is unregulated and informal, workers do not benefit from labour legislation and health and safety regulations. The main markets are the leisure industry in Europe and South Africa but charcoal is also already utilized in a silicon smelter in South Africa. The charcoal production methods are not efficient and emit greenhouse gases which could be avoided by more efficient methods.

In the Kunene region a 250 kW bush-to-electricity gasification power plant was inaugurated in December 2010. According to the project consultant, the plant once it starts operating will clear 480 ha of bush annually[43]. A 10 year harvesting cycle was assumed. The gas is used to generate electricity which is fed into the national electrical grid. As manual or semi-mechanised harvesting methods are applied, the plant was to generate 21 full-time jobs[44]. According to DRFN (2012e), the capital investments totalled 14,000,000 N$. Such a project could also be envisaged to provide electricity to off-grid settlements. DRFN/BRADLEY-COOK (2008, p. 8) calculated for a 0.5 MW wood gasifier a reduction potential of 4,000 tCO2e per year but did not consider in the calculation emissions which were caused by project activities, such as consumption of fuel or electricity on site and transport of biomass. It can be assumed that a 250 kW gasifier would reduce emission less than or in the range of 2,000 tCO2e. According to an employee of GIZ, who was involved in the project, the plant operated only for a couple of month and was then stopped by the operator as the special feed in tariff negotiated with the Namibian power supplier was not high enough to operate the gasifier on a commercial basis. A site visit showed that the thermal energy was not used at all and the generated electricity was partly used to actively cool down the gas before it was filtered and entered the generator. According to the project consultant, the electricity output

need 1700 l/kg. It was assumed that the bush needs less water and the consumption was reduced by 200 l/kg. The total water loss was then 1500 l/kg * 1660 kg/ha * 5000 ha.

[43] The calculation was done based on the following criteria: bush density 15t/ha, thinning rate 50%, plant requirement 9 t (including waste) of wood per day, moisture content 35%, 260 working days per year. (9 [t/d] / (15 [t/ha] * 0.5 * (1-0.35))) * 260 [d/a] = 480 [ha/a].

[44] According to OERTZEN (2012, p. 51), to harvest 4,400 t per year requires 42 workers using axes or pangas, 13 labourers using bush cutters, and 1 fully-mechanised bush harvester.

could be almost doubled if thermal energy was used, too. SOUTHERN AFRICAN INSTITUTE FOR ENVIRONMENTAL ASSESSEMENT (2010, p. 7) conservatively estimated that there is a potential of between 60 and 160 such plants in Namibia. This could add up to over 3,000 permanent employment opportunities. The number of potential plants could be even larger. According to KLERK (2004, p. 8) there were 6,283 commercial farms in bush affected areas in Namibia. CBEND would produce about 0.001 TWh per annum[45]. According to NAMPOWER (2012, p. 4) the Namibian electricity consumption was 4.2 TWh[46] between July 2011 and June 2012 (including transmission line losses). Even with 100 such plants, the electricity produced would be less than 2.5% of the electricity consumption. Small scale gasifiers do not help much in Namibia becoming independent from electricity import.

Another private investor in the region tested the torrefication of wood which could then be used in Namibian power plants. In an environmental assessment SCHULTZ (2011, p. 11 ff.) stated that 200 t of torrefied wood requires about 400 t to be harvested which will clear an area of about 12,900 ha per year considering a harvesting ratio of 80% and a harvesting time of 8 month per annum. The assessment was further based on a bush density of 14 t/ha[47]. For harvesting and plant operations 300 workers are needed. The investor claimed that a 5 hrs test with the torrefied wood in the Van Eck coal power plant in Windhoek in November 2010 led to excellent results and that a large scale rollout of torrefication would result in 25,000 additional jobs. Yet, this number has not been verified by an independent investigation. No further actions have been taken by the Namibian electricity company.

According to a representative of a Namibian logistics company, the company was approached by several European power companies which had indicated interest in the bush as a source of energy. One German power company already started to evaluate if bush wood could be used in Namibian power plants but stopped because the Namibian electricity company lost interest. This project was initially motivated by CDM. A Namibian private investor started to evaluate the feasibility of large scale production of wood chips for European power plants but stopped, too, because of lack of finances. STEAG/TRANSWORLD CARGO (2013, p. 53 f.) concluded in a study that the cost to generate electricity from biomass (wood chips) in a small scale power station (5 MW) in the bush encroached area would be in the range of 1.0 to 1.1 N$/kWh. The price for the biomass raw material was assumed to be not higher than 50 N$/t. As mentioned before Namibia imports a large amount of electricity. According to MONGUDHI (2013, p. 1 f.) the price for imported electricity ranged between 0.14 US$ (about 1.4 N$) and 0.19 US$ (about 1.9 N$)[48]. This implies that a biomass power station would already be competitive. Based on the

[45] 0.001 [TWh] = 250 [kW] * 16 [h/d] * 260 [d/a]
[46] Electricity fed into the grid
[47] 12,857 [ha/a] = (400 [t/d] / (14 [t/ha] * 0.8)) * 360 d/a
[48] 1 US$ = 9.9 N$

electricity demand of 1,800 kWh per inhabitant and year, STEAG/TRANSWORLD CARGO (2013, p. 51 ff.) proposed 5 MW decentralised power stations (operation hours: 7,500) for Okahandja, Otjiwarongo, Grootfontein, Tsumeb, Otavi and Gobabis. The 6 power plants would cover about 5% of the electricity consumption in 2012. To operate one power plant a harvesting area between 5,000 and 14,000 ha would be needed if 50% of bush would be used. Based on a 10 year harvesting cycle, an area of between 75,000 and 105,000 ha per power plant would be required.

A new cement factory in the region of Otjozondjupa uses bush wood as fuel for its cement production process. The objective of the company is to replace 73-79% of coal per annum. The company already evaluated if the project was eligible for CDM. According to a representative of the company, the preliminary examination showed that the project would not meet with the economic additionality requirement. The project is financially viable even without CDM funding. An EIA by COLIN CHRISTIAN & ASSOCIATES (2010b, p. 101 ff.) of that project concluded that it will generate 40-45 permanent employment opportunities. The harvesting and preparation of the wood chips are highly mechanised as the 85,000 t/a needed could not be harvested efficiently by manual labour. Therefore, the project has only a limited effect on employment. However, the report also stated that indirect employment opportunities might be created as farmers have to conduct aftercare to control the re-growth of the bush which requires manual labour. Additionally, as productivity of the land increases more cattle can be kept. This will also contribute to employment generation in downstream operations, such as the beef industry and the transport sector. Yet, COLIN CHRISTIAN & ASSOCIATES (2010b, p. 34) also stated that only 4,250 ha of bush land per year would be needed to meet the energy requirements of the cement factory.

According to GIZ/AGRA (2012, p. 4), most de-bushing projects are either research projects, small scale projects on farms and in national parks or smaller industry projects. Comparing the area needed to operate the described initiatives with the 26 million ha of bush encroached farmland suggests that a real impact on national water resources and farm productivity can only be achieved if bush is used at a larger scale. Large scale debushing has to apply mechanised harvesting methods which do not generate many new jobs. Yet, employment opportunities might be created for other economic activities, such as meat processing, transport, etc. Using the bush might also have an impact on Namibia`s greenhouse gas emission balance. According to MET (2011a, p. 52 f.) the growth of woody biomass for the bush encroached area was 13.4 Mt in 2004. That would be about the amount of bush that could be harvested without adding to the global greenhouse gas emission balance. The regrowth of bush depends on aftercare measures taken by the farmers. If they take proper measures to avoid the bush from encroaching the land again, the usage of bush will not be sustainable and Namibia`s capacity to remove CO2 from the atmosphere will

diminish over time. With this respect, a representative of the agricultural sector stressed that the open question will be: “do we get farmers to do energy farming or is our main target to increase agricultural land?”

Large scale debushing requires strong financially partners from the private sector or the national public sector. Regional councils and local authorities can only play a supportive role, lobby for attractive feed-in-tariffs or facilitate and promote investments. As will be shown later, they do not have the knowledge and the financial means to engage in such kind of projects on their own.

5.3.3.1.3 Energy efficient stoves

59.6% (about 221,000 households) of households in Namibia use wood for cooking (see Table 11). According to the DRFN (2012a), energy efficient wood stoves could reduce the amount of wood needed by more than half. According to MET (2011a, p. 38 ff.), about 1,330 Gg CO2 were released in 2004 by using fire wood (cooking, heating, lighting, etc.). Especially for women, this will have an immediate impact on the quality of life. They are the ones who traditionally collect wood. According to the THE NAMBIAN (2012), a woman from an informal settlement near Windhoek spends half a day collecting enough wood to meet the demand for a day. However, the author of this thesis would like to caution against over-interpreting the time savings with respect to economic value. Most of the women are unemployed and it is questionable if they can use the time to generate additional income.

“Depending on the baseline fuel and stove efficiencies, a number of at least 5,000 efficient stoves will be needed to justify CDM” (MÜLLER et al., 2010, p. 30). They assumed a CER price of 12 Euro. Registered CDM projects by other host countries plan to distribute 12,500 stoves and more (see Table 9).

Ref.	Title	Host country	1st credit period ktCO2e/yr	Credit period in yrs	ktCO2e over credit period	Unit to be distributed/installed	Replacing	Methodology
2711	Efficient Fuel Wood Stoves for Nigeria	Nigeria	31	10	313	12,500	fuel wood	AMS-II.G.
2969	CDM Lusaka sustainable energy project 1	Zambia	130	10	1,300	30,000	fuel wood	AMS-I.E.
4478	Improved Cook Stoves CDM project of JSMBT	India	43	10	426	21,500	fuel wood	AMS-II.G.
4530	Efficient Fuel Wood Cooking Stoves Project in Foothills and Plains of Central Region of Nepal	Nepal	20	10	199	22,920	fuel wood	AMS-II.G.
4772	Improved Cook Stoves CDM project of Samuha	India	47	10	467	21,500	fuel wood	AMS-II.G.

Table 9 Registered energy efficient stove CDM projects
Source: Adapted from FENHANN (2012) and UNFCCC (2012a)

Traditional stoves for cooking consist of three stones around a fire on which a kettle or pan is placed. They are not very fuel efficient. More efficient stoves have been introduced to Namibia. They range from homemade stoves consisting of an old paint drum to more elaborated stoves, like the Tso Tso stove, the Vesto stove or the Ezy stove. The stoves decrease the lateral emission of heat and therefore need less wood. MME (2007, p 111) estimated that only about 2,000 stoves were already in use in Namibia.

Several organisations and programmes have already supported the use of these stoves in Namibia. A number of community driven programmes were supported by the Global Environmental Facility (GEF), like the Uukumwe stove project (2009 – 2011) with 50,000 US$ or the Tso Tso project in Aus (2009 – 2011) with 48,000 US$. A UNDP supported Community Based Adaptation Programme promoted the Ezy stove in northern Namibia. The Ezy stove costs 150 N$ and if subsidised 30 N$. According to CONSULTING SERVICES AFRICA (2012, p. 48), the Tso Tso stove would cost about 300 N$. SGP THE GEF SMALL GRANT PROGRAMME (2012) reported that for the Aus project “the stove has been found to be a little more expensive than anticipated and therefor the sustainability is still in question”. A report for the Uukumwe project could not be obtained.

According to a representative of a NGO, the NGO has already donated 150 Ezy stoves all over Namibia, and the organisation wanted to apply for CDM. The NGO planned to produce 400,000 stoves for 200,000 households in Namibia at a subsidised level. Taking into account that only 221,000 households use wood for cooking, the NGO would cover about 90% of the total market size. That seems quite an unrealistic assumption. According to a representative of a German power company, an energy efficient stove project in Zambia is the company`s most expensive CDM project (per CER) and requires extensive support. The company planned to distribute 30,000 stoves.

CONSULTING SERVICES AFRICA (2012, p. 48) estimated that an initiative to produce and distribute energy efficient stoves (TsoTso) in the region of Otjozondjupa would generate about 10 full-time jobs under optimal conditions. The calculation was based on a market demand of 10,000 stoves, a lifespan of a stove of 2 years, a production rate of 2 stoves per worker per day and 240 working days per year. The 10,000 stoves would reduce 67% of the wood consumption and cut emissions down by 18,500 tCO2e per annum. Considering the same conditions but taking into account a market share of 10-15% (22,100 to 33,150 households) country-wide would result in 46 to 69 full time jobs.

5.3.3.2 Wind power

According to MENDELSOHN et al. (2009, p. 92), wind is a predominant feature of the coastal areas. Calms prevail in the central northern regions. 41% of the days in Grootfontein are calm, whereas at the cost in Lüderitz only 8% and in Walvis Bay only 16% of the days are without wind. Thus, large wind energy projects are investigated along the coast in Lüderitz and Walvis Bay. 44 MW of wind power is scheduled to be installed by 2014 near Lüderitz, and a conditional licence to produce 60 MW of wind power in Walvis Bay has been granted, too. None of the projects have applied for CDM funding. Wind is also used to power water pumps. MME (2007, p. 113) estimates that there are more than 30,000 wind-only or wind/diesel hybrid pumps and more than 10,000 diesel pumps installed in Namibia.

MME (2006, p. 43) calculated how many emissions could be saved by replacing a diesel pump with a solar pump. It assumed that a 3 kW diesel pump consumes 0.77 l/h. With an expected hydraulic load of 1000 m^4/d (flow rate: 2.8 m^3/h, drilling depth 100m), the pump would run about 3.5 h/d. The diesel consumption per year would be calculated as 3.5 h/d * 365 d * 0.77 l/h ≅ 1000 l ≅ 850 kg/a. The study sees a market potential of 1000 to 2000 pumps. The study estimates emission reduction of 2.6 tCO2. However, the study does not consider methane gas and nitrous oxide.

5.3.3.3 Solar power

5.3.3.3.1 Electricity production

MENDELSOHN et al. (2009, p. 76) showed also that large parts of Namibia receives solar radiation of between 5.8 to 6.2 kWh/m^2/day which is almost twice the amount received by Germany which is between 3.0 to 3.8 kWh/m^2/day. A small solar and diesel powered hybrid mini-grid system was installed in Tsumkwe which is a settlement of 700 inhabitants in the east of Otjozondjupa. The settlement is located about 180 km from the next access point to the electricity grid. In the past, power was generated by three diesel generators only and then fed into a mini-grid. As a second source of energy photovoltaic panels were installed and connected to the local grid. According to DRFN (2012b), 70 households, 20 institutions and 15 businesses will have access to 24 hrs of electricity. The capital investments amounted to about 26 million N$. According to MRLGHRD (2012), 75% of the costs of the 200 kW hybrid power plant were borne by the EU, 14% by Nampower and 11% by the region of Otjozondjupa. The project did not apply for CDM funding. UNDP (2006, p. 73) highlighted that a 155 kW small scale solar photovoltaic installation has a payback period for the total transaction costs of more than 38 years if the CER price is 5 US$. The payback period

shrinks to about 13 years if the CER price increases to 15 US$. According to DRFN (2012b), there are more than 3,800 unelectrified rural settlements in Namibia which will stay off grid for the next 20 years. However, there is no data available with respect to the population or household density of these settlements.

Solar home systems are small island systems which use photovoltaic panels to produce electrical energy for individual households. The systems are used to provide lighting, operate radios and charge mobile phones. According to SVK-CDM TECHNOLOGIES (2008, p. 2), more than 100,000 installations are necessary for a viable CDM project. The MINISTRY OF ENVIRONMENT CAMBODIA/UNEP (2010, p. 41) calculated that in the case of Cambodia 33,000 units are required to overcome the transaction costs and that a minimum of 10,000 tCO2 emissions need to be reduced for a viable CDM project[49]. Yet, the registered solar home system CDM projects by other host countries plan to install more than 100,000 units (see Table 10).

Ref.	Title	Host country	1st credit period ktCO2e/yr	Credit period in yrs	ktCO2e credit period	Unit to be distributed/ installed	Replacing	Methodology
182	"Photovoltaic kits to light up rural households in Morocco"	Morocco	39	10	386	101,500	diesel	AMS-I.A.
2699	D.light Rural Lighting Project	India	30	10	301	1,000,000	kerosene	AMS-I.A.
2279	Rural Education for Development Society (REDS) CDM Photovoltaic Lighting Project	India	21	10	211	180,000	kerosene	AMS-I.A.

Table 10 Registered solar home system CDM projects
Source: Adapted from FENHANN (2012) and UNFCCC (2012a)

It can be assumed that Namibian households which do not use electricity for lighting are not connected to the grid or suppress demand. About 37% (137,000 households) of the households in Namibia use electricity (see Table 11).

That means that the theoretical market size for photovoltaic panels in Namibia would be about 235,000 households. These households are using candles, paraffin, wood, gas, or kerosene for lighting. Taking into consideration the required 100,000 installations mentioned by SVK-CDM TECHNOLOGIES that is more than twice the amount of installations needed. However, a barrier for Namibia might surely be the initial costs for private households. According to SOLAR AGE NAMIBIA (2012), a typical solar home system would cost between 5,000 and 30,000 N$ (depending on energy demand). Larger systems for farms would cost up to 100,000 N$. An investor plans to start a pilot project in 2013 to provide 1,000 portable mini-solar-sets to rural households over a period of 2 years. Depending on the capacity (60

[49] The difference in required installations seems to be striking. The Cambodian report does not indicate on what CER price the evaluation is based on. However, the MINISTRY OF ENVIRONMENT CAMBODIA/UNEP (2010, p. 56) mentioned a CERs price of over 12 Euro in the report. Thus, it was assumed that the assessment was based on an income of 12 Euros per CERs. The SVK-CDM TECHNOLOGIES study based its estimation on CER price of 12 US$.

W, 300 W) the set costs 1,000 N$ or 3,000 N$. The investor stressed that the 1,000 sets would reduce 84 tCO2 per annum. According to NPC (2006, p. 33), 28.9% (about 107,000 households) of Namibian households depend on subsistence farming as the main source of income. They might not be in the position to bear the initial costs for a solar home system. That means that the potential market size shrinks to about 128,000 households. GRN et al. (2007, p. 30) estimated a demand of 9,000 systems for Namibia which is far below the 33,000 units mentioned by the MINISTRY OF ENVIRONMENT CAMBODIA/UNEP. They would amount to a reduction of 1,719 tCO2e per annum (based on 50 W modules which are to avoid emission of 0.191 tCO2e per module and annum). Again this is far below the minimum emission reduction requirements for a viable CDM project figured out by the MINISTRY OF ENVIRONMENT CAMBODIA/UNEP. According to PINPOINT ENERGY NAMIBIA (s.t., p. 60), the installation of a solar home system would require 4 human days. Assuming 240 working days per year, the 9,000 installation would result into 150 human years. If 1,800 installations would be installed per year about 30 jobs over a period of 5 years would be generated[50]. It is questionable, if 4 days are needed to install a small and basic solar home system. Thus, the number of generated jobs might be much lower.

Region	Households (HH)	HH with electricity or solar		HH without electricity		HH using wood for cooking		HH with access to piped water	
	No.	%	No.	%	No.	%	No.	%	No.
Caprivi	18,607	20.5	3,814	79.5	14,793	89.3	16,616	44.1	8,206
Erongo	27,713	78.6	21,782	21.4	5,931	13.7	3,797	93.2	25,829
Hardap	16,365	55.2	9,033	44.8	7,332	52.4	8,575	87.8	14,368
Karas	15,570	56.4	8,781	43.6	6,789	33.3	5,185	93.4	14,542
Kavango	32,354	15.6	5,047	84.4	27,307	87.6	28,342	38.0	12,295
Khomas	64,918	72.0	46,741	28.0	18,177	7.4	4,804	98.3	63,814
Kunene	13,365	30.3	4,050	69.7	9,315	83.3	11,133	59.6	7,966
Ohangwena	37,854	5.0	1,893	95.0	35,961	92.0	34,826	46.0	17,413
Omaheke	13,347	28.2	3,764	71.8	9,583	77.1	10,291	82.1	10,958
Omusati	39,248	8.0	3,140	92.0	36,108	92.2	36,187	60.7	23,824
Oshana	31,759	24.7	7,844	75.3	23,915	59.4	18,865	96.3	30,584
Oshikoto	31,871	16.5	5,259	83.5	26,612	85.6	27,282	70.4	22,437
Otjozondjupa	28,707	55.6	15,961	44.4	12,746	54.0	15,502	92.0	26,410
Namibia	371,678	36.8	136,778	63.2	234,900	59.6	221,520	75.0	278,759
Urban	150,533	70.9	106,728	29.1	43,805	17.7	26,644	99.3	149,479
Rural	221,145	13.7	30,297	86.3	190,848	88.0	194,608	58.4	129,149

Table 11 Households in Namibia which have access to electricity, use wood for cooking, and have access to piped water[51]
Source: Adapted from NPC (2006)

Photovoltaic panels are also used to operate water pumps in Namibia. MME (2006, p. x f.) estimated that there are about 30,000 boreholes with a hydraulic load of less than 3,000 m^4/day[52]. For these boreholes photovoltaic pumps would be more cost effective than diesel pumps and depending on the load would break even within less than 6-8 years in average. With a load of about 250 m^4/day the breakeven point would even be reached within one year. Yet, the report mentioned also that only 1,220 photovoltaic water pumps had been installed.

[50] The calculation does not consider after sales service.
[51] Differences are caused by round-off errors.
[52] Daily hydraulic load [m^4/day] = daily flow rate [m^3/day] * head [m].

Only 225 were installed in 2005. The demand seems to be comparatively weak. An earlier report by MME (2005, p. 48 f.) mentioned that photovoltaic pumps can be used most effectively at boreholes with a hydraulic load of 750 m^4/day to 2250 m^4/day and a total head not exceeding 150 m. There are about 15,750 boreholes in Namibia with a total head of less than 5 m. In these cases the payback time would be between 18 and 24 months. Depending on the requirements, a photovoltaic pump would cost between 24,000 N$ (daily water delivery 7,000 litre and a head of 50 m) and 110,000 N$ (50,000 litre /50 m). MICHAELOWA/PUROHIT (2005) stated that a CDM project to replace electric and diesel pumps with photovoltaic pumps in India is not viable as the mitigation costs were higher than 24 €/CER.

5.3.3.3.2 Solar water heater

In the Off-grid Energisation Master Plan for Namibia, SCHULTZ/SCHUMANN (2007, p. 21) omitted solar water heaters because the authors claimed that most of the rural households do not have access to piped water. Yet, according to NPC, 99.3% (149,000 households) of urban households and 58.4% (129,000) of rural households have access to piped water (see Table 11). Nevertheless, many households in informal or rural settlements and former townships share communal water taps and water has to be transported from there in buckets and bottles. However, it can be assumed that in towns many people have access to piped water within their houses. Many of them might also have the financial means to cover the initial investments. According to SOLAR AGE NAMIBIA (2012), the price for solar water heaters ranged between 14,000 and 22,000 N$. The breakeven point will be between five and seven years. DRFN (2012d) estimated that there are about 100,000 electrical geysers in Namibia and the investments into a solar water heater amortize between three to five years. GRN et al. (2007, p. 30) saw a potential for 15,000 water heaters (200 l tank) in Namibia. Based on the assumptions that 40% of new buildings will be equipped with solar water heaters and 2% of old electrical geysers will be replaced EMCOM (2005, p. 37) estimated there will be about 36,000 solar heaters in Namibia in 10 years. EMCOM (2005, p. 3) assumed that emissions are reduced by 1.72 tCO2e per water heater (for a solar heater with a 200 l tank) and annum. Existing CDM projects in other countries planned to install 16,000 and more water heaters. MÜLLER et al. (2010, p. 19) stated that at least 5,000 solar water heaters would have to be distributed as a lower number will not justify the CDM transaction costs. They assumed a price of 12 €/tCO2. Considering a crediting period of 10 years and a CER price of about US$ 15 the SVK-CDM TECHNOLOGIES (2008, p. 28) calculated a positive cash flow for 8,613 installations for a potential CDM project in India.

PINPOINT ENERGY NAMIBIA (s.t., p. 59) estimated that 4 human days are needed locally to install solar water heaters. Considering 240 working days per year, 15,000 installations would add up to 250 human years. Under the assumption that 3,000 water heaters are installed per year this would result in 50 jobs over a period of 5 years[53]. MET (2011a, p. 96) stated that if all electric water heaters are replaced by solar water heaters energy demand would be reduced by 156 GWh over a period of 10 years. With an average annual energy consumption of 15.6 GWh energy consumption would drop by 0.3% compared to the overall energy consumption between June 2011 and June 2012

As the costs for solar water heaters are comparatively high and require houses to be directly connected to the public water supply a programme to promote these heaters would not target the poorer stratum of society.

Ref.	Title	Host country	1st credit period ktCO2e/yr	Credit period in yrs	ktCO2e over credit period	Unit to be distributed/ installed	Replacing	Methodology
4024	iHOT - I water heating service	India	28	7	198	16,000 (collector size: 4m^2)	electricity	AMS-I.C.
5004	iHOT - IV water heating service	India	29	7	204	16,000 (4m^2)	electricity	AMS-I.C.
4659	Solar water heater programme (PoA)	Tunisia	7.2	10	72	30,000 per annum	electricity	AMS-I.C.
4302	SASSA Low Pressure Solar Water Heater Programme (PoA)	South Africa	118.4	10	1184	59,000 per CPA (~1m^2)	electricity and kerosene	AMS-I.C.

Table 12 Registered CFL projects
Source: Adapted from FENHANN (2012) and UNFCCC (2012a)

5.3.3.3.3 Solar cooker

Solar cooker are already used for cooking, boiling and baking in Namibia. According to MME (2005, p. 34 ff.), two main types were in use: solar box cookers and parabolic concentrators. The price for cookers ranged between 500 N$ and 800 N$. Between 1999 and 2004 in average 80 cookers were sold annually. According to MME (2007, p. 111), there were about 600-700 solar cookers in Namibia by 2007. The demand for solar cookers seemed to be low in Namibia. Several other CDM host countries already registered solar cooker projects (see Table 13).

In traditional Namibian households three warm meals are prepared daily. Solar cookers in Namibia could only be used for the preparation of lunches and early evening meals. If wood is used for cooking the usage of solar cookers will reduce its consumption by only 30-40%.

The only registered solar cooker project which replaced fuel-wood was the Aceh project in Indonesia which aimed at reducing 3,500 tCO2e per annum. However, a monitoring report by

[53] The calculation does not consider after sales services.

TRIFELLNER (2007, p. 13) revealed that the Aceh project reduced only 1,077.4 tCO2e between January 2006 and October 2007. A Namibian consultant who was involved in the introduction of solar cookers in Namibia estimated that one person could manufacture 10-20 solar cookers per week (depending on the level of skills). Considering 48 working weeks per year one person would produce between 480 and 960 solar cookers per year. The Namibian consultant also stressed that a solar cooker increases the duration of the cooking process considerably and thus requires thorough planning of the meals. Because of the low number of solar cookers in Namibia which indicates that there is little interest in its technology and the time it takes to cook a meal it is believed that the market for solar cookers will remain a niche market.

Ref.	Title	Host country	1st credit period ktCO2e/yr	Credit period in yrs	ktCO2e over credit period	Unit to be distributed/installed	Replacing	Methodology
218	CDM Solar Cooker Project Aceh 1	Indonesia	3.5	7	24.5	1,000	wood fuel	AMS-I.C.
2307	Federal Intertrade Pengyang Solar Cooker Project	China	35.7	10	357.23	17,000	coal	AMS-I.C.
2311	Federal Intertrade Hong-Ru River Solar Cooker Project	China	35.7	10	357.23	17,000	coal	AMS-I.C.
5106	Heqing Solar Cooker Project II	China	143.7	10	1437.62	49,000	coal	AMS-I.C.

Table 13 Registered solar cooker CDM projects
Source: Adapted from FENHANN (2012) and UNFCCC (2012a)

5.3.3.4 Biogas

5.3.3.4.1 Household biogas digester

Biogas digesters are used to produce biogas from human waste, animal waste, and agricultural substances to provide gas for cooking, lighting and electricity generation. Many installations can already be found in countries like India, Brazil, and China where manure from cattle, poultry or pigs is used to produce biogas. There were about two million cattle in Namibia (see Table 15). Half of them were in the Northern communal areas. Yet, according to MME (2007, p. 112), there were less than 20 biogas digesters installed in Namibia. According to GTZ (s.t., p. 11), unheated biogas digesters work satisfactorily where mean annual temperatures are above 20°C. According to MENDELSOHN et al. (2009, p. 78), this is the case in almost all parts of Namibia. MUELLER et al. (2010, p. 22) mentioned that two to three cows are needed per household and that the cattle must be partially kept in stables. For OTIM et al. (2011, p. 544 ff.) four to six cows are needed to produce enough gas for cooking and lighting for a household consisting of six to eight people in Uganda. According to NPC (2006, p. 16), the average household size in rural areas in Namibia is 5.4 persons. Thus, it can be assumed that roughly the same number of cows is needed to provide enough gas for an average Namibian household. OTIM et al. (2011, p. 544 ff.) highlighted that the cows in Uganda are moved far from home to graze. That is also the case in the communal

areas of Namibia. During the night the cattle is moved back to kraals very close to the house. There are already several domestic biogas digester CDM projects registered in other countries (see Table 14).

Ref.	Title	Host country	1st credit period ktCO2e/yr	Credit period in yrs	ktCO2e credit period	Unit to be distributed/ installed	Replacing	Methodology
121	Bagepalli CDM Biogas Programme	India	20	7	137	5,500	wood fuel	AMS-I.C.
5416	Biogas Support Program - Nepal Activity-4	Nepal	56	7	395	20,348	wood fuel	AMS-I.E.
3779	Accion Fraterna Biogas CDM project for rural communities in Anantapur, Andhra Pradesh	India	49	7	340	15,000	wood fuel	AMS-I.E.
139	Biogas Support Program - Nepal (BSP-Nepal) Activity-2	Nepal	47	7	328	9,688	wood fuel	AMS-I.C.
136	Biogas Support Program - Nepal (BSP-Nepal) Activity-1	Nepal	47	7	329	9,706	wood fuel	AMS-I.C.
3541	Social Education and Development Society (SEDS) Biogas CDM project for the rural poor	India	15	7	106	5,000	wood fuel	AMS-I.E.

Table 14 Registered domestic biogas digester projects
Source: Adapted from FENHANN (2012) and UNFCCC (2012a)

About 125,000 households in Namibia own cattle. South of the veterinary cordon fence there are many large commercial freehold farms. These farms do normally not keep their cattle in stables during the night. The cattle roam comparatively freely around on the farmland. North of the fence there were about 65,500 cattle owning households in the regions of Caprivi, Kavango, Ohangwena, Omusati, and Oshana (see Table 15)[54]. The number of cattle in these regions adds up to about 632,000. It is kept in kraals close to the house during the night. However, a Strategic Environmental Assessment (SEA) for proposed poverty reduction activities in Namibia discovered that in the Northern regions "the number of livestock owned per household [...] vary tremendously [and] areas that traditionally lack accessible water for livestock have far less livestock per household than those that [have access to water resources and that in certain areas] there are more households without cattle than households with cattle" MILLENNIUM CHALLENGE CORPORATION (2008, p. 4-4). This makes it difficult to assess the number of households which have enough cattle to economically operate a biogas digester. However, if only 25% of the households in the north own more than the required number of cattle and keep it close to the house during the night then this provides a potential of about 16,000 biogas digesters.

According to the MINISTRY OF ENVIRONMENT CAMBODIA/UNEP (2010, p. 40), a household biogas digester would cost between 450 to 500 US$. That is in line with MUELLER et al. (2010, p. 23) who stated that low-tech digesters in the tropics cost between 200 and 400 €. These costs need to be compared with the benefits of having gas readily

[54] Please note that the two northern regions of Kunene and Oshikoto were not included as large parts of the land were still freehold land and owned by commercial large scale farms (especially in the constituency of Guinas in Oshikoto and the constituencies of Outjo and Kamanjab in Kunene).

available for lighting and cooking. The manure mainly decomposes aerobically in kraals and in the veld. Thus, CERs cannot be gained using controlled anaerobic digestion of manure. CERs can only be earned if the digesters replace wood as fuel. Yet, many households in the North use cattle dung from the kraals or the veld as fuel for cooking.

Region	Households (HH)	HH owning cattle		Cattle		Assuming that 25% of HH own more than 7 cattle
	No.	%	No.	No.	Cattle/HH owning cattle	No. of HH
Caprivi	18,607	62.8	11,685	110,200	9.4	2,921
Erongo	27,713	15.9	4,406	35,200	8.0	1,102
Hardap	16,365	13.0	2,127	36,900	17.3	532
Karas	15,570	16.5	2,569	23,700	9.2	642
Kavango	32,354	36.5	11,809	199,500	16.9	2,952
Khomas	64,918	28.2	18,307	124,400	6.8	4,577
Kunene	13,365	41.9	5,600	255,200	45.6	1,400
Ohangwena	37,854	44.9	16,996	111,500	6.6	4,249
Omaheke	13,347	38.4	5,125	340,400	66.4	1,281
Omusati	39,248	37.2	14,600	180,500	12.4	3,650
Oshana	31,759	32.7	10,385	30,200	2.9	2,596
Oshikoto	31,871	45.8	14,597	165,100	11.3	3,649
Otjozondjupa	28,707	24.9	7,148	382,200	53.5	1,787
Namibia	371,678	33.7	125,255	1,995,000	15.9	31,339

Table 15 Households depending on subsistence farming and households owning cattle in northern regions in Namibia
Source: Adapted from NPC (2006) and Mendelsohn et al. (2009) and own calculation

5.3.3.4.2 Large scale biogas digester

There are also some larger commercial dairy, pig, and poultry farms in Namibia. Some of these farms might have anaerobic manure management systems in place and CDM might be an option. Yet, installations for commercial farms or the industry (e.g. poultry farms, abattoirs) do not generate much employment and do not have an impact on the alleviation of poverty. “Large-scale biogas production [...] requires only few well trained technicians, so employment creation is low” (DRFN 2009, p. 38). CONSULTING SERVICES AFRICA (2012, p. 63) estimated that two jobs would be generated for a biogas digester on a commercial poultry farm with 25,000 chicken. One worker would be needed to operate and maintain the digester and one worker would handle the fertiliser produced by the digester.

Most of the towns in Namibia use waste water treatment ponds which include anaerobic and aerobic ponds. According to MET (2008, p. 38), there are 31 municipal water treatment plants in Namibia. As mentioned before the methane emissions from domestic and industrial waste water was estimated to amount to 2 GgCH4 in 2000. A CDM consultant doubted that “the emissions would be sufficient to do anything worthwhile like run a generator [or that] the gas from waste water treatment ponds would create many jobs”. He was sure that the methane emissions from the ponds had never been measured. The consultant saw only a CDM potential for treatment plants in Walvis Bay and Windhoek.

5.3.3.5 Energy efficiency

About 37% (137,000) of the households in Namibia used electricity or solar power for lighting (see Table 11). The overwhelming rest uses candles, paraffin, wood, gas, etc. Therefore, a programme to replace incandescent light bulbs with energy saving CFLs would benefit about 137,000 households. In particular in combination with solar home systems CFLs would be beneficial. MME (2007, p. 88 f.) estimated that CFLs will have an amortisation period of less than 5 months in Namibia. Current CFL CDM projects are distributing more than 500,000 light bulbs (see Table 16). Assuming a CER price of $US 5, the WORLD BANK (2004, p. 111 f.) calculated that CFL CDM projects would only be commercially viable at an emission reduction potential of 10,000 tCO2/year. “To achieve emission reductions of 10,000 t per year [...] more than 60,000 households would need to participate” (MÜLLER et al. 2010, p. 30). They based their calculation on 6 bulbs per household which would result in the distribution of at least 360,000 CFLs.

MET (2011a, p. 96) mentioned an exchange programme to replace 900,000 incandescent light bulbs with CFLs over a period of three years which was to lead to a reduction of energy consumption by 22 GWh per annum. The exchange started in 2007 but the result of the project has not been evaluated yet. With that number of CFLs, there was a theoretical potential for a CFL CDM project in Namibia. According to UNDP (s.t., p. 13) the exchange programme did not apply for CDM funding because a fast role out of the programme was desired. GOUVELLO et al. (2008) did not consider Namibia as a CDM host country for efficient lighting technologies in their study. Because of the low number of households per region which have access to electricity a local CDM initiative would not be feasible. As CFLs are not produced in Namibia there would not be any essential impact on employment.

Ref.	Title	Host country	1st credit period ktCO2e/yr	Credit period in yrs	ktCO2e over credit period	Unit to be distributed/ installed	Replacing	Methodology
3659	Qiangling CFL Distribution Project	China	33	7	229	1,010,494	na	AMS-II.J.
1754	Visakhapatnam (India) OSRAM CFL distribution CDM Project	India	27	10	274	450-500,000	na	AMS-II.C.
2457	Yamunanagar & Sonipat (India) OSRAM CFL distribution CDM Project	India	41	10	408	530,000	na	AMS-II.C.
2476	Pune (India) OSRAM CFL distribution CDM Project	India	30	10	300	525,000	na	AMS-II.C.
3404	Rwanda Electrogaz Compact Fluorescent Lamp (CFL) distribution project	Rwanda	24	10	239	800,000	na	AMS-II.J.+AMS-II.C.

Table 16 Registered CFL projects
Source: Adapted from FENHANN (2012) and UNFCCC (2012a)

5.3.3.6 CDM proposals

Numerous studies and reports have been published over the last 10 years to highlight mitigation and CDM potentials in Namibia (e.g. MET, 2002; MET/UNDP, 2007; SCHULZ/SCHUMANN 2007; GOUVELLO et al. 2008; JONES et al. 2009; UNDP 2009; OERTZEN 2009a; HERRMANN/BRÜNTRUP 2010; PÖYRY 2010; MET 2011a).

In a study on low carbon energy projects for Sub-Sahara Africa GOUVELLO et al. (2008, p. 25 ff.) identified 41 potential CDM projects for Namibia. Out of 22 project types considered in the study the authors deemed seven project types as relevant. Five CDM projects were identified where combined heat and power could be generated. Three projects to increase the efficiency of steam systems could also be viable CDM projects. Furthermore, there is the potential for one project which uses agricultural residue to generate renewable energy. In the study 30 potential CDM Jatropha projects were identified to produce biofuels for vehicles and electricity generation. An efficient public transport system for the city of Windhoek would also qualify for CDM. Another opportunity for CDM projects could be the improvement of charcoal production. CO2 and CH4 emissions could be reduced by deploying improved charcoal production technologies. Moreover, the authors highlighted that many other potential projects were not considered because of lack of data (e.g. hydropower). Without considering the Jatropha projects the study proposes a portfolio of 11 projects for Namibia remained which would reduce greenhouse gas emissions by 0.637 million tCO2e/yr.

JONES et al. (2009, p. 25) identified CDM opportunities in the land-use, land-use change and forestry sector (LULUCF) in Namibia, such as restoration of degraded land through afforestation/reforestation, afforestation/reforestation on degraded land for sustainable wood production, methane recovery in animal manure management systems, methane recovery in agricultural activities at the household/small farm level, etc. The authors stated that there are approved CDM methodologies for all the mentioned initiatives. However, as mentioned before methane emissions from manure management are negligible due to farming practises and aerobical decomposition of manure.

UNDP (2009) investigated the potential of CDM projects in Namibia, too. During the investigation the following project ideas were identified: wind parks for electricity generation, biomass power plants, photovoltaic/diesel gensets hybrid power plants, hydropower electricity generation plants, energy efficiency initiative distributing Compact Fluorescent Light (CFL) , bundled greenhouse gas emission reduction technologies (including PV solar home systems, solar water heaters, CFLs, or fuel efficient biomass cooking), biodiesel production, animal waste conversion to biogas for electricity generation or as fuel for vehicles, landfill gas extraction for flaring or electricity generation, capturing biogas from municipal wastewater treatment plants for flaring or electricity production, conversion of

vehicles to use LPG, industrial fuel switching, for example, to charcoal, efficient charcoal production, and biochar . The UNDP initiative resulted in the development of Project Idea Notes (PINs) for a wind farm and the usage of biogas to produce electricity. Projects which require time consuming coordination with project developers, have a high degree of complexity, have no approved methodology or are too small to justify monitoring and validation costs were not considered. The investigation report also highlighted that vehicle fuel switching, biodiesel production, afforestation/reforestation and gas capturing from landfills and municipal wastewater treatment plants might offer significant potentials for CDM in the future.

Up to date several PINs and Project Design Documents (PDDs) have been developed for CDM projects in Namibia. PÖYRY (2010, p. 76) lists 8 projects where either Letter of No Objections (LNOs) have been issued by the DNA, or even PINs or PDDs have been developed. They include an energy efficient stoves project, a landfill gas recovery for flaring project, a waste to energy project, a biomass power plant, a geothermal energy and a wind energy project. According to MME (2007, p. 63), geothermal resources are found in Namibia along a belt which starts in the south in the Bethanie area and continues north to Otjiwarongo and then northwest to the Ruacana area. However, “it is unlikely that geothermal energy will play an important role in an energy supply mix for Namibia [and that there are] insufficient observations [and] insufficient information [...] to make a sound scientific assessment of the geothermal potential” (MME 2007, p. 46).

The UNFCCC (2012a) database included several PDDs for Namibian projects. Two PDDs were developed by a newly established cement production facility in Namibia. One proposal suggested the use of encroacher bush to replace fossil fuel for the production of cement. The other proposal reasoned that setting up a cement plant close to the end consumer market will reduce emissions in the transport sector. Another PDD was developed for the establishment of a 800 MW gas power plant using combined cycle technology. Two CDM projects were registered in December 2012: a power generation from biogas project in Windhoek (Ref. 9310)and a methane recovery and power generation project at the Kupferberg landfill in Windhoek (Ref. 7535).

Several regional Programmes of Activities (PoAs) which include Namibia were found in the UNFCCC database as well. Amongst them are a solar LED PoA by a UK company, a small scale hydro power PoA by a South African entity, and an energy efficient stove PoA by the South African Regional Carbon Facility. None of them has entered the validation phase.

The chances for viable CDM projects in Namibia are currently minimal mainly because of two developments. The price for carbon credits has dropped dramatically over the last years. In many studies on CDM the financial assessment of CDM projects was based on a CER price

of 12 € and more. According to EUROPEAN ENERGY EXCHANGE (2013) the price for CER Futures is currently below 0.6 €[55]. Small local projects might not earn enough CERs to justify the CDM transaction costs. The largest market for trading carbon credits is the EU ETS. Yet, for all projects registered after 2012, EU ETS only allows CERs of these projects to be traded if they come from LDCs[56]. Namibia is an upper middle income country and the trading of CERs generated in Namibia would not be permitted at EU ETS.

5.3.4 Ranking of CDM potentials with respect to LED

5.3.4.1 Ranking criteria

LED aims at improving the living conditions of people in a territory by providing employment and income opportunities. This means that any mitigation initiative taken under the umbrella of an LED programme should contribute to these targets, too. The introduction of technologies and methods which lead to employment generation somewhere else or do not have a measurable and sustainable impact on a locality will not be of high priority in a LED strategy. To use the heat generated in sugar mills to produce electricity, for example, only benefits the sugar mills but does not have a high impact on employment or the community at large. The promotion of solar panels or CFLs will not create much employment in Namibia as the panels and the CFLs are produced outside of the locality. The transfer of new technologies and skills to a CDM host country is one of the major objectives of CDM. However, it is doubtful that employment will be generated in a locality if the technology cannot be handled by local people and companies from outside the locality are needed to install and maintain the installations. Because of the high unemployment rate preference should be given to labour intensive projects which use local resources and available skills. Because of the high poverty rate the focus on LED in Namibia is also on poverty alleviation. Thus, initiatives which promote products to end-users, such as solar home systems, have to ensure that the products are affordable by the poor.

The quality of life - especially for the poorer stratum of society - could be bettered by reducing costs of energy. NPC (2006, p. 105) stated that the average household income in Namibia is N$ 43,521 and the average per capita income is N$ 8,839[57]. However, against the background of the high unemployment rate and a GINI coefficient of about 0.64 it can be assumed that many households consume much less than the average household income

[55] October 23, 2013
[56] See also EU (2013)
[57] "Household income is derived as the sum of total consumption and non-consumption expenditures such as for livestock, motor vehicle license, house and land. Savings are not included in computed household income" (NPC 2006, p. 105).

indicates. That means any savings for example on wood, paraffin, or electricity could be used to cover other basic needs. Activities which reduce unproductive time also better the living conditions of people. For example using energy efficient stoves might mean that women spend less time collecting wood. The quality of life improves immediately with access to electricity as it allows the reception of news services like radio or TV.

LED programmes are always looking for affordable quick wins. Especially in developing countries the public and the private sector often lack the human, financial, institutional and technical capacities to invest in long-term large-scale projects. Therefore, preferred mitigation initiatives would encompass projects, which can be mainly managed by local stakeholders, which do not require high upfront investments, and which immediately show positive results. Projects which require longer planning horizons, sound feasibility studies, sophisticated infrastructure, state of the art technologies (e.g. landfill gas projects, biodiesel), and the development of a whole value chain can only be envisaged by thriving localities.

LED also focuses on projects which catalyse economic development beyond the scope of the actual project. As mentioned before using bush for electricity generation might create employment and provides carbon neutral energy but at the same time increases the productivity of farms and improves the ground water situation. Providing electricity to an unelectrified settlement could spark economic development as the provision of electricity generates new business opportunities.

By nature certain projects will rather be handled on national level or will be initiated by larger private international or national firms like wind parks, hydropower plants, energy efficiency projects in companies, etc. For example, the lack of attractive feed-in tariffs might render local investments in alternative energy sources meaningless. It is the task of the national government to adopt policies which create an enabling environment for such kind of investments. The construction of photovoltaic parks and mini grids for unelectrified settlements might require the technical expertise and financial assistance of the national power company, the national government, or international bi- or multilateral development organisations. On the other hand projects like energy efficient stoves or solar water heaters do not necessarily need to be coordinated on national level and the initiation of them is within the sphere of the influence of the local government.

If a project is of no interest to LED, it does not matter if the project mitigates greenhouse gases or if the project is viable under CDM. The project will not be considered as an LED initiative. The criteria to rank projects focused predominantly on LED aspects. The ranking will be based on weighted criteria (see Figure 5).

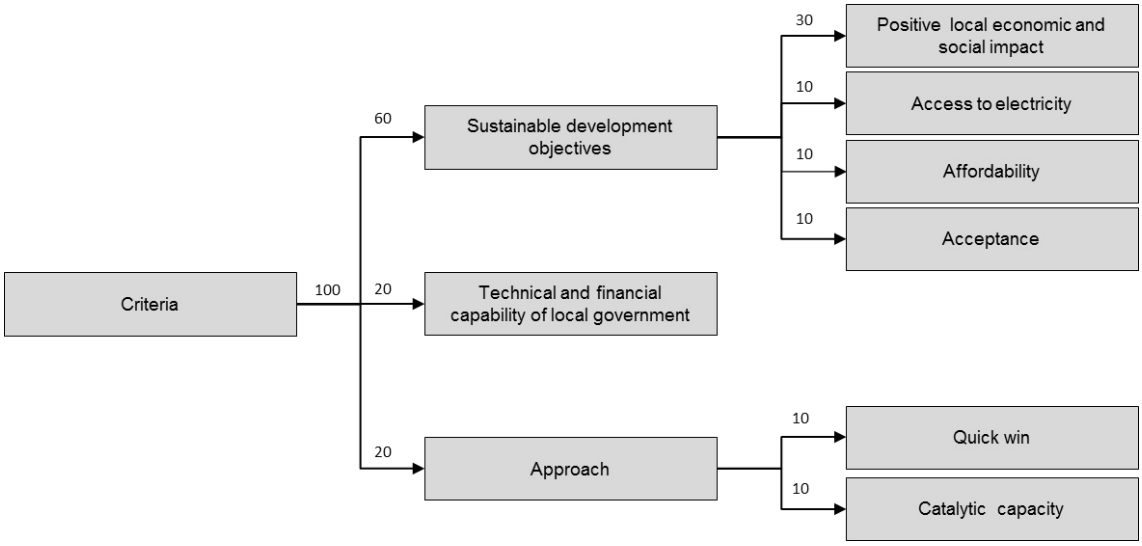


Figure 5 Criteria tree with weights

The criteria will be assessed using the aspects defined in the table below.

Criteria	Value of criterion			
	Good (3)	Satisfactory (2)	Poor (1)	Not assessable/not applicable (0)
Employment opportunities	Employment ≥ 100	Employment ≥ 50	Employment < 50	No real impact on employment
Access to electricity for off-grid settlements	Electricity is fed into mini grid (electricity supply to whole settlement)	PV island solutions / low voltage / not possible to operate all household appliances	Electricity is fed into national grid	No impact on access to electricity
Affordability	Investments < 1,000 N$ (affordable to poorer stratum of society)		Investments >1000 but < 100,000 N$ (affordable to middle class	Investments > 100,000 N$ (affordable by larger companies and farms, etc.)
Acceptance (social and cultural)	Fully accepted by society		Social/cultural obstacles expected	Not accepted at all
Technical and financial capability of local government	Project could be managed by local government without national support	Project could be managed by local government with some national support	Project requires extensive national support but can still be managed on local level	Project cannot be managed on local level
Quick win	Low planning horizon/low investments/ resources locally available		Medium planning horizon/medium investments/resources available in Namibia	Long planning horizon/high investments/resources not available in Namibia
Catalytic capacities	Essential impact beyond scope of project	Medium impact beyond scope of project	Low impact beyond scope of project	No impact beyond scope of project

Table 17 Assessment criteria

5.3.4.2 Ranking process

In a first step the projects will be rated with respect to the criteria mentioned above. The rating is based on information given in the previous sections (see also attachment I Table 45 for a short summary). In a second step the weighted criteria (a) are then multiplied with the rating (b). The sum $\sum a * b$ over all criteria is then used to rank the projects (see Table 18).

Energy efficient stoves, solar home systems, solar water heater, and CFLs seemed to have some potential to be included in LED initiatives in Namibia. Yet, even these projects achieved only between 40% and 63% of the possible scores.

Project		Criteria							Total	% of possible scores of 300	Rank
		Positive local economic and social impact of project	Access to electricity for off-grid settlements	Affordability	Acceptance	Technical and financial capacity	Quick win	Catalytic capacities (impact beyond project boundary)			
	Weight (a)	30	10	10	10	20	10	10			
Energy efficient stoves	Rating (b)	2	0	3	1	3	3	0			
	a*b	60	0	30	10	60	30	0	190	63%	1
Solar cooker	Rating (b)	0	0	3	0	3	0	0			
	a*b	0	0	30	0	60	0	0	90	30%	6
Solar home systems	Rating (b)	1	2	1	1	3	3	0			
	a*b	30	20	10	10	60	30	0	160	53%	2
Small scale bush to energy (<= 5 MW)	Rating (b)	1	3	0	3	0	0	2			
	a*b	30	30	0	30	0	0	20	110	37%	5
Solar energy (parks)	Rating (b)	0	3	0	3	0	0	2			
	a*b	0	30	0	30	0	0	20	80	27%	10
Solar water heater	Rating (b)	1	0	1	3	3	3	0			
	a*b	30	0	10	30	60	30	0	160	53%	2
Large scale bush to energy	Rating (b)	2	0	0	3	0	0	3			
	a*b	60	0	0	30	0	0	30	90	30%	6
Solar water pumps	Rating (b)	0	0	1	3	3	0	0			
	a*b	0	0	10	30	60	0	0	90	30%	6
Household biogas digester	Rating (b)	0	0	1	1	3	0	0			
	a*b	0	0	10	10	60	0	0	80	27%	10
Municipal biogas digester (municipal waste water)	Rating (b)	0	0	0	3	2	0	0			
	a*b	0	0	0	30	40	0	0	70	23%	12
Digesters for dairy farms, poultry farms, abattoirs, etc.	Rating (b)	0	0	1	3	0	0	0			
	a*b	0	0	10	30	0	0	0	40	13%	13
CFLs	Rating (b)	0	0	3	3	3	0	0			
	a*b	0	0	30	30	60	0	0	120	40%	4
Wind pumps	Rating (b)	0	0	1	3	3	0	0			
	a*b	0	0	10	30	60	0	0	90	30%	6

Table 18 Ranking of potential mitigation projects for LED

5.4 Assessment of institutional capacity

Namibia ratified UNFCCC in 1995 and in 2003 acceded to the Kyoto protocol. In the National Development Plan 3, GRN (2008, p. 149 f.) requested that within 5 years a DNA should be established, five CDM projects should be approved, and a national policy on climate change should be drafted.

According to a press release from the cabinet chambers[58], the Namibian cabinet decided to implement a DNA under the Ministry of Environment and Tourism (MET) in 2007. The cabinet approved also of a new position at a deputy director level for the DNA. The tasks of the DNA are taken over by members of other departments as and when required. Because of

[58] See CABINET CHAMBERS (2007): Media Release from Cabinet Chambers, 6 August 2007, Ref: 13/6/26.

the understaffed DNA cooperation between DNA and the private sector is lacking. In addition, procedures to process CDM projects requests in a transparent and objective manner are not in place yet. The DNA is supported by the National Climate Change Committee (NCCC) which is a multi-stakeholder committee and consists of members of the public and private sector and the civil society. The situation has not changed much by 2013. In 2012 MET setup a new subdivision which is to focus on climate change. The subdivision will have 3 staff and will be in charge of CDM as well. The director was only appointed in October 2013 and two staff is to be selected in November 2013.

The cabinet also decided to set up a CDM office to “promote CDM as an economic instrument” under the Ministry of Trade and Industry. The cabinet also approved the establishment of a position at a deputy director level for this office. Up to date neither a CDM promotion office has been set up nor has staff been assigned to the post. Based on information gathered from ministry staff, the reasons stated are: other activities with higher prioritises, lack of time to act on the cabinet decision, and budget constraints.

According to PÖYRY (2010, p. 73 ff.), the DNA had received several hundred requests for CDM guidance by 2010. Yet, so far only two projects were registered. Thus, experience with a complete CDM project cycle is rudimentary in Namibia.

MET (2011a, p. 36) acknowledged that Namibia missed a designated institution to capture, store and analyse greenhouse gas emissions and removals in Namibia. The data are collected and analysed by consultants as and when required. This adds an additional element of uncertainty to the calculation of greenhouse gas emissions and removals. However, reliable data on emissions are essential to make informed decisions on mitigation projects and to attract foreign investments.

In his CDM database, FENHANN (2013) provided a list with about 2050 CDM consultants who were already involved in CDM projects. None of them is from Namibia. On the other hand, PÖYRY (2010, p. 76) stated that there are at least three consultancy companies in Namibia which have already participated in the design of PINs and PPDs and provided CDM training or awareness workshops to the public and private sector. One of the companies was hired to look into the potential of local CDM projects in the region of Otjozondjupa in Namibia. Yet, none of the consulting companies mentioned by PÖYRY was involved in the development of the two registered projects. There is no DOE in Namibia.

The Namibian policy on climate change was adopted by the Namibian cabinet in 2011. In conclusion, Namibian CDM institutions were comparatively ineffective and in an infant stage.

5.5 Barriers for mitigation and CDM projects in Namibia

BOSCH (2011, p. 8) highlighted the low value of carbon credits, the lack of regulations to enforce the reduction of carbon emissions, and the economy of scale which makes it difficult for Namibia to partake in CDM. Additionally, most of the electricity is imported from South Africa. This might prevent the establishment of a baseline value which makes a CDM project feasible. Although the electricity is produced in coal power plants in South Africa CDM regulations do not allow the inclusion of foreign emissions in the baseline calculation. In its Second National Communication to UNFCCC MET (2011a, p.108 ff.) emphasised the need for the acquisition and management of financial resources, stressed the need for the development of new technologies or the transfer of adequate technologies to Namibia, emphasised the fact that research, systematic observation and information is required, underlined the importance of individual and institutional capacity building, and underscored the significance of public awareness, participation and access to information.

In a Namibian study on energy policy scenarios for Namibia MME (2007) drew attention to possible barriers for alternative energy and energy saving initiatives. MME stressed that the electricity tariff structure did not make solar energy an attractive prospect, that subsistence farmers in communal areas did not own the land they occupy and thus could not lease it out to investors who wanted to invest in the production of bio-fuels, and that the usage of solar cooking was hampered by the high cost of the devices, the low level of awareness and people that “prefer an evening meal around a fire” (MME 2007, p. 45). The report further highlighted that without subsidies or higher feed-in tariffs the initial financial requirements did not justify investments in renewable energy generation options, that the Namibian national budget did not make enough provisions for investments in alternative energy resources, and that the assessment of environmental impacts delayed investments in hydropower generation or biofuels. Yet, it is not completely accurate to say that communal land cannot be leased out to private investors. If the community, the traditional authority which administers the land on behalf of the government, and the land board of the ministry of lands and resettlement agree, communal land could be provided to a private investor for a limited period of time. An investor who wanted to invest into a pineapple plantation on communal land in the Kavango regions spoke of 2 years for obtaining all the required approvals.

MME (2005, p. 87 f.) pointed out barriers for the deployment of solar energy technologies (SET) in Namibia. It divided the barriers into five groups: capacity barriers, institutional barriers, public awareness and social acceptability barriers, financial barriers, and technical barriers. The capacity barriers encompass issues like lack of skills to install and maintain SET, the spatial concentration of SET in Windhoek, which is far away from the localities where SET is most needed, the lack of knowledge by NGOs which prevent them from

promoting, designing and installing SETs, the lack of skills by NGO to interpret policies regarding SET, the lack of government capacity to assess applications for SETs or to develop and implement SETs. On institutional level SETs were given little consideration and MME further criticises that there is no institutional ownership of inter-sectoral policies regarding renewable energy technologies either. There was a low public awareness of SETs in terms of performance, costs, availability, funding opportunities, etc. and MME stresses that people still consider solar home systems inferior to grid electricity. High initial investments, lack of financing, inadequate incentives, lack of knowledge of private credit institutions about how to assess loan applications for SETs, lack of confidence that investments in SET will pay off, and lack of knowledge on how to develop business plans for SETs were typical financial barriers for the promotion of SETs in Namibia. Technical barriers were the lack of training facilities, the lack of empirical knowledge, and the lack of techno-economic data to compare different technologies and make informed decisions.

HERRMANN/BRÜNTRUP (2010, p. 1467 ff.) looked into bioenergy value chains and their barriers in Namibia. They highlighted that there was no coherent national rural development strategy[59] in place. It was still unclear how local communities could use the land best. Should it be largely untouched to provide an income from tourism and wildlife or should agriculture be intensified including the cultivation of crops for biofuels? Namibia also missed consistent food security strategies. This might make investments in biofuels difficult. There was also no agricultural support structure that provided incentives, knowledge, credits, inputs, services, etc. with regard to biofuels. The authors further outlined that labour regulation might also challenge investments. The current labour law rightfully tries to protect farm workers from being exploited. However, biofuel production requires some flexibility in terms of seasonal work, piece work, foreign labour, form and formality of enterprises or the special situation of remote areas.

Lack of capacity, insufficient promotion of greenhouse gas emission projects or intellectual property rights are further stumbling blocks for CDM. PÖYRY (2010, p. 74) pointed out that the Namibian DNA did not have adequate guidelines and procedures in place to select and assess CDM projects. There was no full-time staff assigned to the DNA. BOSCH (2011, p. 9 ff.) emphasized that the use of renewable green technologies was hampered by intellectual property rights and that Namibia did not invest enough in the development and promotion of renewable energy options. The author also stressed that there were no pilot or demonstration projects concerning renewables which could help to stimulate investments.

In many sectors basic data to make informed decisions or to attract investors are not available. PÖYRY (2010, p. 80) indicated, for example, that the viability of afforestation,

[59] The Namibian Ministry of Regional and Local Government, Housing and Rural Development (MRLGHRD) is currently developing a national rural development strategy.

reforestation or agricultural projects had not yet been assessed in Namibia. MET (2011a, p. 108 f.) pointed out that research was still needed on fuel switching and fuel use efficiency, that management of agricultural data needed to be formalised, and that profiles of wind regimes needed to be drawn. MET (2011a, p. 36) further stressed that the capturing, storing, and analysing of greenhouse gas inventories was not institutionalised and not carried out on a continuous basis.

During the development of PINs for a wind farm and a biogas-to-electricity project UNDP (2009) discovered the following barriers in Namibia: on the individual and institutional level awareness and knowledge of CDM processes were rudimentary, project proponents were too over-optimistic and then got disillusioned fast, many business propositions were non-viable, upfront costs for PINs, PDDs and project development were too high, there was a general hesitance of companies or project developers to make plans, data and information available, there was a tendency for secrecy, especially regarding financial, legal and intellectual property issues, the greenhouse gas reduction potential was overestimated, and the grid emission factor and feed-in tariffs were unfavourable.

A publication by OERTZEN (2009b, p. 13) mentioned also that the development towards a green energy sector was prevented by low electricity tariffs, the absence of national green energy or energy efficiency targets which could foster new investments and innovation, the nonexistence of tax and investment incentives which specifically promote green energy, the low demand for green energy products and services, and the lack of institutional support.

During the preceding discussion on the business and institutional environment and the mitigation and CDM potentials for Namibia, a number of barriers were already outlined, such as the absence of anaerobic manure management system, high poverty rate, weak climate change institutions, lack of experienced consultants, low density of the population, import of electricity form South Africa, low emissions in Namibia, low market demand for green technologies, and cultural challenges.

General project challenges identified by ELLIS/KAMEL (2007), UNFCCC (2004), PAINULY/FENHANN (2002), JAHN et al. (2004), UNEP (2007), WORLD BANK (2004) are also applicable to Namibian projects, like conventional project risks (e.g. inflation rate, interest rate, capital over-runs, performance risks, time over-runs), CDM specific project risks (e.g. CER price fluctuations, increase of baseline, CER quantity), challenging regulations of carbon emission trading schemes, high transaction costs, complexity of CDM project cycle, etc.

The barriers are summarised in Table 46 (see attachment I) according to barrier types used by PAINULY/FENHANN (2002, p. 6).

A lot of the barriers outlined above are not irrevocable but instead could be influenced by host countries, like poor quality of DNA, lack of awareness on mitigation, and lack of attractive feed-in tariffs. Many of the barriers can even be lowered or removed by local governments. Others, like international CDM framework related issues can be indirectly influenced during the UNFCCC negotiations.

There are many hurdles which prevent the implementation of potential mitigation and CDM projects. Yet, only 14 (24%) out of 59 barriers could be identified as specific CDM barriers. They need to be addressed on international and national level. Issues like insufficient access to technology, absence of infrastructure, low awareness about the economic development potential of emission reduction projects, social rejection of technologies, lack of skilled labour, scarcity of data, project risks, and high initial investments are not CDM specific. Thus, the author of this thesis believes that it is misleading to just speak about CDM barriers.

LED aims at developing the entrepreneurial spirit in a locality, encouraging new business startups, ensuring access to finances, opening up new markets, diversifying the economy, attracting investments, reducing land conflicts, etc. As such, many of the barriers mentioned are typical LED challenges, such as lack of knowledge on how to develop business plans, lack of social acceptance of new technologies, and limited involvement of the business sector.

5.6 Summary

Research has identified a plethora of attracting and inhibiting factors for CDM. In this chapter the factors were investigated with respect to Namibia. To this end, the Namibian business environment, the potentials for mitigation and CDM projects on local level, the institutional setup, and the barriers which might prevent the implementation of potential projects were investigated.

To summarize:

(1) The Namibian industrial base is weak and does not emit high amounts of greenhouse gases. Additionally, most of the electricity is imported and the electricity produced in Namibia is largely based on hydropower. The highest emitter for CO2 is the transport sector and for methane and nitrous oxides the agriculture sector. Most of the methane emissions in Namibia is caused by enteric fermentation. Yet, emission removals by the LUCF sector more than compensate the emissions. Thus, Namibia is considered a sink country.

(2) Many CDM ideas have already been discussed but only a few were developed into PINs or PDDs. Two projects were registered.

(3) Compared to other Sub-Saharan African countries Namibia possesses a comparatively business friendly environment. Most international business environment and governance indices, like the “Ease of Doing Business Index” or the “Global Competitiveness Index” show that Namibia is amongst the leading countries in Sub-Sahara Africa. Based on the business environment Namibia should have more CDM projects registered.

(4) The institutional environment for CDM in Namibia is weak. The Namibian DNA is almost non-existent. Projects are not promoted. A proposed CDM promotion office has not been established yet.

(5) CDM was largely promoted by UNDP in Namibia. There are only a few consultants in Namibia who have experience with the preparation of PINs and PDDs.

(6) The climate change policy was adopted by the Namibian cabinet in 2011.

(7) Literature provides a plethora of barriers for mitigation projects and CDM implementations in Namibia. Yet, only a few are CDM specific. The Namibian government has the power to remove most of the barriers, such as discouraging national policies, lack of attractive feed-in tariffs, etc. Other obstacles can even be eliminated by local governments, like low awareness of mitigation instruments or insufficient promotion of green technologies. Many of the barriers will be addressed by LED initiatives, anyway.

(8) Because the price for carbon credits has dropped dramatically over the last years and due to the fact that CERs of Namibian CDM projects registered after 2012 cannot be traded at the EU ETS the probabilities for viable CDM projects are vanishingly small.

(9) None of the potential mitigation and CDM projects would really have a high impact on employment and income generation. In some cases the project developers over-estimated the contribution of the project to employment generation.

(10) Alternative energy projects would only marginally contribute to Namibia`s overall electricity consumption. However, they could help to electrify off-grid settlements and contribute to the betterment of the livelihood of the people.

(11) The local government as the main LED stakeholder is hardly involved in the projects. Only one project was identified where the regional council was marginally involved.

6 LED stakeholders` perception

6.1 Purpose

In the previous chapter general attracting, supporting and inhibiting factor mitigation and CDM projects were discussed. In this chapter it is investigated what positions LED stakeholders adopt with respect to LED and climate change mitigation and what the factors are which influence that position. Quantitative and qualitative methods are applied.

6.2 Knowledge and awareness

6.2.1 Introduction

Lack of knowledge and awareness has been identified as one of the major barriers for CDM projects worldwide. Not only is there a lack of understanding and awareness of policies and instruments but also about financing opportunities, potentials for economic development, etc. According to UNDP, Ethiopia has considerable CDM potentials but "many potential eligible CDM project concepts are currently unknown to factory owners, communities, NGOs and state utilities" (UNDP, 2010). According to a CDM expert from UNDP in Ethiopia[60], there is still a huge knowledge gap especially on the local level.

In this section the basic knowledge of LED stakeholders about international and Namibian climate change related policies, strategies, and instruments is investigated. Thus, they were asked to rate their knowledge about the most prominent international and national policies, the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto protocol, and the Namibian Policy on Climate Change. Their knowledge on adaptation and mitigation was also assessed. CDM is the major mitigation instrument for developing countries. Therefore, stakeholders' knowledge on CDM and the DNA was evaluated too. Another question was the extent to which stakeholders had already been exposed to climate change initiatives.

6.2.2 Knowledge of selected policies, strategies, and instruments

LED Stakeholders were asked to rate their knowledge of different policies, strategies, and instruments on a scale from 1 (very poor) to 10 (excellent). Non-committal answers were not allowed.

[60] Meeting held on October 4, 2010.

Except for adaptation and mitigation, the data obtained were heavily skewed to the right. All in all, there was very little knowledge on international policies and instruments. Stakeholders seemed to be slightly more knowledgably about mitigation, adaptation, and the Namibian Policy on Climate Change (see attachment I, Table 47 and Table 48). For example, 25% (1st quartile) of all stakeholders rated their knowledge of the Namibian Policy on Climate Change equal or below 2, 50% (median) rated the knowledge 5 or lower and 75% (3rd quartile) deemed their knowledge to be equal or below 7. The knowledge on adaptation is rated 2 (1st quartile), 5 (median), and 7 (3rd quartile). On the other hand, 25% of stakeholders rated their knowledge of CDM 1, 50% rated their knowledge 3 or lower, and 75% only 5 or lower. The percentile ranks for individual stakeholder groups were similar. For example, 25% of the group of councillors rated their knowledge on CDM 1 (1st quartile), 4 (median), and 6 (3rd quartile) whereas they rated their knowledge on the national policy 2 (1st quartile), 5 (median), and 7 (3rd quartile). Does this suggest that the differences observed are significant or are they only due to chance? In other words, is the understanding of policies, strategies, and instruments equally poor or not?

Stakeholder group	Policies, strategies, instruments						
	UNFCCC	Mitigation	Adaptation	Kyoto protocol	CDM	DNA	Namibian Policy on Climate Change
All stakeholders	2, 4, 6	3, 5, 6	3, 5, 7	2, 3, 6	1, 3, 5	1, 4, 6	2, 5, 7
Chief executives	2, 3, 5	3, 5, 5	3, 5, 6	2, 4, 6	2, 3, 4	2, 4, 5	3, 4, 5
Economic planners	2, 4, 6	4, 5, 6	4, 5, 7	2, 4, 5	2, 3, 5	2, 5, 7	2, 5, 7
Consultants	5, 6, 7	6, 6, 8	6, 7, 8	5, 6, 7	3, 6, 7	3, 5, 7	3, 5, 7
Councillors	2, 4, 5.25	3, 4, 6	3, 5, 6.25	1, 2, 5	1, 2, 6	1, 4, 6	2, 5, 7
Other stakeholders	1, 4, 6	3, 5, 7	3, 5, 7	1, 3, 5	1, 2, 5	1, 3, 6	2, 4, 7

Table 19 Percentile ranks of stakeholders` knowledge of policies, strategies, and instruments

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. The sample sizes for every policy, strategy and instrument is 224. The samples are independent from each other. There are seven different policies, strategies and instruments.

Null hypothesis: H_0: $p(x_i>y_j)=0.5$ where i, j = ϵ{UNFCCC, mitigation, adaptation, Kyoto protocol, CDM, DNA, Namibian Policy on Climate Change} and i ≠ j, and x, y = perceived knowledge (score). Stakeholders' knowledge of selected climate change policies, strategies, and instruments does not vary.

Alternative hypothesis: H_a: $p(x_i>y_j)\neq0.5$ where i, j = ϵ{UNFCCC, mitigation, adaptation, Kyoto protocol, CDM, DNA, Namibian Policy on Climate Change} and i ≠ j, and x, y = perceived knowledge (score).The knowledge of selected climate change policies, strategies, and instruments differs significantly.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 4).

Statistical test: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, 21 independent tests were carried out. The test results (U-values, standard deviation, standard score, etc.) can be found in Table 49 (see attachment I). The standard normal significance level was defined as $\alpha = 5\%$. Because of two-tailed tests, the cut-off point was $\alpha/2 = 2.5\%$.

The hypothesis that there was no significant difference between the knowledge on UNFCCC and the Kyoto protocol, UNFCCC and the DNA, UNFCCC and the Namibian policy, mitigation and adaptation, mitigation and the Namibian policy, adaptation and the Namibian policy, the Kyoto protocol and CDM, the Kyoto protocol and the DNA, CDM and the DNA, the DNA and the Namibian policy could not be rejected. Some of the calculated p-values were very small, such as between the knowledge about UNFCCC and the Namibian policy (0.037) and adaptation and the Namibian policy (0.028). For all other tests the burden of proof against the null hypothesis was strong and the hypotheses could be rejected.

Taking into account the calculated test statistics and the percentile ranks two different groups emerged. The first group, where interviewees' level of knowledge is very poor consists of UNFCCC, the Kyoto protocol, CDM and the DNA. The percentile ranks of knowledge about the national policy, mitigation and adaptation were about 1 to 2 ranks higher than the percentile ranks of the elements of the first group.

In recent years Namibia experienced severe floods which were publicly discussed as an impact of global warming. During these years the Policy on Climate Change was developed and strategies to adapt to floods were discussed in towns and regions affected. Moreover, energy prices increased and domestic energy options were deliberated such as solar and wind energy. This might explain why stakeholders are better informed about the national policy, mitigation and adaptation than about international institutions.

Interviews confirmed the results of the survey. Stakeholders` knowledge of the institutional environment of climate change is very rudimentary. As one of them said "it is not my field of expertise [and] I am speaking at an instinct level more than at a knowledge based level". One of the CDM consultants interviewed assumed that people "have heard about climate change in very vague terms, but they have not thought about how it really in physical terms impacts them locally".

The concept of CDM is quite complex and LED stakeholders were not familiar with it yet. Most stakeholders had no idea what CDM is all about. One claimed to "have heard the term" while another one had difficulties to distinguish between mitigation and adaptation: "renewable energy […] is it adaptation or mitigation?". One LED consultant defined it as a funding mechanism within the Global Environment Facility (GEF)[61].

6.2.3 Experience

LED stakeholders were also asked to indicate their previous experience with climate change projects. Their answers could be grouped into five categories: adaptation, mitigation, general environmental issues, policy formulation, others.

Only a few LED stakeholders had been involved in climate change projects. About 19% (42 out of 224 stakeholders) claimed to possess experience with climate change projects. 20% of chief executives (5 out of 25 executives), approximately 19% of economic planners (11 out of 57 economic planners), about 15% of councillors (10 out of 68 councillors), and 9% of other stakeholders (5 out of 57 other stakeholders) indicated former involvement. By comparison, far more than half of the consultants (almost 65% or 11 out of 17) claimed former experience (see also Table 20).

Their experiences varied extensively. Approximately 6% (13 out of 224) of respondents were involved in adaptation projects, such as storm water management or conservation agriculture, about 4% (9 out of 224) in activities which mitigate greenhouse gases, like solar power projects, electrical demand side management or the promotion of windmills, 4% (9 out of 224) were involved in more general environmental activities, like planting of trees or implementing the Agenda 21. About 2% (4 out of 224) had experience with the development of national policies or development plans. Around 3% (7 out of 224) of respondents indicated involvement but could not be classified. For example one responded stated that he uses solar power and had built a low-energy house. Others attended workshop or presentations on climate change.

[61] The GEF was implemented in 1991 as an international funding mechanism within the World Bank by the bank itself, UNDP, and UNEP but is now a separate organisation. It is also entrusted with providing funds for projects under UNFCCC, such as CDM projects. Yet, CDM is not a GEF funding mechanism.

Previous experience		Overall		Chief executives		Economic planners		Consultants		Councillors		Other stakeholders	
		No.	% of total	No.	% of total	No.	% of total	No.	% of total	No.	% of total	No.	% of total
Yes	Adaptation	13	5.8	3	12.0	4	7.0	1	5.9	4	5.9	1	1.8
	Mitigation	9	4.0	1	4.0	3	5.3	4	23.5	1	1.5	0	0.0
	General environment	9	4.0	1	4.0	2	3.5	2	11.8	3	4.4	1	1.8
	Policy/national planning	4	1.8	0	0.0	1	1.8	2	11.8	0	0.0	1	1.8
	Not classifiable	7	3.1	0	0.0	1	1.8	2	11.8	2	2.9	2	3.5
	Sub Total	42	18.8	5	20.0	11	19.3	11	64.7	10	14.7	5	8.8
No		178	79.5	20	80.0	46	80.7	6	35.3	58	85.3	48	84.2
Do not know		4	1.8	0	0.0	0	0.0	0	0.0	0	0.0	4	7.0
Total		**224**	**100.0**	**25**	**100.0**	**57**	**100.0**	**17**	**100.0**	**68**	**100.0**	**57**	**100.0**

Table 20 Stakeholders` experience with climate change projects

Economic planners were only marginally involved in climate change related projects as the projects are normally handled by technical departments of local administrations, such as in the case of the Tsumkwe solar power project in the region of Otjozondjupa. Although, a closer cooperation between the technical and the LED department would be desirable one LED officer admitted that “so far, we have not really [collaborated] that much”. The LED officer of another town complained that “the LED planner is still in the background […] and most of the economic development aspects are still done by our technical members”. Several LED officers mentioned a few instances where private investors contacted the local authority but they were not informed.

In general, the private sector seemed to be reluctant to involve the local public sector when assessing business opportunities in the field of climate change. One international private investor from the solar power industry did not even see the need as in her experience “even the local electricity distributors in Namibia do not have sufficient knowledge on photovoltaic.” A representative of a German power company, which explored the feasibility of a bush-to-energy CDM project admitted that they had not contacted the local governments of the bush encroached regions. They only talked to national ministries and the national power supplier. It was not on their minds at all to consult the local administrations.

6.2.4 Summary

Lack of knowledge has been identified as one of the major obstacles for CDM projects. It can be assumed that this is also the fact when it comes to climate change mitigation initiatives in general. In this chapter, stakeholders’ knowledge was investigated. To this end LED stakeholders were asked to rate their knowledge on selected climate change policies, strategies, and instruments on a scale from 1 (poor) to 10 (excellent). They were also asked to indicate if they had been previously involved in climate change activities. Additional qualitative data were obtained through stakeholder interviews.

To summarize:

(1) LED stakeholders had a low understanding of international and national climate change policies, strategies, and instruments.

(2) Knowledge of CDM was virtually non-existent.

(3) There was more knowledge about the national policy, mitigation and adaptation than of UNFCCC, the Kyoto protocol, CDM, and the DNA.

(4) Some LED stakeholders claimed to have some experience with climate change projects, but only a few of them had experience with mitigation initiatives.

(5) LED stakeholders admitted that climate change aspects in local governments are dealt with by technical departments and economic development departments were rarely consulted.

(6) Based on the analysis of qualitative data obtained through interviews, it could be assumed that knowledge of policies, strategies, and instruments is even lower than indicated by stakeholders' self-assessment.

(7) Is rather unlikely that the level of knowledge of climate change policies, strategies, and instruments or previous experiences with respective projects will prompt LED stakeholders to consider including mitigation projects into LED initiatives.

6.3 Threats

6.3.1 Introduction

According to the DIRECTORATE GENERAL COMMUNICATION (2009, p. 5 f.), climate change was rated by Europeans as the second most serious problem the world is facing today. 47% of the 26,719 interviewees felt that climate change was a severe problem and was even more serious than for example international terrorism, the spread of infectious diseases, armed conflicts, an increasing world population or the proliferation of nuclear weapons. A survey[62] by the WORLD BANK (2009a, p. 4) showed that about 59% of the interviewees considered climate change or global warming to be a "serious problem" whereas 27% saw it as a "somewhat serious problem". Only 9% felt that it was not very serious and 3% thought that it was no problem at all. In the US only 31% of the interviewees

[62] All in all 13,518 people in the US, Japan, France, Russia, Mexico, Turkey, Iran, China, Egypt, Indonesia, India, Vietnam, Senegal, Bangladesh and Kenya were interviewed.

and in Japan only 38% believed that climate change posed a serious problem compared to 85% in Bangladesh and to 90% in Mexico.

Climate change is not only a global or national challenge but its consequences will have severe impacts on the socio-economic development of sub-national geographic and administrative structures, such as regions and towns. That means that climate change will also have ramifications on LED initiatives. In this chapter it is investigated if LED stakeholders perceive climate change to be a threat to the socio-economic development of their territories.

6.3.2 Climate change – a threat to Namibia's development?

In its second communication to UNFCCC the MET (2011a, p.57 ff.) stated that temperatures will increase between 1 and 3.5°C in summer and 1 to 4°C in winter by 2065[63]. Rainfall patterns will change too. DIRKX et al. (2008, p. 13 ff.) projected summer rainfalls to increase over most parts of Namibia between 2046 and 2065[64] whereas winter rainfalls will decrease in the south and the west. The study further indicated that temperatures will increase by 1 to 2°C in summer and 2.5 to 4°C in winter. Surface winds will increase between 0 to 0.8 ms^{-1} in summer and up to 1 ms^{-1} in winter. "Climate in Namibia is inherently highly variable [and] is therefore an added stressor on this variability" (MET, 2009, p. 16).

How does this affect Namibia's development? In its first communication to UNFCCC, MET (2002, p. 36 ff.) highlighted Namibia`s vulnerability with respect to climate change. Development in Namibia might be hampered in the water, agricultural, fishery, tourism, and health sector. Water is a decisive factor for many economic sectors like mining which uses 8 million m^3 of water per year. The report further stressed that half of the energy generation in Namibia depends on water[65]. Furthermore, it emphasized that irrigation in the agricultural sector uses about 120 million m^3 which is half of the total water supply. Less rain will put an additional strain on the productivity of these sectors. People, farmers and companies have to adapt. For example, a uranium mine inaugurated a desalination plant to provide water for its operation in 2010. Conservation agriculture which reduces soil erosion and water loss was promoted in the north of Namibia. MET (2002, p. 36 ff.) also highlighted potentially negative impacts on eco-systems, biodiversity and coastal zones. MET concluded that "the Namibian people, economy, and environment are extremely sensitive to climate change effects and,

[63] Based on IPCC A2 SRES scenario which assumes that fossil fuel will be used at a moderate growth rate.
[64] Based on IPCC A2 SRES scenario and downscaled to regional/local level.
[65] There is currently only one 240 MW hydro power station in operation in Namibia. A second 360 MW one is being discussed.

due to institutional and financial constraints, are highly vulnerable to these effects" (MET, 2002, p.44). In its National Policy on Climate Change, MET (2011b, 13 ff.) stressed that the nation is considered to be extremely vulnerable because the livelihood of many Namibians depend on natural resources, such as arable land, ecosystems, water, and biodiversity and that it expected severe impacts on human and natural development by a changing climate. REID et al. (2007, p. 33) argued that losses of 6.5% of GDP could be sustained annually due to negative impacts on the agricultural and fishery sector. "Vulnerability to environmental change not only depends on change in frequency or duration of climatic conditions, but also on the capacity to respond adequately to those changes" (DIRKX et al., 2008, p. 23). DIRKX et al. (2008, p. 23 f.) further highlighted that Namibia already features a high unemployment, HIV/AIDS, and poverty rate[66]. Its central northern regions are in particular characterized by a high population density[67] and a high population growth rate. A further increase in population will intensify the pressure on land and water resources. The report also highlighted that the high poverty rate and restricted access to productive resources[68] make people even more vulnerable to climate change. Moreover, a substantial number of households still depend on subsistence farming[69] which makes them very dependent on climatic conditions.

Although there are still many uncertainties with respect to the magnitude, speed, and impact of climatic change, there seems to be a scientific consent that Namibia is going to experience an alteration of climatic conditions. Because of that, its development will be negatively affected. Do LED stakeholders perceive climate change as a threat to development? Are there significant differences among stakeholders? These questions will be answered next.

6.3.3 Threat perception

6.3.3.1 General perception

At first stakeholders were asked if they felt that climate change might be a threat to the development of their localities. They were provided with three possible answers: yes, no, and do not know.

[66] Namibia has one of the highest Gini coefficients worldwide. According to UNDP (2013, p. 154), the Gini coefficient was 63.9.
[67] According to NPC (2006, p. 16), about 44% of the Namibian population live in the central north region of Namibia. Yet, the area covers only about 10% of the country.
[68] According NPC (2006, p. 84), 50% of rural households do not own cattle, 30% do not possess poultry, 70% do not own goats, and 25% do not have access to land for crop production.
[69] According to NPC (2006, p. 110), about 37% of the population and 29% of the households in Namibia still rely on subsistence farming.

All consultants believed that climate change poses a threat for the development of a locality. The percentage of yes-answers was between 90% and 92% for all other stakeholder groups. Depending on the point estimators, the confidence coefficient, and the sample size the intervals for the different stakeholder groups were between 8% and 25%. Despite such a low accuracy, the lower boundaries of the intervals were all above 50%. Thus, it can be assumed that the majority of stakeholders believed that climate change poses a threat to development (see Table 21 and Figure 11).

Stakeholder group	Sample size	Yes			No	Do not know
	No. of answers	No. of answers	95% Confidence Interval (p_l/p_u 0 lower/upper bound)		No. of answers	No. of answers
All stakeholders	224	205 (91.52%)	p_l	87.07%	13 (5.80%)	6 (2.68%)
			p_u	94.82%		
Chief executives	25	23 (92.00%)	p_l	73.97%	1 (4.00%)	1 (4.00%)
			p_u	99.02%		
Economic planners	57	52 (91.23%)	p_l	80.70%	3 (5.26%)	2 (3.51%)
			p_u	97.09%		
Consultants	17	17 (100.00%)	p_l	80.89%	0 (0.00%)	0 (0.00%)
			p_u	100.00%		
Councillors	68	61 (89.71%)	p_l	79.93%	6 (8.82%)	1 (1.47%)
			p_u	95.76%		
Other stakeholders	57	52 (91.23%)	p_l	80.70%	3 (5.26%)	2 (3.51%)
			p_u	97.09%		

Table 21 Point estimators and confidence intervals of stakeholders` perception of threat of climate change to local development

6.3.3.2 Observed differences

Stakeholders who believed that climate change constitute a threat were also requested to rate the threat in terms of economic, social and environmental sustainability. The lowest possible rating was one (low threat), the highest 10 (high threat). Stakeholders who did not believe in a threat were given a score of zero (no threat assumed). Sustainable development is not a new concept. Additionally, many of the respondents have been trained in LED and sustainable development. Thus, it could be assumed that the majority of respondents were familiar with the concept and the three constituents of sustainable development.

6.3.3.2.1 Differences among sustainable development dimensions

The calculated percentiles suggested that stakeholders believed that the environment is more threatened by climate change than social and economic development (see Table 22 and attachment I Table 50). 25% (1st quartile) of all stakeholders rated the threat to economic development 4 or lower, 50% (median) 7 or lower and 75% (3rd quartile) 8 or lower. 25% of the stakeholders considered the threat to social development equal or below 5, 50% rated the threat 6 or lower and 75% deemed the threat equal or below 8. The threat to environmental sustainability was ranked by 25% of the stakeholders 5 or lower, while 50%

rated the threat 8 or lower and 75% 9 or lower. This kind of distribution pattern could also be observed for every individual stakeholder group. Are the differences observed significant or are they due to chance?

Stakeholder group	Sustainable development dimension		
	Economic	Social	Environmental
All stakeholders	(4, 7, 8)	(5, 6, 8)	(5, 8, 9)
Chief Executives	(5, 5, 7)	(5, 6, 8)	(5, 7, 8)
Economic Planners	(5, 7, 8)	(5, 7, 9)	(6, 8, 10)
Consultants	(6, 7, 9)	(7, 8, 9)	(8, 9, 10)
Councillors	(4, 7, 8)	(4, 6, 8)	(5, 7.5, 9)
Other stakeholders	(4, 5, 8)	(4, 6, 8)	(5, 8, 10)

Table 22 Percentile ranks of stakeholders` perception of threat

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The overall sample size is 224. The samples are independent from each other. There are three sustainable development dimensions: economic, social, and environmental sustainability. Six stakeholder groups are considered: all stakeholders, chief executives, economic planners, consultants, councillors, and other stakeholders.

Null hypothesis: H_0: $p_s(x_i>y_j) = 0.5$ where i, j = ϵ{economic development, social development, environmental development} and i ≠ j, s = ϵ{all stakeholders, chief executives, economic planners, consultants, councillors, other stakeholders} and x, y = perceived threat (score). Stakeholders of a selected group assume that economic, social, and environmental sustainability are equally threatened by climate change.

Alternative hypothesis: H_a: $p_s(x_i>y_j) \neq 0.5$ where i, j = ϵ{economic development, social development, environmental development} and i ≠ j, s = ϵ{all stakeholders, chief executives, economic planners, consultants, councillors, other stakeholders} and x, y = perceived threat (score). The perceptions of stakeholders of a group concerning economic, social, and environmental sustainability differ significantly.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 4).

Statistical test: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, three independent tests had to be carried out for each stakeholder group which means that 18 tests were necessary. The test

results (U-values, standard deviation, standard score, etc.) can be found in Table 51 (see attachment I). The standard normal significance level was defined as α = 5%. Because of two-tailed tests, the cut-off point was α/2 = 2.5%.

The null hypothesis that stakeholders did not distinguish between the threat of climate change to economic and social development could not be rejected. The p-values were high for each stakeholder group (e.g. about 80% for all stakeholders, 86% for councillors). This is far above the cut-off point of 2.5%. The burden of proof against the null hypothesis was weak.

The test between the threat to economic and environmental sustainability resulted in a p-value of 0.00005 and between the threat to social and environmental sustainability in a p-value of 0.00010. The null hypothesis could be rejected in both cases. The test results were different for individual stakeholder groups. Except for three tests the calculated p-values were above the cut-off point. Although these p-values were above the cut-off point, they were still very small and the smaller the p-value, the more strongly the data contradict the null hypothesis. In addition, the treat to the environment was rated 1 to 2 scores higher than the threat to economic and social development (1st quarter, median, 3rd quarter). Thus, it can be assumed that stakeholders believed that climate change would be a bigger threat to the environment than to economic and social development.

6.3.3.3 Differences among stakeholder groups

It also seemed that the various stakeholder groups differ in their perceptions. For example 25% of the councillors ranked the threat to economic development 4 or lower whereas 25% of the chief executives and economic planners rated the threat 5 or lower (see Table 22 and attachment I Table 52, Table 53, and Table 54). The threat to social development was regarded by 50% of the councillors 6 or lower whereas 50% of the consultants rated the threat 8 or lower. 75% of the economic planners, other stakeholders and consultants ranked the threat to the environment 10 or lower while 75% of the councillors rated the threat 7.5 or lower. Are these findings coincidental or do their perceptions vary significantly?

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The overall sample size is 224. There are three sustainable development dimensions: economic, social, and environmental sustainability. The samples are independent from each other. Five stakeholder groups are considered: chief executives, economic planners, consultants, councillors, and other stakeholders.

Null hypothesis: H_0: $p_d(x_i>y_j) = 0.5$ where d = ϵ{economic development, social development, environmental development} and i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders} and i ≠ j, and x, y = perceived threat (score). Stakeholders perceive the threat to a selected sustainable development dimension equally high.

Alternative hypothesis: H_a: $p_d(x_i>y_j) = 0.5$ where d = ϵ{economic development, social development, environmental development} and i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders} and i ≠ j, and x, y = perceived threat (score). The perception differs significantly among stakeholder groups.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 3)

Statistical test: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, 10 independent tests were needed for each sustainable development dimension which means that 30 tests had to be carried out. The test results (U-values, standard deviation, standard score, etc.) can be found in Table 55, Table 56, and Table 57 (see attachment I). The standard normal significance level was defined as α = 5%. Because of two-tailed tests the cut-off point was α/2 = 2.5%.

The tests revealed that chief executives perceived the threat of climate change to economic development differently from economic planners and consultants. With respect to the threat to social development, there were significant differences between consultants and chief executives, consultants and councillors, and consultants and other stakeholders. Consultants perceived the threat to the environment noticeably different from chief executives, economic planners, councillors, and other stakeholders. The null hypotheses for all these cases could be rejected. For all other tests the null hypotheses could not be rejected. The calculated probabilities were all above the cut-off point.

Yet, for some of the cases the probabilities were very small. For economic development the test between consultants and other stakeholders resulted in a probability of 0.05. For social development the test between economic planners and consultants showed a probability of 0.04 and between economic planners and other stakeholders of 0.06. For the threat to the environment the tests resulted in a probability of 0.06 between economic planners and chief executives and of 0.09 between economic planners and councillors. The smaller the p-value, the more strongly the data contradict the null hypothesis.

Based on the test results, three categories of stakeholders could be distinguished. The first category consisted of chief executives, councillors, and other stakeholders. It seems they rated the threat to economic, social and environmental development equally high. Taking into account the test results and the percentile ranks economic planners felt development more threatened than members of the first category. The percentile ranks of economic planners were zero to two scores higher than the percentile ranks for chief executives, councillors, and other stakeholders. The percentile ranks of the third category, the consultants, were even between zero and three scores higher (see Table 22).

6.3.4 Recognition of climate change related threats in existing local strategies

Most regional and local governments have developed strategic plans or economic development strategies. 19 of them[70] were examined in this thesis. Only Swakopmund's LED strategy recognized climate change explicitly. "An additional threat to development generally underestimated at the coast is the increasing impact of storms at and erosion of beaches to the property development along the coast […] indicating a need for a buffer zone between the sea and the housing development initiatives" (GEISEB, 2009, p. 8). Therefore, the strategy required "the creation of Coastal Environmental Committee that will formally attend to the impact of climate change on the coast and factor those aspects into the expansion plans of the coastal towns" (GEISEB, 2009, p. 24). Other local governments indicated droughts and floods as potential threats to their development, such as the local authority of Mariental and the regional council of Otjozondjupa. However, most towns, like Grootfontein, Karasburg, and Okakarara just made references to general environmental issues, such as waste management, bush fires, littering but not specifically to climate change related issues.

6.3.5 Summary

In this chapter it was investigated if LED stakeholders perceive climate change to be a threat to the socio-economic development of their territories.

LED stakeholders were asked to indicate if they deem climate change a threat to the development of their locality. They were then required to rate the threat on a scale from 1 (low threat) to 10 (high threat) with respect to economic, social, and environmental sustainability.

[70] Enhaana, Gibeon, Gobabis, Grootfontein, Healo Nafidi, Karasburg, Khorixas, Lüderitz, Mariental, Okakarara, Opuwo, Oskikoto, Outapi, Rehoboth, Ruacana, Swakopmund, Tsumeb, Walvis Bay and Windhoek.

In order to find out if the threats were considered in strategic plans and local economic development strategies of regional and local governments, 19 of them were analysed.

To summarize:

(1) Climate change was perceived as a threat to economic, social and environmental sustainability by all stakeholders.

(2) Stakeholders perceived the environment to be more threatened by climate change than economic or social development.

(3) Economic planners and consultants were more aware of a potential threat than chief executives, councillors, and other stakeholders.

(4) Yet, the topic of climate change was hardly an issue in the local development strategies which were analysed during the course of this study.

6.4 Potential

6.4.1 Introduction

In this chapter it is investigated if stakeholders perceive mitigation projects as an engine for socio-economic development, if their perceptions differ and if they have preferences.

6.4.2 Perception of potential

6.4.2.1 General perception of potential

Stakeholders were asked if they felt that climate change initiatives (mitigation or adaptation) contribute to economic development. They were provided with three possible answers: yes, no, and do not know.

All of the consultants surveyed believed that mitigation and adaptation initiatives do offer potentials for economic development. The percentage of yes-answers was between 76% and 89% for all other stakeholder groups. Depending on the point estimators, the confidence coefficient, and the sample size, the intervals for the different stakeholder groups are between 10% and 36%. Despite such a low accuracy, the lower boundaries of the intervals are all above the 50%. Thus, it can be assumed that the majority of stakeholders believed

that mitigation and adaptation initiatives contribute to economic development (see Table 23 and Figure 12).

Stakeholder group	Sample size	Yes			No	Do not know
	No. of answers	No. of answers	Confidence Interval (95%) (p_l/p_u 0 lower/upper bound)		No. of answers	No. of answers
All stakeholders	224	190 (84.82%)	p_l	79.44%	14 (6.25%)	20 (8.93%)
			p_u	89.25%		
Chief executives	25	19 (76.00%)	p_l	54.87%	2 (8.00%)	4 (16.00%)
			p_u	90.64%		
Economic planners	57	51 (89.47%)	p_l	78.48%	5 (8.77%)	1 (1.75%)
			p_u	96.04%		
Consultants	17	17 (100.00%)	p_l	80.49%	0 (0.00%)	0 (0.00%)
			p_u	100.00%		
Councillors	68	58 (85.29%)	p_l	74.61%	2 (2.94%)	8 (11.76%)
			p_u	92.72%		
Other stakeholders	57	45 (78.95%)	p_l	66.13%	5 (8.77%)	7 (12.28%)
			p_u	88.62%		

Table 23 Point estimator and confidence intervals of stakeholder` perception of potential of climate change projects for local economic development

6.4.2.2 Perceived economic development potential of mitigation and adaption

All those stakeholders who believed that there was a potential were also requested to rate the potential with respect to mitigation and adaptation separately. The lowest possible rating was 1 (low potential), the highest was 10 (very high potential). Those stakeholders who did not believe in a potential were given a score of zero (no potential assumed).

6.4.2.2.1 Differences between mitigation and adaptation

25% (1st quartile) of all stakeholders rated the potential of mitigation initiatives to economic development 5 or lower. The median (50%) is also 5 and 75% (3rd quartile) rated the potential 7 or lower. 25% of stakeholders consider the potential for adaptation equal or below 5, while 50% rated the potential 6 or lower and 75% deemed the potential to be equal or below 7.25. The percentile ranks between adaptation and mitigation differ only slightly. The same outcome was obtained when individual stakeholder groups were analysed (see Table 24 and attachment I, Table 58, Table 59, and Table 60). Does this suggest that the differences observed are significant or are they only due to chance?

Stakeholder group	Climate change strategy	
	Mitigation	Adaptation
All stakeholders	(5, 6, 7)	(5, 6, 7.25)
Chief Executives	(5, 5, 7)	(5, 5, 7)
Economic Planners	(5, 6, 8)	(5, 6, 7)
Consultants	(6, 6, 9)	(7, 8, 9)
Councillors	(5, 5, 7)	(4.75, 5, 7)
Other stakeholders	(5, 5, 7)	(5, 5, 7)

Table 24 Percentile ranks of stakeholders` perceived potential of mitigation and adaptation for economic development

Assumptions: The samples include only stakeholders with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The overall sample size is 224. The samples are independent from each other. There are six stakeholder groups.

Null hypothesis: H_0: $p_s(x_{mitigation}>y_{adaptation}) = 0.5$ where s = ϵ{all stakeholders, chief executives, economic planners, consultants, councillors, other stakeholders} and $x_{mitigation}$, $y_{adaptation}$ = perceived potential (rank) of mitigation and adaptation respectively. Stakeholders of a selected group assume that mitigation and adaptation projects contribute equally to local economic development.

Alternative hypothesis: H_a: $p_s(x_{mitigation}>y_{adaptation}) \neq 0.5$ where s = ϵ{ all stakeholders, chief executives, economic planners, consultants, councillors, other stakeholders } and $x_{mitigation}$, $y_{adaptation}$ = perceived potential (rank) of mitigation and adaptation respectively. The perceived potentials of mitigation and adaptation differ significantly from each other.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 4).

Test statistics: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, six tests were required in order to compare the perceived potential for mitigation and adaptation. The test results (U-values, standard deviation, standard score, etc.) can be found in Table 61. The standard normal significance level was defined as α = 5%. Because of two-tailed tests, the cut-off point was α/2 = 2.5%.

None of the null hypotheses could be rejected on a 5% significance level. Failing to reject a null hypothesis does not necessarily mean that the null hypothesis is true. However, the high probabilities seemed to indicate that none of the stakeholders differentiate between mitigation and adaptation when it comes to their economic development potential and the burdens of proof against the null hypotheses are weak.

6.4.2.2.2 Differences among stakeholder groups

The observed percentile ranks of the stakeholder groups differ. For example, 25% of the chief executives rated the potential for mitigation projects 5 or lower whereas 25% of the

consultants rated the potential 6 or lower. The potential of adaptation initiatives was rated 7 or lower by 75% of the councillors whereas 75% of the consultants rated the potential 9 or lower (see Table 24 and attachment I Table 59 and Table 60). Are these differences significant or due to chance?

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The samples are independent from each other. There are 5 stakeholder groups to be considered.

Null hypothesis: H_0: $p_s(x_i>y_j) = 0.5$ where s = ϵ{adaptation, mitigation} and i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders} and i ≠ j, and x, y = perceived potential (score). The perception of the potential of mitigation and adaptation for economic development does not vary between two selected stakeholder groups.

Alternative hypothesis: H_a: $p_s(x_i>y_j) \neq 0.5$ where s = ϵ{adaptation, mitigation} and i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders} and i ≠ j, and x, y = perceived potential (score)The perception of the potential differs significantly among selected stakeholder groups.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 3).

Test statistics: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, 10 independent tests had to be carried out per climate change strategy. With two strategies (mitigation, adaptation), 20 tests were required. The median, the U value, standard deviation, standard score (z value) and probability for all tests can be found in Table 62 (mitigation) and Table 63 (adaptation). The standard normal significance level was defined as α = 5%. Because of two-tailed tests, the cut-off point was α/2 = 2.5%.

For mitigation, the null hypotheses for the tests between consultants and councillors or other stakeholders could be rejected on the basis of a 5% significance level. The test between consultants and chief executives resulted in a probability of only 3% and between economic planners and councillors of about 7%. In these two cases, the burden of proof against the null hypothesis was still strong. In the case of adaptation, the null hypothesis for tests between consultants and all other stakeholder groups could be rejected. For all other tests

(mitigation and adaptation) the null hypotheses could not be rejected. Under the assumption that the null hypotheses are true, the computed probabilities were far above 2.5%. The burdens of proof against these null hypotheses were weak.

For mitigation the percentile ranks of consultants are 1 to 2 ranks higher than those of other stakeholder groups. For adaptation the percentile ranks are even 2 to 3 ranks higher. From these findings, it could be assumed that consultants tend to see a higher local economic development potential of mitigation and adaptation projects than other.

6.4.2.2.3 Reason for preference

Through interviews stakeholders were also asked about their preferences with respect to mitigation and adaption. Based on the answers, stakeholders could be split into six groups.

One group of stakeholders could not see any economic development benefits at all and only saw the threats. A CEO of a seaside town expected that climate change will have negative impacts on the water supply of his town and that they would have to invest in desalination plants. In the end the water price would rise and consequently render the town less competitive for buisinesses and residents. He expressed the fear “that the town will not grow as fast anymore as currently”. One economic development officer of a local authority said, solar power in her town is “just an extra or bonus”. According to the officer the council actually wants to see “more factories that create jobs”. The councillors would not perceive the promotion of solar power as an engine for economic development.

It seemed that often stakeholders` perceptions were based on gutfeeling. One LED stakeholder stated that with mitigation “the immediate first thing that comes to mind is the environment [and] obviously the economy would also benefit but how far […] you do not really know”. Another LED stakeholder stressed that there are potentials for climate change activities, although he admitted not to have enough information on the economic impact of them but believed that “ to make them viable you have to think big”. A third one admitted that she could not provide a qualified answer. “I am not sure which one [adaptation or mitigation] would in the long run have the most potential”. Often stakeholders tried to provide examples of mitigation and adaptation activities which were not linked to climate change. One stakeholder for example mentioned a poisonous plant[71] which kills cattle in one part of Omaheke (a political region in Namibia). Instead of trying to eradicate the plant he stressed that it might be more fruitfull if farmers adapt by building fences, trying out different herding

[71] The stakeholder most probably referred to poison leaf, also called gifblaar or magou in Afrikaans (*Dichapetalum cymosum*) . It grows on sandy soil in the East of Namibia. It is extremely poisonous and kills livestock, especially during droughts and outside the rainy season.

techniques, or stopping the cattle from drinking water after consuming these plants. These examples were then used to make deductions with respect to climate change.

Some stakeholders felt that “mitigation sounds more practical” and that there “has been more attention to date on mitigation”. They found it easier to identify economic development potentials for mitigation projects. “There is a huge opportunity for innovation […], technological advancement [and] the creation of new jobs” one interviewee said. The projects were also assumed to contribute to “efficiency in economic terms”. Mitigation would force people to look at available “untapped resources and transforming them into energy”, such as wind, solar, and biomass and these “are somehow linked to labour absorption or labour intensive technologies”. One stakeholder aired his disappointment that “a country that has so much potential to actually implement some mitigation projects, even if it is not really going to make much impacts on the global scale, does not demonstrate that a country can be 100% green in energy”. He further stated that much of the electricity needed is imported and that making Namibia´s national economy independent from import would provide a competitive advantage. An LED consultant mentioned that some mitigation projects would have a direct impact on poverty. For him poverty had many facets such as economic poverty, poverty of knowledge, poverty of health, etc. If someone could not afford an electrical geyser, he argued, subsidized solar water heaters providing hot water would mean an “immediate improvement of lifestyle and the alleviation of poverty”

Other stakeholders argued that climate change was already a reality and that it could not be stopped in the short run. Thus, LED should focus on the economic development potential of adaptation first. This was also opinionated by a CEO of a local authority who said that “people normally wake up late and then they have to adapt. They are seldom pro-active”. One stakeholder argued that “in order to do that [adaptation] you need innovation, you need people who try out new things”. This would stimulate economic development. A LED consultant stated that “with respect to mitigation a lot of the easier things have been started […] and things will become more complex […], costly and […] technology intensive [whereas] on the adaptation side there will be a lot more things that have not been tried and tested”. Yet, these stakeholders failed to concretize the economic development potentials.

A further group of stakeholders who had a background in the energy sector saw many synergies between mitigation and adaptation. One interviewee highlighted, that “mitigation is actually part of adaptation”, mentioning energy efficient cooking stoves as an example. He argued that because of desertification people might find less fire wood in their area. By using energy efficient stoves they could adapt to this situation, because these ovens would reduce the amount of wood needed. At the same time, this would reduce greenhouse gases emissions. He believed that even at a larger scale mitigation was part of adaptation and provided a further example: A drier climate might reduce the amount of water in the Kunene

River which again might have a negative impact on the electricity generation capacity of the Kunene hydropower plant. Instead of using fossil fuels in new power plants Namibia`s adaptation strategy should be to use other renewable energy sources, such as solar power or wind. He emphasized that “adaptation and mitigation have to go hand in hand”. Because if the ground water level sinks people might be deprived from water. “How do you tell that person that having a diesel pump […] is not the way to go – sit around and wait until you get a solar pump?”. These stakeholders argued that mitigation and adaptation also need the same set of skills. “One of the things that happen with mitigation is that it also comes with new skills and those are similar to the ones you need for adaptation”. One stakeholder mentioned the knowledge and skills you need for planting perennial crops which would remove greenhouse gases and at the same time help local farmers to adapt to increased climate variability. Another stakeholder referred back to the water pump example mentioned above. “If people had used diesel pumps before they had already acquired the skills to operate and maintain them when using solar power instead of diesel”.

Another group did not really distinguish between adaptation and mitigation, arguing that both mitigation and adaptation requires investments and “investments result in economic activities”. For them it was not a question of either adaptation or mitigation. They asked instead: “What is the economic activity that comes out of that [mitigation or adaptation] that is actually benefitting the area?”, “What is the kind of employment generation or the contribution to the structure of the economy?”, “What are the spill-over effects?” and “What are the local externalities of these projects?”. One LED officer highlighted that “LED officers are looking for projects which generate employment. No matter what kind of projects”. It was also mentioned that developing countries always lack behind the developed world and that mitigation and adaptation might be an area for “inventing and developing our own new technologies” and close the gap. As one stakeholder said: “As African countries with their potential in solar energy, we should be leading there.”

All in all, mitigation and adaptation were indeed regarded as a potential for economic development. Especially the development of new skills, the creation of jobs, and the necessity to come up with innovative ways to use readily available resources were considered to be economic development benefits. Mitigation projects were also assumed to contribute to poverty alleviation. Yet, most stakeholders were very vague about their perceptions and could not give examples of how the benefits had been or could be materialized. Only stakeholders with a background in the energy sector and some of the LED consultants could provide some concrete answers.

6.4.2.3 Perceived potential of selected mitigation initiatives

The respondents were provided with a list of 15 possible mitigation initiatives and were asked to rate their economic development potential. If by any reason they could not provide an answer they could leave the question out. The scores for every initiative were added. As there were numerous non-committal answers the final scores were divided by the number of committal answers and ranked.

The average rating was comparatively high and the difference between the lowest (5.71) and highest (7.08) average score is a mere 24%. This is an indication that altogether most stakeholders overrated the potential in general and did not really differentiate between the different mitigation options (see also Figure 6).

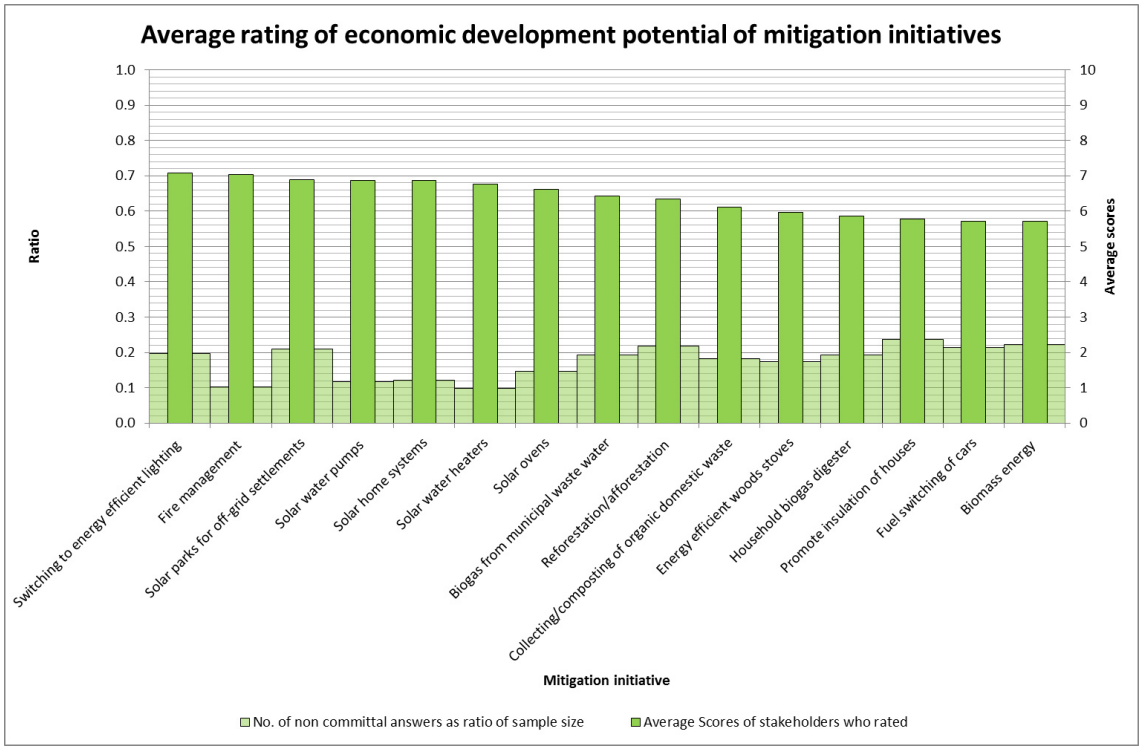


Figure 6 Average rating of economic development potential of mitigation initiatives

Most mitigation initiatives with a high number of non-committal answers had a lower average rating, such as biomass energy production, reforestation/afforestation, etc. This indicated where the knowledge gap was especially wide.

All stakeholder groups prioritized more or less the same top five mitigation initiatives (see also Table 25). LED stakeholders saw a great potential for solar energy, such as solar home systems, solar water pumps, solar water heaters, and solar plants for off grid settlements. In particular, switching to energy efficient lighting systems was believed to contribute to economic development, too.

Stakeholder group		Mitigation initiative														
		Solar water heaters	Solar ovens	Solar home systems	Solar parks for off-grid settlements	Biomass energy	Energy efficient woods stoves	Household biogas digester	Promote insulation of houses	Switching to energy efficient lighting	Solar water pumps	Reforestation/ afforestation	Fire management to reduce bush fires	Composting of organic domestic waste	Fuel switching of cars	Biogas from municipal waste
Overall	No. non-committal answers	22	33	27	47	50	39	43	53	44	26	49	23	41	48	43
	No. committal answers	202	191	197	177	174	185	181	171	180	198	175	201	183	176	181
	Scores (abs.)	1,367	1,263	1,353	1,218	994	1,104	1,062	986	1,275	1,362	1,110	1,415	1,120	1,006	1,162
	Scores (average)	6.77	6.61	6.87	6.88	5.71	5.97	5.87	5.77	7.08	6.88	6.34	7.04	6.12	5.72	6.42
	Rank	6	7	5	3	15	11	12	13	1	4	9	2	10	14	8
Executives	No. non-committal answers	3	2	2	5	4	5	3	4	3	1	4	3	2	5	2
	No. committal answers	22	23	23	20	21	20	22	21	22	24	21	22	23	20	23
	Scores (abs.)	141	133	143	119	106	121	113	122	145	155	124	140	137	117	147
	Scores (average)	6.41	5.78	6.22	5.95	5.05	6.05	5.14	5.81	6.59	6.46	5.90	6.36	5.96	5.85	6.39
	Rank	3	13	6	9	15	7	14	12	1	2	10	5	8	11	4
Economic planners	No. non-committal answers	3	4	5	7	6	5	6	8	7	5	8	2	7	5	4
	No. committal answers	54	53	52	50	51	52	51	49	50	52	49	55	50	52	53
	Scores (abs.)	378	361	383	347	313	331	299	275	365	346	308	384	305	299	360
	Scores (average)	7.00	6.81	7.37	6.94	6.14	6.37	5.86	5.61	7.30	6.65	6.29	6.98	6.10	5.75	6.79
	Rank	3	6	1	5	11	9	13	15	2	8	10	4	12	14	7
Consultants	No. non-committal answers	0	0	1	1	2	1	1	1	1	1	0	0	0	1	2
	No. committal answers	17	17	16	16	15	16	16	16	16	16	17	17	17	16	15
	Scores (abs.)	139	117	126	131	96	103	101	105	125	129	126	128	118	83	114
	Scores (average)	8.18	6.88	7.88	8.19	6.40	6.44	6.31	6.56	7.81	8.06	7.41	7.53	6.94	5.19	7.60
	Rank	2	10	4	1	13	12	14	11	5	3	8	7	9	15	6
Councillors	No. non-committal answers	11	17	11	20	24	18	20	25	19	10	25	11	19	22	21
	No. committal answers	57	51	57	48	44	50	48	43	49	58	43	57	49	46	47
	Scores (abs.)	391	346	375	344	232	292	304	254	336	401	262	395	303	273	295
	Scores (average)	6.86	6.78	6.58	7.17	5.27	5.84	6.33	5.91	6.86	6.91	6.09	6.93	6.18	5.93	6.28
	Rank	4	6	7	1	15	14	8	13	5	3	11	2	10	12	9
Others	No. non-committal answers	5	10	8	14	14	10	13	15	14	9	12	7	13	15	14
	No. committal answers	52	47	49	43	43	47	44	42	43	48	45	50	44	42	43
	Scores (abs.)	318	306	326	277	247	257	245	230	304	331	290	368	257	234	246
	Scores (average)	6.12	6.51	6.65	6.44	5.74	5.47	5.57	5.48	7.07	6.90	6.44	7.36	5.84	5.57	5.72
	Rank	8	5	4	7	10	15	13	14	2	3	6	1	9	12	11

Table 25 Ranking of mitigation initiatives with respect to local economic development potential

Fire management was also seen as an activity to boost development. Namibia is challenged by bush fires virtually every year. MET (2011a, p. 51) stated that about 30-50,000 km^2 are burned by bush fires per year. The fires destroy infrastructure such as cattle fences, reduce grazing areas, kill wild and domestic animals, burn wood which is used by local communities as fuel, and consume water in a water scarce country to extinguish them. Yet, MET forgot to mention the positive impacts of bush fires. Frequent bush fires diminish the amount of dead wood and keep the undesired encroacher bush at bay which means that subsequent wild fires would not be as disastrous as before. To this end, bush fires could be ignited in a controlled way. However, according to BEATTY (s.t. p.1 f.), fire suppression tactics such as firebreaks are costly and if fires erupt in climatic unfavourable conditions, they will jump the breaks and will find enough dry organic matter to continue.

However, the author of this thesis cannot see a high economic development potential in these mitigation initiatives. The impact of small scale solar energy systems on employment and income generation is poor because the systems are manufactured abroad. They do not have a substantial catalytic impact either. Energy efficient light bulbs are also manufactured outside of Namibia and need to be imported. There was no information available on monetary costs and benefits of fire management in Namibia. Therefore, it was difficult to assess if the benefits would outbalance the costs. Fires occur regularly between September and November. Thus, there might only be some seasonal employment opportunities.

One local economic development officer mentioned that “bush fires are what stakeholders experience, what they are seeing and what is happening in their daily life”. He believed that this was the reasons for the high rating of fire management. Another one mentioned that stakeholders rated what was “closest to them” such us bush fires and increasing electricity prices. Solar energy was seen as a means to save costs on electricity and fire management to reduce the impact of bush fires.

The comparatively low rating for biomass energy, in particular the usage of encroacher bush for energy production, was explained by the fact that people link bush encroachment primarily to farm productivity, saying that debushing “means better grazing area for our cattle and not employment generation for people in the area”. Some stakeholders believed that people do not really know which initiatives might create the most employment opportunities. Another stakeholder said, that people regard employment generation as “us looking for a job” and not as an initiative that might create jobs for others. Other stakeholders mentioned that the rating for biomass energy is based on what people know. “What is its practical meaning? […] How do they harvest? […] What is happening after they harvested it?”. One representative of a German power company said that “they did not know about the encroacher bush and its potentials”. At large, the Namibian national government and local governments failed to perceive bush as a comparative advantage and to market the resource internationally.

Altogether, the rating was based on the stakeholders` level of knowledge, their priorities, and their personal motives and experiences.

6.4.3 Summary

In this chapter it was investigated if LED stakeholders believe that climate change activities have a potential for economic development. To this end, stakeholders were asked if they feel that mitigation and adaptation initiatives contribute to local economic development. Stakeholders who believed that here was a potential were asked to rate the potential of mitigation and adaptation initiatives on a scale from 1 (low potential) to 10 (very high potential). Those stakeholders who did not believe in a potential were given a score of zero (no potential assumed). Furthermore, stakeholders were provided with a list of 15 concrete mitigation initiatives. They were requested to rate the potential of every initiative on a scale from 1 (low potential) to 10 (high potential). Non-committal answers were rated as no potential assumed. Additional qualitative data were obtained through stakeholder interviews.

To summarize:

(1) Mitigation and adaptation initiatives were both perceived as a potential for economic development by all stakeholders.

(2) Stakeholders of the same stakeholder group did not differ between the perceived potential for mitigation and adaptation.

(3) LED consultants perceived the potential for mitigation and adaptation higher than other stakeholder groups.

(4) In particular stakeholders with a background in the energy sector did not distinguish between mitigation and adaptation.

(5) LED consultants did not care about distinguishing mitigation from adaptation initiatives as long as they contribute to the objectives of LED.

(6) Mitigation and adaptation were considered to have an impact on job creation, skills development, and inventiveness.

(7) The majority of stakeholders rated the potential based on a gut feeling rather than on knowledge.

(8) Stakeholders could identify the economic development potential for mitigation more easily than for adaptation.

(9) LED consultants and stakeholders with a background in the energy sector provided more qualified answers.

(10) Stakeholders believed that fire management, replacing incandescent light bulbs with energy efficient lighting systems and the usage of solar power have the highest potential for economic development.

(11) The generally high ratings suggested that stakeholders overrated the economic potential and did not differentiate much between initiatives.

(12) The rating was based on the stakeholders` level of knowledge, their priorities, and especially their personal motives and experiences.

6.5 Objectives

6.5.1 Introduction

The sustainable development objectives of mitigation and CDM projects and LED initiatives were already highlighted in chapter 2. The main objectives of LED clearly centre on social and economic issues while environmental sustainable development objectives seem to play a minor role. Yet, sustainable development includes also environmental sustainability. CDM has more balanced approach in that respect seeing that apart from environmental issues, social and economic development is also addressed.

In this chapter it is investigated what kind of development objectives the stakeholders pursue with LED and mitigation projects. In a questionnaire respondents were provided with two lists of 25 LED and 25 mitigation objectives. From each list they had to select the five objectives they rated the most important. The aim of the investigation was to establish if LED stakeholders rate the same or similar objectives for mitigation or LED initiatives. Stakeholders who selected a certain objective were counted and based on the number of counts the objectives were ranked. It should be noted that the composition of the overall sample size (all stakeholder groups combined) is not representative (see also chapter 4) and the overall rating might provide a distorted picture. Thus, it is important to always compare the overall rating with the ratings of the different stakeholder groups. The list of LED objectives were based on literature research, discussions with LED stakeholders and the authors` experience with LED in Namibia. In order to find out if environmental and climate change objectives already play a role in LED a few obvious ones were included in the list, such as strengthening the adaptive capacity of the locality and improve access to affordable energy. The list of mitigation objectives was based on literature research and information obtained from climate change experts.

6.5.2 LED objectives

191 out of 224 stakeholders selected exactly five LED objectives and were further considered in the analysis. 11 respondents selected less than five and 22 selected more than five.

Overall, stakeholders believed that LED should aim to foster cooperation between the civic, public and private sector and improve social cohesion (rank 1), generate employment and income (2), diversify economic activities (3), prevent crime (4), and attract new businesses to the locality (5). The five most important objectives are more or less the same for all

stakeholder groups. Improving the situation of underdeveloped areas (overall ranking: 6) was ranked amongst the top five by chief executives (3), economic planners (1) and consultants (5) (see also Table 26).

LED objectives	All stakeholders		Chief executives		Economic planners		Consultants		Councillors		Other stakeholders	
	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank
Crime prevention/ reduction of drug and alcohol abuse	65	4	7	6	11	9	1	16	24	2	22	2
Strengthen adaptive capacity of locality to climate change impact	48	8	6	7	8	12	4	7	22	3	8	13
Reduce natural resource degradation / protect environment	55	6	3	11	12	6	7	4	17	6	16	4
Better cooperation between civic, public, private sector / improve social cohesion	90	1	12	1	17	4	8	3	28	1	25	1
Improve access to affordable energy/reduce cost of energy	32	14	2	14	6	15	5	5	13	10	6	17
Improve productivity of land (e.g. by debushing)	32	14	1	19	12	6	2	10	10	15	7	16
Improve access to clean water	40	12	2	14	8	12	0	21	15	9	15	6
Reduce dependencies on imports (e.g. electricity, oil)	24	17	1	19	5	17	3	8	7	20	8	13
Improve situation of underdeveloped areas / informal sector	55	6	10	3	22	1	5	5	10	15	8	13
Improve access to resources for the poor/empower disadvantage people	43	9	4	9	8	12	2	10	18	5	11	10
Increase tax revenue/income	16	21	4	9	3	22	1	16	3	22	5	18
Achieve shared vision for development / increase transparency	19	20	1	19	4	20	2	10	8	18	4	20
Diversify economic activities	67	3	8	4	18	3	9	1	16	8	16	4
Reduce aftermath of apartheid	5	25	1	19	1	23	0	21	2	24	1	24
Reduce greenhouse gas emissions	13	22	0	24	1	23	0	21	8	18	4	20
Employment and income generation (quality and number of jobs)	74	2	11	2	22	1	9	1	12	13	20	3
Development of new skills / transfer of new technology	43	9	3	11	10	10	3	8	13	10	14	8
Improve efficient use of resources	29	16	1	19	4	20	2	10	13	10	9	12
Provide housing to people	40	12	6	7	9	11	2	10	12	13	11	10
Empowerment of women / more free time for women	10	24	0	24	1	23	0	21	6	21	3	23
Improve access to finance/ improve financial literacy	23	18	3	11	12	6	0	21	3	22	5	18
Retain and support existing businesses	11	23	2	14	5	17	2	10	2	24	0	25
Improve access to health services / reduce HIV/AIDS	41	11	2	14	6	15	1	16	17	6	15	6
Achieve cleaner environment (e.g. less litter, better waste handling)	21	19	2	14	5	17	1	16	9	17	4	20
Attract new businesses	59	5	8	4	15	5	1	16	22	3	13	9
Sample size (considered)	191		20		45		14		62		50	
Original sample size	224		25		57		17		68		57	

Table 26 Stakeholders` LED objectives

In general, the objectives reflect the socio-economic situation in Namibia. Although the crime rate is not as high as in neighbouring South Africa it is on the rise. The unemployment rate is very high, especially amongst the youth, and vast areas of Namibia are still underdeveloped without access to bulk services or proper education and health services. Even 23 years after independence with the apartheid system abolished, society is still divided along racial and ethnic lines. Therefore it comes as no surprise that the improvement of cooperation and social cohesion is high on the list of LED objectives.

The selected objectives are in line with the information obtained from LED stakeholder interviews. In these interviews stakeholders stressed that “local actors [are to be] mobilized”, that it is essential “getting [local actors] work together around their circumstances” and that “prejudices from the past are overcome”. For them LED should “transform peoples life”, “share the wealth of a nation more equitably amongst the population”, “empower women to participate in economic activities”, “capacitate entrepreneurs”, “increase employment opportunities” and “increase the competitiveness of the locality” so as to attract new businesses, etc. The stakeholders mentioned many socio-economic objectives but none of

them included environmental issues. Only when explicitly asked about greening the economy, did their statements refer to environmental sustainability issues. However, their statements remained very general in scope, such as “it is no longer about economic benefits at all costs”, “environmental factors need to be considered” and companies “are to conduct their businesses in a responsible way so that the impact on the global warming […] decreases over time”.

Every stakeholder group was probed to find out if the selection of objectives correlated with the position of the objective in the list. A graphical assessment of all stakeholders showed no clear trend (see attachment II Figure 13).

6.5.3 Mitigation objectives

Three stakeholders skipped this question and did not provide an answer. 195 out of 224 stakeholders selected exactly five mitigation objectives and were further considered in the analysis. 10 respondents selected less than five and 16 selected more than five objectives.

Overall, stakeholders ranked strengthening the adaptive capacity of a locality (rank 1), reducing natural resource degradation (2), achieving a cleaner environment (3), reducing greenhouse gas emissions (4) and improving the efficient use of resources (5) the top five objectives for climate change mitigation initiatives (see also Table 27). Improving access to affordable energy (overall rating: 6) were selected amongst the top five objectives by chief executives (2), economic planners (4) and other stakeholders (5).

In chapter 6.4 it was shown that stakeholders believed that mitigation and adaptation projects have the potential to foster economic development. Yet typical socio-economic development objectives, such as employment generation (12), skills development and the transfer of new technology (7), attracting new businesses (14), diversifying the economy (7), reducing the dependency on imports (20), supporting and retaining businesses (21), improve access to resources for the poor (13), improve situation of underdeveloped areas (15), and empowerment of women (23) were not rated high. As one economic development officer said, solar power is just presumed to be “an extra or bonus”. It is not assumed to contribute much to the achievement of socio-economic development objectives. The selected mitigation objectives are rather linked to environmental sustainability.

Every stakeholder group was probed to find out if the selection of objectives correlated with the position of the objective in the list. A graphical assessment of all stakeholders showed no clear trend (see attachment II Figure 14).

Mitigation objectives	All stakeholders		Chief executives		Economic planners		Consultants		Councillors		Other stakeholders	
	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank
Crime prevention/ reduction of drug and alcohol abuse	21	18	4	12	2	22	0	17	9	15	6	15
Strengthen adaptive capacity of locality to climate change impact	106	1	11	1	28	1	8	4	30	1	29	1
Reduce natural resource degradation / protect environment	94	2	7	2	23	3	10	1	29	2	25	2
Better cooperation between civic, public, private sector / improve social cohesion	41	9	5	8	10	9	1	15	20	4	5	18
Improve access to affordable energy/reduce cost of energy	60	6	7	2	16	4	5	7	14	9	18	5
Improve productivity of land (e.g. by debushing)	36	11	3	15	13	7	8	4	6	20	6	15
Improve access to clean water	39	10	3	15	11	8	4	9	9	15	12	7
Reduce dependencies on imports (e.g. electricity, oil)	19	20	2	20	4	17	4	9	5	22	4	20
Improve situation of underdeveloped areas / informal sector	31	15	5	8	5	15	3	11	7	18	11	8
Improve access to resources for the poor/empower disadvantaged people	33	13	6	5	8	12	2	12	10	12	7	11
Increase tax revenue/income	3	25	0	25	0	25	0	17	1	24	2	23
Achieve shared vision for development / increase transparency	16	21	2	20	4	17	0	17	7	18	3	21
Diversify economic activities	42	7	5	8	10	9	2	12	18	6	7	11
Reduce aftermath of apartheid	5	24	1	23	1	23	0	17	1	24	2	23
Reduce greenhouse gas emissions	70	4	5	8	16	4	9	3	18	6	22	3
Employment and income generation (quality and number of jobs)	35	12	4	12	4	17	5	7	11	11	11	8
Development of new skills / transfer of new technology	42	7	3	15	9	11	2	12	20	4	8	10
Improve efficient use of resources	64	5	6	5	16	4	6	6	18	6	18	5
Provide housing to people	28	16	6	5	5	15	0	17	10	12	7	11
Empowerment of women / more free time for women	8	23	1	23	1	23	0	17	3	23	3	21
Improve access to finance/ improve financial literacy	21	18	2	20	8	12	0	17	6	20	5	18
Retain and support existing businesses	16	21	3	15	3	20	0	17	8	17	2	23
Improve access to health services / reduce HIV/AIDS	23	17	3	15	3	20	0	17	10	12	7	11
Achieve cleaner environment (e.g. less litter, better waste handling)	90	3	7	2	27	2	10	1	27	3	19	4
Attract new businesses	32	14	4	12	8	12	1	15	13	10	6	15
Sample size (considered)	195		21		47		16		62		49	
Original sample size	224		25		57		17		68		57	

Table 27 Stakeholders` mitigation objectives

6.5.4 Summary

LED focuses mostly on economic and social issues. CDM is foremost an instrument to reduce greenhouse gas emissions. Yet, UNFCCC required that CDM contributes to sustainable development in developing countries and different socio-economic development objectives are pursued by CDM projects worldwide.

Stakeholders were provided with a list of 25 LED and 25 mitigation objectives. From each list they had to select five objectives that they rate the most important. The aim of the investigation was to establish whether LED stakeholders rate the same or similar objectives for LED and mitigation initiatives. Additional qualitative data were obtained through stakeholder interviews

To summarize:

(1) The investigation revealed that stakeholders believed that LED should focus on improving the cooperation between civic, public and private sector and fostering social cohesion, generating employment and income, diversifying economic activities, preventing crime, and attracting more entrepreneurs to the locality. The objectives mirror the socio-economic environment of Namibia, such as high unemployment and the increasing crime rate.

(2) On the other hand mitigation activities were regarded as instruments to strengthen the adaptive capacity of a locality, reduce natural resource degradation, achieve a cleaner environment, reduce greenhouse gas emissions and improve the efficient use of resources.

(3) It is obvious that the majority of selected sustainable mitigation objectives were mostly linked to environmental sustainability only while LED objectives bear reference to socio-economic issues.

(4) This shows that interviewees failed to connect mitigation objectives to the key economic and social development objectives.

6.6 Challenges

6.6.1 Introduction

The inhibiting factors for CDM are not be debated again in this chapter as they were already discussed in chapter 5. The economic development of a locality is faced by many obstacles. They range from lack of finances to the lack of information to the migration of labour. LED initiatives also try to remove these obstacles.

In this chapter it is investigated if LED stakeholders perceive the challenges to LED and mitigation projects alike. In a questionnaire respondents were provided with two lists of 25 LED and 25 mitigation challenges. From each list they had to select the five barriers they rate the most challenging. Stakeholders who selected a certain challenge were counted and based on the number of counts the challenges were ranked. It should be noted that the composition of the overall sample size (all stakeholder groups combined) is not representative (see also chapter 4) and the overall rating might provide a distorted picture. Thus, it is important to always compare the overall rating with the ratings of the different stakeholder groups. The list of mitigation challenges was based on Namibian and international literature on this topic. The list of LED challenges was based on literature, discussions with LED stakeholders and the authors` previous hands-on experience with LED in Namibia. In order to find out if climate change challenges already played a role in LED, the list with LED challenges also included a few general climate change challenges, such as impact on climate change on society and low adaptive capacity of society.

6.6.2 LED challenges

Two respondents skipped the question and did not provide an answer at all. 185 out of 224 stakeholders selected exactly five challenges and were further considered in the analysis. 13 respondents selected less than five and 24 selected more than five challenges.

The participants believed that the most severe challenges LED is facing are insufficient public budget and lack of public income (rank 1), the absence of necessary infrastructure (2), the shortage of serviced land for businesses (3), the lack of finances for end users and businesses (3), the absence of a skilled workforce (5) and the missing interest of stakeholders to participate in LED (5) (see also Table 28). Some of the challenges are logically linked. For example, due to the lack of finances the local public sector is unable to service land and to invest in the development of infrastructure. These challenges were also highlighted by the private sector in other studies in Namibia (e.g. NCCI et al, 2011; SURVEY WAREHOUSE, 2013).

LED challenges	All stakeholders		Chief executives		Economic planners		Consultants		Councillors		Other stakeholders	
	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank
No potentials for economic development	22	17	1	17	2	25	1	19	9	14	9	13
No participation / interest from private sector	52	5	6	6	14	6	5	6	14	7	13	7
Insufficient public budget / lack of income (e.g. tax)	97	1	15	1	25	1	6	2	31	1	20	2
Friction between main stakeholders (e.g. private/public sector)	46	7	4	11	12	7	10	1	6	18	14	5
High impact of climate change on society (e.g. desertification)	17	21	1	17	3	20	0	22	11	12	2	22
Availability of land for business development	61	3	7	3	16	4	2	12	22	3	14	5
History/legacy of apartheid	18	20	3	15	4	19	2	12	4	22	5	19
Unavailability of data for planning	45	9	4	11	11	8	3	10	12	10	15	4
Low capacity of public sector to provide services	46	7	7	3	9	10	6	2	17	5	7	16
Natural disasters (e.g. floods)	30	15	0	24	5	16	2	12	12	10	11	10
High Corruption	33	14	0	24	7	14	6	2	7	16	13	7
Low population density	24	16	7	3	7	14	2	12	4	22	4	21
Unskilled labour force	52	5	5	8	15	5	5	6	16	6	11	10
Migration of skilled labour / brain drain	21	18	2	16	5	16	2	12	4	22	8	14
Lack of infrastructure (roads, sewage system, etc.)	78	2	9	2	17	3	4	8	24	2	24	1
Insufficient access to energy / fuel	11	24	1	17	3	20	0	22	6	18	1	24
Low adaptive capacity of society to climate change	11	24	1	17	3	20	0	22	5	20	2	22
High costs of fuel / electricity	40	11	1	17	8	12	1	19	20	4	10	12
Lack of information /communication technology	41	10	4	11	9	10	2	12	13	9	13	7
Unfair competition from foreign companies	16	22	1	17	3	20	2	12	5	20	5	19
High capital outflow	16	22	4	11	5	16	3	10	4	22	0	25
Lack of available financing of end users/businesses (access to finance)	61	3	6	6	20	2	4	8	14	7	17	3
High crime rate	19	19	1	17	3	20	0	22	7	16	8	14
Low capacity of private sector institutions (e.g. chambers)	34	12	5	8	11	8	1	19	10	13	7	16
Attractiveness / remoteness of locality/region	34	12	5	8	8	12	6	2	8	15	7	16
Sample size (considered)	185		20		45		15		57		48	
Original sample size	224		25		57		17		68		57	

Table 28 Stakeholders` perceived LED challenges

Stakeholders perceived the relationship between the private and public sector to be poor but crucial for LED. This deduction could be drawn because many challenges, such as no participation and interest from private sector (5), friction between public and private sector (7), low capacity of public sector to deliver services (7), and unavailability of data for planning

(9) were ranked comparatively high. This is in line with the opinion of the majority of LED stakeholders interviewed. As one of them said, the main challenge is “to engage with people of different interest and bring them around a table”. Another one stressed that LED is a “local government function that needs partnership that needs interaction with the private sector and the civil society” and for that to happen, the public sector has “to build trust and legitimacy”. It is noteworthy that a further challenge concerning the relationship, namely corruption, was rated high by consultants (2) and other stakeholders (7) but not by public sector stakeholders, such as chief executives (24), councillors (16) and economic planners (14). It was also noticeable that all challenges related to climate change or the energy sector were rated low to very low, such as the low adaptive capacity of the society to climate change (24), insufficient access to energy and fuel (24), high impact of climate change (21), and the high cost of fuel and electricity (11).

LED depends on the circumstances of a locality, and challenges, objectives, and approaches might differ from region to region and town to town. Yet, most of the challenges rated as crucial by the respondents in this study are also rated as central for LED in other countries. For example, in a state-wide economic development needs assessment of Oregon/US by the UNIVERSITY OF OREGON (2012, p. ff.) 70% of respondents declared unskilled labour to be a barrier or major barrier to economic development. Access to capital for individuals, SMEs and municipalities was also rated to be a decisive factor. ROGERSON (2009, p. 51 ff.) counted lack of funding of LED, capacity of the public sector, and issues related to the cooperation within the public sector and between public and private sector amongst the most crucial challenges for LED in South Africa.

Every stakeholder group was probed to find out if the selection of challenges correlated with the position of the challenge in the list. A graphical assessment of all stakeholders showed no clear trend (see attachment II Figure 15).

6.6.3 Mitigation challenges

The required number of mitigation challenges was selected by 188 out of 224 stakeholders. Six respondents did not answer to the question at all, 20 selected less than five and 10 more than five challenges.

The respondents of the survey identified low understanding and awareness of climate change mitigation and instruments (rank 1), insufficient public budget (2), low capacity of local government (3), lack of support from institutions such as the national government or donors (4), and unskilled labour to implement and maintain new technologies (5) as the main obstructions for the implementation of climate change mitigation projects (see also Table 29).

Every stakeholder group was probed to find out if the selection of challenges correlated with the position of the challenge in the list. A graphical assessment of all stakeholders showed no clear trend (see attachment II Figure 16).

Mitigation challenges	All stakeholders		Chief executives		Economic planners		Consultants		Councillors		Other stakeholders	
	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank	Abs. scores	Rank
Low capacity of local government	59	3	8	3	18	3	8	1	15	8	10	7
Climate change is not the mandate of the local government	35	13	8	3	8	10	4	5	8	17	7	15
Low understanding/awareness of climate change mitigation/instruments	117	1	10	2	35	1	8	1	37	1	27	1
Mitigation of climate change is not a priority for LA/RC	41	9	3	14	11	8	2	10	15	8	10	7
Energy is too cheap to justify investments in alternative energy	3	25	0	25	0	25	0	22	2	23	1	25
Local Authority/Region does not have the potential to mitigate	43	7	3	14	14	4	3	7	15	8	8	12
Scale of projects is low (e.g. because of low population density)	24	16	4	11	4	22	5	4	5	20	6	17
Insufficient public budget to invest in mitigation projects	90	2	14	1	22	2	7	3	32	2	15	3
Lack of pilot/demonstration projects in Namibia	43	7	6	7	13	6	3	7	12	12	9	11
Lack of support (e.g. from national government, donors, etc.)	55	4	7	5	14	4	2	10	18	4	14	4
Lack of interest by private sector	40	10	7	5	6	18	1	18	16	7	10	7
High risk of failing (e.g. capital over-runs, time over-runs)	21	20	1	21	6	18	3	7	3	21	8	12
Low demand for green energy products	36	11	4	11	8	10	1	18	17	5	6	17
Only one company has monopoly of providing electricity	34	14	5	8	8	10	0	22	13	11	8	12
Discouraging national policies/strategies (e.g. no tax incentives)	14	24	1	21	7	13	1	18	2	23	3	22
Culture obstacles / Low social acceptance	31	15	2	19	6	18	2	10	8	17	13	5
Low attractiveness/remoteness of locality/region	16	23	2	19	3	23	0	22	9	15	2	24
High upfront investments required for mitigation measures	22	19	5	8	6	18	4	5	2	23	5	20
Lack of available financing for end users/businesses (access to finance)	36	11	5	8	7	13	2	10	12	12	10	7
High crime rate (e.g. risks of solar panels to be stolen)	19	21	1	21	1	24	0	22	10	14	7	15
Unskilled labour to implement and maintain technologies	50	5	3	14	10	9	2	10	19	3	16	2
Lack of infrastructure (e.g. sewage system to collect sewage for biogas)	24	16	4	11	7	13	1	18	9	15	3	22
Lack of data/data are unreliable/no access to information	24	16	3	14	7	13	2	10	6	19	6	17
Complexity of projects is too high	17	22	1	21	7	13	2	10	3	21	4	21
Inadequate quality of available technology/access to technology	46	6	3	14	12	7	2	10	17	5	12	6
Sample size (considered)	188		22		48		13		61		44	
Original sample size	224		25		57		17		68		57	

Table 29 Stakeholders` perceived mitigation challenges

First, shortage of finances, lack of knowledge and the general capacity of local governments came up frequently during stakeholder interviews as the main barriers for the promotion of mitigation and adaptation projects. The interviewed stakeholders believed that “the alternative energy route is much more expensive” and they saw “financial issues as the biggest challenge” for mitigation initiatives. Besides financial constraints, local governments were also believed to lack the necessary knowledge to sustainably engage with private partners in climate change activities. As one LED consultant said, there are “different levels of capacity [but] only equal partnerships persist”. Missing awareness was also singled out as a main stumbling block.

Second, CDM literature highlights unskilled labour, lack of finances, absence of support and missing awareness as major barriers for CDM projects. The selected challenges in the survey are in line with both the challenges obtained from literature and during interviews. It can therefore be concluded that the selected challenges were a plausible choice and corresponded with previous experiences in this field and that therefore the survey provided a realistic picture.

6.6.4 Summary

LED and mitigation projects face a plethora of challenges. In order to provide an enabling environment for businesses to flourish and to provide employment and income opportunities, LED initiatives also aim to eliminate obstacles for economic development. Thus, synergies could be created if the LED challenges were similar to the mitigation or CDM challenges.

Stakeholders were provided with two lists of 25 LED and 25 mitigation challenges each. From each list they had to select five challenges that they rate the most important. The aim of the investigation was to establish whether LED stakeholders rate the same or similar challenges for LED and mitigation initiatives. Additional qualitative data were obtained through stakeholder interviews

To summarize:

(1) LED stakeholders in Namibia believed that the most severe challenges for LED are the insufficient public budget and lack of public income, the absence of necessary infrastructure, the shortage of serviced land for businesses, the lack of finances for end users and businesses, the absence of a skilled workforce and the missing interest of stakeholders to participate in LED.

(2) The main mitigation challenges were identified as low understanding and awareness of climate change instruments, insufficient public budget, low capacity of local government, lack of support from institutions such as the national government or donors and unskilled labour to implement and maintain new technologies.

(3) Some obstacles to mitigation and LED initiatives coincide, such as lack of budget and an unskilled workforce.

(4) Therefore addressing these challenges through LED initiatives definitely benefit mitigation projects.

6.7 Mandates

6.7.1 Introduction

In this chapter the perception of LED stakeholders with respect to the main actors for climate change initiatives and their functions is analysed.

6.7.2 Stakeholders in CDM and LED

6.7.2.1 The role of the public and the private sector

The roles of the private and the public sector in CDM are clearly defined. According to UNFCCC (1998b, p. 35), any private sector organisation could finance, implement and operate CDM projects, while the role of the government is more versatile. In the Marrakesh Accords, UNFCCC (2002, p. 20 ff.) required governments which want to participate in CDM to establish a Designated National Authority (DNA). The DNA of a CDM host country is to validate and approve CDM projects and verify and certify achieved emission reductions. UNEP (2007, p. 28) highlighted that government bodies and municipalities could also develop and operate CDM projects.

The role of the public and private sector in economic development is far more complicated. In principle two strategies or a mix of both are followed to develop a nation. According to PIKE et al. (2006, p. 29), there are state led and market led development strategies. State led strategies include measures like import substitution, public spending or land reforms whereas market led strategies encompass for instance trade liberalization, export promotion or privatisation. Since the 1970s the latter strategy has more and more replaced the former. The so-called Washington Consensus[72] of 1990 epitomizes the market led strategy. It has also been promoted by the World Bank and the International Monetary Fund (IMF) as a guiding principle for economic development in developing countries[73]. The Consensus demands that the state steps back and that the private sector assumes a much more active role in development. According to the Consensus, measures like reducing tariffs or avoiding red tape are to provide an enabling environment for the private sector to grow. This will pave the way to general economic development and growth, reduce regional disparities, alleviate poverty and ultimately will lead to more stability.

The underlying assumption is that poverty will be reduced in an economy which functions under optimal market conditions[74]. Yet, according to RUECKER/TRAH (2007, p. 29), the Washington Consensus ignores the fact that optimal market conditions do not exist and that

[72] The term was coined by the economist John Williamson during a conference on economic development issues in Latin America in Washington in 1990. The concept has been associated with neoliberal politics.

[73] In 2004 the term Beijing Consensus was coined which describes an alternative approach to the Washington Consensus and the development of underdeveloped countries. The framework is based on China's economic success and unlike the Washington Consensus requests much more government interventions.

[74] The so called trickledown effect describes a theory that the benefits of economic development and the betterment of the living standard of the rich will finally trickle down to the poor.

the functioning and failing of markets depend on formal and informal institutions[75]. According to GRABOWSKI et al. (2007, p. 30), experiences in Russia and countries in Latin America, which adopted the Washington Consensus suggest that the market led approach does not always generate the expected results. Moreover, the South Asian countries recovered quickly after the financial crisis in the late 1990s, even though or because their governments were much more involved in economic development activities than recommended by the Consensus.

Therefore, the question is to which degree government intervention in economic development can be justified. DEARDORFF (2000, p. 3) mentions three reasons for government interventions: re-distribution of income, non-economic objectives, and market failures. In many countries income is unequally distributed and government interventions are required such as the provision of unemployment benefits or the adoption of progressive income taxation. Non-economic goals refer for instance to cultural objectives. Theatres, operas, etc. are generally state-subsidised as they are often financially not viable. In a perfect market situation there is an equilibrium of supply and demand of goods and services. Yet, market failures might prevent such a market equilibrium. So-called public goods are non-excludable and non-rivalrous in nature. Therefore, it is financially meaningless for private companies to invest in the provision of such goods and services. Private entities might not have sufficient financial, technical or human capacities to invest in basic research of which the benefits can only be expected in the far future. In this case the government might be obliged to operate research institutions. Market forces might lead to an underprovision of goods and services in remote areas and the government might be impelled to intervene. STERN (2006, p. i) calls climate change the biggest and widest-ranging market failure ever, as the social, economic and environmental costs caused by greenhouse gas emissions are not borne by the emitters. This is a typical case of a negative externality[76].

What are the roles of the private and public sector in LED? According to HELMSING (2005, p. 312), local governments should be restricted to provide opportunities for economic activities, support economic development, and enhance competitiveness through the delivery of services and the initiation of territorial development. Moreover, they should enable local stakeholders to participate in LED initiatives. Although local governments play an important role in balancing environmental, social and economic impacts of LED they are not best equipped to exploit business opportunities or decide matters on behalf of the private sector without prior consultation. RUECKER/TRAH (2007, p. 22) came to the conclusion that

[75] "Institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social, or economic" (NORTH, 1990, p. 3)

[76] Economists distinguish between negative and positive externalities. A positive externality is the spill-over of benefits. For example beekeeping for the production of honey might have a positive impact on the productivity of fruit trees in a neighbouring garden.

governments should address market failures and create an enabling environment whereas the business sector should provide employment and income opportunities. WAL/HILHORST (2007, p. 5 ff.) stated that even for pro-poor economic development programmes, interventions by governments should be restricted to the creation of an enabling environment.

However, many national and local governments already provide direct employment through government owned enterprises. These parastatals undertake commercial activities and provide services and goods on behalf of the government. The establishment of government owned enterprises is normally motivated by the reasons mentioned above: market failures, non-financial objectives and non-competitive markets. Sometimes governments also want to own enterprises to supplement the public budget. In general, a state might want to invest in an enterprise if the social benefits of an investment are greater than the social costs[77]. Many government-owned enterprises can be found in strategic sectors such as public transport, energy and water. Especially in developing countries, the state intervenes in underdeveloped or emerging sectors. For example, if the business development service sector is not developed yet, governments might opt to provide even training and business advisory services. The Namibian national airline is another example of such a parastatal. While the airline is not profitable, it is deemed strategically essential for the development of the tourism sector. The development of the business sector to provide employment and income opportunities depends very much on the entrepreneurial spirit and skills of the people. Developing both is one of the tasks of LED initiatives. However, this takes time. Faced with high unemployment rates governments might be forced to react faster.

The government has many alternatives to motivate the private sector to invest into economic activities, like the provision of government direct subsidies, tax reliefs, public private partnerships, etc. However, even with an enabling business environment there could still be a multitude of reasons why companies refrain from investing. Consequently, if a LED programme identifies a valid and feasible greenhouse gas emission reduction project, which contribute to sustainable development or the strategic objectives of the government, and no private investor takes the risk to invest in such a project, local or regional governments could establish government owned enterprises implement such a project.

[77] Social costs include all costs incurred by an economic activity that is the sum of private costs and negative externalities. Social benefits include all benefits arising by an economic activity that is the sum of private benefits and positive externalities.

6.7.2.2 The role of Official Development Assistance (ODA)

The usage of ODA in CDM is intensively debated. In the Marrakesh Accords UNFCCC emphasises that "clean development mechanism projects from Parties in Annex-I were not to result in the diversion of official development and is to be separate from and not counted towards the financial obligations of Parties included in Annex I"(UNFCCC, 2002, p. 20). However, UNFCCC failed to provide a more detailed definition of what exactly diversion of ODA means. This might be due to the fact that ODA diversion is not expected at all. According to UNFCCC (1998b, p. 35), the Group 77[78] and China raised the question of ODA diversion during the discussions leading to the Kyoto Protocol. In reply to their questions they were told that it is expected that CDM projects would be mainly financed by private entities and in cases that an Annex-I-country directly partakes in a CDM project, it does not alter its funding obligations to ODA. Project developers are requested to indicate in the PPDs that the project does not divert ODA. In the end it is the prerogative of the host country to approve the source of funding.

MICHAELOWA/MICHAELOWA (2005, p. 8 ff.) argued that there were only few areas in which mitigation objectives overlap with ODA priorities. The only example they could identify was the usage of clean energy sources for lighting, cooking, etc. to reduce indoor pollution which would improve the quality of life of the poor and contribute to the achievement of the Millennium Development Goals (MDGs)[79]. Therefore, the "use of development aid for CDM projects and / or their preparation via capacity building is thus clearly not warranted" (MICHAELOWA/MICHAELOWA, 2005, p. 1). However, the author of this thesis believes that this is too short-sighted. If CDM projects provide electricity to off-grid areas, generate employment and income locally they definitely do contribute to the objectives of ODA.

OECD (2004, p. 3) argued that a diversion of ODA only takes place if the profits of CDM flow back to the donor. Therefore, ODA should not be used for activities which are linked to the procurement of CERs. ODA is provided by a donor net of any returns to the donor. There is no diversion assumed, if the income of CER stays in the host country.

[78] Group 77 is a group of 77 developing countries. The group was established on 15 June 1964 during the first session of the United Nations Conference on Trade and Development (UNCTAD) in Geneva/Switzerland.

[79] During the 55th UN plenary meeting in 2000, also called the Millennium Summit, the parties agreed to halve poverty worldwide by 2015. In 2001 eight concrete Millennium Development Goals (MDGs) were worked out by a working group consisting of different organisations like the UN, OECD, and the World Bank. The MDGs address issues like poverty and hunger, education, gender equality, child mortality, maternal health, HIV/AIDS, environmental sustainability and the establishment of a global partnership for development.

In a letter to the chairman of OECD/DAC, the CLIMATE ACTION NETWORK[80] (2004, p. 1 f.), required that countries which did not achieve their 0.7% ODA target, should not be allowed to use ODA funds for any CDM related activity[81]. For countries achieving 0.7%, ODA could be used if ODA is not linked to the purchase of CERs, if the revenue of CDM projects is insufficient to cover the cost of the projects, and if the projects contribute to sustainable development. According to BMZ (2009), only 5 countries (Sweden, Luxemburg, Norway, Denmark, and the Netherlands) reached the 0.7% target in 2008.

JAHN et al. (2004, p. 44) demanded that donors should provide funding for activities to enable Non-Annex-I-countries to develop projects locally, such as capacity building and the removal of barriers for CDM investments. UNDP (2006, p. 22) already financed awareness raising activities, feasibility studies, institutional capacity building initiatives, etc. in a range of developing countries. GOLD STANDARD[82] (2006, p. 16 f.) prohibits the use of ODA to support general project costs, purchase (new) technologies, finance installations and running costs, monitor, verify and certify emission reductions, and purchase CERs. However, GOLD STANDARD allows ODA to be used to support the development of project design documents if the assistance is not linked to CER purchase agreements, to develop new CDM methodologies, and to cover operating and installation costs if the CDM project is part of a wider programme and the CDM project is not a pre-requisite for the implementation of such a programme. The Dutch MINISTRY OF FOREIGN AFFAIRS (2008, p. 86 f.) reasoned that using ODA for CDM might lead to closer links between CDM portfolios of Annex-I-countries and sustainable development priorities of host countries.

Many countries face an additional dilemma. Instead of having reduced greenhouse gases, the emissions of these countries had risen between 1990 and 2007. According to UNFCCC (2009b, p. 16), Japan`s greenhouse gases have risen by 8%, Spain`s by 53.5%, Greece`s by 24.9% and Italy`s by 7.1%[83]. They were far from reaching their Kyoto targets. At the same time, they have to reach the 0.7% ODA target. According to BMZ (2009), Japan reached 0.18%, Spain 0.43%, Greece and Italy 0.2% in 2008. On the one hand counting CDM as ODA would improve the ODA/GNP ratio of donor countries. On the other hand, using ODA to finance CDM would help them to achieve their emission reduction objectives. Considering

[80] Climate Action Network (CAN) is a network of 500 NGOs. Its mission is to support governments and individuals in their efforts to reduce greenhouse gas emissions to ecologically sustainable levels.
[81] "In recognition of the special importance of the role that can be fulfilled only by official development assistance, a major part of financial resource transfers to the developing countries should be provided in the form of official development assistance. Each economically advanced country will progressively increase its official development assistance to the developing countries and will exert its best efforts to reach a minimum net amount of 0.7 percent of its gross national product at market prices by the middle of the decade." (UN, 2012).
[82] The Gold Standard is a non-governmental organisation under Swiss law - established in 2006 and located in Geneva/Switzerland. The foundation is owned by 60 NGO and perceives itself as an operator of a certification scheme for premium carbon credits.
[83] without considering Land Use, Land Use Change and Forestry (LULUCF) projects

the discussions about ODA and CDM it comes as no surprise that for COSBEY et al. (2006, p. 112) there exists a grey area when it comes to the usage of ODA in CDM.

There are no restrictions to the use of ODA in LED and any amount spent by donor organisation on LED is fully counted towards ODA. The usage of ODA is only restricted with respect to CDM. If climate change projects in general contribute to the objectives of LED the usage of ODA is not limited at all.

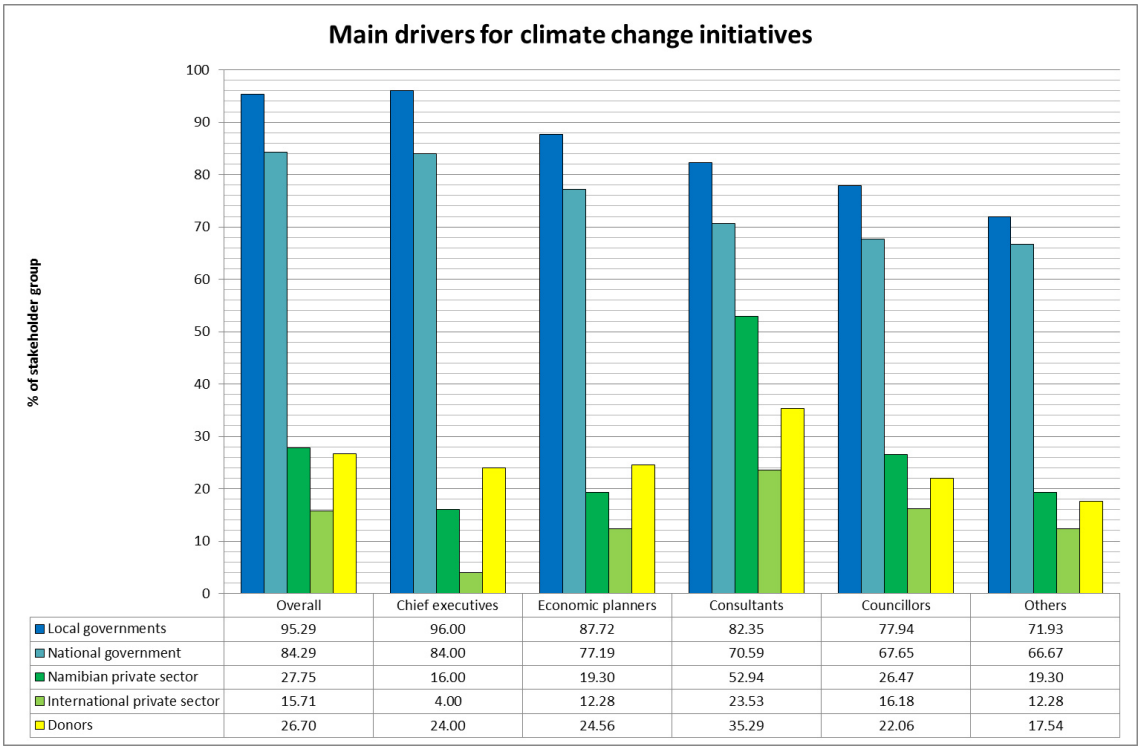
6.7.3 Perceived main drivers for climate change initiatives

LED stakeholders were asked to select the main actors for climate change initiatives in their locality. They could choose from a selection of six actors: the Namibian private sector, the international private sector, donor organisations, the national government, the regional council and the local authority. More than one answer was possible. In Namibia, very few non-governmental organisations (NGOs) play a role, such as the Desert Research Foundations of Namibia (DRFN). However, the author excluded them as he wanted to focus on the major actors only. As there were more stakeholders from local authorities than from regional councils, the category local authority could have received more points. To avoid this bias, the scores for local authorities and regional councils were subsumed under the term ´local governments´. If a stakeholder selected either local authority or regional council or both, the category ´local governments´ received one point.

No. of selected drivers	All stakeholders		Executives		Economic planners		Consultants		Councillors		Other stakeholders	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
1	49	21.88	1	4.00	10	17.54	3	17.65	13	19.12	22	38.60
2	68	30.36	12	48.00	15	26.32	4	23.53	25	36.76	12	21.05
3	62	27.68	7	28.00	19	33.33	5	29.41	18	26.47	13	22.81
4	26	11.61	4	16.00	8	14.04	1	5.88	6	8.82	7	12.28
5	5	2.23	0	0.00	2	3.51	0	0.00	2	2.94	1	1.75
6	14	6.25	1	4.00	3	5.26	4	23.53	4	5.88	2	3.51
Total	**224**	**100.00**	**25**	**100.00**	**57**	**100.00**	**17**	**100.00**	**68**	**100.00**	**57**	**100.00**

Table 30 Number of selected main drivers

The majority of stakeholders clearly distinguished among the importance of actors. Most of the respondents selected either two or three alternatives. Only very few stakeholders felt that all the actors were equally important (see also Table 30).



	Overall	Chief executives	Economic planners	Consultants	Councillors	Others
Local governments	95.29	96.00	87.72	82.35	77.94	71.93
National government	84.29	84.00	77.19	70.59	67.65	66.67
Namibian private sector	27.75	16.00	19.30	52.94	26.47	19.30
International private sector	15.71	4.00	12.28	23.53	16.18	12.28
Donors	26.70	24.00	24.56	35.29	22.06	17.54

Figure 7 Perceived main drivers for climate change initiatives

Stakeholder group		National govern`t	Local govern`t	Donors	Namibian private sector	Internat. private sector	Group size
All stakeholders	Abs. scores	161	182	51	53	30	224
	% of stakeholder group size	84.29	95.29	26.70	27.75	15.71	
	Rank	2	1	4	3	5	
Chief executives	Abs. scores	21	24	6	4	1	25
	% of stakeholder group size	84.00	96.00	24.00	16.00	4.00	
	Rank	2	1	3	4	5	
Economic planners	Abs. scores	44	50	14	11	7	57
	% of stakeholder group size	77.19	87.72	24.56	19.30	12.28	
	Rank	2	1	3	4	5	
Consultants	Abs. scores	12	14	6	9	4	17
	% of stakeholder group size	70.59	82.35	35.29	52.94	23.53	
	Rank	2	1	4	3	5	
Councillors	Abs. scores	46	53	15	18	11	68
	% of stakeholder group size	67.65	77.94	22.06	26.47	16.18	
	Rank	2	1	4	3	5	
Other stakeholders	Abs. scores	38	41	10	11	7	57
	% of stakeholder group size	66.67	71.93	17.54	19.30	12.28	
	Rank	2	1	4	3	5	

Table 31 Perceived main driver for climate change initiatives

Across all groups, stakeholders perceived local governments (95% of 224 stakeholders) and the national government (84%) to be mainly responsible for climate change initiatives in their locality. They did not perceive donor organisations (27%) or the private sector playing a major role (Namibian private sector: 28%; international private sector: 16%). Only the group of consultants felt that donor organisations (35% out of 17 stakeholders) and the Namibian private sector (53%) should play a fairly essential role (see also Figure 7 and Table 31).

6.7.4 Main functions for climate change mitigation initiatives

LED stakeholders were required to assign five different project functions – promotion, sourcing for funding, funding, implementation and operation – to the different actors. More than one function could be assigned to one actor. Before the participants answered the question they were verbally briefed on the meaning of the functions. Due to its complexity, it was impractical to include the explanations in the questionnaire.

Promotion involves activities such a preparing the project (e.g. conducting feasibility studies, developing project proposals), raising awareness, etc. Sourcing for funding encompasses talking to potential investors, development banks, etc. Funding stands for the actual provision of the necessary budget. Implementation means that all steps are taken to make sure that the project can get operational, such as entering into PPP agreements, training, adoption of necessary policies (e.g. feed-in tariffs, subsidies, tax holidays), establishment of government owned enterprises, and installation of equipment (e.g. solar parks, wind parks). Operation refers to the daily management of processes (e.g. planning, monitoring, reviewing, accounting, training) in order to make sure that the final project objectives are fully met.

Two examples should illustrate the five different functions. Energy efficient cooking stoves might be perceived to improve the livelihood of poor rural communities. The feasibility of the project and its impact could be established by the national government. The national government could also negotiate with donor organisations to fund the project. Thereafter, local governments could implement the project in their area. Their task would be to identify private entities which could manufacture and sell the stoves, organize local supply chains and train the workforce. Local governments together with the national government could then initiate promotion programmes to market the stoves and make end-users aware of their benefits. A solar park could be set up to produce electricity for an off-grid settlement. The national government might assume the responsibility of establishing its financial and technical feasibility. The national government, the local government and donors could provide the financial means. The national government might be in charge of the public tendering of the project and overseeing the installation, whereas local governments might be accountable for making sure that the installation is maintained and economically operated.

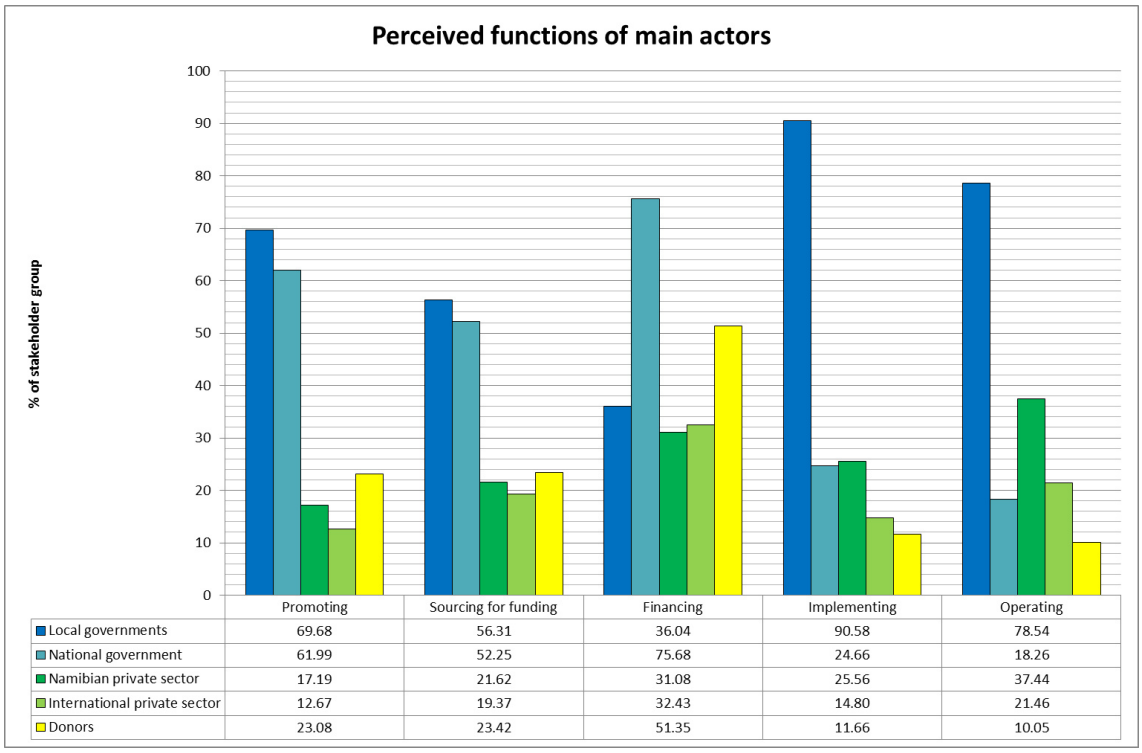
Stakeholders were very conscious of the functions the different actors should assume. Most of them selected either one or two actors for one of the functions. Only very few felt that a function should be assigned to all stakeholders (see also Table 32).

No. of selected drivers	Promoting		Sourcing for funding		Funding		Implementing		Operating	
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	Abs.	%
1	101	45.70	102	45.95	80	36.04	88	39.46	82	37.44
2	49	22.17	63	28.38	56	25.23	68	30.49	84	38.36
3	34	15.38	32	14.41	36	16.22	38	17.04	34	15.53
4	17	7.69	18	8.11	30	13.51	15	6.73	9	4.11
5	12	5.43	2	0.90	8	3.60	7	3.14	6	2.74
6	8	3.62	5	2.25	12	5.41	7	3.14	4	1.83
Total	**221**	**100.00**	**222**	**100.00**	**222**	**100.00**	**223**	**100.00**	**219**	**100.00**

Table 32 Number of selected actors per functions

Promoting initiatives and sourcing for funding is clearly seen as a responsibility of the national government and local governments. The necessary funds should mainly come from the national government and donor organisations whereas the local governments should be in charge of implementing the projects. The projects themselves should then be operated by local governments and the Namibian private sector. It is noticeable that the international private sector was not assumed to play a major role. Donors were to play some role in the initial phases of a project, but in line with the principles of development aid they are not perceived to function as implementing or operating organisations (see also Figure 8).

Contrary to the requirements of the Washington Consensus, LED stakeholders indicated that the government should assume a much more dominant role in mitigation projects. This might be explained by the fact that most stakeholders are national and local government officials or councillors. However, even the group of consultants largely shared this opinion. Yet, they also believed that the private sector needs to assume a more active role in investing, implementing and operating projects.



	Promoting	Sourcing for funding	Financing	Implementing	Operating
Local governments	69.68	56.31	36.04	90.58	78.54
National government	61.99	52.25	75.68	24.66	18.26
Namibian private sector	17.19	21.62	31.08	25.56	37.44
International private sector	12.67	19.37	32.43	14.80	21.46
Donors	23.08	23.42	51.35	11.66	10.05

Figure 8 Perceived functions of main actors

Only a few stakeholders rejected the idea that local governments should develop, implement and operate mitigation projects. One LED consultant believed that “the local government has a role by virtue of its basic function”, which is only to create an enabling environment for the private sector to flourish. Another one said that he would be “hesitant to mix these functions [because they are not public functions and if the private sector is not interested] one should investigate the potential for public-private partnerships”. A representative of a German power supplier mentioned that with respect to CDM “the government has to make sure that the requirements of the Kyoto Protocol are met and [that] nothing more is required from the government”. But he also stressed that he “does not mind the involvement of the government either”.

However, the majority of stakeholders interviewed confirmed the findings of the survey. The reasons why the government should also be involved in financing, implementing and operating mitigation projects can be grouped into four categories: mandate for sustainable development, market failure, state monopoly in the energy sector, and generation of initial demand.

First of all, stakeholders perceived the government “as the watch dog of sustainable development”. One LED officer stressed that “the local authority is the custodian of the city or town […] they must show the way”. But he also emphasized that “you need to partner up with the private sector to address climate change“. A stakeholder with a background in the energy sector mentioned “that there are circumstances where the government can get involved […] for example making the [energy efficient] stoves is not something that the private sector wants to get involved in, because of the fact that it does not have good returns”. For him the private sector “likes low hanging fruits” and “is looking for too much and too quick and too easy”. The private sector produces gas stoves and electrical stoves but “the customers who would use the energy efficient stoves would outnumber the ones who use these fancy stoves”. If the stoves improved the livelihood of the people and the private sector did not see a potential the government should take over by virtue of its poverty reduction and sustainable development mandate.

Other stakeholders believed that “there is an imperative [for the government to intervene if] the market signals are not particularly strong [and if] by delaying these kinds of interventions or actions one might further worsen the situation”. One LED consultant argued that “in history the public sector has taken the lead often […] to support those big kind of leaps of innovation and technology”. Although the government was seen as “the investor of last resort […] but in some cases is the only one available to take on some of the risks”. Another LED consultant highlighted that “the government should come in to at least cushion some of the costs from a public goods perspective”.

One stakeholder mentioned that the government is already “a fairly significant player” in the private sector through state owned enterprises. The state-owned electricity provider Nampower is a monopoly. Independent power producers (IPP) are allowed in Namibia but have to sell to Nampower which dictates the prices and does not offer attractive feed-in tariffs. Therefore, there are only a few pilot projects such as the wood gasification project which feeds its generated electricity into the main grid and the Tsumkwe solar power project which only provides electricity into the Tsumkwe mini grid (see also chapter 4). The technology needed, such as solar panels and the gasifier, is all imported. The author of the thesis does not foresee that there will be attractive feed-in tariffs in the near future. As one politician said, this would mean that “the Namibian customer will actually subsidize employment outside Namibia”. As the state has the monopoly for electricity production, stakeholders believed that “the government has to play an important role also in implementing and operating greenhouse gas emission reduction projects”.

The government is also expected to promote projects by generating an initial demand for products reducing greenhouse gases. One CEO mentioned that “the government should provide subsidies for solar panels […] and should set a good example”. Another consultant thinks that for energy efficient products the “government should take a proactive role to stimulate that kind of demand so […] they would have to take on a role that would really somehow interferes in that market”.

6.7.5 Summary

The role and functions of the public and the private sector entities for CDM are defined by UNFCCC. The government of a CDM host country has to meet certain requirements to participate in CDM, such as establishing a DNA. The private and the public sector could finance, implement and operate CDM projects. The situation is not so clear in LED. Especially, the economic development mandate of the public sector is debated. When and to what extent is the public sector allowed to intervene? Different schools of thought exist. Market-led strategies require governments to just provide an enabling environment, whereas the government is much more involved in private sector activities in state-led strategies. The usage of ODA for CDM projects is restricted, while it could be used without constraints for LED and mitigation projects in general.

In this chapter it was discussed how LED stakeholders perceived the role and functions of different players (the Namibian private sector, the international private sector, donor organisations, the national government, the regional council and the local authority) in the field of climate change. Stakeholders were requested to indicate the main drivers of climate

change activities and to project management functions of mitigation projects (promotion, sourcing for funding, funding, implementation, operation) to the actors.

To summarize:

(1) ODA could be used in LED and for climate change mitigation initiatives in general.

(2) Although UNFCCC restricts the usage of ODA for CDM there seems to be some consensus that ODA could also be used if it is not linked to the procurement of CERs.

(3) The majority of stakeholders perceived the national government and the local governments to be the main drivers for climate change initiatives.

(4) The national government and the local governments were perceived to be mainly responsible for promoting projects and sourcing for funding.

(5) The financial means for mitigation projects should come from the national government and donors.

(6) The local government was assumed to take on the responsibility of implementing projects.

(7) The local government and the private sector were perceived to operate the projects.

(8) Stakeholders perceived the private sector as a partner in climate change but not as taking the lead.

(9) According to stakeholders, the reasons that the national government and local governments were deemed to be the main players was vested in their mandate to ensure sustainable development, in the recognition that the alternative energy sector suffers from market failures, in the fact that the sole electricity provider is a state owned company, and in the responsibility of the state to use its regulatory power to generate an initial demand for carbon neutral products and services.

6.8 LED and climate change mitigation

6.8.1 Introduction

In this chapter it is investigated if LED stakeholders believed that LED should also address mitigation initiatives. To this end stakeholders were asked to provide their opinion on three questions: “Is it possible to initiate mitigation projects in a typical bottom-up, participatory

LED approach?", "Should mitigation projects be included in LED strategies?", and "Should the LED agency in Namibia support mitigation initiatives of local governments?"

As per definition, LED is a bottom-up, participatory approach requiring the involvement of the public, the private and the civic sector. Based on this maxim, LED strategies in Namibia have in many towns. LED strategies are built on local comparative and competitive advantages and focus on the economic development potentials of localities. They normally cover a time span of three to five years. However, local governments often lack the required capacity and need support from outside to develop and implement such strategies. Thus, the national government established an LED agency to assist LED initiatives in regions and towns in Namibia.

6.8.2 LED approach and mitigation

Stakeholders had to indicate if they believed that mitigation projects could be initiated in a bottom-up, participatory LED approach on a scale from 1 (do not agree) to 10 (fully agree).

25% (1st quartile) of stakeholders rated the appropriateness of initiating mitigation projects through an LED approach 5 or lower, 50% (median) 8 or lower, and 75% (3rd quartile) 10 or lower. The percentile ranks of the individual stakeholder groups differed slightly. For example, the 1st quartile, median, and 3rd quartile for chief executives were 5, 6, and 9 respectively while for councillors they were 5, 8, and 9 (see also Table 33 and attachment I Table 64). Are the observed differences significant or are they only due to chance?

	Stakeholder group					
	All stakeholders	**Chief executives**	**Economic planners**	**Consultants**	**Councillors**	**Other stakeholders**
LED approach	(5, 8, 10)	(5, 6, 9)	(5, 8, 9)	(5, 8, 10)	(5, 8, 9)	(6, 9, 10)

Table 33 Percentile ranks of stakeholders` opinion on appropriateness of LED approach for mitigation projects

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The overall sample size is 224. The samples are independent from each other. Five stakeholder groups are considered: chief executives, economic planners, consultants, councillors, and other stakeholders.

Null hypothesis: H_0: $p(x_i>y_j) = 0.5$ where i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders } and $i \neq j$ and x, y = opinion on appropriateness of approach (score). LED stakeholders` assessment with respect to the feasibility of initiating mitigation project by a typical bottom-up, participator LED approach does not differ between two selected stakeholder groups.

Alternative hypothesis: H_a: $p(x_i > y_j) \neq 0.5$ where i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders } and i ≠ j and x, y = opinion on appropriateness of approach (score). LED stakeholders` assessment differs significantly between two selected stakeholder groups.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 4).

Statistical test: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, 10 independent tests had to be carried out. The test results (U-values, standard deviation, standard score, etc.) can be found in Table 65 (see attachment I). The standard normal significance level was defined as α = 5%. Because of two-tailed tests, the cut-off point was α/2 = 2.5%.

A significant difference could only be established between chief executives and other stakeholders. Yet, the test between chief executives and councillors and economic planners and other stakeholders resulted in a probability of only 0.07. The smaller the p-value, the more strongly the data contradict the null hypothesis. The burdens of proof against the null hypotheses for the two cases are still comparatively strong. Taking also into consideration the percentile ranks, it seemed as if chief executives believed less that LED should address mitigation initiatives than other stakeholders. Altogether, the percentile ranks were high for all stakeholder groups. Thus, it can be assumed that LED stakeholders do not oppose the notion that mitigation projects could be addressed by LED.

Only a few stakeholders believed that mitigation projects could not be initiated by a typical LED approach. One stakeholder said that “climate change stuff almost has to be a top down kind of approach [because] it is not in peoples’ consciousness - there is not that level of awareness”. Another stakeholder stressed that the issue of climate change mitigation is too technical to be discussed in LED stakeholder meetings.

Yet, most stakeholders believed that LED is an appropriate approach to promote and initiate mitigation projects. One stakeholder mentioned that no matter whether you use a top-down or bottom-up approach, participation on local level is essential, because “it is around local actors knowing exactly what the trade-offs are and making informed decisions [and] they have got a shared interest about making their locality better”. Another stakeholder cautioned that “we expect local responses [to climate change] to be in the frame of how we understand it globally”. He continues saying that people on local level know what they need but they just

might not have the solutions. Again, another stakeholder stressed that “the issue of capacities is a big factor in the country and I think, if it is very difficult at national level it is worse at […] local authority level”. Nevertheless, he “personally supports a process where there are all people involved so that they all understand what we are doing”. According to one stakeholder, “if you try to do it (climate change mitigation projects) as a project from top down, it probably won’t work”. Nevertheless, he admits that the technical issues of mitigation projects might be a challenge for the local level. Thus, in his opinion “you would have to do the technical translation for the people and then you would have to take their local views and local inputs into account [because] these are kind of best practices […], in the end you have to have people agree and establish ownership.” On the other hand, a CDM specialist of a German power supplier did not perceive technical aspects as major barriers for the initiation of CDM projects on local level. He believed “that there is no need that the local level possesses the technical skills […] they can cooperate with the [national] DNA”.

There is a common understanding that the local level has to be involved but that support is needed. LED is perceived as an approach to ensure that involvement and to obtain the support. However, reality draws a different picture. LED meetings and initiatives on local level are hardly attended by national government organisation. Some ministries, like the Ministry of Agriculture, Water and Forestry, the Ministry of Environment and Tourism, or the Ministry of Trade and Industry have extension officers in some of the 13 Namibian regions, but they hardly attended the LED meetings in which the author of this thesis participated too. The extension officers might lack the technical background too, but could act as intermediaries between the local level and the respective ministries to draw in additional support.

6.8.3 LED strategies and mitigation

Stakeholders had to indicate if they believed that mitigation projects could be included in LED strategies on a scale from 1 (do not agree) to 10 (fully agree).

LED stakeholders believed that mitigation potentials should also be considered in LED strategies. 25% (1st quartile) of all stakeholders rated the necessity to include mitigation projects in LED strategies 6 or lower, 50% (median) rated the necessity 9 or lower, and 75% (3rd quartile) 10 or lower. About 28% of stakeholders rated the necessity at 10. The percentile ranks of the stakeholder groups differed. For example, the 1st quartile for councillors was 5 whereas the 1st quartiles of all other stakeholder groups were either 6 or 7. The median for the group of councillors was 7 while the median for all other groups were either 8 or 9 (see

Table 34 and attachment I Table 66). Does this mean that the perceptions differ significantly or just by chance?

	Stakeholder group					
	All stakeholders	Chief executives	Economic planners	Consultants	Councillors	Other stakeholders
LED strategy	(6, 9, 10)	(6, 7, 9)	(7, 9, 10)	(7, 9, 10)	(5, 8, 10)	(7, 9, 10)

Table 34 Percentile ranks of stakeholders` opinion on including mitigation projects into LED strategies

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The overall sample size is 224. The samples are independent from each other. Five stakeholder groups are considered: chief executives, economic planners, consultants, councillors, and other stakeholders.

Null hypothesis: H_0: $p(x_i>y_j) = 0.5$ where i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders } and i ≠ j and x, y = perception on the necessity to include mitigation projects in LED strategies (score). LED stakeholder groups rate the feasibility of including mitigation projects in LED strategies equally high.

Alternative hypothesis: H_a: $p(x_i>y_j) \neq 0.5$ where i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders } and i ≠ j and x, y = perception on the necessity to include mitigation projects in LED strategies (score). LED stakeholder groups rate the feasibility of including mitigation projects in LED strategies significantly differently.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 3).

Statistical test: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, 10 independent tests had to be carried out. The test results (U-values, standard deviation, standard score, etc.) can be found in Table 67 (see attachment I). The standard normal significance level was defined as α = 5%. Because of two-tailed tests, the cut-off point was α/2 = 2.5%.

A significant difference could only be established between chief executives and economic planners. However, the tests between chief executives and consultants and chief executives and other stakeholders resulted in a probability of only 0.03 and 0.04 respectively. The smaller the p-value, the more strongly the data contradict the null hypothesis. The burdens of proof against the null hypotheses for the two cases were still comparatively strong.

Comparing the percentile ranks it could be assumed that chief executives were less in favour of integrating mitigation projects into LED strategies than other stakeholders. Yet, because of the high percentile ranks it could be assumed that most stakeholders believe that mitigation projects should be addressed in LED strategies.

One stakeholder stressed that "as long as there is a market, as long as there is somebody who is going to buy that mitigation measure or fund it […] it can be introduced as an LED measure". Only measures which "have an impact and direct bearing on local economic development" should be included in a LED strategy. During the last couple of years LED has gained momentum in Namibia and many LED strategies were developed. Contrary to the strong demand to include climate change mitigation activities in LED strategies, only one out of 19 strategies broached the issue of climate change. However, the LED officer of that locality admitted that "climate change was not addressed in detail". Energy generation and manufacturing of solar panels were mentioned in the strategy only in a very general manner. The two initiatives were only given moderately high priorities because stakeholders in that town are "looking at job creation, looking at improving the living conditions of vulnerable people […] and improving the income situation of the council" and the two initiatives were not perceived to contribute much to these objectives.

The discussion on the economic development potentials of mitigation and adaptation projects has shown that most stakeholders only have a very vague idea about the benefits of mitigation projects and do not fully fathom the possible economic development impacts. As outlined before, stakeholders perceive mitigation initiatives to contribute to environmental rather than socio-economic objectives.

Beside the ignorance of recognising possible economic development potentials, the lack of practical skills to start and implement initiatives were also mentioned as crucial barriers for the inclusion of mitigation initiatives in LED strategies. As one stakeholder pointed out "the biggest problem is getting people to take the idea and run with it".

6.8.4 LED agency (LEDA) and mitigation

Stakeholders had to indicate if they believed that mitigation projects could be included in the service portfolio of an LED agency on a scale from 1 (do not agree) to 10 (fully agree).

The results of the survey indicated that support for mitigation initiatives by the LED agency is required. 25% (1st quartile) of stakeholders rated the need 6 or lower, 50% (median) 8 or lower, and 75% 9 or lower. About 25% rated the necessity at 10. The percentile ranks or the various stakeholder groups differed slightly. For example, the 1st quartile for consultants

equalled 5, whereas the 1st quartiles for all other stakeholder groups equalled 6 or 7. The median for economic planners was 9 while it was 8 for all other stakeholder groups. (see Table 35 and attachment I Table 68) Do the differences indicate that they are just observed by chance or are they significant?

	Stakeholder group					
	All stakeholders	**Chief executives**	**Economic planners**	**Consultants**	**Councillors**	**Other stakeholders**
LED agency	(6, 8, 9)	(6, 8, 9)	(7, 9, 10)	(5, 8, 10)	(6, 8, 9)	(6, 8, 10)

Table 35 Percentile ranks of the perception of stakeholders that the LED agency in Namibia should also support climate change mitigation projects

Assumptions: The samples include only people with an assumed interest in LED. The data types are ordinal. 25 chief executives, 57 economic planners, 17 consultants, 68 councillors, and 57 other stakeholders were surveyed. The overall sample size is 224. The samples are independent from each other. Five stakeholder groups are considered: chief executives, economic planners, consultants, councillors, and other stakeholders.

Null hypothesis: H_0: $p(x_i>y_j) = 0.5$ where i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders } and i ≠ j and x, y = perception that the LED agency should supports also mitigation projects (score). The perception that the LED agency should support mitigation initiatives of local governments does not differ between two selected stakeholder groups.

Alternative hypothesis: H_a: $p(x_i>y_j) \neq 0.5$ where i, j = ϵ{chief executives, economic planners, consultants, councillors, other stakeholders } and i ≠ j and x, y = perception that LEDA supports also mitigation projects (score). The perception that the LED agency should support mitigation initiatives of local governments differs significantly between two selected stakeholder groups.

Significance level: α = 5%.

Data preparation: Missing data were imputed (see also chapter 4).

Statistical test: The Mann Whitney U Test was used to conduct the tests. The significance level was approximated with the standard score (z-value).

p-value: Two-tailed (assuming the null hypothesis is true)

Test results: Applying the formula for k-combinations, 10 independent tests had to be carried out. The test results (U-values, standard deviation, standard score, etc.) can be found in Table 69 (see attachment I). The standard normal significance level was defined as α = 5%. Because of two-tailed tests, the cut-off point was α/2 = 2.5%.

The tests failed to reject all null hypotheses. The p-values are comparatively high and the burdens of proof against the null hypotheses were weak. Because of the high percentile ranks, it could be assumed that all stakeholders want the LED agency to support local governments with respect to climate change mitigation. But what kind of services do stakeholders expect from an LED agency?

According to an LED stakeholder, an agency has "to encourage networking and interaction between LED stakeholders [and] to build relationships with other partners in the economy". This was corroborated by another stakeholder who stressed that "there is space in between the private sector and the public sector that needs to be filled with an organisation that can facilitate interactions between the two sectors". Therefore "the agency needs to have an intimate knowledge of what the government is doing", while at the same time should also be "looking at leveraging […] private sector resources". As one stakeholder put it, "it is almost like matchmaking". "Facilitating partnerships between public sector and private sector" was also mentioned as a "critical role" by yet another stakeholder. Again, another stakeholder underlined that an agency should "complement the efforts of local government [and] complement the efforts of businesses and civil society organisations".

An agency should also make linkages to "other agencies in a country to give firms in one area footing in another part of the country [and to help companies access] new markets, [even] export markets". Several stakeholders stressed that an agency is also to "attract investment […] and facilitates global linkages". One stakeholder emphasized that an LED agency has "a direct line into government" and can play a facilitating role especially for smaller companies. Another stakeholder highlighted that an agency should support companies by providing "government incentives to participate in trade fairs and trade missions, mentorship [programmes], and business information [and] market information".

Stakeholders identified the promotion of investments in catalytic projects as another important agency function. Catalytic projects are projects which have an expected impact beyond the scope of the project. According to one stakeholder, an LED agency should focus on "four or five catalytic projects which would have the ability to really transform the country". Another stakeholder provided an example of a fish canning factory. He said that "if we facilitate that fish canning factory then we are also going to give a shoot in the arm to the whole fishing industry".

Another function of an agency should be capacity building of private sector and public sector entities. As one stakeholder put it, the agency should be a "sort of conduit for training". According to another stakeholder, the agency has also to make sure that "communities are able to benefit from [private sector projects] and are able to build capacity in the specific sector". Again, another stakeholder uttered that there is "not a uniformed understanding of

exactly what LED is […] for some LED include large projects or catalytic projects that includes big businesses, for others it is just the SME sector and for others it is everything that can improve the local economy somehow". Thus, the "LED agency should advise what LED is and start an educational process". However, capacity building is not restricted to the transfer of knowledge and skills but entails, as one stakeholder stressed, the necessity of "the agency providing local governments or other actors such as community organisations or business associations with administrative, financial capacities".

An LED agency should also provide assistance for climate change mitigation initiatives. One of the stakeholders indicated that an agency "should look out for who is doing what […], where are the good practices […], and link them to growth, number of jobs created […] and skills needed". Another stakeholder requested the involvement of LED agencies as long as "greenhouse gas projects are driving or contributing to economic development and growth, contributing to job creation, and contributing to efficiency in economic terms". Climate change projects are seen by one stakeholder as "a big opportunity for an agency […] as long as [it is not given] ten other tasks".

One stakeholder proposed that the agency "might be championing the installation of solar water heating in every single house in Namibia […] so immediately reliance on electricity consumption decreases and the standard of living at household level increases and economic opportunities increase because you now have a new economic sector coming into a local area". He believed that the agency should pave the way to roll out projects. For example, for the solar water heating initiative an agency could negotiate with the electricity provider or the ministry of housing to provide subsidies and to make sure that "a process is in place to establish a panel of accredited installation people". Another stakeholder highlighted that an agency "should engage with ministries […] and play a connecting role".

Another stakeholder stressed that an agency "could be looking at opportunities [and] awareness raising around regulation and negative impacts". One stakeholder doubted that local authorities and regional councils in Namibia were really interested in climate change because they are not fully aware of the threats and do not see the opportunities for economic development. Thus he felt that the agency might be an instrument for "getting local and regional authorities on board".

Another function of an agency could be the dissemination of information. One LED officer highlighted that "people want to have physical proof". Thus, another stakeholder stressed "the LED agency is to showcase successes, to test things out, to pilot projects, to document projects and disseminate the information". One stakeholder emphasized that "an economic development agency in any region […] is fundamentally to enhance the competitiveness of that region". If a climate change mitigation project is identified as an opportunity for improving

the competitiveness, then an agency “could play a very valuable role [in getting] people the right information so they could make truly informed decisions”.

There seemed to be a strong demand that climate change issues should be included in the service portfolio of an LED agency. The LED agency in Namibia does not provide advice on climate change issues at all. It does not have the knowledge and the human capacities to consult local authorities and regional councils in this respect. As outlined before, the local governments do not have the capacity either. The agency focuses on economic development issues and is liaising with the respective ministries, like the Ministry of Trade and Industry but is not in contact with the Ministry of Environment and Tourism which is in charge of climate change or the Ministry of Mines and Energy. The private sector that is already active in the sector does not or is reluctant to cooperate with local governments or the agency. NGOs or research institutions working in the field of climate change have no formal or informal working relationships with the agency, such as the Renewable Energy and Energy Efficiency Institute (REEEI) or the Desert Research Foundation of Namibia (DRFN). REEEI, for example, established energy shops in different localities in Namibia to provide poor households with small solar powered appliances. Neither the LED agency nor its ministry was consulted. The local governments involved did not give feedback to the ministry or the agency either. Contrary to the demand by the stakeholders, the agency does not see itself as a partner for climate change and energy related topics. It is currently not recognized as a potential partner by the private, the public and the civic sector either.

6.8.5 Summary

In this chapter it was investigated if LED stakeholders believed that climate change mitigation activities and LED could be intertwined more closely. To this end stakeholders were asked to provide their opinion on three questions: “Is it possible to initiate mitigation projects in a typical bottom-up, participatory LED approach?”, “Should mitigation projects be included in LED strategies?”, and “Should the LED agency in Namibia support mitigation initiatives of local governments?” For each question respondents were required to rate their opinion on a scale from 1(do not agree) to 10 (fully agree). Additional qualitative data were obtained through stakeholder interviews.

To summarize:

(1) The majority of stakeholders believed that mitigation projects could be initiated by a bottom-up, participatory approach.

(2) The people in a locality know best what they need and the buy-in of local stakeholders was seen as absolutely necessary.

(3) The technical aspects of mitigation projects might prove to be a challenge but the required skills could be drawn in by including relevant organisations and experts.

(4) Many organisations dealing with climate change issues have already regional offices in Namibia and could easily participate in LED.

(5) However, this does barely happen in Namibia as the organisations and experts hardly participate in LED.

(6) The majority of stakeholders believed that mitigation initiatives which have a direct impact on economic development should also be included in LED strategies.

(7) In contradiction to the aforesaid only a few out of 19 strategies investigated addressed climate change issues, though, only in a very general manner.

(8) LED strategies centre on job creation and improving the livelihood of vulnerable people, while mitigation projects are not seen as contributing to the achievement of these objectives.

(9) Even if stakeholders see a potential for job creation or poverty alleviation they lack the skills to implement any projects arising from these opportunities which prevent them also from prioritising mitigation projects.

(10) The majority of LED stakeholders requested that the LED agency assist local governments in the field of climate change mitigation too.

(11) Stakeholders requested the agency to facilitate economic development by initiating capacity building measures, playing a connecting role between the different actors in economic development, and searching for opportunities to accelerate the process of economic growth.

(12) With respect to mitigation, the agency should provide support as long as the initiatives contributed to economic growth and development.

(13) The services required are similar to the ones the agency provides within its economic development mandate described before.

(14) The agency could be instrumental with respect to facilitating linkages between the public and the private sector, attracting investments by promoting business opportunities, disseminating information, and building capacities.

(15) In reality, neither organisations working in the field of climate change nor the agency approached them.

(16) The LED agency in Namibia is not up to the task yet and will not be so in the near future.

(17) With a few exceptions the perception of the different stakeholder groups with respect to the LED approach, the LED strategy, and the LED agency does not differ significantly.

7 Case study: LED strategy for Otjozondjupa

7.1 Purpose

In this chapter, the results of a real life case study are outlined and discussed. In the case study an LED strategy development initiative was investigated in the region of Otjozondjupa in Namibia which tried to incorporate CDM projects. It was planned as a single exploratory-descriptive as well as exploratory-explanatory case study. The main aim of it was to provide context data to the overall research and discover new phenomena. The actual strategy development phase and the subsequent implementation phase were investigated.

7.2 Otjozondjupa - demographic and economic overview

According to NPC (2012, p. 45), the region of Otjozondjupa (see also Figure 1) covers an area of about 105,460 km^2 and has a population of about 142,500 inhabitants. It is the fourth largest region of Namibia. There are 5 local authorities (villages, towns, municipalities) in which about half the population live and several declared settlements. The towns comprise of Otjiwarongo (28,000 inhabitants), which is the regional capital, Okahandja (22,500), Grootfontein (16,400), Otavi (5,200) and Okakarara (3,700).

According to NLSW (2010, p. 16), the strict unemployment rate was 30.6%. Especially, women (52.5%) and young people (50.5%) were unemployed. According to GEISEB (2009, p. 6), the most important economic sectors of Otjozondjupa are agriculture (including hunting and forestry), manufacturing, tourism, retail, and mining. Data from NPC (2006, p. 33) showed that 72.9% of households live on income derived from wages and salaries, 7.1% live on pensions, 4.9% receive cash remittances, 4.5% generate income from business activities, for 3.7% the main source of income is subsistence farming, 2.8% receive in-kind-receipts, 1.9% make a living from commercial farming.

According to NPC (2006, p. 49 ff.), 44.4% of households in Otjozondjupa are without access to electricity. 92% of them have access to piped water which includes those with access to communal water taps only. NPC (2012, p. 56) estimated that there are 32,000 households in Otjozondjupa of which 27,100 are in the five towns mentioned above.

7.3 Case findings and analysis

7.3.1 Introduction

In 2009, the regional council of Otjozondjupa planned to develop a 3 to 5 year LED strategy for the region. As part of the strategy development, the author of this study initiated a project where greenhouse gas mitigation initiatives – in particular CDM – and their economic and social development potentials were to be studied, too. If found promising, they were to be included in the LED strategy. The LED strategy development project commenced in May 2010, the CDM evaluation project in August 2010. Both projects were awarded to firms of consultants. To inform stakeholders about the initiative, the overall project was officially kicked off with a briefing session in July 2010. The LED strategy was adopted by the regional council of Otjozondjupa in Mai 2011, after which the local government started to implement the strategy.

This was the first time that a LED strategy for a Namibian region was developed. Moreover, it was also the first time that a LED strategy development project was to include mitigation and CDM projects. The regional council was fully in charge of the project management for the LED strategy development as well as the study on CDM potentials.

This chapter presents the key findings discovered during the course of the research. Data were captured through observations during stakeholder workshops, project team meetings, etc., interviews with LED stakeholders, and the studying of project documents (workshop reports, strategy document or CDM assessment report).

7.3.2 Framework conditions of the case

7.3.2.1 Project management structures

The project was to be conducted in a participatory and bottom-up approach. At the same time the projects had to be efficiently and effectively managed. Moreover, the structure had to ensure that project issues (technical details, management aspects) were discussed on the right level of expertise. Thus, a four-level project management structure was designed where the degree of technical detail to be debated would diminish from level 1 to level 4 (see Figure 9).

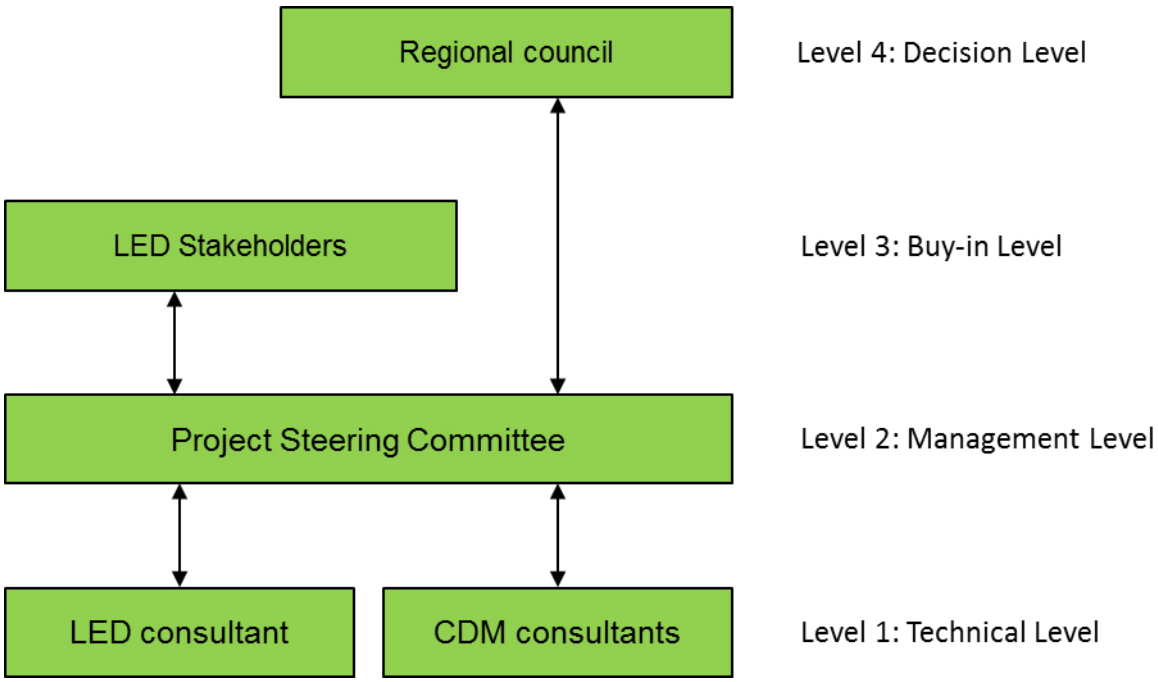


Figure 9 Four-level project management structure of Otjozondjupa`s LED strategy development project

The two sub-projects were managed by two different teams of consultants who were supervised and steered by one common project steering committee consisting of regional council and local authority personnel. The steering committee did not include representatives from the private sector because they were not interested to participate. Regular meetings took place to get feedback from the consultants and to adjust the projects accordingly. The steering committee was entitled to make decisions concerning the overall management of the projects. To inform and regularly update LED stakeholders in the region and receive their feedback, people from private and public sector entities and the civil society were invited to attend information-sharing and awareness sessions and workshops (buy-in level). The final LED strategy had to be approved by the regional council.

7.3.2.2 Stakeholders

The people involved in the strategy development project were representatives of local authorities, regional councils, national ministries, communal conservancies, traditional authorities and civil society organisations. The private sector was clearly underrepresented. The kick-off meeting for the overall project was attended by 42 participants; only two were from the private sector. During the course of the project workshops on the main economic sectors were arranged. The workshop on mining, services and SMEs was attended by 38 stakeholders, the one on agriculture by 30, on tourism by 27, and on manufacturing by 11. Although explicitly invited by the regional council, the private sector at large did not join the sector workshops. Only one representative of a manufacturing company took part in the

workshop on the manufacturing sector. Only one private farmer participated in the workshop on agriculture. With seven attendants, only the tourism sector was better attended by the private sector. The kick-off meeting on mitigation and CDM was joined by only 10 people. One was from the private sector. None of the meetings and workshops was attended by councillors.

7.3.2.3 Operational sequences

In line with the principles of LED, the strategy development followed a participatory, consultative and bottom-up approach. The strategy was to be based on comparative and competitive advantages of the region. Thus, a rapid regional economic assessment of the mentioned main sectors was conducted and development and growth opportunities were worked out. 81 individual interviews with stakeholders from all seven constituencies of Otjozondjupa and national organisations were conducted of which 29 were representatives from or owners of private sector entities (e.g. companies, business support organisations).

The results of the economic assessment were discussed in a sector workshop in November 2010. Based on issues discussed during the sector workshops and the results of the economic assessment, economic development initiatives were further debated. In the end 63 project ideas (see attachment I Table 70) were included in the LED strategy (agriculture: 15, tourism: 9, manufacturing: 8, service: 14, mining: 6, SME and informal sector: 11).

The CDM assessment project was kicked off with a workshop in October 2010 during which LED stakeholders were introduced to the topic of climate change and CDM. The workshop was also used to brainstorm on technically and financially feasible and useful mitigation projects. In preparation of this CDM workshop, the CDM consultant already identified 8 CDM project ideas. At the workshop 10 more mitigation project ideas were put forward by the participants. The ideas were then preliminary screened. Additional four ideas were discussed during the screening. After the screening, it was decided to concentrate on 10 project ideas (see attachment I Table 71). They were finally included in the strategy. Scoring criteria were developed to evaluate these ideas on a 10 point scoring system. The criteria were additionally weighted. For every criterion the scores were multiplied by the weights and the individual weighted scores were added up (see attachment I Table 72).

After considering the steering committee`s priorities, the financial and human capacity of the regional council and the CDM limitations, the following projects were selected to be promoted first:

- fuel-efficient biomass stoves

- avoidance of methane emissions and fertiliser production at commercial poultry farms
- hybrid biogas-diesel electricity generation for off-grid settlements
- local manufacturing (SME) of charcoal briquettes

The poultry farm project was the only project considered to have viable local CDM potential but would not contribute to economic development. Fuel-efficient biomass stoves were only suited for CDM on the national level.

7.3.3 Main findings and analytical deductions

7.3.3.1 General project approach

It was observed that the CDM part of the project was managed in a much more top-down and input driven way than the LED part. For the latter a regional economic assessment was conducted in order to identify the growth sectors of the region while no such assessment was carried out for the CDM projects. Whereas potential LED initiatives were developed based on information obtained from companies, local governments and civil society organisations, the CDM ideas were based on literature, the consultants` experience with CDM and an initial brainstorming amongst a group of 10 stakeholders. But even during the brainstorming session most of the ideas were put forward by the CDM consultants themselves. On the other hand, the LED consultant only collected, filtered and fine-tuned the proposed LED initiatives. He only assumed the role of a facilitator whereas the CDM consultants were technically much more involved in the actual elaboration of the projects.

The identified LED projects were unspecific, vaguely outlined and did not entail clearly defined and measurable objectives. The “Outreach of existing skills development programmes”, for example, is described in the strategy as “an initiative to facilitate the access to existing skills development programmes for farmers in communal areas and resettlement farms” (GEISEB[84], 2011, p. 16). The “Support to communal conservancies initiative” is described as an institutional support programme to mobilize “various conservancies and support organizations towards ensuring that communal conservancies achieve an acceptable standard with their facilities, attractions, etc.” (GEISEB, 2011, p. 21).The initiatives were to be defined and planned in more detail during the implementation phase. The CDM projects on the other hand were more concrete, had a clear focus and measurable objectives. For example, the fuel-efficient cook stove project was predicted to save 75% on wood and might result in 20 additional employment opportunities for Otjozondjupa.

[84] Geiseb was the LED consultant who facilitated the development of the LED strategy.

Because the overall project was split into an LED and a CDM part, people did not consider the two parts subsets of the same projects. One steering committee member mentioned that CDM was not a priority for stakeholders at all. She was involved in the CDM meetings but still her approach to the CDM project was “let us develop the LED strategy first and from there maybe we can also look into the CDM part […] although it was parallel we concentrated more on the LED part that we could get a clear picture on”.

For the CDM part of the project, ideas were assessed based on calculations and estimates such as emission reductions, cost savings, etc. while the ideas in LED never really underwent a methodical economic analysis. This was also criticised by the CDM consultants. They acknowledged that the LED consultant had a much broader scope but also pointed out that they “had to go into detail in order to demonstrate whether or not CDM would apply”.

The final project selection process seemed very arbitrary. One CDM consultant highlighted that “in the end I am not so sure how well we welded the two project parts together […] it seemed a little bit rushed”. In one of the workshops, for example, when potential LED initiatives were screened, the consultant provided a set of criteria to help participants to assess the proposed initiatives. Yet, the criteria were seldom considered during the discussions. Besides, as no supportive data were given, the assessment was based more on gut feeling than sound analyses and calculations. One CDM consultant feared that stakeholders “were not carefully thinking things through […] because they had not the time to think about it at all. I was throwing a lot of detail on them in a short amount of time that they were not able to process all of it”.

7.3.3.2 Identification of potentials

During the course of the CDM project, it was recognised that it would be too restrictive to consider CDM potentials only. One of the CDM consultants remarked “that every time we had a good idea that fit in with the methodologies it would not work for Namibia, like landfill gas”. Additionally, he was concerned that the focus on a subnational region might reduce the number of potential CDM applications even further. Furthermore, some of the proposed projects, like biochar, were not approved by UNFCCC or did not have a methodology yet. Another obstacle for CDM was the low price of carbon credits. The second CDM consultant involved in the project outlined that CDM was too restrictive for LED. For him the focus should be on green technologies in general. This would “be sustainable over a long time and therefore if governments are willing to bear that heavy initial cost then this can actually bring very long term benefits to the people even though it does not look like that because there are

cheaper dirtier options". Because of these challenges, it was agreed to concentrate on any kind of mitigation projects which might have a positive impact on LED.

The initial project ideas put forward by the CDM consultants were not fully thought through. The applicability of some projects was doubtful, such as LPG fuel switching for vehicles. With the low population size, the high unemployment and poverty rate, the technical obstacles, and national and local bureaucratic challenges it would be quite unlikely that such a project could be meaningfully initiated by the regional council of Otjozondjupa. One consultant even admitted that he "was a little bit sceptical and worried that we would not come up with any ideas [and] part of that was based on my experience with the PIN (project idea notes) project we did for the UNDP […] where at the end of the day we were rushed to come up with ideas".

During one of the sector workshops, 29 participants were asked to indicate if they saw a potential for mitigation projects in Otjozondjupa. 12 stakeholders believed there are potentials. 11 of them provided concrete ideas for mitigation projects, such as biogas, waste recycling, afforestation, solar energy, wood pellet production for export to Europe, bush-to energy, clay houses, dry sanitation, fire management, and composting. Some of them mentioned projects which were already implemented in the region and others knew about potential investors, such as a supermarket which installed photovoltaic panels to reduce energy costs, a cement factory which invested in a bush-to-energy project to use bush wood as a fuel to produce cement, and a farmer who wanted to export wood pellets to Europe. Against this background it was surprising that only one project was marginally discussed during the sector workshops. During the workshop on agriculture one farmer mentioned that "invader bush provides a huge opportunity for employment and energy generation". He stressed the lack of grazing area and thought that "the bush on farms, which is already there, could be used in a power plant in Otjiwarongo which would need a huge amount of bush". He further stressed that increasing charcoal production would still not clear enough land of bush to visibly increase farm productivity and outlined "that energy production from bush wood should not be solely based on business interests and cost benefit analyses but on the interests of the national economy".

One CDM consultant highlighted that "it was difficult to find CDM projects for Otjozondjupa […] so you would not expect somebody who is not even familiar with CDM to come up with such ideas." He also pointed out that people "know from the news and from awareness raising programmes in Namibia that climate change and increasing climate variability in Namibia causes a threat to them […] but when they think about what is causing it [for them] it is like air pollution from power stations and cars and that kind of thing […] that is out of their reach they cannot control that".

In general, most mitigation projects aim at replacing fossil fuel with alternative energy sources or promote energy saving. The provision of energy is deemed to be a mandate of the national government and therefore the sector was not covered in the strategy. Because of this, there was no real opportunity to discuss mitigation options and their possible positive impact on economic development efforts during the workshops.

7.3.3.3 Prioritization

During the course of the project, it could be detected that the prioritisation of projects was influenced by the perceived availability of resources for implementing initiatives. The LED consultant realized that "if you ask stakeholders […] they are going to say we do not have money [...] for us it can never be a priority activity until we receive money […] so priorities would be determined by the extent to which local authorities feel they have resources to implement that particular function". He also gave an example saying that for every town the formalisation of informal settlements should be a priority but "if you went and ask local governments […] it will never be a priority as long as this ministry (MRLGHRD) does not send money to them and says formalise that informal settlement...they will not do it […] but every guy who stands up and becomes a politician actually sings the song about informal settlements […] it just does not happen […] at local level what is priority for these guys is to pay people (staff of local governments)".

During the workshops and meetings it was observed that participants were unable to link CDM with LED. The LED consultant, for example, mentioned that "there are a few things that make sense to people like the need to convene tourism forums […] CDM has not really been appreciated at the same level […] and naturally there are people who just do not get it". A member of the steering committee mentioned that people "did not see a role for themselves in the projects". If people cannot see the benefits of CDM projects, they rate them low in priority, too. Especially, stakeholders did not see "how CDM would eventually translate into the kind of things that people wants to see of LED that is to create employment and eventually poverty reduction". The steering committee member felt that is was better to "take out the international aspects of CDM...in terms of going the carbon trading market […] and rather look at it […] as a non-typical LED project that can actually create employment".

High cost of electricity and insufficient access to electricity were included in the LED strategy as challenges for the development of the agricultural, tourism and manufacturing sector. This should actually motivate investments into alternative energies. Yet, they were lost among other issues, such as access to lands for businesses, access to finance, lack of skilled people, poor housing, low level of public services, inadequate by-laws, etc. These challenges

seemed to be of greater importance and were also identified in several surveys of the private sector (e.g. SURVEY WAREHOUSE, 2013; NCCI et al., 2011).

The implementation of most LED projects identified in the strategy was assigned to the regional government. The responsibilities for the mitigation and CDM projects were not defined in the strategy but the underlying perception was that they were to be taken up by the private sector. One of the members of the steering committee mentioned that “you need the right actors for CDM” and referred to the private sector. Another member also believed that only “the private sector guys […] really know what CDM is all about”. As most of the stakeholders were from the public sector, this assumption might have led to a bias towards LED initiatives.

7.3.3.4 Stakeholders` participation

The attitude of stakeholders in LED workshops and CDM meetings differed. There were lively discussions on LED related topics whereas there were hardly any contributions with respect to CDM projects.

As one committee member emphasised, very often people “attend because they are nominated by the local authorities and regional councils to come and attend but these persons do not really understand the topic at hand”. Based on her experience, the steering committee member highlighted that “if people understand they are willing to participate in anything you bring about”. If they do not understand “they will leave a consultative workshop and you will never hear about them again”.

The participation also depended very much on the sector discussed. It was observed that stakeholders’ participation was especially high when the tourism, agricultural and service sectors were discussed. Hardly any comments were received from stakeholders when the manufacturing sector or CDM projects were debated.

7.3.3.5 Complexity of CDM

CDM was assumed to be too complex and technical to be discussed with all stakeholders. One member of the steering committee mentioned that the CDM consultants “made [CDM] look so difficult [and] in the end that was what scared people off”. He felt that “for the target group the concept was too advanced […] and people could not see themselves fitting into the ideas. They did not know how to benefit.” Even for him “the procedures were too cumbersome”.

The LED consultant pointed out that he felt that the international aspects of CDM were difficult to grasp for local LED stakeholders. He mentioned that “to look at carbon emission reduction and then look at the issue of trading those credits and things like that […] was not comprehended [at local level]”. He stressed that “almost every time we (the project team) raised CDM issues we had to explain what it means because it is a fairly new concept”. Because “CDM […] is not the kind of [project to be found in] a in a typical LED process [where] you engage all kind of people […]. You need a different level of promoters that even understand the risks of trading on a carbon market or generally the kind of investment that may even be required”. Initiatives such as debushing “are of a scale which should rather be discussed on national level”. He believes that “many participants did not really comprehend what had been discussed”. Yet, he also believed that even “LED was a new concept for quite a lot of people”.

One of the CDM consultants also highlighted the lack of awareness and knowledge. The other one wondered if “the bottom understands because bottom up works very well when the people at the bottom understand you […] in Namibia one of the challenges is that people see development projects as sort of hand out of money”. He believed that “the approach was ok but what I saw I think the understanding of the people of the project was not really good”. One steering committee member also outlined that LED could be a platform to discuss and initiate CDM projects but cautioned that people have to “have the same level of understanding”.

One of the CDM consultants hoped that “in the future there will be stronger international agreements that will make it more necessary and then economically it would make more sense, too. But right now it is a bit of a challenge seeing that we are not an Annex-I and we are not forced to reduce [greenhouse gases], so all we got now is the CDM and if the price of carbon were a lot higher that would make it a lot more viable, too”. Therefore, he argued that LED is not “the right tool to engage in CDM projects on the local level”

7.3.3.6 Objectives

The 63 LED initiatives identified all focused on the improvement of the business environment such as developing infrastructure, capturing and sharing of information, developing skills needed by the private sector, implementing standards, improving public service provision and accessibility (e.g. potable water, electricity), providing financial means for the socio-economic development of the locality, creating platforms for private and public sector to exchange information or intensify public private partnerships, and enhancing the contribution of key economic sectors to regional economic growth. The overall aim of the strategy was to

create employment and reduce poverty. The focus was clearly on social and economic aspects.

During the discussions and interviews, it was observed that stakeholders mostly linked climate change mitigation with environmental objectives. One member of the steering committee, for example, responded to the question why mitigation projects did not feature more prominently in the strategy by saying that “the environment is not yet an issue […] there are not many reports which alarm people why they should take extra care of the environment at the moment”.

On the other hand, if climate change related projects are included in the LED strategy, then they have to meet economic and social objectives, such as the creation of jobs, the development of new skills, the transfer of new technology to the region, the inflow of new foreign investments, the reduction of poverty and the development of underdeveloped areas. Other objectives like the reduction of greenhouse gases or the adaptation to climate change impact are not of high priority.

However, one of the CDM consultants believed that it is too short-sighted to look at immediate economic development benefits only. Instead “you have to look beyond CDM because CDM […] is a temporary thing, […] it was meant to raise awareness, […] it was meant to demonstrate that there are options but [he does] not think that CDM will be sustainable because it requires a constant flow of money from somewhere else”. He called CDM “a guilt trap [because] I keep saying you are guilty for my situation therefore you have to pay”.

7.3.3.7 Mandates

LED is seen as a mandate of the government. Local governments (45 initiatives) and national ministries (11) were assumed responsible for most of the LED project in the strategy. The private sector and civil society organisations were seen to be in the lead only for seven projects, such as “Provision of hospitality infrastructure”, “Charcoal production” or “Rangeland management training for communal farmers”. All together, the private sector was only to play a primary or secondary role for 27 out of 63 LED initiatives.

According to UNEP (2007, p. 28), CDM projects can be planned, financed, implemented and operated by public, private and civil society organisations. Yet, one of the steering committee members very much advocated that “the implementation should be done by the private sector. The public sector is much too weak”. For CDM projects it is important to identify the role players that are “people who really understand what is going on […] and not general

developmental guys". Another steering committee member believed that the LED stakeholders are not the right people to engage in mitigation projects. For her, the private sector would have to play a crucial role. Because, "when we talk about LED stakeholders mostly we talk about government ministries, the local authorities. The private sector is not that much involved".

However, it seems that the public sector as well as the private sector did not live up to expectations.

The LED strategy was adopted in May 2011. By the end of September 2013 only one of the initiatives was started by the local government. None of the mitigation projects in the strategy were initiated. One of the steering committee members summarised the situation. "You get a grip of good ideas and they go on to a report and they pretty much fade away and then someone picks them up later and […] you see the same old ideas kind of being recycled and you just kind of hope the right donor comes in and really takes the projects to the next step. I do not know to what extent we see projects being rolled out." Several causes for the sluggish implementation could be identified.

One of the project steering committee members believed that the situation is caused by lack of finances, by unclear responsibilities (e.g. responsibilities of local and national government), by insufficient communication between national and regional/local level, by the capacity and knowledge of CEOs and by a poor working ethic (e.g. punctuality, misuse of working time). He stressed in particular that "people are not used to implement what had been discussed and agreed upon". Financial problems and the impotence to generate public income or collect outstanding fees are one of the major obstacles also seen by other steering committee members. One of the CDM consultants said, that "a typical drawback in all these development projects is that you come up with great ideas but then where is the money going to come from for actually implementing them".

The success of LED projects depends on determined actors. "Some projects will be ´quick wins´ that can be implemented in the short term and play an important role in building momentum and trust. Others will be medium to long term. In each case, projects should be ´championed´ by individuals or group of stakeholders according to interests, resources and commitment." (WORLD BANK, 2003, p.12). In line with this thinking, one of the steering committee members highlighted that the slow implementation of mitigation projects is due to the fact that "the process of identifying champions did not go well for most of the ideas". Private sector partners could not be attracted. He stressed "that someone must have an interest" in taking up the opportunities, ignoring that it is the role of the local government in economic development to look out for such champions. Moreover, the implementation of the overall LED strategy was to be managed by the local government which had to convene

regular meetings as indicated in the strategy to control and monitor the progress of the strategy implementation. No meetings have ever been conducted.

7.3.3.8 Cooperation

Lack of cooperation was observed on project level, between local and national public sector entities and between the private and public sector. As mentioned before, the private sector did not cooperate significantly, neither during the strategy development nor during the implementation phase.

Although invited to participate in the strategy development, neither the Ministry of Mines and Energy nor the Ministry of Environment and Tourism sent representatives to the meetings and workshops. The DNA was not involved either. Although extension officers of the Ministry of Agriculture, Water and Forestry were involved, they did not possess any or only superficial knowledge about climate change mitigation. Even though the Namibian national power supplier, a monopolist, was invited, it did not sent a representative to the project meetings either. None of the national organisations which are able to provide technical input about alternative energies and mitigation projects attended. Thus, mitigation projects were only promoted by the two CDM consultants and the project steering committee. Overall, national political support was missing.

The project steering committee was in charge of coordinating the two parts of the project. Both firms of consultants had to attend the steering committee meetings. Yet, outside these meetings there was no regular exchange of data between the two firms of consultants and the steering committee did not insist on it. Information collected during the rapid economic assessment, for example, was not forwarded to the CDM consultants.

The LED consultant clearly had no idea about CDM while the CDM consultants did not fully comprehend LED. As the LED consultant said “I must confess that it is almost the first time that I came across CDM as a concept […] and I must also say it is really the first time that I have been able to look at [its] economic significance and that it clearly could make a contribution in the same way LED really tries to do”. One of the CDM consultants felt “quite excited to be part of a LED project or programme” as he “was already quite interested in LED”. He was the lead consultant for the assessment of the infrastructure of 18 towns in Namibia but had never really been involved in LED.

7.4 Summary

An LED strategy development initiative in the region of Otjozondjupa in Namibia was investigated which tried to incorporate CDM projects. It was a single exploratory-descriptive as well as exploratory-explanatory case study. The strategy development initiative was split into two separate projects: the actual LED strategy development and the CDM assessment.

To summarize:

(1) The LED part of the strategy development started in May 2010, the CDM part in August 2010. The two parts were finally merged in April 2011. The strategy was adopted by the Otjozondjupa regional council in May 2011. The strategy covered a time span of 3 to 5 years and implementation was supposed to start immediately after the adoption of the strategy.

(2) The project management structure was designed to ensure that technical details and project management issues were discussed on the right level of expertise. The management of the actual CDM and LED project was outsourced to different firms of consultants. The two projects were controlled and monitored by a steering committee which consisted of staff from the Otjozondjupa regional council and local authorities of the region. The steering committee had the power to make decisions on the project level. It convened regular meetings to inform LED stakeholders of the region about the progress of the project and seek their feedback. The steering committee presented the final LED strategy to the regional council for adoption.

(3) LED stakeholders were mostly staff from the public sector or civil society organisations. The private sector did hardly attend meetings. The project failed to include the political level which in the end was supposed to adopt the strategy.

(4) The idea of including mitigation projects in an LED strategy was new to all LED stakeholders.

(5) LED initiatives were based on the analysis of 81 stakeholder interviews and a rapid economic assessment of key sectors in the region. The selected economic sectors were tourism, agriculture, mining, service and manufacturing. The SME and informal sector were also considered.

(6) CDM project ideas were based on literature research, the consultants` experience and the outcome of a brainstorming session with selected LED stakeholders. A total of 22 projects were discussed.

(7) The final LED strategy included 63 LED initiatives and 10 mitigation initiatives. Only one of the mitigations projects – avoidance of methane gas at a poultry farm – was suited for CDM but did not have much economic development potential.

(8) By terms of reference, the CDM consultant was required to generate a specified number of CDM projects. Yet, many of the proposed CDM projects turned out to be not feasible in Otjozondjupa. Therefore, the scope of the project was expanded to any kind of technically feasible and financially viable mitigation projects.

(9) The CDM part of the project followed a top-down approach, was project based, and had concrete and measurable objectives. The LED approach was completely bottom up and participatory but the initiatives proposed were vaguely defined and did not include measurable objectives.

(10) CDM projects were repeatedly screened and evaluated using economic, social, environmental, and CDM selection criteria and then prioritised while LED projects never underwent a methodological economic assessment.

(11) On the one hand, stakeholders indicated that they see an economic development potential for mitigation projects and even named initiatives but on the other hand they did not consider them in the final strategy. This contradiction could be explained by the

- lack of knowledge of mitigation and CDM
- complexity of CDM
- perception that mitigation projects focus on environmental sustainability objectives
- sector approach of the LED strategy which did not include the energy sector
- assumption that traditional LED projects contribute more to socio-economic development than mitigation projects
- non-availability of financial and human resources to implement projects
- fact that the project was split into two parts, which somehow strengthen the impression that the CDM part of the project was an environmental programme
- incompetence of stakeholders to mentally interconnect LED and mitigation projects
- identified sector challenges where issues such as cost of electricity and lack of access to electricity was not a high priority
- perception that the private sector is in the lead for mitigation projects

This last assumption combined with the fact that the majority of stakeholders were from the public sector might have also biased the selection process.

(12) Including all stakeholders in the development process of a strategy ensures their commitment. It was observed that the participation depended very much on the knowledge of stakeholders about the topic or sector discussed. The participation was comparatively low if the discussion was on mitigation options while it was noticeable higher if economic sectors

were discussed where stakeholders were involved, such as agriculture and service. Many stakeholders own small farms and most of them work in the public sector.

(13) The public sector was assumed responsible for LED projects in general while the private sector was expected to be in charge of mitigation or CDM projects. Both sectors did not live up to expectations. After more than two years since the LED strategy was adopted, only one LED initiative was started. Several aspects had been singled out which caused the slow implementation, such as lack of public budget, unmotivated and unpunctual staff, and conflict of competencies between local and national public sector institutions. Successful LED needs private sector champions which are motivated to drive initiatives. So far, the regional council was incapable of finding champions for the initiatives and no-one from the private sector came forward to assume responsibility for a project.

(14) Cooperation was sub-optimal on all levels. The private sector did not participate in stakeholder workshops and meetings. That was also the case for Namibian institutions essential for the planning and implementation of climate change projects. It could even be observed that the CDM and LED consultants did not cooperate closely. None of the LED consultants interviewed prior to the project were familiar with CDM and the CDM consultants did not have much LED experience.

(15) The LED strategy project failed to include CDM projects because CDM was assumed to be too restrictive, too complex, too time consuming, and too cost intensive. Moreover, local stakeholders lack knowledge about CDM. The price of carbon credits is low and Namibia, as a non-Annex-I-country is not forced to reduce carbon emissions. Thus, there is no political incentive to foster mitigation projects in Namibia. The support from national CDM institutions for the Otjozondjupa project was non-existent.

8 Summary and conclusion

8.1 Purpose

In this chapter the study's major findings are outlined, its restrictions are explained and topics for additional research are highlighted.

8.2 Summary

Due to anthropogenic greenhouse gas emissions, average global temperatures have increased since the beginning of the industrialisation era. Compared to the 1980 to 1999 level, IPCC (2007b p. 13) forecasted that temperatures will likely have increased between 1.1 to 6.4°C till the end of the century. "New studies confirm that Africa is one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity" (IPCC 2007c, p. 13). In its National Policy on Climate Change MET (2011b, 13 ff.) stressed that the nation is considered to be extremely vulnerable because the livelihood of many Namibians depends on natural resources. To reduce the impact of climate change, UNFCCC (2010, p. 5) demanded to keep the increase of temperature below 2°C till the end of the century.

During the UN Conference on Environment and Development in Rio de Janeiro in 1992, the UN Framework Convention on Climate Change (UNFCCC) was negotiated. Based on UNFCCC, the Kyoto Protocol was passed by UNFCCC in 1997. In the protocol so-called Annex-I-Countries agreed to reduce their aggregated greenhouse gases by 5% below the 1990 level between 2008 and 2012. To achieve this target cost effectively, the Kyoto protocol provides several mechanisms, one of them is the Clean Development Mechanism (CDM). CDM allows Annex-I-Countries to invest in mitigation projects in developing countries. They can then "use the certified emission reductions [CER] accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reductions commitments" (UNFCCC, 1998, p. 19). At the same time, CDM investments must contribute to sustainable development in the CDM host countries.

UNFCCC highlighted "the need to promote equitable geographic distribution of clean development mechanism project activities at regional and sub-regional levels" (UNFCCC 2002, p. 20). Yet, according to FENHANN (2013), most of the CDM projects were implemented in fast growing economies, such as China, India, or Brazil. Because of the lack of greenhouse gas emissions or inadequate economic framework conditions, there are not many projects in Sub-Sahara Africa. Several initiatives (e.g. Nairobi Framework) tried to

promote CDM investments in Africa. Although the number of projects increased slightly, the ratio between African CDM projects and CDM projects worldwide stayed the same (see also chapter 2).

The aim of this study was to investigate if mitigation projects – in particular CDM projects – could be initiated by LED initiatives in developing countries. “LED means more than just economic growth. It is promoting participation and local dialogue, connecting people and their resources for better employment and a higher quality of life for both men and women.” (ILO 2013). LED is also used as an instrument by local governments in Namibia.

The research took place in Namibia. The author is not aware of any other study in this specific field of research.

In a first step the CDM potential, the institutional environment, and the economic framework conditions were investigated. In the literature consulted, these factors were seen to be crucial for CDM investments (see also chapter 5). In a second step the perceptions of LED stakeholders and the conditions with respect to the inclusion of mitigation projects in LED initiatives were investigated by means of quantitative and qualitative research methods. Furthermore, the author of this thesis, in cooperation with the local government of Otjozondjupa, initiated a real life case study. With 105,000 km^2, Otjozondjupa is the fourth largest region of Namibia. The regional council intended to develop an LED strategy for the region. As part of the strategy process, the CDM potential of the region was also to be studied. Projects with a socio-economic development potential were then to be included in the LED strategy. The regional government commissioned a firm of consultants with the development of the strategy and another one with the evaluation of the CDM potential.

The largest market for trading carbon credits is the EU ETS. For all projects registered after 2012, the EU (2013) only allows CERs of these projects to be traded at EU ETS if they come from projects registered in LDCs. Namibia is an upper middle income country and the trading of CERs gained in Namibia would not be permitted at EU ETS. The price of CERs also dropped enormously in recent years. Both factors make CDM implementations in Namibia unattractive. Thus, the focus of the research was extended from CDM to mitigation projects in general.

Quantitative data were captured during LED conferences and workshops. The data from 224 questionnaires were statistically evaluated. 28 face-to-face interviews and a focus group discussion with 20 participants were conducted to gather qualitative data. Data captured during observations and informal discussions and information gained through literature research were also used in the analysis process. The Grounded Theory approach was deployed to capture and analyse qualitative data.

As the field of research was new, the objective of the research was to discover, describe and explain new phenomena. To enhance the quality of the research results, methodological triangulation and data triangulation were deployed. Data were collected from five clearly distinguishable groups: chief executives of local governments, LED officers of towns and regions, Namibian LED consultants, councillors, and other LED stakeholders.

The research process was evolutionary. Thus, knowledge gained during the research could be used to adjust research methods and questions. However, this did not change the main focus of research.

8.3 Conclusion

In this chapter key messages are stated and conclusions with respect to the research question are drawn.

Mitigation projects in Namibia would not contribute considerably to employment generation.

According to UNEP (2007, p. 8 ff.), 2.3 million jobs were created in the renewable energy sector worldwide. An additional 4 million jobs were generated due to energy efficiency measures. Yet, mitigation projects assessed in this study will hardly create permanent employment or income opportunities. Solar products (solar home systems, solar water heaters), for example, are manufactured outside Namibia. Thus, new jobs are only created for installation and maintenance activities. However, the sustainable usage of encroacher bush for electricity production could be a potential job engine. Based on data from STEAG/TRANSWORLD CARGO (2013, p. 51 f.), encroacher bush could already be used economically in power stations. This would, however, require a mechanised harvesting of bush which would not offer considerable employment opportunities for the unskilled work force. Yet, upstream and downstream value chain activities, such as in the transport, construction, and service sector could have a positive impact on employment. Overall, in most of the literature researched, the impact on employment of mitigation projects was deemed rather minimal (see chapter 5). Yet, investments in renewable energy would supply electricity to off-grid households and help to reduce poverty related implications, such as insufficient access to information, health problems due to usage of paraffin for lighting, etc.

Stakeholders perceive the idea of initiating mitigation projects through LED positively.

About 92% of stakeholders perceived climate change as a threat to the sustainable development of their locality. The threat to environmental sustainability was perceived higher than to social or economic sustainable development. On a 5% significance level the observed difference was significant. In addition, LED officers and consultants tended to perceive the economic, social, and environmental development to be more threatened by climate change than chief executives and councillors.

Yet, about 85% of stakeholders also believed that climate change initiatives could foster economic development. The locality would benefit because of the development of new skills, the creation of jobs, and the necessity to come up with innovative ways to use readily available resources. Again, LED officers and LED consultants saw a higher development potential in mitigation and adaptation projects than councillors and chief executive officers.

Stakeholders welcomed the idea of integrating mitigation projects in LED initiatives. The majority of stakeholders believed that potential projects could be identified by a participative, bottom-up LED approach, that mitigation projects should be included in a LED strategy, and that the Namibian LED agency should actively support local governments with the implementation of mitigation projects. Only few stakeholders stated that mitigation should not be part of LED as it is too technical and stakeholders lack the necessary knowledge about mitigation. The majority of interviewed stakeholders were of the opinion that their knowledge about cultural, economic, and social circumstances should be taken into account for successfully planning and implementing projects. Moreover, a participative LED approach might increase acceptance of new technologies in a locality. According to stakeholders, the LED agency should facilitate linkages among local governments, national institutions and international and national private sector entities. The agency should also initiate pilot projects to demonstrate the feasibility of an initiative and assist in building respective capacities in local governments.

Local framework conditions do not stimulate investments in mitigation projects; LED initiatives could help to lower the barriers for investments.

Compared to other Sub-Saharan African countries Namibia has a business friendly environment. Most international business environment and governance indices show that Namibia is amongst the leading countries in Sub-Sahara Africa. According to stakeholders, the situation is totally different on the local level. They identified insufficient public budget and lack of public income, the absence of necessary infrastructure, the shortage of serviced land for businesses, the lack of finances for end users and businesses, the absence of a skilled

workforce, the missing interest of stakeholders to participate in LED, the insufficient coordination between national and local government bodies, the poor work ethics of local government staff, and the slow implementation of business friendly laws and regulations as main challenges for the local economy. In addition, local governments have different departments for environmental and economic development issues. According to stakeholders, the two units do not efficiently cooperate.

The poor framework conditions were also reflected in the LED strategy of Otjozondjupa. The unavailability of land for businesses, insufficient public services, and lack of skilled workforce were named as development challenges for the region. The lack of cooperation between national and local government bodies became obvious during the course of the strategy development process, too. The local government of Otjozondjupa invited the relevant national institutions to participate in the strategy development. Only a few took part but irregularly.

Many barriers for mitigation and CDM projects (see chapter 5) are due to poor economic framework conditions. Many mitigation challenges identified by local stakeholders are related to framework conditions such as lack of skilled people, lack of national support and lack of finances. By virtue of its function, LED is to address these challenges. This was also to improve the situation for mitigation projects. However, the strategy project of Otjozondjupa showed that the identified issues are not always addressed adequately by the local government. Two years after the adoption of the strategy by the regional council only one project - a social and economic development trust fund - to improve the financial situation for regional development initiatives was started. As part of their Corporate Social Responsibility (CSR) activities companies could contribute to the fund.

Mitigation project are perceived to aim at achieving environmental or climate change objectives.

Stakeholders believed that LED initiatives were to improve cooperation between the private and the public sector, generate employment and income opportunities, diversify the economy, reduce crime and alcohol and drug abuse, and promote new investments. On the other hand, mitigation initiatives were to increase the adaptive capacity of a locality, protect natural resources, provide a cleaner environment, reduce greenhouse gases, and improve the efficient use of available resources.

Initiatives defined in the LED strategy of Otjozondjupa were aimed at providing employment opportunities, reducing poverty, ensuring efficient public service, such as the provision of water and electricity, promoting the construction of necessary infrastructure, stimulating

regional key sectors, and providing skilled people for local businesses. Environmental or climate change objectives did not play a role. This was also the case in most of the 19 Namibian strategies investigated during the course of the research. Only one coastal town touched on climate change issues in the strategy.

The results of the literature research did also point to the fact that environmental sustainable development objectives do not play a major role in LED (see chapter 2). Against the background of a high unemployment rate and high income disparities the focus of LED will be on projects which have an immediate positive impact on social and economic issues. Although an LED officer stressed that „LED officers are looking for projects which generate employment, no matter what kind of projects", emission reduction initiatives are not considered because they are perceived to contribute to environmental and climate change objectives.

The elaborated project ideas do not sufficiently take into account the personal motives and experiences of stakeholders.

Based on the evaluation of mitigation project potentials by the author of this study, energy efficient biomass stoves, solar home systems, solar water heaters, CFLs, and small scale bush-to-energy implementations were identified as initiatives with some LED potential. The promotion of energy efficient biomass stoves, projects which avoid methane emissions from poultry farms, diesel-biomass hybrid power generators, and local charcoal production were chosen by the CDM consultants and the steering committee of the Otjozondjupa strategy development project as initiatives because they were assumed to have some LED and CDM potential. In the survey LED stakeholders were provided with a list of 15 mitigation projects which they had to rate with respect to their presumed economic development potential. All of the proposed projects were rated rather high. The promotion of energy efficient lighting systems, management of wild fires, setup of solar parks to provide electricity to off-gird settlements, and promotion of solar water pumps and solar home systems were perceived to have an especially high potential.

The author's evaluation was based on the assumption that projects were to contribute to LED objectives such as the improvement of the social and economic situation of a locality and a better access to electricity. Moreover, projects should be preferred which can be implemented quickly and have an impact beyond the scope of the actual project. The amount of emission reductions was not considered. The CDM consultant and the project steering committee looked at economic, social and environmental benefits. Additionally, the projects

were evaluated if they were eligible for CDM. Projects without any social or economic sustainable development impact, such as industrial projects were not considered at all.

Stakeholders prioritized mitigation projects depending on personal experiences, knowledge and motives and the presumed availability of human and financial resources to implement projects rather than on general economic development objectives and potential negative impacts of climate change. Stakeholders saw a potential for energy efficient lighting due to high electricity costs. Many stakeholders own small farms and wild fires annually threaten infrastructure and cattle. Thus, they are interested in a better management of wild fires. Most Namibian rivers are ephemeral streams. Thus, farmers use diesel pumps to pump up ground water. As the price of diesel increases, farmers are looking for more cost effective alternatives, such as solar water pumps. On the other hand, bush encroachment is perceived a liability and not a resource for energy production. Stakeholders still view debushing basically as an initiative which is to increase the productivity of farmland.

The complexity of CDM, insufficient financial means, and too little knowledge of CDM prevent the initiation of CDM projects through LED.

CDM projects are time and cost intensive and because of regulatory requirements very complex. There is only one CDM institution in Namibia, the DNA, which is inefficient and does not promote CDM. Besides, it is not known to local LED stakeholders. The local public sector does not have the financial means to invest in CDM projects or to promote them.

In literature on CDM, lack of knowledge was highlighted as one of the barriers for CDM implementations (see also chapter 5). A self-assessment by 224 LED stakeholders showed that the level of knowledge of international conventions, protocols, instruments is low in Namibia. As one stakeholder said, climate change “is not my field of expertise [and] I am speaking at an instinct level more than at a knowledge based level”. Only a few stakeholders had practical experience with climate change projects. However, these were initiated by national government or non-government organisations. The local level was only marginally involved. Only nine out of 224 stakeholders claimed to have gathered some experience with mitigation projects such as solar power installations, electrical demand side management or the promotion of windmills. Representatives of international and national private sector entities pointed out that due to this lack of knowledge and experience they had refrained from including local governments into discussions concerning their climate change project plans.

During the development of the Otjozondjupa strategy, it was observed that participation in workshops and general meetings depended very much on stakeholders’ knowledge about the topic or the economic sector discussed. Participation was comparatively low if the

discussion was on mitigation options while it was noticeably higher if economic sectors were debated where stakeholders were involved, such as agriculture and service.

Based on the analysis of interviews, it could be concluded that the level of knowledge is even lower than suggested by the self-assessment. Many of the interviewees emphasised that they had heard of climate change. But their answers to conventions, protocols, and instruments were often either vague or wrong, e.g. people mixed up mitigation with adaptation whereas CDM was almost unknown.

The private sector and public sector do not live up to stakeholders` expectations

LED requires motivated and committed representatives of the private sector – so called champions – who possess the technical and management expertise to plan and implement projects. That is also true for mitigation and CDM projects. This requires, however, that the private and public sector cooperate well. Yet, stakeholders indicated in the survey the poor relationship between public and private sector as one of the major challenges in LED and for mitigation projects.

This challenge became obvious during the strategy development in Otjozondjupa, too. The strategy was adopted two years ago but up to date only one LED project was started but none of the selected mitigation projects. The regional council justified the sluggish implementation with the disinterest of the private sector to actively participate in the implementation.

On the other hand, the majority of stakeholders considered the government – national and local – responsible for mitigation projects. Stakeholders wanted the national and local public sector to play a leading role in implementing and operating mitigation projects because the public sector is in charge of achieving sustainable development objectives, the national power supplier is a government owned enterprise and a monopolist, the renewable energy sector suffers from market failure, and the government has the mandate to pass laws and regulations to make investments in alternative energies or energy saving initiatives more attractive. However, as stakeholders believed that local governments were not familiar with climate change strategies and instruments and there is no sufficient public budget to promote and finance mitigation projects they relied more on in the expertise of the private sector.

Private companies and households have already invested in viable alternative energy solutions. The investments were not triggered by LED initiatives or motivated by CDM but the decision to invest was based on cost effective analyses. Projects such as the promotion of energy efficient biomass stoves or the provision of electricity to off-grid settlements through

solar power parks have immediate social and economic implications. They might not be financially viable but it is the mandate of the government to promote technologies important for the national economy, to foster social and economic development and to better of the livelihood of people. If the private sector cannot be won to invest in such kind of projects the government must assume the role of an investor.

There are no restrictions to use ODA to implement mitigation projects. Some projects were already implemented with the support of multi- or bilateral development aid, such as the photovoltaic park in Tsumkwe or the wood gasifier in the Kunene region. Yet, these projects were initiated top-down by the national government and non-governmental organisations and local institutions were only marginally involved. Within certain limits, even CDM projects could make use of ODA (see chapter 5).

The initiation of mitigation projects through LED will be less challenging if the energy sector becomes a focus of LED strategies.

Due to the sectorial approach of the Otjozondjupa strategy development initiative, mitigation projects were largely ignored. Climate change projects were not discussed in any of the sector working groups. Because the strategy did not focus on the energy sector, no working group was set up. Although energy costs and the insufficient access to electricity were seen as challenges for the development of the agricultural, the tourism, and the manufacturing sector, other challenges were deemed more critical, such as the availability of land for businesses, lack of skilled labour force, etc. Thus, in the working groups, the usage of alternative energy sources or energy efficiency measures was not debated. Mitigation and CDM projects were discussed separately and included in the LED strategy as an additional chapter but not integrated in the individual sector strategies. This sectorial approach was also observed in other LED strategies of Namibian local governments. In the majority, they did not focus on the energy sector either.

Final statements

Initiating CDM projects as part of LED in Namibia is hardly an option because of the complexity of the CDM process, low amount of greenhouse gas emissions, market situation for trading emission rights (restrictions, low price of CERs), high transaction costs, insufficient local public budget, poor institutional support structure, and lack of CDM knowledge on local level.

Yet, according to stakeholders, mitigation projects in general have a chance to be integrated into LED if the projects support LED objectives. As mitigation projects do not contribute much to the generation of employment opportunities in Namibia, these initiatives should foremost aim at improving access to electricity and alleviating poverty-related ramifications. This requires, however, that LED strategies also cover the energy sector.

Moreover, the probability of using climate change mitigation potentials in LED could be increased if local governments were willing and capacitated to initiate mitigation projects, if national and local public institutions cooperated, if national and local economic framework conditions were improved so as to attract more private investments, and if personal experiences and interest of stakeholders were considered during the planning process

LED does not focus on greenhouse gas emission reduction. If a project does not reduce enough emissions to justify the lengthy and costly CDM process, it might still contribute to LED objectives and it might be worthwhile to implement it. If so, the project would also contribute to the reduction of greenhouse gas emissions. With a sole focus on CDM, these opportunities for mitigating climate change impacts would be sacrificed. There are no restrictions to use multi- or bilateral development aid to study and implement these potentials.

Different local government institutions and departments are in charge of climate change programmes and LED programmes. The cooperation between these entities or programmes is rather weak. As LED and climate change programmes are often faced by the same business environment related challenges, stronger linkages would be of mutual benefit.

8.4 Limitations

This thesis is to provide a first in-sight into the topic. An all-encompassing research would go beyond its scope, in particular with respect to finances, time requirements and human resources. Thus, the following limitations have to be taken into account when reading the study:

- The private sector was not fully considered. The quantitative data for the research were collected during LED conferences and workshops which in the majority were attended by staff from local governments, national institutions, community development organisations and NGOs. In order to include the private sector,

representatives of international and national companies of the energy sector were interviewed.

- Because of financial and time restrictions only one case study was conducted. However, due to similar conditions in other regions of Namibia, the results of additional case studies would be most probably identical.
- Statistical tests were based on a relatively small and non-representative sample size (see chapter 3 and 4). Due to the small sample size, cases with missing data were not deleted but stochastic methods were used instead to impute missing data. Qualitative data were used to back up the results of statistical calculations.

8.5 Further research

As mentioned before, this thesis is to provide an in-sight into the topic. Therefore, many open questions remain which might become the subject of further research. Some will be mentioned here. The results of the study were only based on data from Namibia. Thus, generalising the results is only partly possible. Studies in other countries would need to be conducted to either support or refute the results of this study. In-depth studies of macro- and microeconomic impacts and benefits of potential mitigation projects would on the one hand help to promote potential mitigation projects and on the other hand would provide public and private sector entities with data to make informed decisions. In this study, the possibility to initiate mitigation and CDM projects through LED was investigated. Other development initiatives on the local level might be better suited to promote mitigation projects, such as rural development programmes which have a stronger focus on social issues and poverty alleviation. As described above, different institutions or programmes are mandated to support economic development and climate change initiatives. A stronger cooperation between their areas of competence would be of mutual benefit. Further research might concentrate on this issue. A concept of such a cooperative network, including the challenges that could arise in particular at institutional level, could become a further topic of research.

9 Zusammenfassung und Schlussfolgerung

9.1 Absicht des Kapitels

In diesem Kapitel werden Verlauf, Struktur und Ergebnisse der vorliegenden Arbeit zusammenfassend dargestellt. Zugleich werden die Ergebnisse der Untersuchung bewertet und in einen allgemeinen Zusammenhang gestellt werden. Darüber hinaus wird noch einmal auf die Grenzen der Untersuchung und auf die Notwendigkeit weiterführender Forschungsarbeit hingewiesen.

9.2 Zusammenfassung der Arbeit

Aufgrund anthropogener Treibhausgasemissionen ist die globale Durchschnittstemperatur seit Beginn der Industrialisierung gestiegen. IPCC (2007c, p. 13) sagt gegenüber dem Zeitraum von 1980 bis 1999 eine weitere Erhöhung der Temperatur von 1,1 bis 6,6°C bis zum Ende des 21. Jahrhunderts voraus. Von dieser Prognose wären besonders Entwicklungsländer betroffen, deren Strukturen im Gegensatz zu entwickelten Ländern noch besonders anfällig gegenüber inneren und äußeren negativen Einflüssen sind und deren Anpassungsfähigkeit in Bezug auf den Klimawandel gering sind. In der namibischen Klimastrategie führt MET (2011b, 13 ff.) aus, dass Namibia extrem gefährdet ist, da die überwiegende Mehrheit der Bevölkerung von natürlichen Ressourcen abhängt. Um den Auswirkungen des Klimawandels entgegenzuwirken, hat sich UNFCCC (2010, p. 5) nach langen Verhandlungen das Ziel gesetzt, den Temperaturanstieg bis zum Ende des 21. Jahrhunderts auf 2°C gegenüber der vorindustriellen Zeit zu begrenzen.

Auf der UN-Konferenz für Umwelt und Entwicklung 1992 in Rio de Janeiro wurde auch die Klimarahmenkonvention verabschiedet. Darauf aufbauend wurde Ende 1997 das sogenannte Kyoto-Protokoll erarbeitet. Darin werden Annex-I-Länder – dabei handelt es sich im Wesentlichen um entwickelte Länder bzw. Industrieländer – verpflichtet, zwischen 2008 und 2012 ihre kombinierten Treibhausgasemissionen um mindestens 5% unter das Niveau von 1990 zu bringen. Um dieses Ziel zu erreichen, stehen den Annex-I-Staaten verschiedene, im Protokoll definierte, Instrumente zur Verfügung. Ein Instrument ist der „Mechanismus für umweltverträgliche Entwicklung“ (Clean Development Mechanism, CDM), der es Annex-I-Ländern erlaubt, kostengünstig Treibhausgasemissionen in Entwicklungsländern einzusparen. Die erzielten Reduktionen können gemäß UNFCCC (1998, p. 19) auf die eigenen Ziele angerechnet bzw. die Emissionsgutschriften (Certified Emission Reductions, CER) gehandelt werden. Gleichzeitig wird damit beabsichtigt,

Investitionen in Entwicklungsländern zu fördern und durch den Transfer von Technologie und Wissen einen Beitrag zur nachhaltigen Entwicklung in diesen Ländern zu leisten.

Die Absicht von UNFCCC (2002, p. 20) war es, das Instrument CDM flächendeckend in allen Entwicklungsländern zum Einsatz zu bringen. Nach FENHANN (2013) wurde jedoch CDM besonders in aufstrebenden Wirtschaftsmächten wie China, Indien, Brasilien eingesetzt. Länder in Sub-Sahara Afrika kamen kaum in den Genuss von CDM, weil aufgrund der geringen Industrialisierung das Potential zur Treibhausgasreduktion fehlte oder die wirtschaftlichen Rahmenbedingungen unzureichend waren. In den letzten Jahren gab es einige internationale Initiativen (z. B. Nairobi Framework), um die Verteilung der CDM-Projekte zugunsten Sub-Sahara Afrikas zu ändern, jedoch ohne durchschlagenden Erfolg. Zwar wurden durch diese Bemühungen mehr Projekte ins Leben gerufen, aber der prozentuale Anteil Sub-Sahara Afrikas an weltweiten CDM-Projekten blieb weitgehend gleich (vgl. Kapitel 3).

Diese Arbeit geht deshalb der Frage nach, ob CDM-Projekte auch durch lokale Wirtschaftsförderungsansätze in Entwicklungsländern initiiert werden können. Die Frage wurde am Beispiel Namibias untersucht. Es wurden keine bestehenden Forschungsarbeiten zu diesem Thema gefunden.

Lokale Wirtschaftsförderung ist ein Ansatz, der in einem definierten Gebiet wirtschaftliche Entwicklung fördern soll, und erfordert die aktive Mitwirkung der öffentlichen Hand, der Privatwirtschaft und der Zivilgesellschaft. Die wirtschaftlichen Entwicklungsziele und -ansätze sind nicht von der Nationalregierung vorgegeben, sondern werden lokal definiert und initiiert. Das Hauptziel lokaler Wirtschaftsförderung ist die nachhaltige Verbesserung der Lebensbedingungen der Bewohner eines Gebietes durch die Schaffung von Arbeitsplätzen und Einkommensmöglichkeiten. Lokale Wirtschaftsförderung wird auch in Namibia als Instrument für die wirtschaftliche und soziale Entwicklung von Städten und Regionen genutzt.

Zur Beantwortung der Forschungsfrage wurden zuerst das CDM-Potential, die institutionellen Voraussetzungen und die wirtschaftlichen Rahmenbedingungen, die in der Literatur (vgl. Kapitel 5) als essenziell für die Nutzung von CDM angesehen werden, in Bezug auf Namibia untersucht. Danach wurde die Haltung von Schlüsselpersonen der kommunalen und regionalen Wirtschaftsförderung bezüglich der Einbindung von Mitigations- bzw. CDM-Projekten in lokale Wirtschaftsförderung mit Hilfe von quantitativen und qualitativen Untersuchungsmethoden erforscht. Darüber hinaus initiierte der Verfasser dieser wissenschaftlichen Arbeit in Zusammenarbeit mit der Regionalregierung von Otjozondjupa eine Fallstudie. In der Region Otjozondjupa, der mit 105.000 km^2 viertgrößten Region Namibias, sollte eine lokale Wirtschaftsförderungsstrategie entwickelt werden. Als Teil der

Strategieentwicklung sollten auch das CDM-Potential der Region eingeschätzt, CDM-Projektideen entwickelt und deren nachhaltige soziale und wirtschaftliche Auswirkungen beurteilt werden. Erfolg versprechende Projekte sollten anschließend in die Strategie integriert werden. Die Regionalverwaltung beauftragte Berater der lokalen Wirtschaftsförderung und CDM-Berater zur Erstellung der Strategie.

Wenn CDM- Projekte nach 2013 registriert werden, akzeptiert der europäische Emissionshandel nur noch Gutschriften von Projekten aus Least Developed Countries. Da aber der europäische Emissionshandel der weltweit größte Emissionsrechtehandel und Namibia kein Least Developed Country ist und gleichzeitig der Preis für Emissionsgutschriften stark fiel, verringert das die Chancen auf attraktive CDM-Projekte in Namibia. Deshalb wurde im Verlauf der Untersuchung die Fragestellung erweitert, d.h., es wurden Mitigationsprojekte im Allgemeinen betrachtet.

Im Rahmen von Konferenzen und Seminaren zu lokaler Wirtschaftsförderung wurden quantitative Daten über einen Fragebogen erhoben. Insgesamt wurden 224 Fragebögen mit statistischen Methoden ausgewertet. Für die qualitative Forschung wurden 28 persönliche Interviews und eine Zielgruppendiskussion mit 20 Teilnehmern durchgeführt. Die in zahlreichen informellen Gesprächen gewonnenen Einsichten flossen ebenfalls in die Analyse mit ein. Der qualitativen Forschung lag die „Gegenstandsbezogene Theorie“ (Grounded Theory) zugrunde.

Da es sich um ein neues Forschungsfeld handelt, war das Ziel der Arbeit, neue Phänomene zu entdecken, zu beschreiben und zu erklären. Dem Prinzip der Triangulation folgend, wurden zum einen verschiedene Forschungsmethoden auf den Untersuchungsgegenstand angewandt und zum anderen Daten von unterschiedlichen, klar abgrenzbaren Personengruppen erhoben. Dabei wurden zwischen folgenden Gruppen unterschieden: Geschäftsführer der Stadt- und Regionalverwaltung, Wirtschaftsförderer der Gemeinden und Regionen, namibische Berater in der lokalen Wirtschaftsförderung, kommunale und regionale Ratsmitglieder, andere Personen innerhalb der lokalen Wirtschaftsförderung. Sie werden im Nachfolgenden Akteure genannt.

Der Forschungsprozess war evolutionär, d.h., die während der Forschungstätigkeit gewonnenen Erkenntnisse machten es im Einzelfall erforderlich, Methoden oder Forschungsfragen im Detail anzupassen. Dabei wurde der Untersuchungsgegenstand nicht verändert.

9.3 Schlussfolgerung

Im Folgenden werden die Einzelerkenntnisse der Arbeit zu Kernaussagen sowie zu einem abschließenden Fazit verdichtet.

Dass Investitionen in Mitigationsprojekte einen starken Motor für die Schaffung von Arbeitsplätzen darstellen, kann für Namibia nicht bestätigt werden.

UNEP (2007, p. 8 ff.) führt aus, das weltweit mehr als 2,3 Millionen Arbeitsplätze im Bereich alternativer Energien geschaffen wurden. Zusätzlich entstanden 4 Millionen Arbeitsplätze aufgrund von Energieeinsparmaßnahmen. Die in dieser Arbeit untersuchten namibischen Projekte schaffen kaum Arbeitsplätze und zusätzliches Einkommen. Da Solarprodukte im Ausland gefertigt werden, entstehen aufgrund der geringen Nachfrage nur Arbeitsplätze beim Einbau und bei der Wartung. Ein möglicher Beschäftigungsmotor könnte die nachhaltige Nutzung von Busch zur Stromgewinnung sein. Basierend auf den Daten einer Studie von STEAG/TRANSWORLD CARGO (2013, p. 51 f.) ist eine wirtschaftliche Nutzung im Kraftwerksbetrieb bereits möglich. Sie würde aber eine mechanisierte „Ernte“ des Busches erfordern, die kaum Arbeitsplätze für ungelernte Arbeitskräfte schaffen würde. Jedoch könnte die Nutzung des Busches Beschäftigungswirkungen in vor- und nachgelagerten Sektoren, wie zum Beispiel dem Transport-, Bau- und Dienstleistungssektor, zur Folge haben. Insgesamt wurde aber in den meisten Studien (vgl. Kapitel 5) das Potential für die Schaffung von Arbeitsplätzen durch Mitigationsprojekte nicht sehr hoch bewertet. Dennoch könnten Investitionen in alternative Energiequellen die flächendeckende Versorgung der Bevölkerung mit Strom fördern und damit einen Beitrag zur Minderung von armutsbedingten Beeinträchtigungen (z. B. keinen Zugang zu Informationsquellen, Gesundheitsprobleme durch Rauch von Petroleumlampen) haben.

Die Akteure der lokalen Wirtschaftsförderung stehen der Idee, Mitigationsprojekte durch lokale Wirtschaftsförderung zu initiieren, positiv gegenüber.

Annähernd 92% der befragten Akteure sahen im Klimawandel eine Bedrohung für die nachhaltige Entwicklung ihrer Kommune oder Region. Die Bedrohung der Umwelt wurde dabei von allen Akteuren besonders hoch eingeschätzt. Gegenüber der Bedrohung der wirtschaftlichen und sozialen Entwicklung konnte auf der Basis eines Signifikanzniveaus von 5% ein statistisch signifikanter Unterschied festgestellt werden. Ein Vergleich der Einschätzungen unterschiedlicher Akteure hat jedoch gezeigt, dass lokale Wirtschaftsförderer und Berater tendenziell ein höheres Risiko für sowohl wirtschaftliche,

soziale als auch ökologische nachhaltige Entwicklung sahen als Ratsmitglieder und Geschäftsführer der Kommunen und Regionen.

Rund 85% der Akteure sahen in klimarelevanten Projekten aber auch ein wirtschaftliches Entwicklungspotential insbesondere für die Entwicklung neuer Berufsfelder, die Schaffung von Arbeitsplätzen, für Armutsreduzierung und Innovationsförderung. Wirtschaftsförderer und Berater sahen tendenziell ein höheres Potential für Mitigation und Adaption als Ratsmitglieder und Geschäftsführer.

Zudem wurde überwiegend die Annahme vertreten, dass lokale Wirtschaftsförderung und ihre Institutionen geeignet sind, um Mitigationsprojekte zu initiieren bzw. zu unterstützen. Die Mehrzahl der an der Umfrage beteiligten Akteure glaubte, dass potentielle Mitigationsprojekte durch partizipative, „bottom-up“ Wirtschaftsförderungsansätze gefördert werden könnten, dass diese Projekte in lokale Wirtschaftsförderungsstrategien eingebunden werden sollten und dass die namibische lokale Wirtschaftsförderungsagentur Lokalverwaltungen aktiv bei der Umsetzung von Mitigationsprojekten unterstützen sollte. Einige der Akteure argumentierten, dass das Thema Mitigation für lokale Wirtschaftsförderung „zu technisch“ sei und dass aufgrund des geringen Kenntnisstandes der Akteure lokale Wirtschaftsförderung nicht das geeignete Instrument wäre, um Mitigationsprojekte zu initiieren. Die Mehrzahl der interviewten Akteure war der Meinung, dass die vorhandenen Kenntnisse der lokalen Bevölkerung zu lokalen, kulturellen, wirtschaftlichen und sozialen Umstände eine gute Voraussetzung für die erfolgreiche Planung und Implementierung von Projekten seien. Die lokale Bevölkerung wisse, was am besten für sie sei. Darüber hinaus könnte man durch den partizipativen Wirtschaftsförderungsansatz eher die Bevölkerung für ein Projekt gewinnen. Es wurde auch hervorgehoben, dass durch eine solche Vorgehensweise die Akzeptanz von neuen Technologien in einer Kommune oder Region erhöht werden könnte. Die lokale Wirtschaftsförderungsagentur wurde von den Akteuren nicht als technischer Dienstleister für Mitigationsprojekte gesehen, sondern als Verbindungsglied zwischen Lokalverwaltungen, nationalen Behörden und der internationalen und nationalen Privatindustrie. Sie könnte auch Pilot- bzw. Vorzeigeprojekte initiieren und zum Aufbau von entsprechenden Kapazitäten in den Lokalverwaltungen beitragen.

Die wirtschaftlichen Rahmenbedingungen auf lokaler Ebene sind nicht investitionsfördernd für Mitigationsprojekte; lokale Wirtschaftsförderung trägt zum Abbau der Hürden für Mitigationsprojekte mit bei.

Die Untersuchung der namibischen Rahmenbedingungen anhand internationaler Indices und der Vergleich mit anderen afrikanischen Ländern hat für Namibia ein eher positives Bild ergeben. Nach Meinung der Akteure sieht dies auf lokaler und regionaler Ebene grundlegend anders aus. Sie identifizierten als besondere Herausforderungen das geringe öffentliche Budget und die ungenügenden Einkommensmöglichkeiten der Kommunen und Regionen, um Investitionen zur Verbesserung der wirtschaftlichen Rahmenbedingungen zu tätigen. Dies zeige sich unter anderem in unzureichender Infrastruktur oder dem Mangel an erschlossenem Land. Weitere Herausforderungen seien ungenügend ausgebildete Fachkräfte und das Fehlen von adäquaten Finanzdienstleistungen für Kleinunternehmen. Zu den schlechten Rahmenbedingungen kommt noch die unzureichende Zusammenarbeit zwischen Privatsektor und öffentlicher Hand hinzu, die sich darin äußert, dass der Privatsektor wenig Interesse hat, bei kommunalen und regionalen Wirtschaftsförderungsinitiativen aktiv mitzuwirken. Einige der befragten Akteure nannten die mangelnde Abstimmung bzw. das Kompetenzgerangel zwischen nationalen und regionalen Behörden, die schlechte Arbeitsmoral der Mitarbeiter in lokalen Verwaltungen sowie die zögerliche Umsetzung von Vorschriften als weitere Belege für ein schlechtes Geschäftsklima. Außerdem sind die Mandate für Umwelt und Klima sowie Wirtschaftsförderung in Lokalverwaltungen unterschiedlichen Abteilungen zugeordnet und eine Zusammenarbeit findet nach Auskunft der Akteure selbst dort nur unzureichend statt.

Die schlechten lokalen Rahmenbedingungen spiegelten sich auch in der Beschreibung der sektoralen Herausforderungen in der Wirtschaftsförderungsstrategie von Otjozondjupa wider. So wurden auch dort beispielsweise die begrenzte Verfügbarkeit von erschlossenem Land, schlechte öffentliche Dienstleistungen und das Fehlen von Fachkräften als Hindernisse für wirtschaftliche Entwicklung genannt. Die unzureichende Kooperation zwischen nationalen und lokalen Stellen wurde während der Strategieentwicklung deutlich. Wichtige nationale Behörden waren bei der Entwicklung der Mitigationsprojekte nicht eingebunden, obwohl sie hierzu von der Regionalregierung aufgefordert wurden.

Viele der in der Literatur genannten Hürden für Mitigations- bzw. CDM-Projekte (vgl. Kapitel 2) beruhen auf schlechten wirtschaftlichen Rahmenbedingungen. Auch die von den Akteuren der lokalen Wirtschaftsförderung genannten Herausforderungen für Mitigationsprojekte beziehen sich auf schlechte allgemeine wirtschaftliche Rahmenbedingungen, wie zum Beispiel der schon mehrmals erwähnte Mangel an Fachkräften, das Fehlen nationaler Unterstützung oder unzureichende öffentliche Haushaltsmittel. Diese könnten durch nationale und lokale Wirtschaftsförderungsanstrengungen mindestens teilweise gelöst

werden. Leider hat das Beispiel Otjozondjupa gezeigt, dass die Probleme nicht immer mit dem nötigen Willen in Angriff genommen werden. Nach Annahme der Strategie durch die Regionalverwaltung wurde innerhalb von zwei Jahren nur ein Projekt zur Verbesserung der Rahmenbedingungen initiiert. Dabei handelt es sich um die geplante Einrichtung eines regionalen Entwicklungsfonds, in den lokale Unternehmen im Rahmen ihrer Corporate Social Responsibility (CSR) Aktivitäten einzahlen können.

Mitigationprojekte werden mit Umwelt- bzw. Klimazielen assoziiert, aber diese spielen in der lokalen Wirtschaftsförderung keine Rolle.

Auf die Frage, mit welchen Zielen sie Mitigations- und Wirtschaftsförderungsprojekte verbinden, antworteten die Akteure, dass lokale Wirtschaftsförderungsprogramme insbesondere die Kooperation zwischen Privatsektor und der öffentlichen Hand verbessern, Arbeitsplätze und Einkommen schaffen, die Wirtschaft diversifizieren, Kriminalität und den Missbrauch von Alkohol und Drogen bekämpfen und Neuinvestitionen fördern sollten. Demgegenüber glaubten sie, dass Mitigationsprojekte eher die Kommune oder Region gegenüber den Auswirkungen des Klimawandels stärken, natürliche Ressourcen schützen, eine sauberere Umwelt erzielen, Treibhausgase reduzieren und eine effizientere Nutzung vorhandener Ressourcen ermöglichen sollten.

Die in der Fallstudie betrachtete Wirtschaftsförderungsstrategie von Otjozondjupa soll Arbeitsplätze schaffen und Armut verringern, sowie öffentliche Dienstleistungen sicherstellen, wie zum Beispiel die Versorgung der Bevölkerung mit bezahlbarer Elektrizität oder Wasser, den Aufbau von notwendiger Infrastruktur, und regionale wirtschaftliche Schlüsselsektoren fördern und die für Unternehmen notwendigen Fachkräfte bereitstellen. Wie bei 19 anderen untersuchten lokalen Wirtschaftsförderungsstrategien in Namibia, spielten Ziele des Klimawandels auch hier keine große Rolle.

Obwohl lokale Wirtschaftsförderung auf eine nachhaltige Entwicklung zielt, spielten Umweltziele in der lokalen Wirtschaftsförderung eine untergeordnete Rolle. Dieser Umstand spiegelt sich auch in der Literatur wider (vgl. Kapitel 2). Die Literaturrecherche ergab nur sehr wenige ökologische Entwicklungsziele für lokale Wirtschaftsförderung. Besonders vor dem Hintergrund einer extrem hohen Arbeitslosigkeit und enormen Einkommensunterschieden wird der Fokus von lokaler Wirtschaftsförderung in Namibia auch in Zukunft überwiegend auf Projekten liegen, die soziale und wirtschaftliche Verbesserungen versprechen. Der Wirtschaftsförderer einer Kommune betonte, dass „LED officers are looking for projects which generate employment, no matter what kind of projects". Initiativen

zur Reduzierung von Treibhausgasen werden aber eher mit Umwelt- bzw. Klimazielen in Verbindung gebracht.

Die erarbeiteten Projektideen berücksichtigen nicht den Erfahrungshorizont und die Interessen der Akteure der lokalen Wirtschaftsförderung.

Bei der theoretischen Untersuchung der Wirtschaftsentwicklungspotentiale für Mitigationsprojekte kamen energieeffiziente Holzöfen, solare Photovoltaik-Kleinanlagen, Solaranlagen für Warmwasseraufbereitung, Energiesparlampen und kleinere Biomassekraftwerke in die engere Wahl. Im Rahmen des Otjozondjupa-Strategieprojektes wurden von der Projektsteuerungsgruppe und den beauftragten CDM-Beratern folgende Projekte ausgewählt: energieeffiziente Holzöfen, die Verringerung von Methanemissionen in gewerblichen Hühnerhöfen, die Förderung von Diesel-Biomasse-Hybridanlagen zur Stromerzeugung und die Unterstützung der lokalen Holzkohleproduktion. In einer Umfrage wurden den Akteuren der lokalen Wirtschaftsförderung 15 potentielle Mitigationsprojekte zur Bewertung vorgelegt. Insgesamt wurde das wirtschaftliche Entwicklungspotential für alle Projekte hoch eingeschätzt. Die Akteure sahen aber ein besonderes lokales Entwicklungspotential in energieeffizienten Beleuchtungssystemen, in der besseren Bekämpfung von Buschbränden, in der Versorgung von nicht ans Leitungsnetz angeschlossenen Siedlungen mit Strom durch den Bau von lokalen Photovoltaikparks, in der Vermarktung von solar betriebenen Wasserpumpen in ländlichen Gebieten und in der Förderung von kleinen Photovoltaikanlagen für bedürftige Haushalte.

Da es das Ziel der Arbeit war, die Möglichkeit der Initiierung von Mitigationsprojekten durch lokale Wirtschaftsförderung zu untersuchen, wurde bei der Beurteilung der Potentiale durch den Verfasser der Arbeit insbesondere berücksichtigt, wie sich Projekte auf die soziale und wirtschaftliche Entwicklung einer Örtlichkeit und die Versorgung mit Elektrizität auswirken. Des Weiteren sollten die Projekte schnell und kostengünstig umgesetzt werden können und katalytische Wirkungen jenseits der eigentlichen Projektgrenzen entfalten. Bei der Beurteilung der im Rahmen der Strategieentwicklung definierten Mitigationsprojekte durch die Berater und das Projektsteuerungsteam wurden auch ökologische und klimarelevante Aspekte betrachtet. Ein zusätzlicher Faktor war die Eignung für CDM. Projekte, die keinen hohen wirtschaftlichen Entwicklungswert versprachen, wurden nicht berücksichtigt.

Qualitative Untersuchungen ergaben jedoch, dass Akteure der lokalen Wirtschaftsförderung die Auswahl und Priorisierung von Mitigationsprojekten stark abhängig machten von eigenen Belangen und Erfahrungen und den finanziellen und personellen Möglichkeiten einer Region oder Kommune solche Projekte umzusetzen und weniger von allgemeinen

Wirtschaftsförderungsinteressen oder möglichen Gefahren des Klimawandels. Der Preis für Elektrizität steigt, also möchte man energieeffiziente Beleuchtungssysteme. Viele der Befragten unterhalten auch kleine Farmen und sind jedes Jahr von Buschfeuern betroffen, die Weideflächen und Infrastruktur zerstören und Vieh töten, also möchte man Maßnahmen einleiten, die dies verhindern. Da es in Namibia so gut wie kein Oberflächenwasser gibt, sind die Farmen auf Grundwasser angewiesen, das über dieselbetriebene Pumpen gefördert werden muss. Deren Betriebskosten sind an den steigenden Ölpreis gekoppelt, also möchte man solarbetriebene Pumpen gefördert sehen. Die Verbuschung von landwirtschaftlichen Flächen wird als Problem gesehen und nicht als mögliche Ressource für Energiegewinnung. Die Akteure verstehen unter Entbuschung in erster Linie die Verbesserung der Farmproduktivität.

Die Komplexität von CDM, unzureichende finanzielle Mittel und das fehlende Fachwissen bezüglich CDM verhindern die Initiierung von CDM-Projekten durch lokale Wirtschaftsförderung.

CDM-Projekte sind zeit- und kostenintensiv und aufgrund der UNFCCC-Regeln und Prozesse in ihrer Anwendung kompliziert. Die einzige nationale CDM-Institution in Namibia, die DNA, ist ineffizient und auf lokaler Ebene weitgehend unbekannt. Sie unterstützt auch nicht die lokalen Verwaltungen. Darüber hinaus verfügt der lokale öffentliche Haushalt über zu wenig finanzielle Mittel, um CDM-Projekte anzustoßen.

In der Literatur werden fehlende Kenntnisse über CDM oft als Hürde bei der Umsetzung von CDM-Projekten genannt (vgl. Kapitel 5). Der Kenntnisstand der Akteure bezüglich internationaler Konventionen, Protokolle und Instrumente des Klimaschutzes und der Klimaanpassung war erwartungsgemäß auch in Namibia gering. Wie ein Akteur zugab: „It is not my field of expertise [and] I am speaking at an instinct level more than at a knowledge based level". Darüber hinaus hatten nur sehr wenige der Akteure praktische Erfahrung mit Klimaprojekten gesammelt. Diese wurden zudem von nationalen Instituten oder nichtstaatlichen Organisationen initiiert, und die lokalen Behörden waren nur marginal beteiligt. Nur neun von 224 Personen behaupteten, in Mitigationsprojekte eingebunden gewesen zu sein (e.g. Solarkraftwerk, Demand Side Management, Förderung der Nutzung von Windkraft). Repräsentanten des Privatsektors gaben diese fehlenden Kenntnisse und Erfahrungen als Grund an, warum der Privatsektor sich bisher nicht an lokale Verwaltungen wandte, wenn er in Mitigationsprojekte investieren wollte.

Auch während der Erarbeitung der Otjozondjupa-Strategie war die Teilnahme an Diskussionen von den Erfahrungen und dem Kenntnisstand der Teilnehmer geprägt. Die

meisten der Akteure sind im öffentlichen Sektor tätig und viele von ihnen besitzen, wie gesagt, auch kleine Farmen. Deshalb wurde über den Landwirtschaftssektor und den öffentlichen Sektor angeregt diskutiert, während die Diskussion über Mitigations- und CDM Projekte eher schleppend verlief.

Die Analyse der Interviews lassen den Schluss zu, dass die Kenntnisse tendenziell noch geringer waren, als in der Umfrage angegeben. Die interviewten Akteure erklärten, schon vom Klimawandel gehört zu haben, aber die Antworten zu Instrumenten, Konventionen, etc. waren eher vage. CDM war weitgehend unbekannt. Oft waren die Antworten auch falsch, so wurden z.B. Adaptationsprojekte als Beispiele für Mitigationsprojekte genannt.

Der Privatsektor und der lokale öffentliche Sektor nehmen ihre Mandate nicht wahr und erfüllen nicht die in sie gesetzten Erwartungen.

Gemäß der Theorie brauchen lokale Wirtschaftsförderungsinitiativen motivierte und engagierte Repräsentanten des Privatsektor – sogenannte Champions -, die mit ihrem Management- und Fachwissen Projekte vorantreiben können. Das gilt insbesondere für Mitigations- und CDM- Projekte.

In der Umfrage heben die Akteure der lokalen Wirtschaftsförderung besonders das geringe Interesse des Privatsektors, sich an gemeinsamen LED Initiativen zu beteiligen, und die schlechten Beziehungen zwischen Privatsektor und öffentlicher Hand als Herausforderung für lokale Wirtschaftsförderung hervor. Das fehlende Interesse des Privatsektors wurde als das Hauptproblem bei der Umsetzung von Mitigationsprojekten gesehen.

Dieses Problem war auch bei der Strategieentwicklung in Otjozondjupa augenfällig. Obwohl die Strategie schon vor zwei Jahren beschlossen wurde, wurde bisher erst ein Wirtschaftsförderungsprojekt, aber noch keins der beschlossenen Mitigationsprojekte in Angriff genommen. Die zögerliche Implementierung wurde damit begründet, dass es bisher nicht gelang, einen „Champion“ aus dem Privatsektor für ein Projekt zu gewinnen.

Im Widerspruch zu der oben gesehenen Führungsrolle des Privatsektors bei Mitigationsprojekten stellte sich aber bei der Umfrage heraus, dass die überwiegende Mehrzahl der befragten Akteure für Mitigationsprojekte die nationalen und lokalen Regierungen in der Pflicht sahen. Es war überraschend, dass die meisten Befragten den öffentlichen Sektor bei der Implementierung und Durchführung von Projekten in der Verantwortung sahen. In ihren Augen liegt die Verantwortung bei nationalen und lokalen Regierungsstellen, weil die öffentliche Hand verantwortlich für nachhaltige Entwicklung sei, der nationale Stromversorger ein Staatsunternehmen ist und eine Monopolstellung inne hat,

der alternative Energiesektor unter Marktversagen leide und der Staat das Mandat hat, Verordnungen und Gesetze zu erlassen, die eine Nachfrage nach alternativen Energien fördern sollen. Da die Akteure aber auf der anderen Seite erklärten, dass in den Lokalregierungen die Instrumente des Klimaschutzes und der Klimaanpassung weitgehend unbekannt seien, dass das öffentliche Budget nicht ausreiche, um Mitigationsprojekte zu fördern und zu finanzieren, und es in den öffentlichen Lokalverwaltungen keine Stellen gebe, die sich diesem Thema annehmen könnten, baut man für die Initiierung von Mitigationsprojekten letztendlich auf das Engagement der Privatwirtschaft.

Betriebswirtschaftliche Entwicklungspotentiale werden von Unternehmen und privaten Haushalten auch ohne lokale Wirtschaftsförderungsanstrengungen und ohne CDM-Finanzierung bereits genutzt. Hier spielen nicht etwa Klimaschutzüberlegungen eine Rolle, vielmehr werden die Projekte aufgrund einer positiven Gewinn-Verlust-Rechnung durchgeführt. Das CDM-Potential auf lokaler Ebene ist in Namibia eher als gering einzuschätzen. Dies gilt jedoch nicht für Mitigationsprojekte im Allgemeinen. Einige Projekte, wie zum Beispiel die Bereitstellung von Elektrizität durch Photovoltaikparks und Biomassekraftwerke für abgelegene und vom Stromnetz abgekoppelte Siedlungen oder die Förderung von energieeffizienten Holzöfen hätten direkte Auswirkungen auf die sozialen und wirtschaftlichen Umstände der Bevölkerung. Da der Staat den Auftrag hat, volkwirtschaftlich und sozial zukunftsweisende Entwicklungspotentiale zu fördern, um damit die Lebensqualität der Bevölkerung langfristig und nachhaltig zu sichern bzw. zu steigern, sollten diese Projekte, falls die Privatwirtschaft nicht dafür gewonnen werden kann, vom Staat durchgeführt werden.

Für die Umsetzung von Mitigationsprojekten könnten Mittel der internationalen Entwicklungszusammenarbeit herangezogen werden. Es wurden bereits einige Projekte in Namibia von internationaler Geberseite unterstützt. Genannt seien hier das Photovoltaikpark-Projekt, das die weit abgelegene Siedlung Tsumkwe mit Elektrizität versorgt, und ein Holzvergaser zur Stromerzeugung in der Kunene-Region. Jedoch wurden diese Projekte top-down von nationalen Instituten oder nichtstaatlichen Organisationen initiiert. Die lokalen Institutionen waren nur marginal beteiligt. Zwar sahen über 50% der befragten Akteure der lokalen Wirtschaftsförderung auch die internationale Entwicklungszusammenarbeit als potentielle Finanzierungsquelle an, aber es gab bisher keine Anstrengungen von lokalen Behörden, diese Quelle für Mitigationsprojekte zu nutzen. Entwicklungshilfe kann für Wirtschaftsförderungsprogramme, Mitigationsprojekte und innerhalb bestimmter Grenzen auch für CDM-Projekte beantragt werden (vgl. Kapitel 5).

Um Mitigationsprojekte durch lokale Wirtschaftsförderung zu initiieren, muss der Energiesektor Teil der Wirtschaftsförderungsstrategie werden.

Der sektorale Ansatz bei der Erarbeitung der Strategie für Otjozondjupa hat mit dazu beigetragen, dass Mitigationsprojekten keine hohe Priorität eingeräumt wurde. In keiner der Sektorarbeitsgruppen wurden klimarelevante Projekte diskutiert. Da der Energiesektor nicht durch die Strategie abgedeckt wurde, wurde dafür auch keine Arbeitsgruppe gegründet, und in keiner der anderen Gruppen stand die Nutzung alternativer Energiequellen oder die Energieeffizienz im Fokus. Für den Agrarsektor, den Tourismussektor und den Fertigungssektor wurden zwar auch hohe Energiekosten und die mangelnde Versorgung mit Elektrizität durch fehlende Leitungsnetze als Herausforderung genannt, aber gemessen an anderen Problemen wie der begrenzten Verfügbarkeit von erschlossenem Land, fehlenden Fachkräften, etc. besaßen diese keinen hohen Stellenwert. Die in die Strategie eingebrachten Mitigations- bzw. CDM-Projekte wurden als zusätzlicher Sektor in der Wirtschaftsförderungsstrategie verankert. Eine wirkliche Einbindung der Projekte in die einzelnen Sektorstrategien fand nicht statt. Diesen sektoralen Ansatz findet man auch bei allen anderen Wirtschaftsförderungsstrategien in Namibia. Auch dort wird der Energiesektor nicht berücksichtigt.

Fazit

Als Fazit der Arbeit kann postuliert werden, dass aufgrund der Komplexität von CDM, des geringen Ausstoßes von Treibhausgasen, der schlechten Marktsituation für Emissionsrechte, unzureichender finanzieller Mittel, der hohen Transaktionskosten, mangelnder institutioneller Voraussetzungen und fehlenden Fachwissens über CDM die Initiierung von CDM-Projekten durch lokale Wirtschaftsförderung wenig Aussicht auf Erfolg hat.

Jedoch besteht seitens der Akteure die grundsätzliche Bereitschaft, Mitigationsprojekte in lokale Wirtschaftsförderung zu integrieren, wenn damit vorrangig die Ziele der Wirtschaftsförderung erreicht werden können. Da Mitigationsprojekte in Namibia keinen wirksamen Beschäftigungsmotor darstellen, sollten die Ziele im Bereich der flächendeckenden Elektrizitätsversorgung und der Armutsbekämpfung liegen. Dazu ist es aber zwingend notwendig, dass bei Wirtschaftsförderungsanstrengungen auch der Energiesektor im Fokus steht, lokale Verwaltungen die Verantwortung für die Initiierung von Mitigationsprojekten übernehmen, nationale und lokale Behörden effizienter zusammenarbeiten und die lokalen Rahmenbedingungen so verbessert werden, dass der Privatsektor bereit ist, seine Rolle in der Wirtschaftsförderung zu übernehmen. Bei der Planung von lokalen Mitigationsprojekten sollte weiter darauf geachtet werden, dass die

Interessen der Bevölkerung berücksichtigt und die Akteure frühzeitig in den Entscheidungsprozess eingebunden werden.

Wie viel Treibhausgase ein Mitigationsprojekt einspart, spielt bei lokaler Wirtschaftsförderung keine Rolle. Selbst wenn ein Projekt nicht genügend Treibhausgase reduziert, um einen teuren und langwierigen CDM-Prozess zu rechtfertigen, könnte es aufgrund seiner wirtschaftlichen und sozialen positiven Auswirkungen trotzdem initiiert werden. Das würde unabhängig von CDM zu einer Reduzierung von Treibhausgasen führen. Dazu würden auch finanzielle Mittel der multi- und bilateralen Entwicklungszusammenarbeit zur Verfügung stehen.

Die Zuständigkeiten für Klimaschutz- und Klimaanpassungsprogramme sowie Wirtschaftsförderungsprogramme sind auf nationaler und lokaler Ebene in Namibia getrennt. Da sowohl Klimaprogramme als auch Wirtschaftsförderungsprogramme oft vor den gleichen Herausforderungen stehen, wäre eine Vernetzung, nicht zuletzt auch wegen des Synergieeffekts, wünschenswert.

9.4 Grenzen der Untersuchung

Die vorliegende Arbeit soll einen ersten Einblick in ein neues Forschungsfeld geben. Eine allumfassende Untersuchung würde den Rahmen dieser Arbeit hinsichtlich finanzieller Mittel, Personaleinsatz und Bearbeitungszeit sprengen. Deshalb sind die Kernaussagen und Schlussfolgerungen vor folgendem Hintergrund zu bewerten:

- Der Privatsektor konnte bei der Erhebung der quantitativen Daten nicht berücksichtigt werden, da die Daten auf Wirtschaftsförderungskonferenzen und -seminaren erhoben wurden, die in der Mehrheit von Mitarbeitern der nationalen und lokalen öffentlichen Verwaltung frequentiert wurden. Um zumindest teilweise eine Vorstellung von der Haltung des Privatsektors zu bekommen, wurden Vertreter internationaler und nationaler Firmen des Energiesektors zum Thema befragt.
- Aufgrund des zeitlichen Rahmens und der finanziellen Möglichkeiten konnte nur eine Fallstudie durchgeführt werden. Die Ergebnisse wären jedoch mit hoher Wahrscheinlichkeit aufgrund vergleichbarer Rahmenbedingungen in anderen Regionen Namibias ähnlich ausgefallen.
- Die statistischen Auswertungen sind vor dem Hintergrund einer relativ kleinen, nicht repräsentativen Gesamtstichprobe zu sehen. (vgl. Kapitel 3 und 4). Deshalb wurden fehlende Daten nicht gelöscht, sondern mittels eines stochastischen

Ersatzwertverfahrens ergänzt. Außerdem wurden qualitative Daten in die Analyse einbezogen.

9.5 Weitergehender Forschungsbedarf

Wie bereits erwähnt, konnte die vorliegende Arbeit das Thema nicht in seiner ganzen Tiefe erkunden, so dass offene Punkte bleiben, die Gegenstand weiterer Forschung sein könnten. Einige wenige werden hier genannt. Die Studienergebnisse fußten nur auf Daten aus Namibia, deshalb ist eine Generalisierung nur bedingt möglich. Weiterführende Untersuchungen könnten der Frage nachgehen, inwieweit die Ergebnisse durch Studien in anderen Ländern verallgemeinert werden könnten. Eine tiefergehende gesamtwirtschaftliche Betrachtung möglicher Mitigationsprojekte, die auf der Basis empirischer Daten die wirtschaftlichen und sozialen Auswirkungen im Detail bewerten würden, könnte als Entscheidungsgrundlage für die nationale Regierung und die Lokalbehörden Namibias dienen. In der vorliegenden Arbeit wurde untersucht, ob lokale Wirtschaftsförderung Mitigationsprojekte auf lokaler Ebene fördern kann. Andere, auf lokaler Ebene wirkende Ansätze, wie zum Beispiel ländliche Entwicklungsprogramme, deren Fokus noch stärker auf Armutsreduzierung liegt, wären möglicherweise erfolgreicher. Wie oben beschrieben, fallen viele Probleme für Mitigationsprojekte eher in den Zuständigkeitsbereich von lokaler Wirtschaftsförderung. Es kann deshalb angenommen werden, dass eine stärkere Vernetzung von Wirtschaftsförderungsprogrammen und Initiativen des Klimawandels sich für Mitigationsprojekte günstig auswirken würde. Wie eine solche Vernetzung aussehen könnte und welche Probleme vor allem auf institutioneller Ebene dadurch entstünden, könnte Thema weiterer Forschung sein.

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Attachment I Tables

Dimension	Objective (impact on...)	
Overall	1.	quality of life
Social	2.	equity (empowerment of disadvantaged people) / impact on marginalized populations (benefits)
	3.	job creation
	4.	quality of jobs / labour conditions
	5.	poverty eradication
	6.	access to basic services (water, electricity, etc.)
	7.	access to health care services
	8.	access to sanitation
	9.	community social structures / gender equality /empowerment of members of local community
	10.	social heritage
	11.	provision of social amenities / access to clean and affordable energy
	12.	development of formerly underdeveloped areas
	13.	distribution of benefits (fair, reasonable)
	14.	human institutional capacity
	15.	reduction of health-damaging pollution
	16.	reduction of resource degradation
	17.	adaptive ability of population to climate change / resilience of communities and regions
Economical	18.	rural development
	19.	adult basic education
	20.	skills development
	21.	technology training
	22.	basic infrastructure
	23.	sustainability of project / economic effectiveness
	24.	foreign exchange requirement / balance of payment
	25.	existing economic activities
	26.	reduction of dependency on fuel imports
	27.	reduction of cost of energy
	28.	foreign direct investments
	29.	transfer of technology / technological self-reliance
	30.	replication of projects
	31.	capacity of local manufacturers
	32.	development potential of other (neighbouring) regions
Environmental	33.	enforcement of environmental regulation
	34.	participatory environmental governance
	35.	air quality
	36.	water quality
	37.	reduction of solid waste
	38.	reduction of other pollutants
	39.	reduction of noise pollution
	40.	better usage of natural resources (including water, minerals, non-renewable resources) / efficiency of resource utilisation
	41.	biodiversity (genetic, species, eco-systems)

Table 36 Sustainable development criteria in CDM

Source: Adapted from COSBEY et al. (2006), DEPARTMENTS OF MINERALS AND ENERGY (2004),KIM (2003), MINSTRY OF ENVIRONMENT AND SUSTAINABL DEVELOPMENT (2009), NATIONAL COMMISSION FOR CLEAN DEVELOPEMENT (2009)

Dimension	Criteria (impact on...)	
Overall	1.	quality of life
Social	2.	poverty alleviation / income disparities / income for men and women / economic situation in poor rural areas and urban slums
	3.	formalization of informal sector
	4.	reduction of migration to urban centres
	5.	protection of indigenous people
	6.	empowerment of local communities / fostering pro-active attitude
	7.	cooperation between civil, public and private sector
	8.	quality of service delivery by local administrations
	9.	mobilisation of business and civic leaders
	10.	political leadership
	11.	political stability at local/regional level
	12.	democracy
	13.	shared development vision of people
	14.	promotion of decent jobs / generation of jobs based on skill level of local labour pool
	15.	harmonisation and integration of social and economic issues
	16.	free and fair access to education, knowledge and technology
	17.	creation of vocational education and training opportunities
	18.	provision of housing
	19.	reduction of land use conflicts
	20.	supply of water/electricity/infrastructure
	21.	property rights
	22.	preservation of cultural heritage
	23.	reduction of terrorism
	24.	peace keeping
	25.	reduction of crime level
Economical	26.	business climate
	27.	business opportunities
	28.	competitiveness of locality
	29.	promotion of economic opportunities outside the capital
	30.	investment attraction (attracting outside companies to locality / increasing private investment)
	31.	legalisation of source of traditional income (e.g. hunting, fishing, etc.)
	32.	autonomy (independent from global economy)
	33.	provision of labour
	34.	provision of land
	35.	regional integration
	36.	diversification of economic activities
	37.	local economic stability
	38.	new business start-ups / development of entrepreneurial spirit
	39.	access to markets / opening up of new markets
	40.	transparency and accountability of public and private institutions
	41.	public management / public services
	42.	development and upgrading of value chains
	43.	access to financial means
	44.	effective and efficient infrastructure for businesses
	45.	minimising negative / maximising positive externalities
Environmental	46.	usage of natural resources
	47.	ecological environment

Table 37 Sustainable development criteria in LED
Source: Adapted from ANDERSON/NACKER (2003), BLAIR/CAROLL (2009), BLAKELY/BRADSHWAW (2002), CANZANELLI (2001), GOMM/BECKER (2004), GRABOWSKI/SELF/SHIELDS (2007), HELMSING (2005), LASIMBANG (2008), MENDOZA (2007), PIKE et al. (2006), RODRIGUEZ-POSE/TIJMSTRA (2007), RUECKER/TRAH (2007), UN-HABITAT (2005), USAID (s.t.), WALZER/ATHIYAMAN (2007)

Indices			Year	Sources
Geography	Area	842,000 km2	2011	NPC (2012)
	Agricultural land	47.0%	2007	UN (2013)
	Arable lands	0.9%	2007	
	Forest	9.1%	2007	
Demography	Population (millions)	2.1	2011	NPC (2012)
		1.8	2001	
	Average annual growth	1.6%	2011	own calculation
	Urban (% of total)	42.1%	2011	NPC (2012)
		33.0%	2001	
	Rural (% of total)	57.9%	2011	
		67.0%	2001	
Development	Human Development Index (HDI)	Rank 128 out of 186 countries	2012	UNDP (2013)
	Gini coefficient	63.9	2000-2010	
	Population living below the international poverty line of $1.25/day	31.9%	2001-2011	
	Unemployment rate	51.2% (broad unemployment definition); 37.6% (strict definition)	2008	MLSW (2010)
	Corruption index	Rank 58 out of 174 countries	2012	TRANSPARENCY INTERNATIONAL (2013)
Economy	GDP growth	56% between 2001 and 2011	2001-2011	WORLD BANK (2012a)
	GDP Composition for 2010	• Agriculture, forestry, fishing & hunting (7.4%) • Mining and quarrying (9.6%) • Manufacturing (15.8%) • Electricity, gas and water (2.8%) • Construction (4.4%) • Wholesale and retail trade, hotels and restaurants (14.9%) • Transport, storage and communication (5.8%) • Finance, real estate and business services (28.7%) • General government services (9.7%) • Other services (0.8%)	2010	AFRICAN DEVELOPMENT BANK et al. (2012)
	Global Competitiveness Index	Rank 92 out of 144 countries	2013	WORLD ECONOMIC FORUM, 2013
	Doing Business Index	Rank 87 out of 185 countries	2013	WORLD BANK (2013)
	Foreign direct investments	Ranks 10 amongst Sub-Saharan African countries	2010	UNCTAD (2011)
Climate	GHG emissions (CO2e)	9,124 GgCO2e	2000	MET (2011)
	GHG removals (CO2e)	10,566 GgCO2e	2000	

Table 38 Namibian indices
Sources: See table

Missing answers		No. of questionnaires x no. of missing answers		Accumulated frequency	
No.	**%**	**Abs.**	**%**	**Abs.**	**%**
0	0.00%	85	37.12%	85	37.12%
1	2.17%	40	17.47%	125	54.59%
2	4.35%	29	12.66%	154	67.25%
3	6.52%	20	8.73%	174	75.98%
4	8.70%	10	4.37%	184	80.35%
5	10.87%	10	4.37%	194	84.72%
6	13.04%	4	1.75%	198	86.46%
7	15.22%	4	1.75%	202	88.21%
8	17.39%	5	2.18%	207	90.39%
9	19.57%	7	3.06%	214	93.45%
10	21.74%	3	1.31%	217	94.76%
11	23.91%	2	0.87%	219	95.63%
12	26.09%	1	0.44%	220	96.07%
13	28.26%	1	0.44%	221	96.51%
14	30.43%	0	0.00%	221	96.51%
15	32.61%	2	0.87%	223	97.38%
16	34.78%	1	0.44%	224	97.82%
17	36.96%	0	0.00%	224	97.82%
18	39.13%	1	0.44%	225	98.25%
19	41.30%	1	0.44%	226	98.69%
20	43.48%	0	0.00%	226	98.69%
21	45.65%	1	0.44%	227	99.13%
22	47.83%	0	0.00%	227	99.13%
23	50.00%	0	0.00%	227	99.13%
24	52.17%	0	0.00%	227	99.13%
25	54.35%	0	0.00%	227	99.13%
26	56.52%	0	0.00%	227	99.13%
27	58.70%	0	0.00%	227	99.13%
28	60.87%	0	0.00%	227	99.13%
29	63.04%	0	0.00%	227	99.13%
30	65.22%	0	0.00%	227	99.13%
31	67.39%	1	0.44%	228	99.56%
32	69.57%	0	0.00%	228	99.56%
33	71.74%	0	0.00%	228	99.56%
34	73.91%	0	0.00%	228	99.56%
35	76.09%	0	0.00%	228	99.56%
36	78.26%	0	0.00%	228	99.56%
37	80.43%	0	0.00%	228	99.56%
38	82.61%	0	0.00%	228	99.56%
39	84.78%	1	0.44%	229	100.00%
40	86.96%	0	0.00%	229	100.00%
41	89.13%	0	0.00%	229	100.00%
42	91.30%	0	0.00%	229	100.00%
43	93.48%	0	0.00%	229	100.00%
44	95.65%	0	0.00%	229	100.00%
45	97.83%	0	0.00%	229	100.00%
46	100.00%	0	0.00%	229	100.00%
Total		**229**	**100.00%**		

Table 39 Missing data frequency table

No.	Local Authority	Stakeholder category			Total
		Chief executives	Economic planners	Councillors	
1	Arandis	1	1	2	4
2	Aranos	1	0	0	1
3	Aroab	1	0	0	1
4	Berseba	1	0	1	2
5	Bethanie	0	1	0	1
6	Eenhana	0	1	3	4
7	Gibeon	1	0	1	2
8	Gochas	1	1	0	2
9	Grootfontein	0	2	0	2
10	Helao Nafidi	0	1	0	1
11	Kalkrand	0	0	2	2
12	Kamanjab	0	0	1	1
13	Karasburg	1	0	0	1
14	Karibib	0	2	0	2
15	Katima Mulilo	0	1	0	1
16	Keetmanshoop	0	1	0	1
17	Khorixas	0	1	0	1
18	Koes	1	0	0	1
19	Leonardville	1	0	2	3
20	Luederitz	0	3	3	6
21	Maltahoehe	1	0	1	2
22	Mariental	0	1	0	1
23	Nukurenkuru	0	0	7	7
24	Okahandja	1	1	0	2
25	Okahao	1	1	3	5
26	Okakarara	1	2	1	4
27	Omaruru	0	0	2	2
28	Omuthiya	1	0	0	1
29	Ondangwa	1	0	1	2
30	Ongwediva	0	1	4	5
31	Opuwo	1	0	0	1
32	Oshakati	1	2	0	3
33	Oshikuku	1	1	2	4
34	Otjiwarongo	0	1	0	1
35	Outapi	1	1	4	6
36	Outjo	1	2	0	3
37	Rehoboth	0	2	0	2
38	Ruacana	0	2	3	5
39	Rundu	1	1	0	2
40	Stampriet	1	0	0	1
41	Swakopmund	0	2	1	3
42	Tsumeb	1	1	2	4
43	Usakos	0	1	0	1
44	Walvis Bay	0	1	0	1
	Total	**23**	**38**	**46**	**107**

Table 40 Respondents from local authorities

Variable	Description	Data type	Question in questionnaire
SG	Stakeholder group	nominal	Function
Q1	Perception that climate change threatens development	nominal	Question 1
Q2-1	Threat to economic development	ordinal	Question 2-1
Q2-2	Threat to social development	ordinal	Question 2-2
Q2-3	Threat to environmental development	ordinal	Question 2-3
Q3	Potential of mitigation/adaptation projects for economic development	nominal	Question 3
Q4-1	Potential of mitigation projects	ordinal	Question 4-1
Q4-2	Potential of adaptation projects	ordinal	Question 4-2
Q5	Objectives of LED	nominal	Question 5
Q6	Objectives of climate change projects	nominal	Question 6
Q7-1	Economic development potential of solar water heaters	ordinal	Question 7-1
Q7-2	Economic development potential of solar ovens	ordinal	Question 7-2
Q7-3	Economic development potential of solar home systems	ordinal	Question 7-3
Q7-4	Economic development potential of solar parks	ordinal	Question 7-4
Q7-5	Economic development potential of biomass energy	ordinal	Question 7-5
Q7-6	Economic development potential of energy efficient stoves	ordinal	Question 7-6
Q7-7	Economic development potential of household biogas	ordinal	Question 7-7
Q7-8	Economic development potential of insulation of houses	ordinal	Question 7-8
Q7-9	Economic development potential of energy efficient lighting	ordinal	Question 7-9
Q7-10	Economic development potential of solar water pumps	ordinal	Question 7-10
Q7-11	Economic development potential of reforestation / afforestation	ordinal	Question 7-11
Q7-12	Economic development potential of fire management	ordinal	Question 7-12
Q7-13	Economic development potential of composting	ordinal	Question 7-13
Q7-14	Economic development potential of fuel switching	ordinal	Question 7-14
Q7-15	Economic development potential of biogas from municipal waste water	ordinal	Question 7-15
Q8	Challenges for LED	nominal	Question 8
Q9	Challenges for mitigation projects	nominal	Question 9
Q10-1	Knowledge of UNFCCC	ordinal	Question 10-1
Q10-2	Knowledge of Kyoto protocol	ordinal	Question 10-2
Q10-3	Knowledge of CDM	ordinal	Question 10-3
Q10-4	Knowledge of DNA	ordinal	Question 10-4
Q10-5	Knowledge of National Policy on Climate Change in Namibia	ordinal	Question 10-5
Q11-1	Driving force for climate change initiative is the national private sector	nominal	Question 11
Q11-2	Driving force for climate change initiative is the international private sector	nominal	
Q11-3	Driving force for climate change initiative are donor organisations	nominal	
Q11-4	Driving force for climate change initiative is the national government	nominal	
Q11-5	Driving force for climate change initiative are regional councils	nominal	
Q11-6	Driving force for climate change initiative are local authorities	nominal	
Q12-1-1	Promoting mitigation projects is the responsibility of national government	nominal	Question 12-1
Q12-1-2	Promoting mitigation projects is the responsibility of regional councils	nominal	
Q12-1-3	Promoting mitigation projects is the responsibility of local authorities	nominal	
Q12-1-4	Promoting mitigation projects is the responsibility of national private sector	nominal	
Q12-1-5	Promoting mitigation projects is the responsibility of international private sector	nominal	
Q12-1-6	Promoting mitigation projects is the responsibility of donor organisations	nominal	
Q12-2-1	Sourcing for investors for mitigation projects is the responsibility of national government	nominal	Question 12-2
Q12-2-2	Sourcing for investors for mitigation projects is the responsibility of regional councils	nominal	
Q12-2-3	Sourcing for investors for mitigation projects is the responsibility of local authorities	nominal	
Q12-2-4	Sourcing for investors for mitigation projects is the responsibility of national private sector	nominal	
Q12-2-5	Sourcing for investors for mitigation projects is the responsibility of international private sector	nominal	
Q12-2-6	Sourcing for investors for mitigation projects is the responsibility of donor organisations	nominal	
Q12-3-1	Financing mitigation projects is the responsibility of national government	nominal	Question 12-3
Q12-3-2	Financing mitigation projects is the responsibility of regional councils	nominal	
Q12-3-3	Financing mitigation projects is the responsibility of local authorities	nominal	
Q12-3-4	Financing mitigation projects is the responsibility of national private sector	nominal	
Q12-3-5	Financing mitigation projects is the responsibility of international private sector	nominal	
Q12-3-6	Financing mitigation projects is the responsibility of donor organisations	nominal	
Q12-4-1	Implementing mitigation projects is the responsibility of national government	nominal	Question 12-4
Q12-4-2	Implementing mitigation projects is the responsibility of regional councils	nominal	
Q12-4-3	Implementing mitigation projects is the responsibility of local authorities	nominal	
Q12-4-4	Implementing mitigation projects is the responsibility of national private sector	nominal	
Q12-4-5	Implementing mitigation projects is the responsibility of international private sector	nominal	
Q12-4-6	Implementing mitigation projects is the responsibility of donor organisations	nominal	
Q12-5-1	Operating mitigation projects is the responsibility of national government	nominal	Question 12-5
Q12-5-2	Operating mitigation projects is the responsibility of regional councils	nominal	
Q12-5-3	Operating mitigation projects is the responsibility of local authorities	nominal	
Q12-5-4	Operating mitigation projects is the responsibility of national private sector	nominal	
Q12-5-5	Operating mitigation projects is the responsibility of international private sector	nominal	
Q12-5-6	Operating mitigation projects is the responsibility of donor organisations	nominal	
Q13-1	Perception that mitigation should be part of LED strategies	ordinal	Question 13-1
Q13-2	Perception that mitigation should be a function of the LED agency	ordinal	Question 13-2
Q14	Own involvement in climate change initiatives	nominal	Question 14
Q15-1	Organisation which approached respondent with respect to climate change	nominal	Question 15-1
Q15-2	Organisation which was approached by respondent with respect to climate change	nominal	Question 15-2
Q16	Potential that mitigation projects can be part of typical LED approaches	ordinal	Question 16
Q17-1	Own assessment of knowledge (mitigation)	ordinal	Question 17-1
Q17-2	Own assessment of knowledge (adaptation)	ordinal	Question 17-2

Table 41 Definition and description of variables

Variables	All stakeholders			Chief executives			Economic planners			Consultants			Councillors			Other stakeholders		
	Answers	Missing answers	Missing %	Answers	Missing answers	Missing %	Answers	Missing answers	Missing %	Answers	Missing answers	Missing %	Answers	Missing answers	Missing %	Answers	Missing answers	Missing %
SG	224	0	0.0	25	0	0.0	57	0	0.0	17	0	0.0	68	0	0.0	57	0	0.0
Q1	222	2	0.9	25	0	0.0	57	0	0.0	17	0	0.0	68	0	0.0	55	2	3.5
Q2-1	216	8	3.6	25	0	0.0	55	2	3.5	16	1	5.9	67	1	1.5	53	4	7.0
Q2-2	213	11	4.9	25	0	0.0	55	2	3.5	17	0	0.0	66	2	2.9	50	7	12.3
Q2-3	213	11	4.9	25	0	0.0	56	1	1.8	16	1	5.9	65	3	4.4	51	6	10.5
Q3	219	5	2.2	25	0	0.0	56	1	1.8	17	0	0.0	67	1	1.5	54	3	5.3
Q4-1	212	12	5.4	25	0	0.0	55	2	3.5	16	1	5.9	65	3	4.4	51	6	10.5
Q4-2	202	22	9.8	25	0	0.0	53	4	7.0	16	1	5.9	61	7	10.3	47	10	17.5
Q5	191	33	14.7	20	5	20.0	45	12	21.1	14	3	17.6	62	6	8.8	50	7	12.3
Q6	195	29	12.9	21	4	16.0	47	10	17.5	16	1	5.9	62	6	8.8	49	8	14.0
Q7-1	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-2	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-3	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-4	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-5	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-6	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-7	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-8	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-9	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-10	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-11	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-12	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-13	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-14	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q7-15	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q8	185	39	17.4	20	5	20.0	45	12	21.1	15	2	11.8	57	11	16.2	48	9	15.8
Q9	188	36	16.1	22	3	12.0	48	9	15.8	13	4	23.5	61	7	10.3	44	13	22.8
Q10-1	212	12	5.4	25	0	0.0	56	1	1.8	16	1	5.9	61	7	10.3	54	3	5.3
Q10-2	208	16	7.1	24	1	4.0	55	2	3.5	16	1	5.9	59	9	13.2	54	3	5.3
Q10-3	213	11	4.9	25	0	0.0	56	1	1.8	16	1	5.9	62	6	8.8	54	3	5.3
Q10-4	206	18	8.0	24	1	4.0	56	1	1.8	16	1	5.9	57	11	16.2	53	4	7.0
Q10-5	218	6	2.7	25	0	0.0	57	0	0.0	16	1	5.9	63	5	7.4	57	0	0.0
Q11	223	1	0.4	25	0	0.0	57	0	0.0	17	0	0.0	67	1	1.5	57	0	0.0
Q12-1	206	18	8.0	24	1	4.0	51	6	10.5	17	0	0.0	61	7	10.3	53	4	7.0
Q12-2	187	37	16.5	22	3	12.0	53	4	7.0	14	3	17.6	49	19	27.9	49	8	14.0
Q12-3	200	24	10.7	22	3	12.0	55	2	3.5	17	0	0.0	58	10	14.7	48	9	15.8
Q12-4	193	31	13.8	22	3	12.0	53	4	7.0	17	0	0.0	54	14	20.6	47	10	17.5
Q12-5	183	41	18.3	22	3	12.0	51	6	10.5	17	0	0.0	45	23	33.8	48	9	15.8
Q13-1	207	17	7.6	23	2	8.0	56	1	1.8	16	1	5.9	62	6	8.8	50	7	12.3
Q13-2	197	27	12.1	23	2	8.0	56	1	1.8	17	0	0.0	52	16	23.5	49	8	14.0
Q14	221	3	1.3	24	1	4.0	57	0	0.0	17	0	0.0	67	1	1.5	56	1	1.8
Q15-1	224	0	0.0	25	0	0.0	57	0	0.0	17	0	0.0	68	0	0.0	57	0	0.0
Q15-2	224	0	0.0	25	0	0.0	57	0	0.0	17	0	0.0	68	0	0.0	57	0	0.0
Q16	213	11	4.9	24	1	4.0	57	0	0.0	16	1	5.9	62	6	8.8	54	3	5.3
Q17-1	214	10	4.5	23	2	8.0	56	1	1.8	17	0	0.0	65	3	4.4	53	4	7.0
Q17-2	204	20	8.9	23	2	8.0	56	1	1.8	17	0	0.0	60	8	11.8	48	9	15.8
Total1	**9778**	**526**	**5.1**	**1108**	**42**	**3.7**	**2536**	**86**	**3.3**	**758**	**24**	**3.1**	**2914**	**214**	**6.8**	**2462**	**160**	**6.1**
Total2	**9019**	**389**	**4.1**	**1025**	**25**	**2.4**	**2351**	**43**	**1.8**	**700**	**14**	**2.0**	**2672**	**184**	**6.4**	**2271**	**123**	**5.1**

Table 42 Missing data per variable

Total2 does not consider questions 5, 6, 8, and 9

Variable	Q1	Q2-1	Q2-2	Q2-3	Q3	Q4-1	Q4-2	Q7-1	Q7-2	Q7-3	Q7-4	Q7-5	Q7-6	Q7-7	Q7-8	Q7-9	Q7-10	Q7-11	Q7-12	Q7-13	Q7-14	Q7-15	Q10-1	Q10-2	Q10-3	Q10-4	Q10-5	Q11	Q12-1	Q12-2	Q12-3	Q12-4	Q12-5	Q13-1	Q13-2	Q14	Q16	Q17-1	Q17-2
Q1		0.5	0.4	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.1	0.0	0.2	0.2	0.1
Q2-1			0.7	0.4	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.2	0.2	0.1
Q2-2				0.7	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.0	0.2	0.2	0.3
Q2-3					0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	0.2	0.2	0.1	0.2	0.1	0.2	0.0	0.2	0.2	0.3
Q3						0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
Q4-1							0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.1	0.2	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Q4-2								0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.3	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Q7-1									1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-2										1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-3											1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-4												1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-5													1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-6														1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-7															1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-8																1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-9																	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-10																		1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-11																			1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-12																				1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-13																					1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-14																						1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q7-15																							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Q10-1																								0.8	0.8	0.6	0.7	0.0	0.2	0.3	0.2	0.1	0.2	0.3	0.3	0.1	0.1	0.2	0.3
Q10-2																									0.7	0.6	0.6	0.2	0.2	0.3	0.3	0.1	0.3	0.2	0.3	0.3	0.2	0.3	0.3
Q10-3																										0.7	0.7	0.0	0.2	0.3	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.3	0.3
Q10-4																											0.6	0.2	0.3	0.2	0.3	0.1	0.2	0.3	0.3	0.3	0.2	0.3	0.4
Q10-5																												0.0	0.2	0.2	0.1	0.0	0.1	0.4	0.3	0.2	0.2	0.2	0.1
Q11																													0.0	0.2	0.2	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.2
Q12-1																														0.3	0.3	0.2	0.3	0.2	0.1	0.3	0.1	0.2	0.1
Q12-2																															0.2	0.5	0.4	0.2	0.4	0.1	0.1	0.2	0.3
Q12-3																																0.5	0.6	0.2	0.2	0.3	0.3	0.1	0.3
Q12-4																																	0.6	0.2	0.3	0.3	0.3	0.2	0.3
Q12-5																																		0.2	0.3	0.2	0.2	0.1	0.3
Q13-1																																			0.6	0.4	0.4	0.5	0.3
Q13-2																																				0.3	0.6	0.4	0.4
Q14																																					0.5	0.5	0.4
Q16																																						0.6	0.5
Q17-1																																							0.7
Q17-2																																							

Table 43 Correlation matrix for missing data

Questions5, 6, 8, and 9 were not considered. Question 15 did not have any missing data and was not considered either

Variable	1st. Quartile	Median	3rd. Quartile
Q2-1	4	6.5	8
Q2-2	5	6	8
Q3-3	5	8	9
Q4-1	5	6	7
Q4-2	5	6	8
Q7-1	4	7	9
Q7-2	2	7	9
Q7-3	3	7	9
Q7-4	1	7	8
Q7-5	1	4	8
Q7-6	2	5	8
Q7-7	2	5	8
Q7-8	1	5	7
Q7-9	3	6	9
Q7-10	3	7	9
Q7-11	1	6	8
Q7-12	4	7	9
Q7-13	2	5	8
Q7-14	1	5	8
Q7-15	1.5	5	8
Q10-1	2	4	6
Q10-2	1	3	6
Q10-3	1	3	5
Q10-4	1	3.5	6
Q10-5	2	5	7
Q13-1	7	9	10
Q13-2	6	8	9
Q16	5	8	10
Q17-1	3	5	6
Q17-2	3	5	7

Table 44 1st. quartile, median, and 3rd quartile of non-binary variables

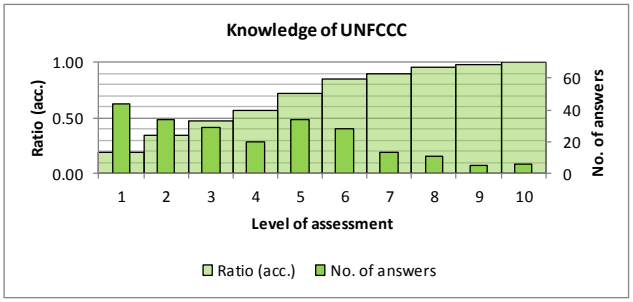
Potential initiatives	Direct employment opportunities by project itself (country wide)	Access to electricity for off-grid settlements	Affordability (price per installation) and acceptance	Acceptance (social and cultural aspects)	Technical and financial capability of local governments	Quick win with regard to sustainable development objectives	Catalytic impact (e.g. employment opportunities beyond scope of project)
Energy efficient stoves	Reduction of wood consumption about 50% / for a market share of 10-15%: 49-69 jobs.	No	>150 N$	Because people like to sit around open fire they accept the systems	Yes	Yes	No
Solar cooker	Because of low demand employment impact negligible / saving of wood consumption: 30-40%	No	500-800 N$	Because of long cooking hours people are reluctant to accept system	Yes	No	No
Solar home systems	About 30 over a period of 5 years	Because of low capacity only useful for small household appliances	5,000 – 30,000 N$ (~500 – 3,000 €)	People believe system too inferior to grid electricity	Yes	Yes	No
Small scale bush to energy (<= 5 MW)	Medium as debushing might be mechanised	Possible solution for off-grid settlement	High investments (e.g. ~900,000 € for 250 kW wood gasifier)	Yes	No	No	Yes, upstream/upstream activities (e.g. debushing transport, maintenance, other economic activities due to electricity)
Solar energy (parks)	Assumed low	Possible solution for off-grid settlement	High investments (e.g 26 Mio N$ for Tsumkwe solar park)	Yes	No	No	Yes (other economic activities due to electricity)
Solar water heater	about 50 over a period of 5 years	No	14,000-22,000 N$ (~1,400 – 2,200 €)	Yes	Yes	Yes	No
Large scale bush to energy	Number of jobs medium as only mechanized de-bushing provides much jobs	No (it is assumed that power will be fed into grid)	assumed high investments (e.g. planning, EIA, feasibility studies, conversion of power station, etc.)	Yes	No	No	Yes, upstream/upstream activities (e.g. jobs through debushing transport, maintenance, etc.)
Solar water pumps	Assumed low	No	Medium investments (~ 24,000 N$ to 110,000 N$)	Yes	Yes	No	No
Household biogas digester	Low because of number of potential installations	No	>200 € (about 2,600 N$) /	People cook directly with dung	Yes	No	No
Municipal biogas digester (municipal waste water)	No information available but considered low because of number of treatment plants	No	No information available but assumed high	Yes	Yes (but only in larger towns)	No	No
Digesters for dairy farms, poultry farms, abattoirs, etc.	1-2 people per digester	No	No information available but assumed medium high	Yes	No	No	No
CFLs	Very low	No	Very low	Yes	Yes	No	No
Wind pumps	Assumed low (wind pumps are already in use)	No	No information available but higher than 10,000 N$	Yes	Yes	No	No

Table 45 Assessment of mitigation projects with respect to LED aspects
Source: Adapted from KLERK (2004), EMCOM (2005), MICHAELOWA/PUROHIT (2005), MME (2005), MME (2006), MWAF (2006), NPC (2006), UNDP (2006), MET/UNDP (2007), MME (2007), SCHULZ/SCHUHMANN (2007), TRIFELLNER (2007), DRFN/BRADLEY-COOK (2008), GOUVELLO et al. (2008), MILLENNIUM CHALLENGE CORPORATION (2008), MET (2008), SVK TECHNOLOGIES (2008), DRFN (2009), MENDELSOHN et al. (2009), ACCLAIM TECHNOLOGY SERVICES (2010), BRÜNTRUP/HERRMANN (2010), COLIN CHRISTIAN & ASSOCIATES CC (2010a), COLIN CHRISTIAN & ASSOCIATES CC (2010b), DIEKMANN/MUDOWA (2010), DRFN (2010), MINISTRY OF ENVIRONMENT CAMBODIA/UNEP (2010), MÜLLER et al. (2010), VAN ZYL/BARBOUR (2010), CARTER (2011), MET (2011b), SCHULZ (2011a), SCHULZ (2011b), AURECON NAMIBIA (2012), DRFN (2012b), DRFN (2012c), FENHANN (2012b), MRLGHRD (2012), SOLAR AGE NAMIBIA (2012), UNFCCC (2012), OTIM et al. (s.t.), PINPOINT ENERGY NAMIBIA (s.t.), and own considerations

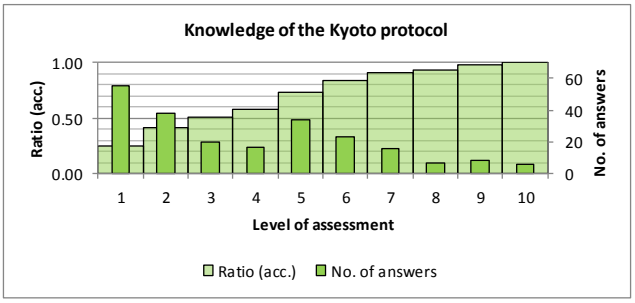
Barrier type	Barriers		Power of decision / Power to change
	Description	CDM specific	
Institution	1. Poor quality and ineffectiveness of DNA (staff, structure, no guidelines)	✓	National level
	2. No DOEs in Namibia (only one in South Africa)	✓	n/a
	3. No agricultural support structure		National level
	4. Lack of general government support (green energy sector depends on vision of individuals)		National/local level
	5. Insufficient research (e.g. on wind regimes in Namibia)		National level
	6. Insufficient CDM promotion (CDM promotion centre at MTI not established yet)	✓	National level
	7. Tendency for secrecy by private investors (in respect to financial, legal and property rights issues)		n/a
	8. Lack of knowledge to interpret/implement policies (e.g. on NGO level)		National level
	9. Lack of ownership of inter-sectoral policies regarding SET		National level
	10. Lack of cooperation between DNA and potential investors	✓	
	11. Other priorities and insufficient resources prevent the establishment of a CDM promotion office	✓	
Market	12. Weak industrial base (number of opportunities, small market size)		n/a
	13. Market for LULUCF projects limited (limitations concerning the acceptance of credits from forestry projects)	✓	International level
	14. Limited involvement of private sector		National/local level
	15. Alternative CDM investment opportunities in other countries in regard to project type/size (e.g. low hanging fruits)	✓	n/a
	16. Uncertainty about post Kyoto Protocol	✓	International level
	17. Spatial concentration of SET in capital (Windhoek)		National/local level
Awareness	18. Low awareness of climate change, mitigation, and adaptation		National/local level
	19. Access to information and reliability of data insufficient		National/local level
	20. No pilot projects (demonstration projects/lack of empirical knowledge)		National/local level
	21. Lack of sound market and feasibility studies on mitigation opportunities (or old studies)		
	22. Project proponents are overoptimistic or disillusioned		n/a
Financial	23. Lack of knowledge to manage and acquire financial resources		
	24. National budget does not make enough provisions for renewable energy projects		National/local level
	25. Private credit institutes are not able to assess credit applications for SET		
	26. Lack of confidence that investments will pay off		
Economic	27. High transaction costs	✓	International level
	28. High investment costs		n/a
	29. High costs and time to develop methodologies (baseline calculation)	✓	n/a
	30. High complexity of CDM process	✓	International level
	31. CDM related risks (e.g. inflation rates, increase of baseline, interest rates, price of CERs, CER quantity, etc.)	✓	n/a
	32. Conventional project risks (e.g. construction risks, capital over-runs, performance risks, time over-runs, risk to get permission to run project, etc.)		n/a
	33. Delay of financial flows (inflow of money from selling credits) for unilateral projects	✓	n/a
	34. Low electricity tariffs for industry (industry not motivated)		National level
	35. Unfavourable grid factor (electricity is imported from South Africa)		National level
	36. Currently, low demand for green energy products and services		National/local level
	37. Low theoretical market potential (economic of scale)		
	38. Lack of tax and investment incentives to foster investments in green energy		National level
	39. Business propositions are financially non-viable		n/a
	40. Lack of knowledge on how to develop a business plan		n/a
	41. Some projects require the development of whole value chains (e.g. bio disel)		
	42. Low value of carbon credits		National/local level
Technical	43. Lack of equipment and insufficient access to technology		n/a
	44. Inadequate maintenance facilities		n/a
	45. Low quality of available technology		n/a
	46. Technology not adapted to local conditions		n/a
	47. Technology needs not assessed		National/local level
	48. Lack of techno-economic data to compare technologies		National level
Capacity	49. Unskilled workforce (e.g. to implement and maintain renewable energy technologies)		National/local level
	50. Lack of training institutes for SET		National/local level
Social	51. Lack of social acceptance of technology / Traditional value (e.g. solar cooker versus evening meal along a fire)		National/local level
	52. Lack of involvement by local stakeholders (participation)		National/local level
	53. Open social issue: biofuel versus food security!?		National/local level
	54. SET considered inferior to grid electricity		National/local level
Policies and regulations	55. Inadequate CDM policies and regulations (e.g.sustainable development criteria, enforcement)	✓	National level
	56. National climate change policy only since 2011		National level
	57. Lack of enforcing or encouraging policies, strategies and regulations or regulations discouraging investments in renewable energies (e.g. no feed in tariffs, property rights, labour regulations, land ownership issues in communal areas, land resettlement issues, rural development strategy, environmental law, subsidies)		National level
	58. Lack of national green energy or energy efficiency targets		National level
	59. Environmental impact assessments take to long		National level

Table 46 Major barriers for CDM in Namibia
Source: Adapted from PAINULY/FENHANN (2002), , JAHN et al. (2004), UNFCCC (2004), WORLD BANK (2004), MME (2005), ELLIS/KAMEL (2007), MME (2007), UNEP (2007), ECB (2009), UNDP (2009), POEYRY (2010), BRUENTRUP/HERRMANN (2010), BOSCH (2011), MET (2011a) and own considerations

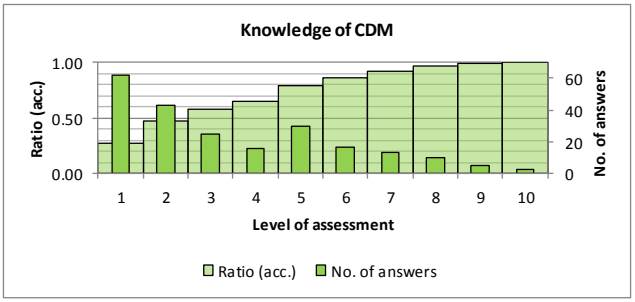
UN Framework Convention on Climate Change (UNFCCC)		1st. Quartile	2.00
		Median	4.00
		3rd. Quartile	6.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	44	44	0.20
2	34	78	0.35
3	29	107	0.48
4	20	127	0.57
5	34	161	0.72
6	28	189	0.84
7	13	202	0.90
8	11	213	0.95
9	5	218	0.97
10	6	224	1.00



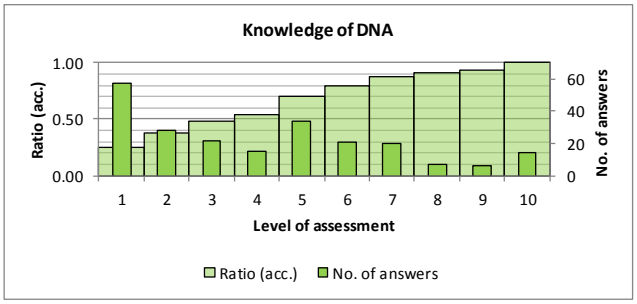
Kyoto protocol		1st. Quartile	2.00
		Median	3.00
		3rd. Quartile	6.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	55	55	0.25
2	38	93	0.42
3	20	113	0.50
4	17	130	0.58
5	34	164	0.73
6	23	187	0.83
7	16	203	0.91
8	7	210	0.94
9	8	218	0.97
10	6	224	1.00



Clean Development Mechanism (CDM)		1st. Quartile	1.00
		Median	3.00
		3rd. Quartile	5.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	62	62	0.28
2	43	105	0.47
3	25	130	0.58
4	16	146	0.65
5	30	176	0.79
6	17	193	0.86
7	13	206	0.92
8	10	216	0.96
9	5	221	0.99
10	3	224	1.00



Designated National Authority (DNA) in Namibia		1st. Quartile	1.00
		Median	4.00
		3rd. Quartile	6.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	57	57	0.25
2	28	85	0.38
3	22	107	0.48
4	15	122	0.54
5	34	156	0.70
6	21	177	0.79
7	20	197	0.88
8	7	204	0.91
9	6	210	0.94
10	14	224	1.00



National Policy on Climate Change in Namibia		1st. Quartile	2.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	38	38	0.17
2	33	71	0.32
3	20	91	0.41
4	9	100	0.45
5	44	144	0.64
6	22	166	0.74
7	24	190	0.85
8	11	201	0.90
9	15	216	0.96
10	8	224	1.00

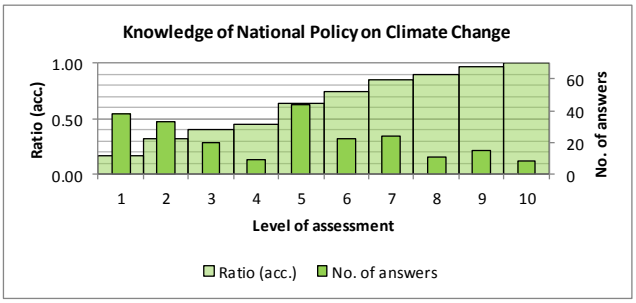
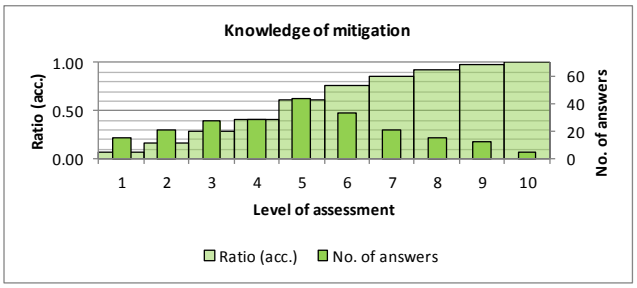


Table 47 Stakeholders` assessment of their knowledge of climate change policies and instruments

Knowledge of mitigation		1st. Quartile	3.00
		Median	5.00
		3rd. Quartile	6.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	15	15	0.07
2	21	36	0.16
3	28	64	0.29
4	29	93	0.42
5	44	137	0.61
6	33	170	0.76
7	21	191	0.85
8	15	206	0.92
9	13	219	0.98
10	5	224	1.00



Knowledge of adaptation		1st. Quartile	3.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	14	14	0.06
2	20	34	0.15
3	26	60	0.27
4	34	94	0.42
5	40	134	0.60
6	24	158	0.71
7	27	185	0.83
8	19	204	0.91
9	14	218	0.97
10	6	224	1.00

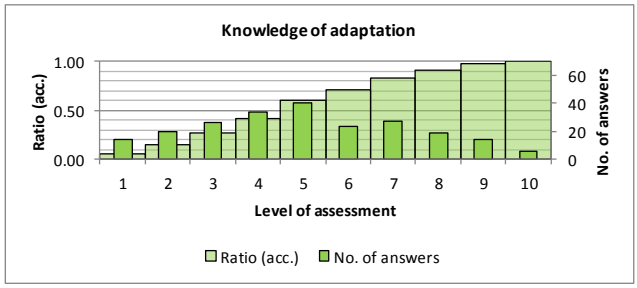


Table 48 Stakeholders` assessment of their knowledge of climate change strategies (mitigation, adaptation)

UNFCCC (n1) – Mitigation (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	44	15	30.0	1826.0	622.5
2	34	21	87.0	3944.0	2436.0
3	29	28	143.0	5046.0	4872.0
4	20	29	196.0	4260.0	6177.0
5	34	44	259.5	9061.0	11726.0
6	28	33	329.0	9254.0	10906.5
7	13	21	376.5	4862.0	7854.0
8	11	15	406.5	4438.5	6052.5
9	5	13	428.5	2122.5	5518.5
10	6	5	443.0	2649.0	2207.5
Σ	224	224		47463.0	58372.5

U1	30829.5	σU corr	1359.18
U2	19346.5	z value	4.22
μ_U	25088.0	**p value**	**0.00002**

UNFCCC (n1) – Adaptation (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	44	14	29.5	1826.0	581.0
2	34	20	85.5	3944.0	2320.0
3	29	26	140.0	5046.0	4524.0
4	20	34	194.5	4260.0	7242.0
5	34	40	258.5	9061.0	10660.0
6	28	24	321.5	9254.0	7932.0
7	13	27	367.5	4862.0	10098.0
8	11	19	402.5	4438.5	7666.5
9	5	14	427.0	2122.5	5943.0
10	6	6	442.5	2649.0	2649.0
Σ	224	224		47463.0	59615.5

U1	31435.0	σU corr	1360.08
U2	18741.0	z value	4.67
μ_U	25088.0	**p value**	**0.00000**

UNFCCC (n1) – Kyoto protocol(n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	44	55	50.0	2200.0	2750.0
2	34	38	135.5	4607.0	5149.0
3	29	20	196.0	5684.0	3920.0
4	20	17	239.0	4780.0	4063.0
5	34	34	291.5	9911.0	9911.0
6	28	23	351.0	9828.0	8073.0
7	13	16	391.0	5083.0	6256.0
8	11	7	414.5	4559.5	2901.5
9	5	8	430.0	2150.0	3440.0
10	6	6	442.5	2655.0	2655.0
Σ	224	224		51457.5	49118.5

U1	23918.5	$\sigma_{U\ corr}$	1354.92
U2	26257.5	z value	0.86
μ_U	25088.0	**p value**	**0.38806**

UNFCCC (n1) – CDM (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	44	62	53.5	2354.0	3317.0
2	34	43	145.0	4930.0	6235.0
3	29	25	210.5	6104.5	5262.5
4	20	16	255.5	5110.0	4088.0
5	34	30	305.5	10387.0	9165.0
6	28	17	360.0	10080.0	6120.0
7	13	13	395.5	5141.5	5141.5
8	11	10	419.0	4609.0	4190.0
9	5	5	434.5	2172.5	2172.5
10	6	3	444.0	2664.0	1332.0
Σ	224	224		53552.5	47023.5

U1	21823.5	$\sigma_{U\ corr}$	1353.07
U2	28352.5	z value	2.41
μ_U	25088.0	**p value**	**0.01584**

UNFCCC (n1) – DNA(n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	44	57	51.0	2244.0	2907.0
2	34	28	132.5	4505.0	3710.0
3	29	22	189.0	5481.0	4158.0
4	20	15	232.0	4640.0	3480.0
5	34	34	283.5	9639.0	9639.0
6	28	21	342.0	9576.0	7182.0
7	13	20	383.0	4979.0	7660.0
8	11	7	408.5	4493.5	2859.5
9	5	6	423.0	2115.0	2538.0
10	6	14	438.5	2631.0	6139.0
Σ	224	224		50303.5	50272.5

U1	25072.5	σU corr	1355.43
U2	25103.5	z value	0.01
μ_U	25088.0	**p value**	**0.99088**

UNFCCC (n1) – National CC policy (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	44	38	41.5	1826.0	1577.0
2	34	33	116.0	3944.0	3828.0
3	29	20	174.0	5046.0	3480.0
4	20	9	213.0	4260.0	1917.0
5	34	44	266.5	9061.0	11726.0
6	28	22	330.5	9254.0	7271.0
7	13	24	374.0	4862.0	8976.0
8	11	11	403.5	4438.5	4438.5
9	5	15	424.5	2122.5	6367.5
10	6	8	441.5	2649.0	3532.0
Σ	224	224		47463.0	53113.0

U1	27913.0	σU corr	1357.44
U2	22263.0	z value	2.08
μ_U	25088.0	**p value**	**0.03742**

Mitigation (n1) – Adaptation (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	15	14	15.0	405.0	378.0
2	21	20	50.0	1690.5	1610.0
3	28	26	97.5	3682.0	3419.0
4	29	34	156.0	5060.5	5933.0
5	44	40	229.5	10450.0	9500.0
6	33	24	300.0	10197.0	7416.0
7	21	27	352.5	7539.0	9693.0
8	15	19	393.5	5917.5	7495.5
9	13	14	424.0	5479.5	5901.0
10	5	6	443.0	2210.0	2652.0
Σ	224	224		52631.0	53997.5

U1	25817.0	σU corr	1359.10
U2	24359.0	z value	0.54
μ_U	25088.0	**p value**	**0.59169**

Mitigation (n1) – Kyoto protocol (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	15	55	35.5	405.0	1485.0
2	21	38	100.0	1690.5	3059.0
3	28	20	153.5	3682.0	2630.0
4	29	34	200.5	5060.5	2966.5
5	44	34	262.5	10450.0	8075.0
6	33	23	329.5	10197.0	7107.0
7	21	16	376.0	7539.0	5744.0
8	15	7	405.5	5917.5	2761.5
9	13	8	427.0	5479.5	3372.0
10	5	6	443.0	2210.0	2652.0
Σ	224	224		52631.0	39852.0

U1	18463.0	σU corr	1358.88
U2	31713.0	z value	4.88
μ_U	25088.0	**p value**	**0.00000**

Mitigation (n1) – CDM (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	15	62	39.0	585.0	2418.0
2	21	43	109.5	2299.5	4708.5
3	28	25	168.0	4704.0	4200.0
4	29	16	217.0	6293.0	3472.0
5	44	30	276.5	12166.0	8295.0
6	33	17	338.5	11170.5	5754.5
7	21	13	380.5	7990.5	4946.5
8	15	10	410.0	6150.0	4100.0
9	13	5	431.5	5609.5	2157.5
10	5	3	444.5	2222.5	1333.5
Σ	224	224		59190.5	41385.5

U1	16185.5	σU corr	1358.33
U2	33990.5	z value	6.55
μ_U	25088.0	**p value**	**0.00000**

Mitigation (n1) – DNA (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	15	57	36.5	547.5	2080.5
2	21	28	97.0	2037.0	2716.0
3	28	22	146.5	4102.0	3223.0
4	29	15	193.5	5611.5	2902.5
5	44	34	254.5	11198.0	8653.0
6	33	21	320.5	10576.5	6730.5
7	21	20	368.0	7728.0	7360.0
8	15	7	399.5	5992.5	2796.5
9	13	6	420.0	5460.0	2520.0
10	5	14	439.0	2195.0	6146.0
Σ	224	224		55448.0	45128.0

U1	19928.0	σU corr	1359.28
U2	30248.0	z value	3.80
μ_U	25088.0	**p value**	**0.00015**

Mitigation (n1) – NPCC (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	15	38	27.0	405.0	1026.0
2	21	33	80.5	1690.5	2656.5
3	28	20	131.5	3682.0	2630.0
4	29	9	174.5	5060.5	1570.5
5	44	44	237.5	10450.0	10450.0
6	33	22	309.0	10197.0	6798.0
7	21	24	359.0	7539.0	8616.0
8	15	11	394.5	5917.5	4339.5
9	13	15	421.5	5479.5	6322.5
10	5	8	442.0	2210.0	3536.0
Σ	224	224		52631.0	47945.0

U1	22745.0	σU corr	1359.08
U2	27431.0	z value	1.72
μ_U	25088.0	**p value**	**0.08472**

Adaptation (n1) – Kyoto protocol (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	14	55	35.0	371.0	1457.5
2	20	38	98.5	1580.0	3002.0
3	26	20	150.5	3341.0	2570.0
4	34	17	199.0	5882.0	2941.0
5	40	34	261.5	9460.0	8041.0
6	24	23	322.0	7236.0	6934.5
7	27	16	367.0	9450.0	5600.0
8	19	7	401.5	7419.5	2733.5
9	14	8	425.5	5880.0	3360.0
10	6	6	442.5	2649.0	2649.0
Σ	224	224		53268.5	39288.5

U1	17899.5	σU corr	1359.70
U2	32276.5	z value	5.29
μ_U	25088.0	**p value**	**0.00000**

Adaptation(n1) – CDM (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	14	62	38.5	539.0	2387.0
2	20	43	108.0	2160.0	4644.0
3	26	25	165.0	4290.0	4125.0
4	34	16	215.5	7327.0	3448.0
5	40	30	275.5	11020.0	8265.0
6	24	17	331.0	7944.0	5627.0
7	27	13	371.5	10030.5	4829.5
8	19	10	406.0	7714.0	4060.0
9	14	5	430.0	6020.0	2150.0
10	6	3	444.0	2664.0	1332.0
Σ	224	224		59708.5	40867.5

U1	15667.5	σU corr	1359.06
U2	34508.5	z value	6.93
μ_U	25088.0	**p value**	**0.00000**

Adaptation (n1) – DNA (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	14	57	36.0	504.0	2052.0
2	20	28	95.5	1910.0	2674.0
3	26	22	143.5	3731.0	3157.0
4	34	15	192.0	6528.0	2880.0
5	40	34	253.5	10140.0	8619.0
6	24	21	313.0	7512.0	6573.0
7	27	20	359.0	9693.0	7180.0
8	19	7	395.5	7514.5	2768.5
9	14	6	418.5	5859.0	2511.0
10	6	14	438.5	2631.0	6139.0
Σ	224	224		56022.5	44553.5

U1	19353.5	σU corr	1360.02
U2	30822.5	z value	4.22
μ_U	25088.0	**p value**	**0.00002**

Adaptation (n1) – National CC policy (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	14	38	26.5	371.0	1007.0
2	20	33	79.0	1580.0	2607.0
3	26	20	128.5	3341.0	2570.0
4	34	9	173.0	5882.0	1557.0
5	40	44	236.5	9460.0	10406.0
6	24	22	301.5	7236.0	6633.0
7	27	24	350.0	9450.0	8400.0
8	19	11	390.5	7419.5	4295.5
9	14	15	420.0	5880.0	6300.0
10	6	8	441.5	2649.0	3532.0
Σ	224	224		53268.5	47307.5

U1	22107.5	σU corr	1359.92
U2	28068.5	z value	2.19
μ_U	25088.0	**p value**	**0.02840**

Kyoto protocol (n1) – CDM (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	55	62	59.0	3245.0	3658.0
2	38	43	158.0	6004.0	6794.0
3	20	25	221.0	4420.0	5525.0
4	17	16	260.0	4420.0	4160.0
5	34	30	308.5	10489.0	9255.0
6	23	17	360.5	8291.5	6128.5
7	16	13	395.0	6320.0	5135.0
8	7	10	418.0	2926.0	4180.0
9	8	5	433.0	3464.0	2165.0
10	6	3	444.0	2664.0	1332.0
Σ	224	224		52243.5	48332.5

U1	23132.5	σU corr	1350.09
U2	27043.5	z value	1.45
μ_U	25088.0	**p value**	**0.14750**

Kyoto protocol (n1) – DNA (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	55	57	56.5	3107.5	3220.5
2	38	28	145.5	5529.0	4074.0
3	20	22	199.5	3990.0	4389.0
4	17	15	236.5	4020.5	3547.5
5	34	34	286.5	9741.0	9741.0
6	23	21	342.5	7877.5	7192.5
7	16	20	382.5	6120.0	7650.0
8	7	7	407.5	2852.5	2852.5
9	8	6	421.5	3372.0	2529.0
10	6	14	438.5	2631.0	6139.0
Σ	224	224		49241.0	51335.0

U1	26135.0	σU corr	1352.87
U2	24041.0	z value	0.77
μ_U	25088.0	**p value**	**0.43898**

Kyoto protocol (n1) – National CC policy (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	55	38	47.0	2585.0	1786.0
2	38	33	129.0	4902.0	4257.0
3	20	20	184.5	3690.0	3690.0
4	17	9	217.5	3697.5	1957.5
5	34	44	269.5	9163.0	11858.0
6	23	22	331.0	7613.0	7282.0
7	16	24	373.5	5976.0	8964.0
8	7	11	402.5	2817.5	4427.5
9	8	15	423.0	3384.0	6345.0
10	6	8	441.5	2649.0	3532.0
Σ	224	224		46477.0	54099.0

U1	28899.0	σU corr	1355.68
U2	21277.0	z value	2.81
μ_U	25088.0	**p value**	**0.00494**

CDM (n1) – DNA (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	62	57	60.0	3720.0	3420.0
2	43	28	155.0	6665.0	4340.0
3	25	22	214.0	5350.0	4708.0
4	16	15	253.0	4048.0	3795.0
5	30	34	300.5	9015.0	10217.0
6	17	21	351.5	5975.5	7381.5
7	13	20	387.0	5031.0	7740.0
8	10	7	412.0	4120.0	2884.0
9	5	6	426.0	2130.0	2556.0
10	3	14	440.0	1320.0	6160.0
Σ	224	224		47374.5	53201.5

U1	28001.5	σU corr	1350.69
U2	22174.5	z value	2.16
μ_U	25088.0	**p value**	**0.03100**

CDM (n1) – National CC policy (n2)

LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	62	38	50.5	3131.0	1919.0
2	43	33	138.5	5955.5	4570.5
3	25	20	199.0	4975.0	3980.0
4	16	9	234.0	3744.0	2106.0
5	30	44	283.5	8505.0	12474.0
6	17	22	340.0	5780.0	7480.0
7	13	24	378.0	4914.0	9072.0
8	10	11	407.0	4070.0	4477.0
9	5	15	427.5	2137.5	6412.5
10	3	8	443.0	1329.0	3544.0
Σ	224	224		44541.0	56035.0

U1	30835.0	σU corr	1354.26
U2	19341.0	z value	4.24
μ_U	25088.0	**p value**	**0.00002**

DNA (n1) – National CC policy (n2)

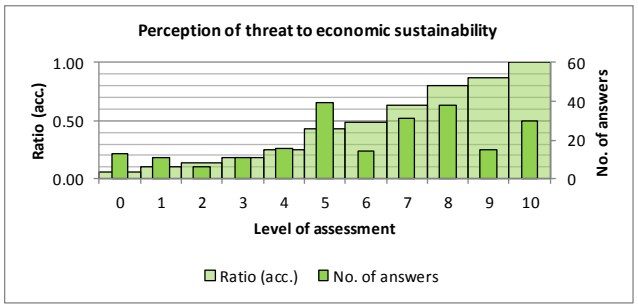
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	57	38	48.0	2736.0	1824.0
2	28	33	126.0	3528.0	4158.0
3	22	20	177.5	3905.0	3550.0
4	15	9	210.5	3157.5	1894.5
5	34	44	261.5	8891.0	11506.0
6	21	22	322.0	6762.0	7084.0
7	20	24	365.5	7310.0	8772.0
8	7	11	396.5	2775.5	4361.5
9	6	15	416.0	2496.0	6240.0
10	14	8	437.5	6125.0	3500.0
Σ	224	224		47686.0	52890.0

U1	27690.0	σU corr	1356.12
U2	22486.0	z value	1.92
μ_U	25088.0	**p value**	**0.05502**

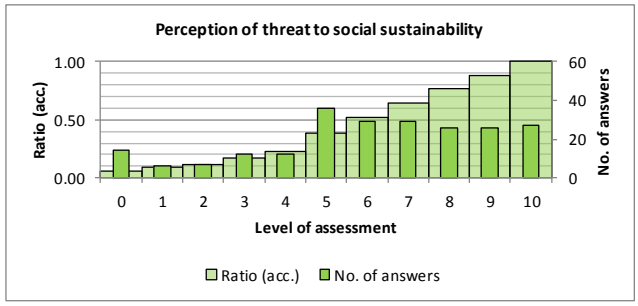
LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 49 Results of Mann Whitney U tests for differences among stakeholders` knowledge of climate change policies, strategies, and instruments

Economic Sustainability		1st. Quartile	4.00
		Median	7.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	13	13	0.06
1	11	24	0.11
2	6	30	0.13
3	11	41	0.18
4	16	57	0.25
5	39	96	0.43
6	14	110	0.49
7	31	141	0.63
8	38	179	0.80
9	15	194	0.87
10	30	224	1.00



Social Sustainability		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	14	14	0.06
1	6	20	0.09
2	7	27	0.12
3	12	39	0.17
4	12	51	0.23
5	36	87	0.39
6	29	116	0.52
7	29	145	0.65
8	26	171	0.76
9	26	197	0.88
10	27	224	1.00



Environmental Sustainability		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	13	13	0.06
1	3	16	0.07
2	2	18	0.08
3	9	27	0.12
4	11	38	0.17
5	24	62	0.28
6	16	78	0.35
7	24	102	0.46
8	35	137	0.61
9	33	170	0.76
10	54	224	1.00

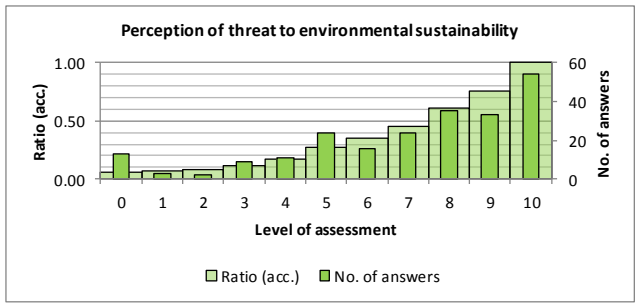


Table 50 Stakeholders` assessment of threat of climate change to economic, social and environmental sustainability

Economic -Social Development

All stakeholders						Chief ecécutives						Economic planners						Consultants						Councillors						Other stakeholders					
LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2
0	13	14	14.0	182.0	196.0	0	1	1	1.5	1.5	1.5	0	3	3	3.5	10.5	10.5	0	0	0	#N/A	#N/A	#N/A	0	6	6	6.5	39.0	39.0	0	3	4	4.0	12.0	16.0
1	11	6	36.0	396.0	216.0	1	1	0	3.0	3.0	0.0	1	0	0	#N/A	#N/A	#N/A	1	0	0	#N/A	#N/A	#N/A	1	5	3	16.5	82.5	49.5	1	5	3	11.5	57.5	34.5
2	6	7	51.0	306.0	357.0	2	1	2	5.0	5.0	10.0	2	1	1	7.5	7.5	7.5	2	0	0	#N/A	#N/A	#N/A	2	3	2	23.0	69.0	46.0	2	1	2	17.0	17.0	34.0
3	11	12	69.0	759.0	828.0	3	0	1	7.0	0.0	7.0	3	7	3	13.5	94.5	40.5	3	0	0	#N/A	#N/A	#N/A	3	2	4	28.5	57.0	114.0	3	2	4	21.5	43.0	86.0
4	16	12	94.5	1512.0	1134.0	4	2	1	9.0	18.0	9.0	4	1	2	20.0	20.0	40.0	4	2	0	1.5	3.0	0.0	4	5	3	35.5	177.5	106.5	4	6	6	30.5	183.0	183.0
5	39	36	146.0	5694.0	5256.0	5	11	7	19.5	214.5	136.5	5	8	11	31.0	248.0	341.0	5	1	0	3.0	3.0	0.0	5	7	11	48.5	339.5	533.5	5	12	7	46.0	552.0	322.0
6	14	29	205.0	2870.0	5945.0	6	2	3	31.0	62.0	93.0	6	1	6	44.0	44.0	264.0	6	4	3	7.0	28.0	21.0	6	4	8	63.5	254.0	508.0	6	3	9	61.5	184.5	553.5
7	31	29	256.5	7951.5	7438.5	7	4	7	39.0	156.0	273.0	7	9	6	55.0	495.0	330.0	7	3	2	13.0	39.0	26.0	7	11	7	78.5	863.5	549.5	7	5	7	73.5	367.5	514.5
8	38	26	318.5	12103.0	8281.0	8	1	1	45.5	45.5	45.5	8	14	6	72.5	1015.0	435.0	8	1	4	18.0	18.0	72.0	8	11	11	98.5	1083.5	1083.5	8	10	4	86.5	865.0	346.0
9	15	26	371.0	5565.0	9646.0	9	1	1	47.5	47.5	47.5	9	3	10	89.0	267.0	890.0	9	2	5	24.0	48.0	120.0	9	6	7	116.0	696.0	812.0	9	3	3	96.5	289.5	289.5
10	30	27	420.0	12600.0	11340.0	10	1	1	49.5	49.5	49.5	10	10	9	105.0	1050.0	945.0	10	4	3	31.0	124.0	93.0	10	8	6	129.5	1036.0	777.0	10	7	8	107.0	749.0	856.0
∑	224	224		49938.5	50637.5	∑	25	25		602.5	672.5	∑	57	57		3210.0	3345.0	∑	17	17		263.0	332.0	∑	68	68		4697.5	4618.5	∑	57	57		3320.0	3235.0
U1		25437.5	$\sigma_{U\ corr}$		1360.29	U1		347.5	$\sigma_{U\ corr}$		50.01	U1		1650.5	$\sigma_{U\ corr}$		174.73	U1		179.0	$\sigma_{U\ corr}$		28.57	U1		2272.5	$\sigma_{U\ corr}$		228.30	U1		1582.0	$\sigma_{U\ corr}$		175.30
U2		24738.5	z value		0.26	U2		277.5	z value		0.70	U2		1598.5	z value		0.15	U2		110.0	z value		1.21	U2		2351.5	z value		0.17	U2		1667.0	z value		0.24
μ_U		25088.0	**p value**		**0.79723**	μ_U		312.5	**p value**		**0.48397**	μ_U		1624.5	**p value**		**0.88171**	μ_U		144.5	**p value**		**0.22715**	μ_U		2312.0	**p value**		**0.86264**	μ_U		1624.5	**p value**		**0.80844**

Economic -Environmental Development

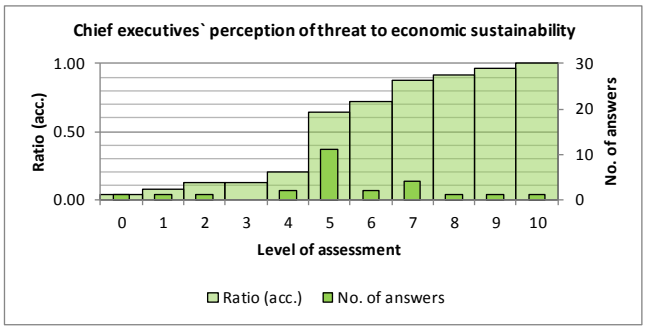
All stakeholders						Chief ecécutives						Economic planners						Consultants						Councillors						Other stakeholders					
LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2
0	13	13	13.5	175.5	175.5	0	1	1	1.5	1.5	1.5	0	3	3	3.5	10.5	10.5	0	0	0	#N/A	#N/A	#N/A	0	6	6	6.5	39.0	39.0	0	3	3	3.5	10.5	10.5
1	3	11	33.5	100.5	368.5	1	0	1	3.0	0.0	3.0	1	0	0	#N/A	#N/A	#N/A	1	0	0	#N/A	#N/A	#N/A	1	5	3	16.5	82.5	49.5	1	5	0	9.0	45.0	0.0
2	2	6	44.5	89.0	267.0	2	1	1	4.5	4.5	4.5	2	1	0	7.0	7.0	0.0	2	0	0	#N/A	#N/A	#N/A	2	3	0	22.0	66.0	0.0	2	1	1	12.5	12.5	12.5
3	9	11	58.5	526.5	643.5	3	0	0	#N/A	#N/A	#N/A	3	7	3	12.5	87.5	37.5	3	0	0	#N/A	#N/A	#N/A	3	2	2	25.5	51.0	51.0	3	2	4	16.5	33.0	66.0
4	11	16	82.0	902.0	1312.0	4	1	2	7.0	7.0	14.0	4	1	1	18.5	18.5	18.5	4	2	0	1.5	3.0	0.0	4	5	5	32.5	162.5	162.5	4	6	4	24.5	147.0	98.0
5	24	39	127.0	3048.0	4953.0	5	5	11	16.5	82.5	181.5	5	8	7	27.0	216.0	189.0	5	1	0	3.0	3.0	0.0	5	7	7	44.5	311.5	311.5	5	12	5	38.0	456.0	190.0
6	16	14	173.5	2776.0	2429.0	6	4	2	27.5	110.0	55.0	6	1	1	35.5	35.5	35.5	6	4	0	5.5	22.0	0.0	6	4	6	56.5	226.0	339.0	6	3	5	50.5	151.5	252.5
7	24	31	216.0	5184.0	6696.0	7	4	4	34.5	138.0	138.0	7	9	9	45.5	409.5	409.5	7	3	2	10.0	30.0	20.0	7	11	5	69.5	764.5	347.5	7	5	4	59.0	295.0	236.0
8	35	38	280.0	9800.0	10640.0	8	4	1	41.0	164.0	41.0	8	14	8	65.5	917.0	524.0	8	1	4	15.0	15.0	60.0	8	11	10	88.0	968.0	880.0	8	10	10	73.5	735.0	735.0
9	33	15	340.5	11236.5	5107.5	9	2	1	45.0	90.0	45.0	9	3	8	82.0	246.0	656.0	9	2	4	20.5	41.0	82.0	9	6	13	108.0	648.0	1404.0	9	3	6	88.0	264.0	528.0
10	54	30	406.5	21951.0	12195.0	10	3	1	48.5	145.5	48.5	10	10	17	101.0	1010.0	1717.0	10	4	7	29.0	116.0	203.0	10	8	11	127.0	1016.0	1397.0	10	7	15	103.5	724.5	1552.5
∑	224	224		743.0	532.0	∑	25	25		743.0	532.0	∑	57	57		2916.5	3638.5	∑	17	17		230.0	365.0	∑	68	68		4335.0	4981.0	∑	57	57		2874.0	3681.0
U1		30589.0	$\sigma_{U\ corr}$		1358.07	U1		418.0	$\sigma_{U\ corr}$		50.49	U1		1944.5	$\sigma_{U\ corr}$		173.94	U1		212.0	$\sigma_{U\ corr}$		28.35	U1		2635.0	$\sigma_{U\ corr}$		228.20	U1		2028.0	$\sigma_{U\ corr}$		174.84
U2		19587.0	z value		4.05	U2		207.0	z value		2.09	U2		1304.5	z value		1.84	U2		77.0	z value		2.38	U2		1989.0	z value		1.42	U2		1221.0	z value		2.31
μ_U		25088.0	**p value**		**0.00005**	μ_U		312.5	**p value**		**0.03666**	μ_U		1624.5	**p value**		**0.06580**	μ_U		144.5	**p value**		**0.01725**	μ_U		2312.0	**p value**		**0.15695**	μ_U		1624.5	**p value**		**0.02101**

Social -Environmental Development

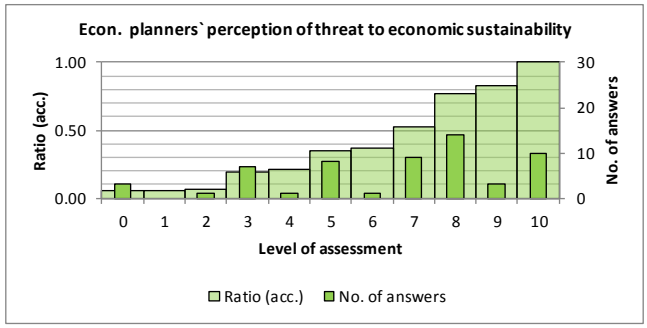
All stakeholders						Chief ecécutives						Economic planners						Consultants						Councillors						Other stakeholders					
LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2
0	14	13	14	196	182	0	1	1	1.5	1.5	1.5	0	3	3	3.5	10.5	10.5	0	0	0	#N/A	#N/A	#N/A	0	6	6	6.5	39.0	39.0	0	4	3	4.0	16.0	12.0
1	6	3	32	192	96	1	0	0	#N/A	#N/A	#N/A	1	0	0	#N/A	#N/A	#N/A	1	0	0	#N/A	#N/A	#N/A	1	3	3	15.5	46.5	46.5	1	3	0	9.0	27.0	0.0
2	7	2	41.0	287.0	82.0	2	2	1	4.0	8.0	4.0	2	1	0	7.0	7.0	0.0	2	0	0	#N/A	#N/A	#N/A	2	2	0	19.5	39.0	0.0	2	2	1	12.0	24.0	12.0
3	12	9	56.0	672.0	504.0	3	1	0	6.0	6.0	0.0	3	3	3	10.5	31.5	31.5	3	0	0	#N/A	#N/A	#N/A	3	4	2	23.5	94.0	47.0	3	4	4	17.5	70.0	70.0
4	12	11	78.0	936.0	858.0	4	1	1	7.5	7.5	7.5	4	2	1	15.0	30.0	15.0	4	0	0	#N/A	#N/A	#N/A	4	3	5	30.5	91.5	152.5	4	6	4	26.5	159.0	106.0
5	36	24	119.5	4302.0	2868.0	5	7	5	14.5	101.5	72.5	5	11	7	25.5	280.5	178.5	5	0	0	#N/A	#N/A	#N/A	5	11	7	43.5	478.5	304.5	5	7	5	37.5	262.5	187.5
6	29	16	172.0	4988.0	2752.0	6	3	4	24.0	72.0	96.0	6	6	1	38.0	228.0	38.0	6	3	0	2.0	6.0	0.0	6	8	6	59.5	476.0	357.0	6	9	5	50.5	454.5	252.5
7	29	24	221.0	6409.0	5304.0	7	7	4	33.0	231.0	132.0	7	6	9	49.0	294.0	441.0	7	2	2	5.5	11.0	11.0	7	7	5	72.5	507.5	362.5	7	7	4	63.0	441.0	252.0
8	26	35	278.0	7228.0	9730.0	8	1	4	41.0	41.0	164.0	8	6	8	63.5	381.0	508.0	8	4	4	11.5	46.0	46.0	8	11	10	89.0	979.0	890.0	8	4	10	75.5	302.0	755.0
9	26	33	338.0	8788.0	11154.0	9	1	2	45.0	45.0	90.0	9	10	8	79.5	795.0	636.0	9	5	4	20.0	100.0	80.0	9	7	13	109.5	766.5	1423.5	9	3	6	87.0	261.0	522.0
10	27	54	408.0	11016.0	22032.0	10	1	3	48.5	48.5	145.5	10	9	17	101.5	913.5	1725.5	10	3	7	29.5	88.5	206.5	10	6	11	128.0	768.0	1408.0	10	8	15	103.0	824.0	1545.0
∑	224	224		562.0	713.0	∑	25	25		562.0	713.0	∑	57	57		2972.5	3582.5	∑	17	17		251.5	343.5	∑	68	68		4285.5	5030.5	∑	57	57		2841.0	3714.0
U1		30362.0	$\sigma_{U\ corr}$		1359.00	U1		388.0	$\sigma_{U\ corr}$		50.79	U1		1931.0	$\sigma_{U\ corr}$		174.29	U1		190.5	$\sigma_{U\ corr}$		28.17	U1		2684.5	$\sigma_{U\ corr}$		228.16	U1		2061.0	$\sigma_{U\ corr}$		175.07
U2		19814.0	z value		3.88	U2		237.0	z value		1.49	U2		1318.0	z value		1.76	U2		98.5	z value		1.63	U2		1939.5	z value		1.63	U2		1188.0	z value		2.49
μ_U		25088.0	**p value**		**0.00010**	μ_U		312.5	**p value**		**0.13713**	μ_U		1624.5	**p value**		**0.07866**	μ_U		144.5	**p value**		**0.10249**	μ_U		2312.0	**p value**		**0.10254**	μ_U		1624.5	**p value**		**0.01265**

Table 51 Results of Mann Whitney U tests for differences among stakeholders` perception of threat of climate change to economic, social, and environmental sustainability

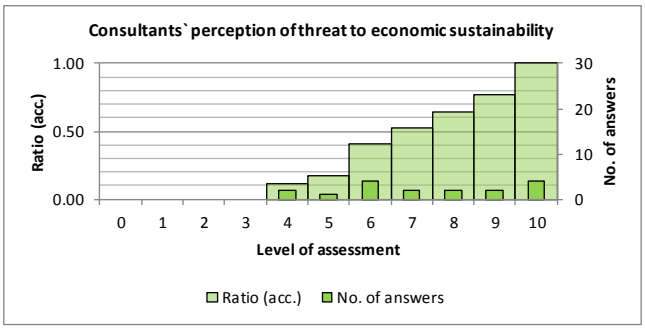
Chief executives		1st. Quartile	5.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	1	1	0.04
1	1	2	0.08
2	1	3	0.12
3	0	3	0.12
4	2	5	0.20
5	11	16	0.64
6	2	18	0.72
7	4	22	0.88
8	1	23	0.92
9	1	24	0.96
10	1	25	1.00



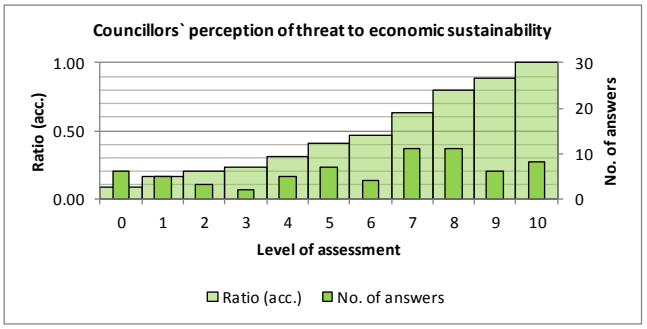
Economic planners		1st. Quartile	5.00
		Median	7.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.05
1	0	3	0.05
2	1	4	0.07
3	7	11	0.19
4	1	12	0.21
5	8	20	0.35
6	1	21	0.37
7	9	30	0.53
8	14	44	0.77
9	3	47	0.82
10	10	57	1.00



Consultants		1st. Quartile	6.00
		Median	7.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	0	0	0.00
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	2	2	0.12
5	1	3	0.18
6	4	7	0.41
7	2	9	0.53
8	2	11	0.65
9	2	13	0.76
10	4	17	1.00



Councillors		1st. Quartile	4.00
		Median	7.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	6	6	0.09
1	5	11	0.16
2	3	14	0.21
3	2	16	0.24
4	5	21	0.31
5	7	28	0.41
6	4	32	0.47
7	11	43	0.63
8	11	54	0.79
9	6	60	0.88
10	8	68	1.00



Other stakeholders		1st. Quartile	4.00
		Median	5.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.06
1	5	8	0.15
2	1	9	0.17
3	2	11	0.21
4	6	17	0.33
5	12	29	0.56
6	3	32	0.62
7	5	37	0.71
8	10	42	0.81
9	3	45	0.87
10	7	52	1.00

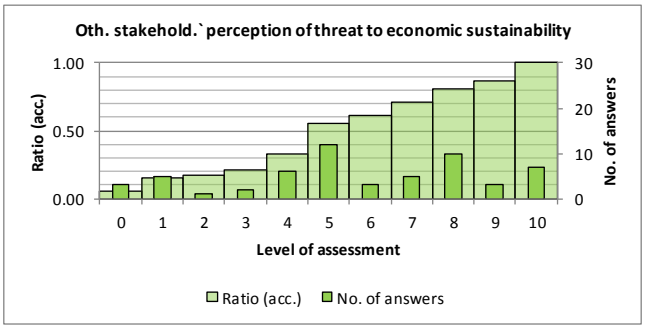
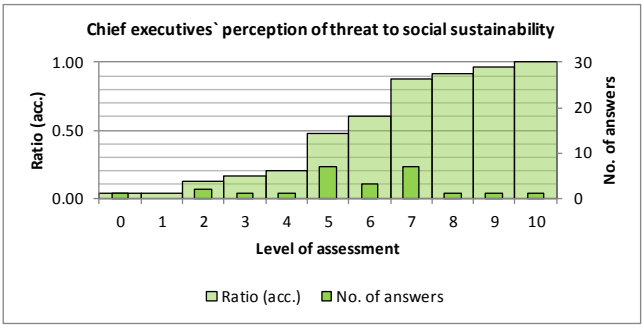
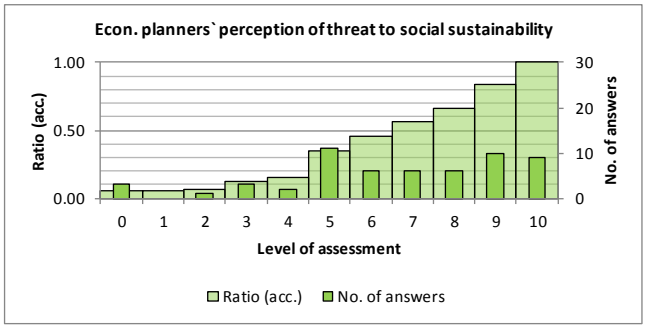


Table 52 Stakeholders` perception of threat of climate change to economic sustainability

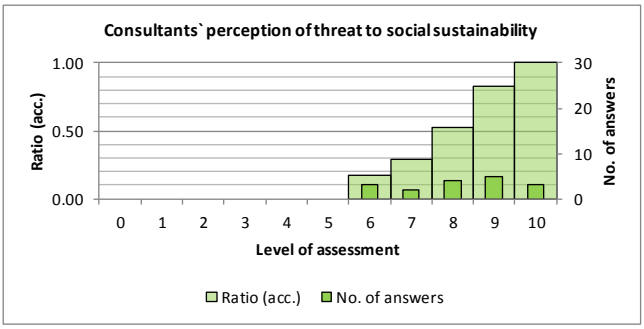
Chief executives		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	1	1	0.04
1	0	1	0.04
2	2	3	0.12
3	1	4	0.16
4	1	5	0.20
5	7	12	0.48
6	3	15	0.60
7	7	22	0.88
8	1	23	0.92
9	1	24	0.96
10	1	25	1.00



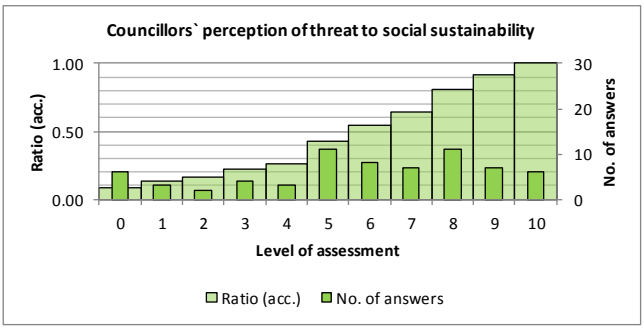
Economic planners		1st. Quartile	5.00
		Median	7.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.05
1	0	3	0.05
2	1	4	0.07
3	3	7	0.12
4	2	9	0.16
5	11	20	0.35
6	6	26	0.46
7	6	32	0.56
8	6	38	0.67
9	10	48	0.84
10	9	57	1.00



Consultants		1st. Quartile	7.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	0	0	0.00
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	0	0	0.00
5	0	0	0.00
6	3	3	0.18
7	2	5	0.29
8	4	9	0.53
9	5	14	0.82
10	3	17	1.00



Councillors		1st. Quartile	4.00
		Median	6.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	6	6	0.09
1	3	9	0.13
2	2	11	0.16
3	4	15	0.22
4	3	18	0.26
5	11	29	0.43
6	8	37	0.54
7	7	44	0.65
8	11	55	0.81
9	7	62	0.91
10	6	68	1.00



Other stakeholders		1st. Quartile	4.00
		Median	6.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	4	4	0.07
1	3	7	0.12
2	2	9	0.16
3	4	13	0.23
4	6	19	0.33
5	7	26	0.46
6	9	35	0.61
7	7	42	0.74
8	4	46	0.81
9	3	49	0.86
10	8	57	1.00

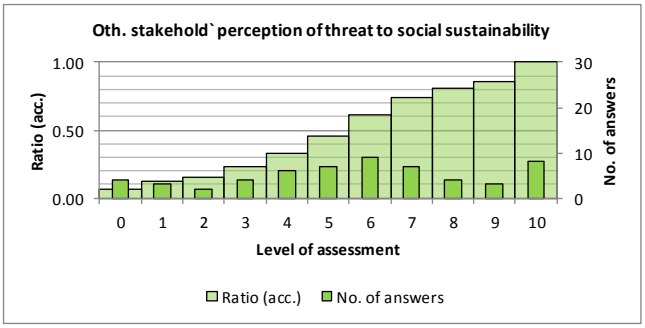
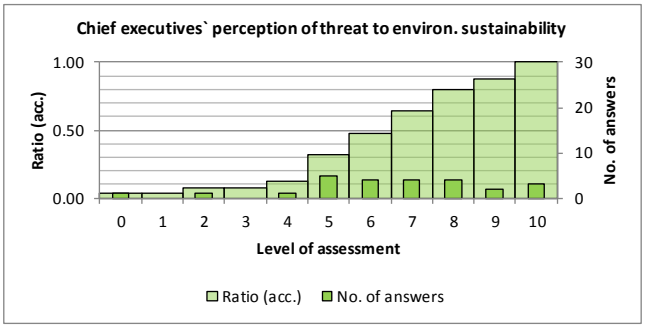
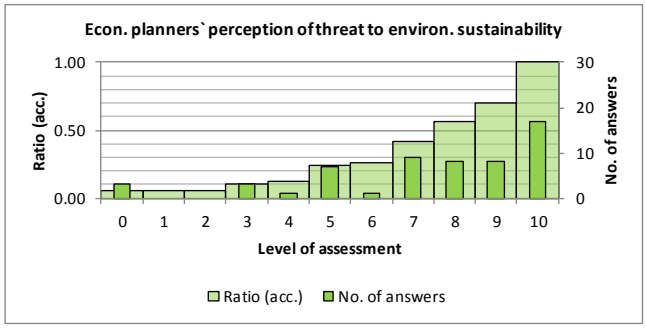


Table 53 Stakeholders` perception of threat of climate change to social sustainability

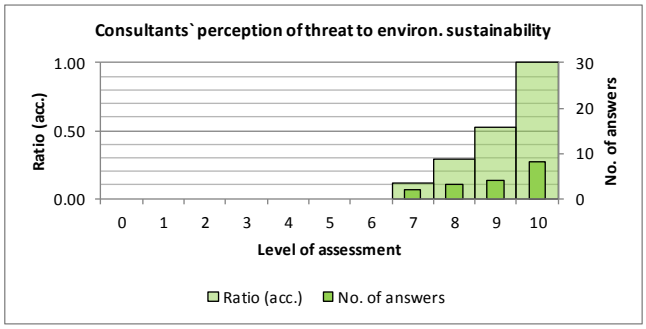
Chief executives		1st. Quartile	5.00
		Median	7.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	1	1	0.04
1	0	1	0.04
2	1	2	0.08
3	0	2	0.08
4	1	3	0.12
5	5	8	0.32
6	4	12	0.48
7	4	16	0.64
8	4	20	0.80
9	2	22	0.88
10	3	25	1.00



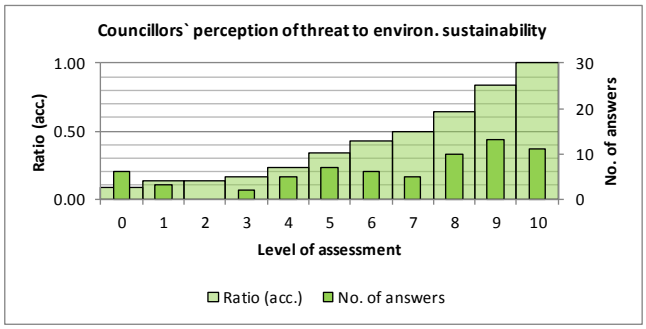
Economic planners		1st. Quartile	6.00
		Median	8.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.05
1	0	3	0.05
2	0	3	0.05
3	3	6	0.11
4	1	7	0.12
5	7	14	0.25
6	1	15	0.26
7	9	24	0.42
8	8	32	0.56
9	8	40	0.70
10	17	57	1.00



Consultants		1st. Quartile	8.00
		Median	9.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	0	0	0.00
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	0	0	0.00
5	0	0	0.00
6	0	0	0.00
7	2	2	0.12
8	3	5	0.29
9	4	9	0.53
10	8	17	1.00



Councillors		1st. Quartile	5.00
		Median	7.50
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	6	6	0.09
1	3	9	0.13
2	0	9	0.13
3	2	11	0.16
4	5	16	0.24
5	7	23	0.34
6	6	29	0.43
7	5	34	0.50
8	10	44	0.65
9	13	57	0.84
10	11	68	1.00



Other stakeholders		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.05
1	0	3	0.05
2	1	4	0.07
3	4	8	0.14
4	4	12	0.21
5	5	17	0.30
6	5	22	0.39
7	4	26	0.46
8	10	36	0.63
9	6	42	0.74
10	15	57	1.00

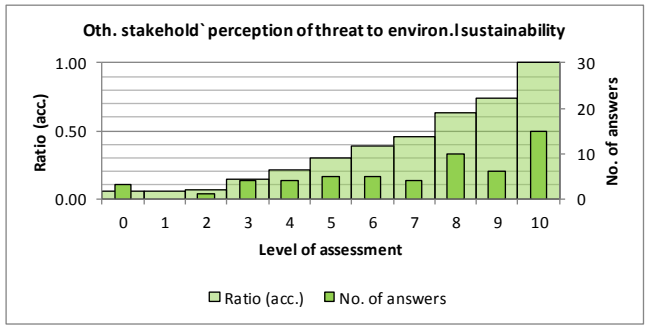


Table 54 Stakeholders` perception of threat of climate change to environmental sustainability

Chief executives (n1) – Economic planners(n2)						Chief executives (n2) – Consultants(n1)						Chief executives (n1) – Councillors(n2)						Chief executives (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	1	3	2.5	2.5	7.5	0	0	1	1.0	0.0	1.0	0	1	6	4.0	4.0	24.0	0	1	3	2.5	2.5	7.5
1	1	0	5.0	5.0	0.0	1	0	1	2.0	0.0	2.0	1	1	5	10.5	10.5	52.5	1	1	5	7.5	7.5	37.5
2	1	1	6.5	6.5	6.5	2	0	1	3.0	0.0	3.0	2	1	3	15.5	15.5	46.5	2	1	1	11.5	11.5	11.5
3	0	7	11.0	0.0	77.0	3	0	0	#N/A	#N/A	#N/A	3	0	2	18.5	0.0	37.0	3	0	2	13.5	0.0	27.0
4	2	1	16.0	32.0	16.0	4	2	2	5.5	11.0	11.0	4	2	5	23.0	46.0	115.0	4	2	6	18.5	37.0	111.0
5	11	8	27.0	297.0	216.0	5	1	11	13.5	13.5	148.5	5	11	7	35.5	390.5	248.5	5	11	12	34.0	374.0	408.0
6	2	1	38.0	76.0	38.0	6	4	2	22.5	90.0	45.0	6	2	4	47.5	95.0	190.0	6	2	3	48.0	96.0	144.0
7	4	9	46.0	184.0	414.0	7	2	4	28.5	57.0	114.0	7	4	11	58.0	232.0	638.0	7	4	5	55.0	220.0	275.0
8	1	14	60.0	60.0	840.0	8	2	1	33.0	66.0	33.0	8	1	11	71.5	71.5	786.5	8	1	10	65.0	65.0	650.0
9	1	3	69.5	69.5	208.5	9	2	1	36.0	72.0	36.0	9	1	6	81.0	81.0	486.0	9	1	3	72.5	72.5	217.5
10	1	10	77.0	77.0	770.0	10	4	1	40.0	160.0	40.0	10	1	8	89.0	89.0	712.0	10	1	7	78.5	78.5	549.5
Σ	25	57		809.5	2593.5	Σ	17	25		467.0	436.0	Σ	25	68		1035.0	3336.0	Σ	25	57		964.5	2438.5
U1		940.5	$\sigma_{U\,corr}$		97.99	U1		108.5	$\sigma_{U\,corr}$		38.40	U1		990.0	$\sigma_{U\,corr}$		114.45	U1		785.5	$\sigma_{U\,corr}$		97.86
U2		484.5	z value		2.33	U2		316.5	z value		2.71	U2		710.0	z value		1.22	U2		639.5	z value		0.75
μ_U		712.5	**p value**		**0.01998**	μ_U		212.5	**p value**		**0.00676**	μ_U		850.0	**p value**		**0.22125**	μ_U		712.5	**p value**		**0.45568**

Economic planners (n2) – Consultants (n1)						Economic planners (n2) – Councillors (n1)						Economic planners (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	3	2.0	0.0	6.0	0	3	6	5.0	15.0	30.0	0	3	3	3.5	10.5	10.5
1	0	0	#N/A	#N/A	#N/A	1	0	5	12.0	0.0	60.0	1	0	5	9.0	0.0	45.0
2	0	1	4.0	0.0	4.0	2	1	3	16.5	16.5	49.5	2	1	1	12.5	12.5	12.5
3	0	7	8.0	0.0	56.0	3	7	2	23.0	161.0	46.0	3	7	2	18.0	126.0	36.0
4	2	1	13.0	26.0	13.0	4	1	5	30.5	30.5	152.5	4	1	6	26.0	26.0	156.0
5	1	8	19.0	19.0	152.0	5	8	7	41.0	328.0	287.0	5	8	12	39.5	316.0	474.0
6	4	1	26.0	104.0	26.0	6	1	4	51.0	51.0	204.0	6	1	3	51.5	51.5	154.5
7	2	9	34.0	68.0	306.0	7	9	11	63.5	571.5	698.5	7	9	5	60.5	544.5	302.5
8	2	14	47.5	95.0	665.0	8	14	11	86.0	1204.0	946.0	8	14	10	79.5	1113.0	795.0
9	2	3	58.0	116.0	174.0	9	3	6	103.0	309.0	618.0	9	3	3	94.5	283.5	283.5
10	4	10	67.5	270.0	675.0	10	10	8	116.5	1165.0	932.0	10	10	7	106.0	1060.0	742.0
Σ	17	57		705.0	2070.0	Σ	57	68		3851.5	4023.5	Σ	57	57		3543.5	3011.5
U1		424.0	$\sigma_{U\,corr}$		76.91	U1		1677.5	$\sigma_{U\,corr}$		199.90	U1		1358.5	$\sigma_{U\,corr}$		174.59
U2		545.0	z value		0.79	U2		2198.5	z value		1.30	U2		1890.5	z value		1.52
μ_U		484.5	**p value**		**0.43148**	μ_U		1938.0	**p value**		**0.19252**	μ_U		1624.5	**p value**		**0.12763**

Consultants (n1) – Councillors (n2)						Consultants (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	6	3.5	0.0	21.0	0	0	3	2.0	0.0	6.0
1	0	5	9.0	0.0	45.0	1	0	5	6.0	0.0	30.0
2	0	3	13.0	0.0	39.0	2	0	1	9.0	0.0	9.0
3	0	2	15.5	0.0	31.0	3	0	2	10.5	0.0	21.0
4	2	5	20.0	40.0	100.0	4	2	6	15.5	31.0	93.0
5	1	7	27.5	27.5	192.5	5	1	12	26.0	26.0	312.0
6	4	4	35.5	142.0	142.0	6	4	3	36.0	144.0	108.0
7	2	11	46.0	92.0	506.0	7	2	5	43.0	86.0	215.0
8	2	11	59.0	118.0	649.0	8	2	10	52.5	105.0	525.0
9	2	6	69.5	139.0	417.0	9	2	3	61.0	122.0	183.0
10	4	8	79.5	318.0	636.0	10	4	7	69.0	276.0	483.0
Σ	17	68		876.5	2778.5	Σ	17	57		790.0	1985.0
U1		432.5	$\sigma_{U\,corr}$		90.40	U1		332.0	$\sigma_{U\,corr}$		77.18
U2		723.5	z value		1.61	U2		637.0	z value		1.98
μ_U		578.0	**p value**		**0.10752**	μ_U		484.5	**p value**		**0.04816**

Councillors (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	3	6	5.0	15.0	30.0
1	5	5	14.5	72.5	72.5
2	1	3	21.5	21.5	64.5
3	2	2	25.5	51.0	51.0
4	6	5	33.0	198.0	165.0
5	12	7	48.0	576.0	336.0
6	3	4	61.0	183.0	244.0
7	5	11	72.5	362.5	797.5
8	10	11	91.0	910.0	1001.0
9	3	6	106.0	318.0	636.0
10	7	8	118.0	826.0	944.0
Σ	57	68		3533.5	4341.5
U1		1995.5	$\sigma_{U\,corr}$		200.30
U2		1880.5	z value		0.29
μ_U		1938.0	**p value**		**0.77406**

LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 55 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the threat of climate change to economic sustainability

Chief executives (n1) – Economic planners(n2)						Chief executives (n2) – Consultants(n1)						Chief executives (n1) – Councillors(n2)						Chief executives (n1) – Other stakeholders(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	1	3	2.5	2.5	7.5	0	0	1	1	0	1	0	1	6	4.0	4.0	24.0	0	1	4	3.0	3.0	12.0
1	0	0	#N/A	#N/A	#N/A	1	0	0	#N/A	#N/A	#N/A	1	0	3	9.0	0.0	27.0	1	0	3	7.0	0.0	21.0
2	2	1	6.0	12.0	6.0	2	0	2	2.5	0.0	5.0	2	2	2	12.5	25.0	25.0	2	2	2	10.5	21.0	21.0
3	1	3	9.5	9.5	28.5	3	0	1	4.0	0.0	4.0	3	1	4	17.0	17.0	68.0	3	1	4	15.0	15.0	60.0
4	1	2	13.0	13.0	26.0	4	0	1	5.0	0.0	5.0	4	1	3	21.5	21.5	64.5	4	1	6	21.0	21.0	126.0
5	7	11	23.5	164.5	258.5	5	0	7	9.0	0.0	63.0	5	7	11	32.5	227.5	357.5	5	7	7	31.5	220.5	220.5
6	3	6	37.0	111.0	222.0	6	3	3	15.5	46.5	46.5	6	3	8	47.0	141.0	376.0	6	3	9	44.5	133.5	400.5
7	7	6	48.0	336.0	288.0	7	2	7	23.0	46.0	161.0	7	7	7	59.5	416.5	416.5	7	7	7	57.5	402.5	402.5
8	1	6	58.0	58.0	348.0	8	4	1	30.0	120.0	30.0	8	1	11	72.5	72.5	797.5	8	1	4	67.0	67.0	268.0
9	1	10	67.0	67.0	670.0	9	5	1	35.5	177.5	35.5	9	1	7	82.5	82.5	577.5	9	1	3	71.5	71.5	214.5
10	1	9	77.5	77.5	697.5	10	3	1	40.5	121.5	40.5	10	1	6	90.0	90.0	540.0	10	1	8	78.0	78.0	624.0
Σ	25	57		860.0	2543.0	Σ	17	25		511.5	391.5	Σ	25	68		1097.5	3273.5	Σ	25	57		1033.0	2370.0
U1		899.0	$\sigma_{U\,corr}$		98.23	U1		66.5	$\sigma_{U\,corr}$		38.58	U1		927.5	$\sigma_{U\,corr}$		114.46	U1		717.0	$\sigma_{U\,corr}$		98.49
U2		526.0	z value		1.90	U2		358.5	z value		3.78	U2		772.5	z value		0.68	U2		708.0	z value		0.05
μ_U		712.5	**p value**		**0.05763**	μ_U		212.5	**p value**		**0.00015**	μ_U		850.0	**p value**		**0.49835**	μ_U		712.5	**p value**		**0.96356**

						Economic planners (n2) – Consultants (n1)						Economic planners (n2) – Councillors (n1)						Economic planners (n1) – Other stakeholders (n2)					
						LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
						0	0	3	2	0	6	0	3	6	5.0	15.0	30.0	0	3	4	4.0	12.0	16.0
						1	0	0	#N/A	#N/A	#N/A	1	0	3	11.0	0.0	33.0	1	0	3	9.0	0.0	27.0
						2	0	1	4.0	0	4	2	1	2	14.0	14.0	28.0	2	1	2	12.0	12.0	24.0
						3	0	3	6.0	0	18	3	3	4	19.0	57.0	76.0	3	3	4	17.0	51.0	68.0
						4	0	2	8.5	0	17	4	2	3	25.0	50.0	75.0	4	2	6	24.5	49.0	147.0
						5	0	11	15.0	0	165	5	11	11	38.5	423.5	423.5	5	11	7	37.5	412.5	262.5
						6	3	6	25.0	75	150	6	6	8	56.5	339.0	452.0	6	6	9	54.0	324.0	486.0
						7	2	6	33.5	67	201	7	6	7	70.0	420.0	490.0	7	6	7	68.0	408.0	476.0
						8	4	6	42.5	170	255	8	6	11	85.0	510.0	935.0	8	6	4	79.5	477.0	318.0
						9	5	10	55.0	275	550	9	10	7	102.0	1020.0	714.0	9	10	3	91.0	910.0	273.0
						10	3	9	68.5	205.5	616.5	10	9	6	118.0	1062.0	708.0	10	9	8	106.0	954.0	848.0
						Σ	17	57		794.0	1981.0	Σ	57	68		3910.5	3964.5	Σ	57	57		3609.5	2945.5
						U1		329.5	$\sigma_{U\,corr}$		76.99	U1		1618.5	$\sigma_{U\,corr}$		200.19	U1		1292.5	$\sigma_{U\,corr}$		175.22
						U2		639.5	z value		2.01	U2		2257.5	z value		1.60	U2		1956.5	z value		1.89
						μ_U		484.5	**p value**		**0.04408**	μ_U		1938.0	**p value**		**0.11049**	μ_U		1624.5	**p value**		**0.05812**

												Consultants (n1) – Councillors (n2)						Consultants (n1) – Other stakeholders (n2)					
												LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
												0	0	6	3.5	0.0	21.0	0	0	4	2.5	0.0	10.0
												1	0	3	8.0	0.0	24.0	1	0	3	6.0	0.0	18.0
												2	0	2	10.5	0.0	21.0	2	0	2	8.5	0.0	17.0
												3	0	4	13.5	0.0	54.0	3	0	4	11.5	0.0	46.0
												4	0	3	17.0	0.0	51.0	4	0	6	16.5	0.0	99.0
												5	0	11	24.0	0.0	264.0	5	0	7	23.0	0.0	161.0
												6	3	8	35.0	105.0	280.0	6	3	9	32.5	97.5	292.5
												7	2	7	45.0	90.0	315.0	7	2	7	43.0	86.0	301.0
												8	4	11	57.0	228.0	627.0	8	4	4	51.5	206.0	206.0
												9	5	7	70.5	352.5	493.5	9	5	3	59.5	297.5	178.5
												10	3	6	81.0	243.0	486.0	10	3	8	69.0	207.0	552.0
												Σ	17	68		1018.5	2636.5	Σ	17	57		894.0	1881.0
												U1		290.5	$\sigma_{U\,corr}$		90.31	U1		228.0	$\sigma_{U\,corr}$		77.30
												U2		865.5	z value		3.18	U2		741.0	z value		3.32
												μ_U		578.0	**p value**		**0.00146**	μ_U		484.5	**p value**		**0.00091**

																		Councillors (n1) – Other stakeholders (n2)					
																		LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
																		0	4	6	5.5	22.0	33.0
																		1	3	3	13.5	40.5	40.5
																		2	2	2	18.5	37.0	37.0
																		3	4	4	24.5	98.0	98.0
																		4	6	3	33.0	198.0	99.0
																		5	7	11	46.5	325.5	511.5
																		6	9	8	64.0	576.0	512.0
																		7	7	7	79.5	556.5	556.5
																		8	4	11	94.0	376.0	1034.0
																		9	3	7	106.5	319.5	745.5
																		10	8	6	118.5	948.0	711.0
																		Σ	57	68		3497.0	4378.0
LoA = Level of assessment																		U1		2032.0	$\sigma_{U\,corr}$		200.55
n1 = no. of observations sample 1																		U2		1844.0	z value		0.47
n2 = no. of observations sample 2																		μ_U		1938.0	**p value**		**0.63927**

Table 56 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the threat of climate change to social sustainability

Chief executives (n1) – Economic planners(n2)						Chief executives (n2) – Consultants(n1)						Chief executives (n1) – Councillors(n2)						Chief executives (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	1	3	2.5	2.5	7.5	0	0	1	1	0	1	0	1	6	4.0	4.0	24.0	0	1	3	2.5	2.5	7.5
1	0	0	#N/A	#N/A	#N/A	1	0	0	#N/A	#N/A	#N/A	1	0	3	9.0	0.0	27.0	1	0	0	#N/A	#N/A	#N/A
2	1	0	5.0	5.0	0.0	2	0	1	2.0	0.0	2.0	2	1	0	11.0	11.0	0.0	2	1	1	5.5	5.5	5.5
3	0	3	7.0	0.0	21.0	3	0	0	#N/A	#N/A	#N/A	3	0	2	12.5	0.0	25.0	3	0	4	8.5	0.0	34.0
4	1	1	9.5	9.5	9.5	4	0	1	3.0	0.0	3.0	4	1	5	16.5	16.5	82.5	4	1	4	13.0	13.0	52.0
5	5	7	16.5	82.5	115.5	5	0	5	6.0	0.0	30.0	5	5	7	25.5	127.5	178.5	5	5	5	20.5	102.5	102.5
6	4	1	25.0	100.0	25.0	6	0	4	10.5	0.0	42.0	6	4	6	36.5	146.0	219.0	6	4	5	30.0	120.0	150.0
7	4	9	34.0	136.0	306.0	7	2	4	15.5	31.0	62.0	7	4	5	46.0	184.0	230.0	7	4	4	38.5	154.0	154.0
8	4	8	46.5	186.0	372.0	8	3	4	22.0	66.0	88.0	8	4	10	57.5	230.0	575.0	8	4	10	49.5	198.0	495.0
9	2	8	57.5	115.0	460.0	9	4	2	28.5	114.0	57.0	9	2	13	72.0	144.0	936.0	9	2	6	60.5	121.0	363.0
10	3	17	72.5	217.5	1232.5	10	8	3	37.0	296.0	111.0	10	3	11	86.5	259.5	951.5	10	3	15	73.5	220.5	1102.5
Σ	25	57		856.5	2546.5	Σ	17	25		501.5	401.5	Σ	25	68		1122.5	3248.5	Σ	25	57		989.5	2580.5
U1		896.0	$\sigma_{U\,corr}$		97.94	U1		71.0	$\sigma_{U\,corr}$		38.43	U1		902.5	$\sigma_{U\,corr}$		114.47	U1		813.0	$\sigma_{U\,corr}$		98.24
U2		529.0	z value		1.87	U2		354.0	z value		3.68	U2		797.5	z value		0.46	U2		612.0	z value		1.02
μ_U		712.5	**p value**		**0.06098**	μ_U		212.5	**p value**		**0.00023**	μ_U		850.0	**p value**		**0.64651**	μ_U		712.5	**p value**		**0.30629**

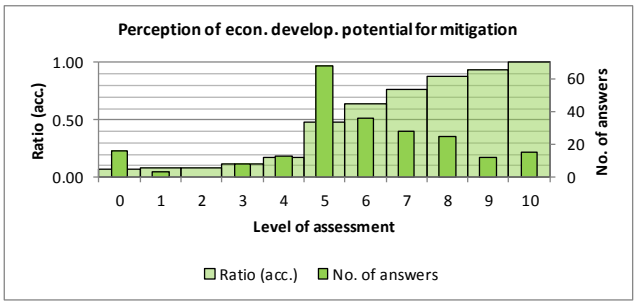
						Economic planners (n2) – Consultants (n1)						Economic planners (n2) – Councillors (n1)						Economic planners (n1) – Other stakeholders (n2)					
						LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
						0	0	3	2	0	6	0	3	6	5.0	15.0	30.0	0	3	3	3.5	10.5	10.5
						1	0	0	#N/A	#N/A	#N/A	1	0	3	11.0	0.0	33.0	1	0	0	#N/A	#N/A	#N/A
						2	0	0	#N/A	#N/A	#N/A	2	0	0	#N/A	#N/A	#N/A	2	0	1	7.0	0.0	7.0
						3	0	3	5.0	0.0	15.0	3	3	2	15.0	45.0	30.0	3	3	4	11.0	33.0	44.0
						4	0	1	7.0	0.0	7.0	4	1	5	20.5	20.5	102.5	4	1	4	17.0	17.0	68.0
						5	0	7	11.0	0.0	77.0	5	7	7	30.5	213.5	213.5	5	7	5	25.5	178.5	127.5
						6	0	1	15.0	0.0	15.0	6	1	6	41.0	41.0	246.0	6	1	5	34.5	34.5	172.5
						7	2	9	21.0	42.0	189.0	7	9	5	51.5	463.5	257.5	7	9	4	44.0	396.0	176.0
						8	3	8	32.0	96.0	256.0	8	8	10	67.5	540.0	675.0	8	8	10	59.5	476.0	595.0
						9	4	8	43.5	174.0	348.0	9	8	13	87.0	696.0	1131.0	9	8	6	75.5	604.0	453.0
						10	8	17	62.0	496.0	1054.0	10	17	11	111.5	1895.5	1226.5	10	17	15	98.5	1674.5	1477.5
						Σ	17	57		793.0	1982.0	Σ	57	68		1326.5	2951.5	Σ	57	57		3202.5	3583.5
						U1		314.0	$\sigma_{U\,corr}$		75.84	U1		1599.0	$\sigma_{U\,corr}$		199.46	U1		1478.0	$\sigma_{U\,corr}$		173.69
						U2		655.0	z value		2.25	U2		2277.0	z value		1.70	U2		1771.0	z value		0.84
						μ_U		484.5	**p value**		**0.02457**	μ_U		1938.0	**p value**		**0.08921**	μ_U		1624.5	**p value**		**0.39897**

												Consultants (n1) – Councillors (n2)						Consultants (n1) – Other stakeholders (n2)					
												LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
												0	0	6	3.5	0.0	21.0	0	0	3	2	0	6
												1	0	3	8.0	0.0	24.0	1	0	0	#N/A	#N/A	#N/A
												2	0	0	#N/A	#N/A	#N/A	2	0	1	4.0	0.0	4.0
												3	0	2	10.5	0.0	21.0	3	0	4	6.5	0.0	26.0
												4	0	5	14.0	0.0	70.0	4	0	4	10.5	0.0	42.0
												5	0	7	20.0	0.0	140.0	5	0	5	15.0	0.0	75.0
												6	0	6	26.5	0.0	159.0	6	0	5	20.0	0.0	100.0
												7	2	5	33.0	66.0	165.0	7	2	4	25.5	51.0	102.0
												8	3	10	43.0	129.0	430.0	8	3	10	35.0	105.0	350.0
												9	4	13	58.0	232.0	754.0	9	4	6	46.5	186.0	279.0
												10	8	11	76.0	608.0	836.0	10	8	15	63.0	504.0	945.0
												Σ	17	68		619.5	758.5	Σ	17	57		912.0	2014.0
												U1		274.0	$\sigma_{U\,corr}$		89.89	U1		276.0	$\sigma_{U\,corr}$		76.28
												U2		882.0	z value		3.38	U2		693.0	z value		2.73
												μ_U		578.0	**p value**		**0.00072**	μ_U		484.5	**p value**		**0.00627**

																		Councillors (n1) – Other stakeholders (n2)					
																		LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
																		0	3	6	5.0	15.0	30.0
																		1	0	3	11.0	0.0	33.0
																		2	1	0	13.0	13.0	0.0
																		3	4	2	16.5	66.0	33.0
																		4	4	5	24.0	96.0	120.0
																		5	5	7	34.5	172.5	241.5
																		6	5	6	46.0	230.0	276.0
																		7	4	5	56.0	224.0	280.0
																		8	10	10	70.5	705.0	705.0
																		9	6	13	90.0	540.0	1170.0
																		10	15	11	112.5	1687.5	1237.5
																		Σ	57	68		3749.0	4126.0
LoA = Level of assessment																		U1		1780.0	$\sigma_{U\,corr}$		199.78
n1 = no. of observations sample 1																		U2		2096.0	z value		0.79
n2 = no. of observations sample 2																		μ_U		1938.0	**p value**		**0.42901**

Table 57 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the threat of climate change to environmental sustainability

Mitigation potential		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	16	16	0.07
1	3	19	0.08
2	0	19	0.08
3	8	27	0.12
4	13	40	0.18
5	68	108	0.48
6	36	144	0.64
7	28	172	0.77
8	25	197	0.88
9	12	209	0.93
10	15	224	1.00



Adaptation potential		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	7.25
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	16	16	0.07
1	1	17	0.08
2	2	19	0.08
3	6	25	0.11
4	18	43	0.19
5	62	105	0.47
6	27	132	0.59
7	36	168	0.75
8	25	193	0.86
9	12	205	0.92
10	19	224	1.00

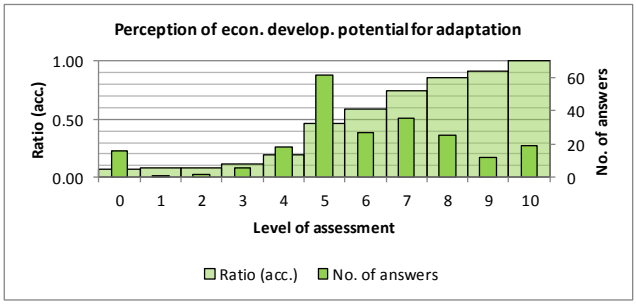
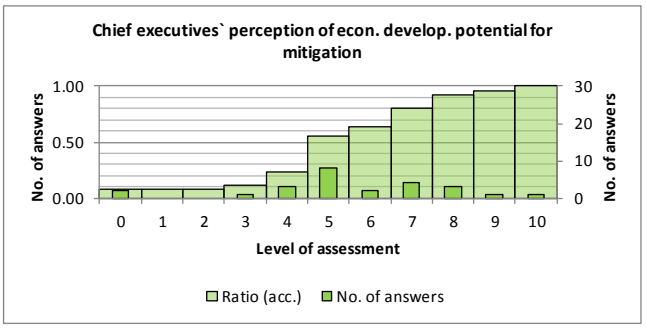
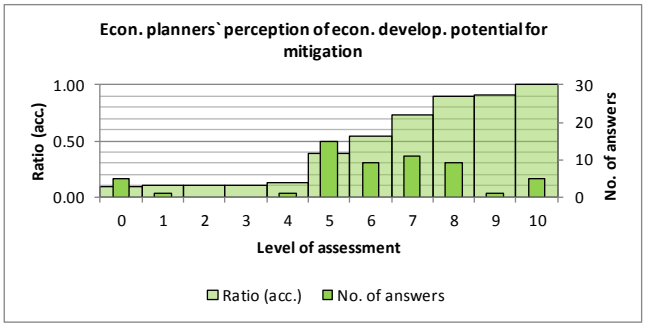


Table 58 Stakeholders` perception of economic development potential for mitigation and adaptation

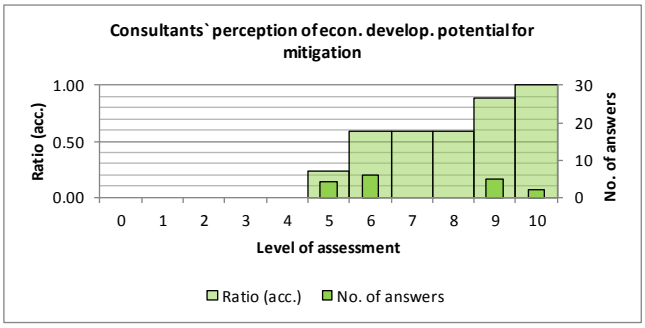
Chief executives		1st. Quartile	5.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	2	2	0.08
1	0	2	0.08
2	0	2	0.08
3	1	3	0.12
4	3	6	0.24
5	8	14	0.56
6	2	16	0.64
7	4	20	0.80
8	3	23	0.92
9	1	24	0.96
10	1	25	1.00



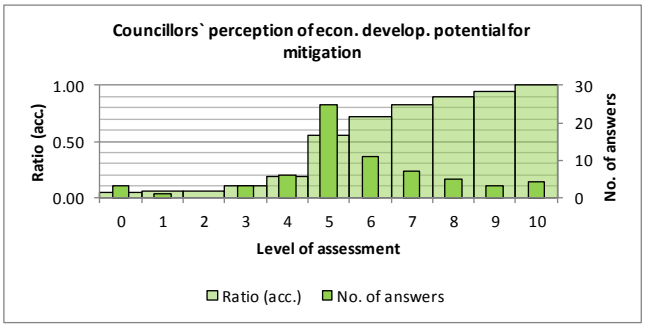
Economic planners		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	8.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	5	5	0.09
1	1	6	0.11
2	0	6	0.11
3	0	6	0.11
4	1	7	0.12
5	15	22	0.39
6	9	31	0.54
7	11	42	0.74
8	9	51	0.89
9	1	52	0.91
10	5	57	1.00



Consultants		1st. Quartile	6.00
		Median	6.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	0	0	0.00
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	0	0	0.00
5	4	4	0.24
6	6	10	0.59
7	0	10	0.59
8	0	10	0.59
9	5	15	0.88
10	2	17	1.00



Councillors		1st. Quartile	5.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.04
1	1	4	0.06
2	0	4	0.06
3	3	7	0.10
4	6	13	0.19
5	25	38	0.56
6	11	49	0.72
7	7	56	0.82
8	5	61	0.90
9	3	64	0.94
10	4	68	1.00



Other stakeholders		1st. Quartile	5.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	6	6	0.11
1	1	7	0.12
2	0	7	0.12
3	4	11	0.19
4	3	14	0.25
5	16	30	0.53
6	8	38	0.67
7	6	44	0.77
8	8	52	0.91
9	2	54	0.95
10	3	57	1.00

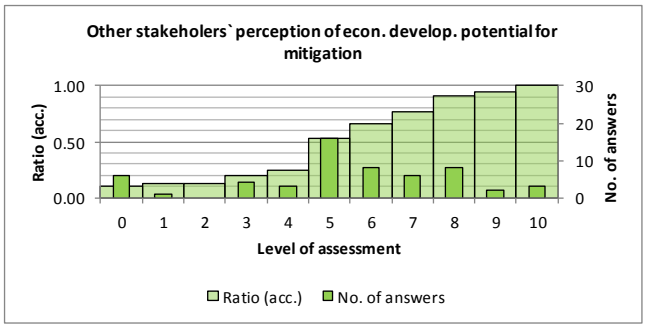
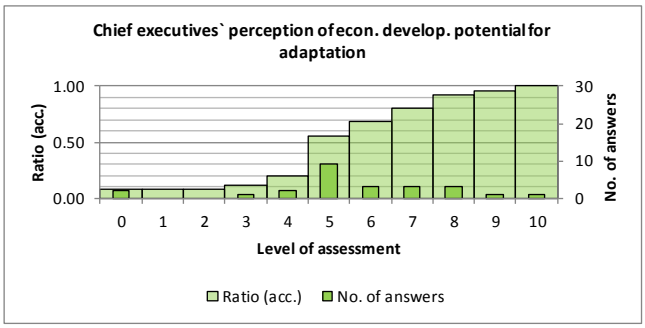
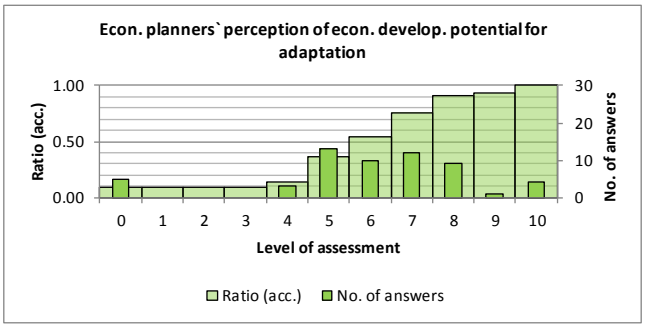


Table 59 Stakeholders` perception of economic development potential for mitigation

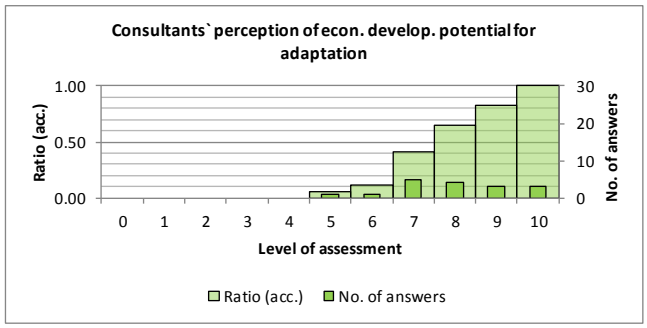
Chief executives		1st. Quartile	5.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	2	2	0.08
1	0	2	0.08
2	0	2	0.08
3	1	3	0.12
4	2	5	0.20
5	9	14	0.56
6	3	17	0.68
7	3	20	0.80
8	3	23	0.92
9	1	24	0.96
10	1	25	1.00



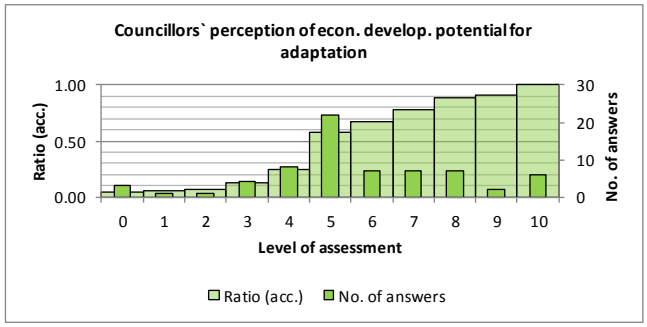
Economic planners		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	5	5	0.09
1	0	5	0.09
2	0	5	0.09
3	0	5	0.09
4	3	8	0.14
5	13	21	0.37
6	10	31	0.54
7	12	43	0.75
8	9	52	0.91
9	1	53	0.93
10	4	57	1.00



Consultants		1st. Quartile	7.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	0	0	0.00
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	0	0	0.00
5	1	1	0.06
6	1	2	0.12
7	5	7	0.41
8	4	11	0.65
9	3	14	0.82
10	3	17	1.00



Councillors		1st. Quartile	4.75
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	3	3	0.04
1	1	4	0.06
2	1	5	0.07
3	4	9	0.13
4	8	17	0.25
5	22	39	0.57
6	7	46	0.68
7	7	53	0.78
8	7	60	0.88
9	2	62	0.91
10	6	68	1.00



Other stakeholders		1st. Quartile	5.00
		Median	5.00
		3rd. Quartile	7.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
0	6	6	0.11
1	0	6	0.11
2	1	7	0.12
3	1	8	0.14
4	5	13	0.23
5	17	30	0.53
6	6	36	0.63
7	9	45	0.79
8	2	47	0.82
9	5	52	0.91
10	5	57	1.00

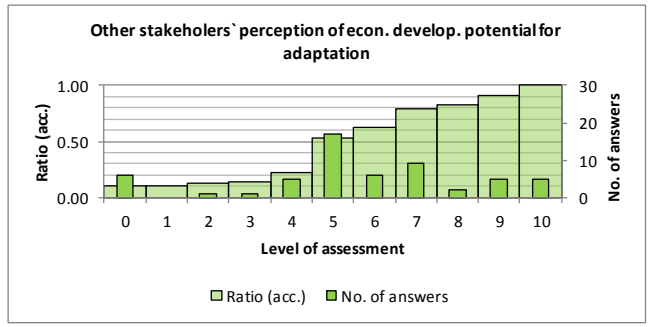


Table 60 Stakeholders` perception of economic development potential for adaptation

All stakeholders						Chief ececutives						Economic planners						Consultants						Councillors						Other stakeholders					
LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2	LoA	n1	n2	Rank	∑Rank n1	∑Rank n2
0	16	16	16.5	264.0	264.0	0	2	2	2.5	5.0	5.0	0	5	5	5.5	27.5	27.5	0	0	0	#N/A	#N/A	#N/A	0	3	3	3.5	10.5	10.5	0	6	6	6.5	39.0	39.0
1	3	1	34.5	103.5	34.5	1	0	0	#N/A	#N/A	#N/A	1	1	0	11.0	11.0	0.0	1	0	0	#N/A	#N/A	#N/A	1	1	1	7.5	7.5	7.5	1	1	0	13.0	13.0	0.0
2	0	2	37.5	0.0	75.0	2	0	0	#N/A	#N/A	#N/A	2	0	0	#N/A	#N/A	#N/A	2	0	0	#N/A	#N/A	#N/A	2	0	1	9.0	0.0	9.0	2	0	1	14.0	0.0	14.0
3	8	6	45.5	364.0	273.0	3	1	1	5.5	5.5	5.5	3	0	0	#N/A	#N/A	#N/A	3	0	0	#N/A	#N/A	#N/A	3	3	4	13.0	39.0	52.0	3	4	1	17.0	68.0	17.0
4	13	18	68.0	884.0	1224.0	4	3	2	9.0	27.0	18.0	4	1	3	13.5	13.5	40.5	4	0	0	#N/A	#N/A	#N/A	4	6	8	23.5	141.0	188.0	4	3	5	23.5	70.5	117.5
5	68	62	148.5	10098.0	9207.0	5	8	9	20.0	160.0	180.0	5	15	13	29.5	442.5	383.5	5	4	1	3.0	12.0	3.0	5	25	22	54.0	1350.0	1188.0	5	16	17	44.0	704.0	748.0
6	36	27	245.0	8820.0	6615.0	6	2	3	31.0	62.0	93.0	6	9	10	53.0	477.0	530.0	6	5	0	8.0	40.0	0.0	6	11	7	86.5	951.5	605.5	6	8	6	67.5	540.0	405.0
7	28	36	308.5	8638.0	11106.0	7	4	3	37.0	148.0	111.0	7	11	12	74.0	814.0	888.0	7	1	6	14.0	14.0	84.0	7	7	7	102.5	717.5	717.5	7	6	9	82.0	492.0	738.0
8	25	25	365.5	9137.5	9137.5	8	3	3	43.5	130.5	130.5	8	9	9	94.5	850.5	850.5	8	0	4	19.5	0.0	78.0	8	5	7	115.5	577.5	808.5	8	8	2	94.5	756.0	189.0
9	12	12	402.5	4830.0	4830.0	9	1	1	47.5	47.5	47.5	9	1	1	104.5	104.5	104.5	9	5	3	25.5	127.5	76.5	9	3	2	124.0	372.0	248.0	9	2	5	103.0	206.0	515.0
10	15	19	431.5	6472.5	8198.5	10	1	1	49.5	49.5	49.5	10	5	4	110.0	550.0	440.0	10	2	3	32.0	64.0	96.0	10	4	6	131.5	526.0	789.0	10	3	5	110.5	331.5	552.5
∑	224	224		1275.0	640.0	∑	25	25		635.0	640.0	∑	57	57		3240.0	3315.0	∑	17	17		257.5	337.5	∑	68	68		1196.0	1289.0	∑	57	57		3220.0	3335.0
U1		25764.5	$\sigma_{U\,corr}$		1347.92	U1		315.0	$\sigma_{U\,corr}$		50.34	U1		1611.5	$\sigma_{U\,corr}$		173.78	U1		184.5	$\sigma_{U\,corr}$		28.56	U1		2277.5	$\sigma_{U\,corr}$		224.29	U1		1682.0	$\sigma_{U\,corr}$		173.92
U2		24411.5	z value		0.50	U2		310.0	z value		0.05	U2		1637.5	z value		0.07	U2		104.5	z value		1.40	U2		2346.5	z value		0.15	U2		1567.0	z value		0.33
μ_U		25088.0	**p value**		**0.61575**	μ_U		312.5	**p value**		**0.96039**	μ_U		1624.5	**p value**		**0.94037**	μ_U		144.5	**p value**		**0.16140**	μ_U		2312.0	**p value**		**0.87775**	μ_U		1624.5	**p value**		**0.74094**

Table 61 Results of Mann Whitney U tests for differences among stakeholders` perception of economic development potential of mitigation and adaptation initiatives

Chief executives (n1) – Economic planners(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	2	5	4.0	8.0	20.0
1	0	1	8.0	0.0	8.0
2	0	0	#N/A	#N/A	#N/A
3	0	0	#N/A	#N/A	#N/A
4	3	1	9.5	28.5	9.5
5	8	15	22.5	180.0	337.5
6	2	9	38.5	77.0	346.5
7	2	11	50.0	100.0	550.0
8	2	9	61.0	122.0	549.0
9	1	1	66.5	66.5	66.5
10	1	5	69.5	69.5	347.5
Σ	21	57		783.0	2141.0
U1		834.0	$\sigma_{U\,corr}$		97.54
U2		591.0	z value		1.25
μ_U		712.5	**p value**		**0.21289**

Chief executives (n2) – Consultants(n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	2	1.5	0.0	3.0
1	0	0	#N/A	#N/A	#N/A
2	0	0	#N/A	#N/A	#N/A
3	0	0	#N/A	#N/A	#N/A
4	0	3	3.0	0.0	9.0
5	4	8	10.0	40.0	80.0
6	6	2	19.0	114.0	38.0
7	0	2	23.5	0.0	47.0
8	0	2	24.5	0.0	49.0
9	5	1	27.5	137.5	27.5
10	2	1	31.0	62.0	31.0
Σ	17	21		330.5	314.0
U1		128.5	$\sigma_{U\,corr}$		38.34
U2		296.5	z value		2.19
μ_U		212.5	**p value**		**0.02847**

Chief executives (n1) – Councillors(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	2	3	3.0	6.0	9.0
1	0	1	6.0	0.0	6.0
2	0	0	#N/A	#N/A	#N/A
3	0	3	7.0	0.0	21.0
4	3	6	13.0	39.0	78.0
5	8	25	33.5	268.0	837.5
6	2	11	55.5	111.0	610.5
7	2	7	66.0	132.0	462.0
8	2	5	73.0	146.0	365.0
9	1	3	77.5	77.5	232.5
10	1	4	81.0	81.0	324.0
Σ	21	68		681.0	831.0
U1		856.5	$\sigma_{U\,corr}$		112.42
U2		843.5	z value		0.06
μ_U		850.0	**p value**		**0.95389**

Chief executives (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	2	6	4.5	6.0	18.0
1	0	1	9.0	0.0	9.0
2	0	0	#N/A	#N/A	#N/A
3	0	4	10.5	0.0	42.0
4	3	3	15.5	46.5	46.5
5	8	16	30.0	240.0	480.0
6	2	8	46.0	92.0	368.0
7	2	6	54.5	109.0	327.0
8	2	8	62.5	125.0	500.0
9	1	2	68.0	68.0	136.0
10	1	3	70.5	70.5	211.5
Σ	21	57		867.5	2067.0
U1		712.0	$\sigma_{U\,corr}$		97.64
U2		713.0	z value		0.01
μ_U		712.5	**p value**		**0.99591**

Economic planners (n2) – Consultants (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	5	3.0	0.0	15.0
1	0	1	6.0	0.0	6.0
2	0	0	#N/A	#N/A	#N/A
3	0	0	#N/A	#N/A	#N/A
4	0	1	7.0	0.0	7.0
5	4	15	17.0	68.0	255.0
6	6	9	34.0	204.0	306.0
7	0	11	47.0	0.0	517.0
8	0	9	57.0	0.0	513.0
9	5	1	64.5	322.5	64.5
10	2	5	71.0	142.0	355.0
Σ	17	57		751.0	2024.0
U1		385.5	$\sigma_{U\,corr}$		76.57
U2		583.5	z value		1.29
μ_U		484.5	**p value**		**0.19605**

Economic planners (n2) – Councillors (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	5	3	4.5	22.5	13.5
1	1	1	9.5	9.5	9.5
2	0	0	#N/A	#N/A	#N/A
3	0	3	12.0	0.0	36.0
4	1	6	17.0	17.0	102.0
5	15	25	40.5	607.5	1012.5
6	9	11	70.5	634.5	775.5
7	11	7	89.5	984.5	626.5
8	9	5	105.5	949.5	527.5
9	1	3	114.5	114.5	343.5
10	5	4	121.0	605.0	484.0
Σ	57	68		1307.0	2971.0
U1		1584.5	$\sigma_{U\,corr}$		197.45
U2		2291.5	z value		1.79
μ_U		1938.0	**p value**		**0.07340**

Economic planners (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	5	6	6.0	30.0	36.0
1	1	1	12.5	12.5	12.5
2	0	0	#N/A	#N/A	#N/A
3	0	4	15.5	0.0	62.0
4	1	3	19.5	19.5	58.5
5	15	16	37.0	555.0	592.0
6	9	8	61.0	549.0	488.0
7	11	6	78.0	858.0	468.0
8	9	8	95.0	855.0	760.0
9	1	2	105.0	105.0	210.0
10	5	3	110.5	552.5	331.5
Σ	57	57		3455.0	3100.0
U1		1365.5	$\sigma_{U\,corr}$		173.67
U2		1883.5	z value		1.49
μ_U		1624.5	**p value**		**0.13587**

Consultants (n1) – Councillors (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	3	2.0	0.0	6.0
1	0	1	4.0	0.0	4.0
2	0	0	#N/A	#N/A	#N/A
3	0	3	6.0	0.0	18.0
4	0	6	10.5	0.0	63.0
5	4	25	28.0	112.0	700.0
6	6	11	51.0	306.0	561.0
7	0	7	63.0	0.0	441.0
8	0	5	69.0	0.0	345.0
9	5	3	75.5	377.5	226.5
10	2	4	82.5	165.0	330.0
Σ	17	68		618.0	760.0
U1		348.5	$\sigma_{U\,corr}$		88.72
U2		807.5	z value		2.59
μ_U		578.0	**p value**		**0.00968**

Consultants (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	6	3.5	0.0	21.0
1	0	1	7.0	0.0	7.0
2	0	0	#N/A	#N/A	#N/A
3	0	4	9.5	0.0	38.0
4	0	3	13.0	0.0	39.0
5	4	16	24.5	98.0	392.0
6	6	8	41.5	249.0	332.0
7	0	6	51.5	0.0	309.0
8	0	8	58.5	0.0	468.0
9	5	2	66.0	330.0	132.0
10	2	3	72.0	144.0	216.0
Σ	17	57		803.0	1972.0
U1		301.0	$\sigma_{U\,corr}$		76.64
U2		668.0	z value		2.39
μ_U		484.5	**p value**		**0.01666**

Councillors (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	6	3	5.0	30.0	15.0
1	1	1	10.5	10.5	10.5
2	0	0	#N/A	#N/A	#N/A
3	4	3	15.0	60.0	45.0
4	3	6	23.0	69.0	138.0
5	16	25	48.0	768.0	1200.0
6	8	11	78.0	624.0	858.0
7	6	7	94.0	564.0	658.0
8	8	5	107.0	856.0	535.0
9	2	3	116.0	232.0	348.0
10	3	4	122.0	366.0	488.0
Σ	57	68		1459.0	2819.0
U1		1949.5	$\sigma_{U\,corr}$		197.44
U2		1926.5	z value		0.06
μ_U		1938.0	**p value**		**0.95355**

LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 62 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the economic development potential of mitigation projects

Chief executives (n1) – Economic planners(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	2	5	4	8	20
1	0	0	#N/A	#N/A	#N/A
2	0	0	#N/A	#N/A	#N/A
3	1	0	8	8.0	0.0
4	2	3	11	22.0	33.0
5	9	13	24.5	220.5	318.5
6	3	10	42	126.0	420.0
7	3	12	56	168.0	672.0
8	3	9	69.5	208.5	625.5
9	1	1	76.5	76.5	76.5
10	1	4	80	80.0	320.0
Σ	25	57		904.0	2499.0
U1		832.5	$\sigma_{U\,corr}$		97.60
U2		592.5	z value		1.23
μ_U		712.5	**p value**		**0.21889**

Chief executives (n2) – Consultants(n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	2	1.5	0	3
1	0	0	#N/A	#N/A	#N/A
2	0	0	#N/A	#N/A	#N/A
3	0	1	3.0	0.0	3.0
4	0	2	4.5	0.0	9.0
5	1	9	10.5	10.5	94.5
6	1	3	17.5	17.5	52.5
7	5	3	23.5	117.5	70.5
8	4	3	31.0	124.0	93.0
9	3	1	36.5	109.5	36.5
10	3	1	40.5	121.5	40.5
Σ	17	25		503.5	399.5
U1		77.5	$\sigma_{U\,corr}$		38.49
U2		347.5	z value		3.51
μ_U		212.5	**p value**		**0.00045**

Chief executives (n1) – Councillors(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	2	3	3.0	6.0	9.0
1	0	1	6.0	0.0	6.0
2	0	1	7.0	0.0	7.0
3	1	4	10.0	10.0	40.0
4	2	8	17.5	35.0	140.0
5	9	22	38.0	342.0	836.0
6	3	7	58.5	175.5	409.5
7	3	7	68.5	205.5	479.5
8	3	7	78.5	235.5	549.5
9	1	2	85.0	85.0	170.0
10	1	6	90.0	90.0	540.0
Σ	25	68		784.5	1045.5
U1		840.5	$\sigma_{U\,corr}$		112.91
U2		859.5	z value		0.08
μ_U		850.0	**p value**		**0.93295**

Chief executives (n1) – Other stakeholders(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	2	6	4.5	9.0	27.0
1	0	0	#N/A	#N/A	#N/A
2	0	1	9.0	0.0	9.0
3	1	1	10.5	10.5	10.5
4	2	5	15.0	30.0	75.0
5	9	17	31.5	283.5	535.5
6	3	6	49.0	147.0	294.0
7	3	9	59.5	178.5	535.5
8	3	2	68.0	204.0	136.0
9	1	5	73.5	73.5	367.5
10	1	5	79.5	79.5	397.5
Σ	25	57		988.0	2415.0
U1		734.5	$\sigma_{U\,corr}$		97.34
U2		690.5	z value		0.23
μ_U		712.5	**p value**		**0.82118**

Economic planners (n2) – Consultants (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	5	3	0	15
1	0	0	#N/A	#N/A	#N/A
2	0	0	#N/A	#N/A	#N/A
3	0	0	#N/A	#N/A	#N/A
4	0	3	7.0	0	21
5	1	13	15.5	15.5	201.5
6	1	10	28.0	28	280
7	5	12	42.0	210	504
8	4	9	57.0	228	513
9	3	1	65.5	196.5	65.5
10	3	4	71.0	213	284
Σ	17	57		887.0	1888.0
U1		231.0	$\sigma_{U\,corr}$		76.69
U2		738.0	z value		3.31
μ_U		484.5	**p value**		**0.00095**

Economic planners (n2) – Councillors (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	5	3	4.5	22.5	13.5
1	0	1	9.0	0.0	9.0
2	0	1	10.0	0.0	10.0
3	0	4	12.5	0.0	50.0
4	3	8	20.0	60.0	160.0
5	13	22	43.0	559.0	946.0
6	10	7	69.0	690.0	483.0
7	12	7	87.0	1044.0	609.0
8	9	7	104.5	940.5	731.5
9	1	2	114.0	114.0	228.0
10	4	6	120.5	482.0	723.0
Σ	57	68		1410.0	2868.0
U1		1617.0	$\sigma_{U\,corr}$		198.53
U2		2259.0	z value		1.62
μ_U		1938.0	**p value**		**0.10591**

Economic planners (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	5	6	6.0	30.0	36.0
1	0	0	#N/A	#N/A	#N/A
2	0	1	12.0	0.0	12.0
3	0	1	13.0	0.0	13.0
4	3	5	17.5	52.5	87.5
5	13	17	36.5	474.5	620.5
6	10	6	59.5	595.0	357.0
7	12	9	78.0	936.0	702.0
8	9	2	94.0	846.0	188.0
9	1	5	102.5	102.5	512.5
10	4	5	110.0	440.0	550.0
Σ	57	57		3416.0	3139.0
U1		1425.5	$\sigma_{U\,corr}$		173.79
U2		1823.5	z value		1.15
μ_U		1624.5	**p value**		**0.25219**

Consultants (n1) – Councillors (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	3	2.0	0.0	6.0
1	0	1	4.0	0.0	4.0
2	0	1	5.0	0.0	5.0
3	0	4	7.5	0.0	30.0
4	0	8	13.5	0.0	108.0
5	1	22	29.0	29.0	638.0
6	1	7	44.5	44.5	311.5
7	5	7	54.5	272.5	381.5
8	4	7	66.0	264.0	462.0
9	3	2	74.0	222.0	148.0
10	3	6	81.0	243.0	486.0
Σ	17	68		637.5	740.5
U1		234.0	$\sigma_{U\,corr}$		89.74
U2		922.0	z value		3.83
μ_U		578.0	**p value**		**0.00013**

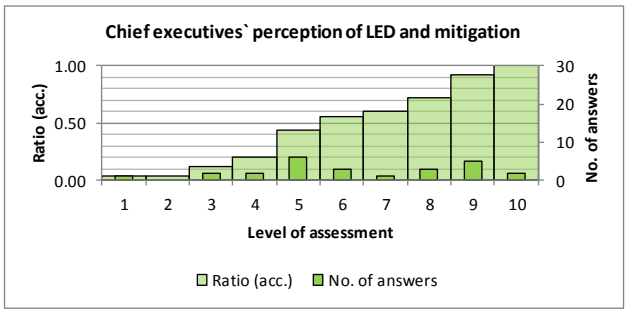
Consultants (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	0	6	3.5	0.0	21.0
1	0	0	#N/A	#N/A	#N/A
2	0	1	7.0	0.0	7.0
3	0	1	8.0	0.0	8.0
4	0	5	11.0	0.0	55.0
5	1	17	22.5	22.5	382.5
6	1	6	35.0	35.0	210.0
7	5	9	45.5	227.5	409.5
8	4	2	55.5	222.0	111.0
9	3	5	62.5	187.5	312.5
10	3	5	70.5	211.5	352.5
Σ	17	57		877.0	1898.0
U1		216.0	$\sigma_{U\,corr}$		76.81
U2		753.0	z value		3.50
μ_U		484.5	**p value**		**0.00047**

Councillors (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
0	6	3	5.0	30.0	15.0
1	0	1	10.0	0.0	10.0
2	1	1	11.5	11.5	11.5
3	1	4	15.0	15.0	60.0
4	5	8	24.0	120.0	192.0
5	17	22	50.0	850.0	1100.0
6	6	7	76.0	456.0	532.0
7	9	7	90.5	814.5	633.5
8	2	7	103.0	206.0	721.0
9	5	2	111.0	555.0	222.0
10	5	6	120.0	600.0	720.0
Σ	57	68		1526.0	2752.0
U1		1871.0	$\sigma_{U\,corr}$		198.04
U2		2005.0	z value		0.34
μ_U		1938.0	**p value**		**0.73512**

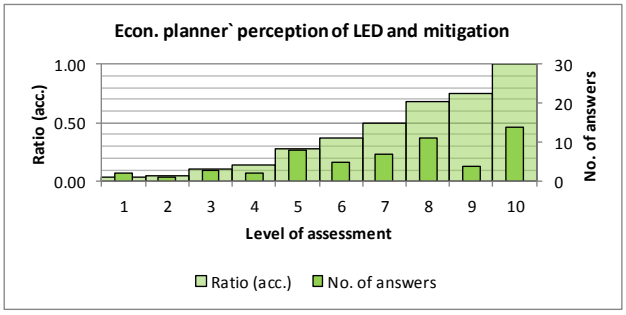
LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 63 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the economic development potential of adaptation projects

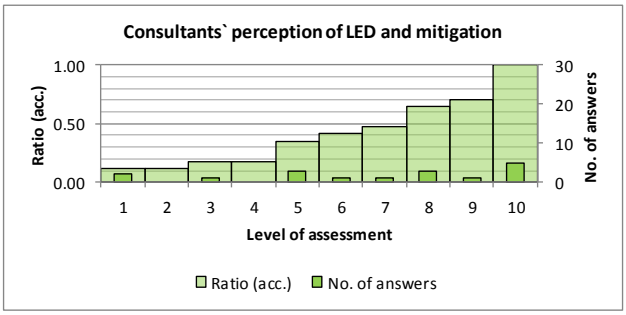
Chief executives		1st. Quartile	5.00
		Median	6.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	1	1	0.04
2	0	1	0.04
3	2	3	0.12
4	2	5	0.20
5	6	11	0.44
6	3	14	0.56
7	1	15	0.60
8	3	18	0.72
9	5	23	0.92
10	2	25	1.00



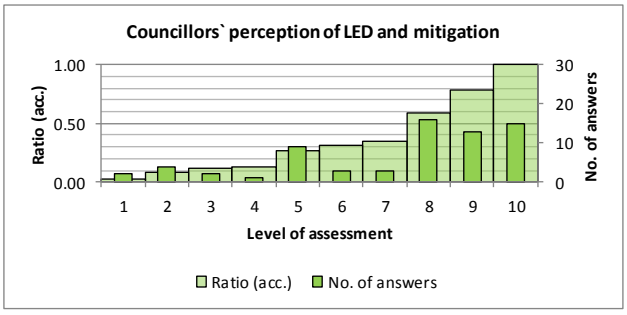
Economic planners		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	2	2	0.04
2	1	3	0.05
3	3	6	0.11
4	2	8	0.14
5	8	16	0.28
6	5	21	0.37
7	7	28	0.49
8	11	39	0.68
9	4	43	0.75
10	14	57	1.00



Consultants		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	2	2	0.12
2	0	2	0.12
3	1	3	0.18
4	0	3	0.18
5	3	6	0.35
6	1	7	0.41
7	1	8	0.47
8	3	11	0.65
9	1	12	0.71
10	5	17	1.00



Councillors		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	2	2	0.03
2	4	6	0.09
3	2	8	0.12
4	1	9	0.13
5	9	18	0.26
6	3	21	0.31
7	3	24	0.35
8	16	40	0.59
9	13	53	0.78
10	15	68	1.00



Other stakeholders		1st. Quartile	6.00
		Median	9.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	2	2	0.04
3	1	3	0.05
4	1	4	0.07
5	8	12	0.21
6	6	18	0.32
7	3	21	0.37
8	7	28	0.49
9	5	33	0.58
10	24	57	1.00

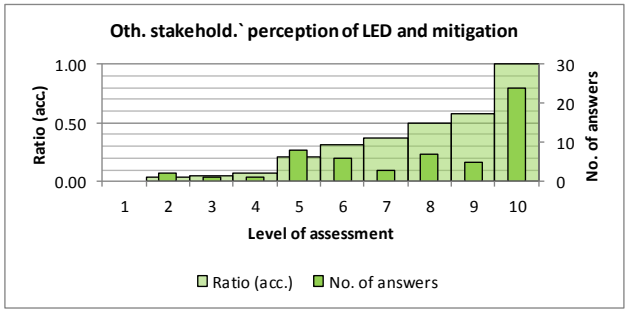


Table 64 Stakeholders` assessment of the feasibility of initiating mitigation projects in a bottom-up, participatory LED approach

Chief executives (n1) – Economic planners(n2)						Chief executives (n2) – Consultants(n1)						Chief executives (n1) – Councillors(n2)						Chief executives (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	1	2	2.0	2.0	4.0	1	2	1	2.0	4.0	2.0	1	1	2	2.0	2.0	4.0	1	1	0	1.0	1.0	0.0
2	0	1	4.0	0.0	4.0	2	0	0	0.0	0.0	0.0	2	0	4	5.5	0.0	22.0	2	0	2	2.5	0.0	5.0
3	2	3	7.0	14.0	21.0	3	1	2	5.0	5.0	10.0	3	2	2	9.5	19.0	19.0	3	2	1	5.0	10.0	5.0
4	2	2	11.5	23.0	23.0	4	0	2	7.5	0.0	15.0	4	2	1	13.0	26.0	13.0	4	2	1	8.0	16.0	8.0
5	6	8	20.5	123.0	164.0	5	3	6	13.0	39.0	78.0	5	6	9	22.0	132.0	198.0	5	6	8	16.5	99.0	132.0
6	3	5	31.5	94.5	157.5	6	1	3	19.5	19.5	58.5	6	3	3	32.5	97.5	97.5	6	3	6	28.0	84.0	168.0
7	1	7	39.5	39.5	276.5	7	1	1	22.5	22.5	22.5	7	1	3	37.5	37.5	112.5	7	1	3	34.5	34.5	103.5
8	3	11	50.5	151.5	555.5	8	3	3	26.5	79.5	79.5	8	3	16	49.0	147.0	784.0	8	3	7	41.5	124.5	290.5
9	5	4	62.0	310.0	248.0	9	1	5	32.5	32.5	162.5	9	5	13	67.5	337.5	877.5	9	5	5	51.5	257.5	257.5
10	2	14	74.5	149.0	1043.0	10	5	2	39.0	195.0	78.0	10	2	15	85.0	170.0	1275.0	10	2	24	69.5	139.0	1668.0
Σ	25	57		906.5	2496.5	Σ	17	25		397.0	506.0	Σ	25	68		968.5	3402.5	Σ	25	57		765.5	2637.5
U1		843.5	$\sigma_{U\,corr}$		98.24	U1		181.0	$\sigma_{U\,corr}$		38.60	U1		1056.5	$\sigma_{U\,corr}$		113.86	U1		984.5	$\sigma_{U\,corr}$		97.18
U2		581.5	z value		1.33	U2		244.0	z value		0.82	U2		643.5	z value		1.81	U2		440.5	z value		2.80
μ_U		712.5	**p value**		**0.18238**	μ_U		212.5	**p value**		**0.41449**	μ_U		850.0	**p value**		**0.06972**	μ_U		712.5	**p value**		**0.00513**

Economic planners (n2) – Consultants (n1)						Economic planners (n2) – Councillors (n1)						Economic planners (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	2	2	2.5	5.0	5.0	1	2	2	2.5	5.0	5.0	1	2	0	1.5	3.0	0.0
2	0	1	5.0	0.0	5.0	2	1	4	7.0	7.0	28.0	2	1	2	4.0	4.0	8.0
3	1	3	7.5	7.5	22.5	3	3	2	12.0	36.0	24.0	3	3	1	7.5	22.5	7.5
4	0	2	10.5	0.0	21.0	4	2	1	16.0	32.0	16.0	4	2	1	11.0	22.0	11.0
5	3	8	17.0	51.0	136.0	5	8	9	26.0	208.0	234.0	5	8	8	20.5	164.0	164.0
6	1	5	25.5	25.5	127.5	6	5	3	38.5	192.5	115.5	6	5	6	34.0	170.0	204.0
7	1	7	32.5	32.5	227.5	7	7	3	47.5	332.5	142.5	7	7	3	44.5	311.5	133.5
8	3	11	43.5	130.5	478.5	8	11	16	66.0	726.0	1056.0	8	11	7	58.5	643.5	409.5
9	1	4	53.0	53.0	212.0	9	4	13	88.0	352.0	1144.0	9	4	5	72.0	288.0	360.0
10	5	14	65.0	325.0	910.0	10	14	15	111.0	1554.0	1665.0	10	14	24	95.5	1337.0	2292.0
Σ	17	57		630.0	2145.0	Σ	57	68		3445.0	4430.0	Σ	57	57		2965.5	3589.5
U1		492.0	$\sigma_{U\,corr}$		76.68	U1		2084.0	$\sigma_{U\,corr}$		198.84	U1		1936.5	$\sigma_{U\,corr}$		172.37
U2		477.0	z value		0.10	U2		1792.0	z value		0.73	U2		1312.5	z value		1.81
μ_U		484.5	**p value**		**0.92208**	μ_U		1938.0	**p value**		**0.46280**	μ_U		1624.5	**p value**		**0.07028**

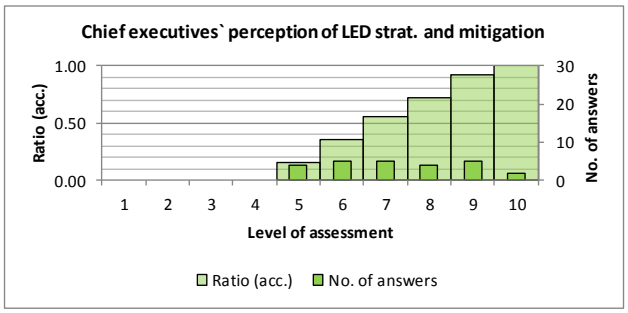
Consultants (n1) – Councillors (n2)						Consultants (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2	LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	2	2	2.5	5.0	5.0	1	2	0	1.5	3.0	0.0
2	0	4	6.5	0.0	26.0	2	0	2	3.5	0.0	7.0
3	1	2	10.0	10.0	20.0	3	1	1	5.5	5.5	5.5
4	0	1	12.0	0.0	12.0	4	0	1	7.0	0.0	7.0
5	3	9	18.5	55.5	166.5	5	3	8	13.0	39.0	104.0
6	1	3	26.5	26.5	79.5	6	1	6	22.0	22.0	132.0
7	1	3	30.5	30.5	91.5	7	1	3	27.5	27.5	82.5
8	3	16	42.0	126.0	672.0	8	3	7	34.5	103.5	241.5
9	1	13	58.5	58.5	760.5	9	1	5	42.5	42.5	212.5
10	5	15	75.5	377.5	1132.5	10	5	24	60.0	300.0	1440.0
Σ	17	68		689.5	2965.5	Σ	17	57		543.0	2232.0
U1		619.5	$\sigma_{U\,corr}$		89.56	U1		579.0	$\sigma_{U\,corr}$		75.15
U2		536.5	z value		0.46	U2		390.0	z value		1.26
μ_U		578.0	**p value**		**0.64310**	μ_U		484.5	**p value**		**0.20861**

Councillors (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	2	1.5	0.0	3.0
2	2	4	5.5	11.0	22.0
3	1	2	10.0	10.0	20.0
4	1	1	12.5	12.5	12.5
5	8	9	22.0	176.0	198.0
6	6	3	35.0	210.0	105.0
7	3	3	42.5	127.5	127.5
8	7	16	57.0	399.0	912.0
9	5	13	77.5	387.5	1007.5
10	24	15	106.0	2544.0	1590.0
Σ	57	68		3877.5	3997.5
U1		1651.5	$\sigma_{U\,corr}$		197.39
U2		2224.5	z value		1.45
μ_U		1938.0	**p value**		**0.14665**

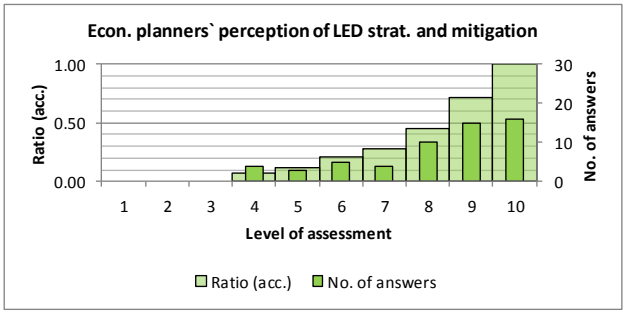
LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 65 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the idea of initiating mitigation projects through bottom-up, participatory LED approaches

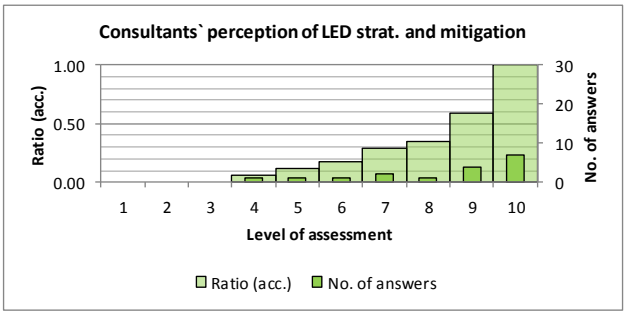
Chief executives		1st. Quartile	6.00
		Median	7.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	0	0	0.00
5	4	4	0.16
6	5	9	0.36
7	5	14	0.56
8	4	18	0.72
9	5	23	0.92
10	2	25	1.00



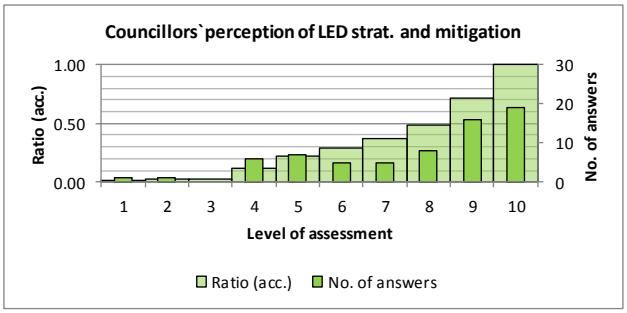
Economic planners		1st. Quartile	7.00
		Median	9.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	4	4	0.07
5	3	7	0.12
6	5	12	0.21
7	4	16	0.28
8	10	26	0.46
9	15	41	0.72
10	16	57	1.00



Consultants		1st. Quartile	7.00
		Median	9.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	1	1	0.06
5	1	2	0.12
6	1	3	0.18
7	2	5	0.29
8	1	6	0.35
9	4	10	0.59
10	7	17	1.00



Councillors		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	1	1	0.01
2	1	2	0.03
3	0	2	0.03
4	6	8	0.12
5	7	15	0.22
6	5	20	0.29
7	5	25	0.37
8	8	33	0.49
9	16	49	0.72
10	19	68	1.00



Other stakeholders		1st. Quartile	7.00
		Median	9.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	1	1	0.02
2	0	1	0.02
3	1	2	0.04
4	3	5	0.10
5	3	8	0.16
6	5	13	0.26
7	7	20	0.40
8	6	19	0.38
9	13	32	0.64
10	18	50	1.00

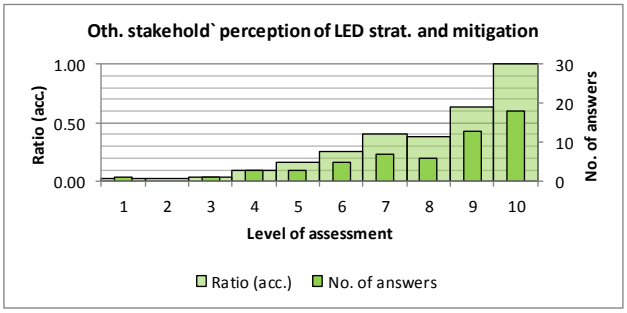


Table 66 Stakeholders` assessment of the feasibility of including mitigation projects in LED strategies

Chief executives (n1) – Economic planners(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	0	0.0	0.0	0.0
2	0	0	0.0	0.0	0.0
3	0	0	0.0	0.0	0.0
4	0	4	2.5	0.0	10.0
5	4	3	8.0	32.0	24.0
6	5	5	16.5	82.5	82.5
7	5	4	26.0	130.0	104.0
8	4	10	37.5	150.0	375.0
9	5	15	54.5	272.5	817.5
10	2	16	73.5	147.0	1176.0
Σ	25	57		814.0	2589.0
U1		936.0	$\sigma_{U\ corr}$		97.59
U2		489.0	z value		2.29
μ_U		712.5	**p value**		**0.02201**

Chief executives (n2) – Consultants(n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	0	0.0	0.0	0.0
2	0	0	0.0	0.0	0.0
3	0	0	0.0	0.0	0.0
4	1	0	1.0	1.0	0.0
5	1	4	4.0	4.0	16.0
6	1	5	9.5	9.5	47.5
7	2	5	16.0	32.0	80.0
8	1	4	22.0	22.0	88.0
9	4	5	29.0	116.0	145.0
10	7	2	38.0	266.0	76.0
Σ	17	25		450.5	452.5
U1		127.5	$\sigma_{U\ corr}$		38.43
U2		297.5	z value		2.21
μ_U		212.5	**p value**		**0.02699**

Chief executives (n1) – Councillors(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	1	2.0	0.0	2.0
3	0	0	0.0	0.0	0.0
4	0	6	5.5	0.0	33.0
5	4	7	14.0	56.0	98.0
6	5	5	24.5	122.5	122.5
7	5	5	34.5	172.5	172.5
8	4	8	45.5	182.0	364.0
9	5	16	62.0	310.0	992.0
10	2	19	83.0	166.0	1577.0
Σ	25	68		1009.0	3362.0
U1		1016.0	$\sigma_{U\ corr}$		113.68
U2		684.0	z value		1.46
μ_U		850.0	**p value**		**0.14424**

Chief executives (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	0	0.0	0.0	0.0
3	0	1	2.0	0.0	2.0
4	0	3	4.0	0.0	12.0
5	4	3	9.0	36.0	27.0
6	5	5	17.5	87.5	87.5
7	5	7	28.5	142.5	199.5
8	4	6	39.5	158.0	237.0
9	5	13	53.5	267.5	695.5
10	2	18	72.5	145.0	1305.0
Σ	25	57		836.5	2566.5
U1		913.5	$\sigma_{U\ corr}$		97.66
U2		511.5	z value		2.06
μ_U		712.5	**p value**		**0.03957**

Economic planners (n2) – Consultants (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	0	0.0	0.0	0.0
2	0	0	0.0	0.0	0.0
3	0	0	0.0	0.0	0.0
4	1	4	3.0	3.0	12.0
5	1	3	7.5	7.5	22.5
6	1	5	12.5	12.5	62.5
7	2	4	18.5	37.0	74.0
8	1	10	27.0	27.0	270.0
9	4	15	42.0	168.0	630.0
10	7	16	63.0	441.0	1008.0
Σ	17	57		696.0	2079.0
U1		426.0	$\sigma_{U\ corr}$		75.79
U2		543.0	z value		0.77
μ_U		484.5	**p value**		**0.44018**

Economic planners (n2) – Councillors (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	1	2.0	0.0	2.0
3	0	0	0.0	0.0	0.0
4	4	6	7.5	30.0	45.0
5	3	7	17.5	52.5	122.5
6	5	5	27.5	137.5	137.5
7	4	5	37.0	148.0	185.0
8	10	8	50.5	505.0	404.0
9	15	16	75.0	1125.0	1200.0
10	16	19	108.0	1728.0	2052.0
Σ	57	68		3726.0	4149.0
U1		1803.0	$\sigma_{U\ corr}$		197.45
U2		2073.0	z value		0.68
μ_U		1938.0	**p value**		**0.49416**

Economic planners (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	0	0.0	0.0	0.0
3	0	1	2.0	0.0	2.0
4	4	3	6.0	24.0	18.0
5	3	3	12.5	37.5	37.5
6	5	5	20.5	102.5	102.5
7	4	7	31.0	124.0	217.0
8	10	6	44.5	445.0	267.0
9	15	13	66.5	997.5	864.5
10	16	18	97.5	1560.0	1755.0
Σ	57	57		3290.5	3264.5
U1		1611.5	$\sigma_{U\ corr}$		172.35
U2		1637.5	z value		0.08
μ_U		1624.5	**p value**		**0.93987**

Consultants (n1) – Councillors (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	1	2.0	0.0	2.0
3	0	0	0.0	0.0	0.0
4	1	6	6.0	6.0	36.0
5	1	7	13.5	13.5	94.5
6	1	5	20.5	20.5	102.5
7	2	5	27.0	54.0	135.0
8	1	8	35.0	35.0	280.0
9	4	16	49.5	198.0	792.0
10	7	19	72.5	507.5	1377.5
Σ	17	68		834.5	2820.5
U1		474.5	$\sigma_{U\ corr}$		88.95
U2		681.5	z value		1.16
μ_U		578.0	**p value**		**0.24459**

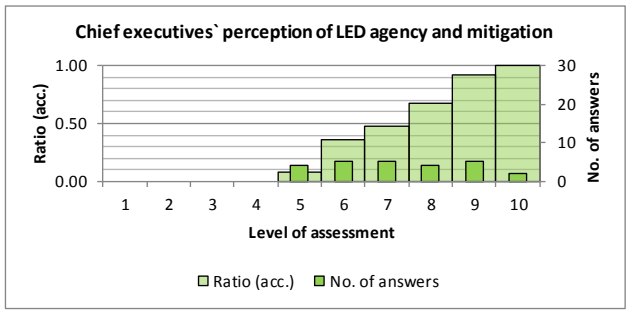
Consultants (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	0	0.0	0.0	0.0
3	0	1	2.0	0.0	2.0
4	1	3	4.5	4.5	13.5
5	1	3	8.5	8.5	25.5
6	1	5	13.5	13.5	67.5
7	2	7	21.0	42.0	147.0
8	1	6	29.0	29.0	174.0
9	4	13	41.0	164.0	533.0
10	7	18	62.0	434.0	1116.0
Σ	17	57		695.5	2079.5
U1		426.5	$\sigma_{U\ corr}$		75.69
U2		542.5	z value		0.77
μ_U		484.5	**p value**		**0.44351**

Councillors (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	1	1	1.5	1.5	1.5
2	0	1	3.0	0.0	3.0
3	1	0	4.0	4.0	0.0
4	3	6	9.0	27.0	54.0
5	3	7	18.5	55.5	129.5
6	5	5	28.5	142.5	142.5
7	7	5	39.5	276.5	197.5
8	6	8	52.5	315.0	420.0
9	13	16	74.0	962.0	1184.0
10	18	19	107.0	1926.0	2033.0
Σ	57	68		3710.0	4165.0
U1		1819.0	$\sigma_{U\ corr}$		197.45
U2		2057.0	z value		0.60
μ_U		1938.0	**p value**		**0.54672**

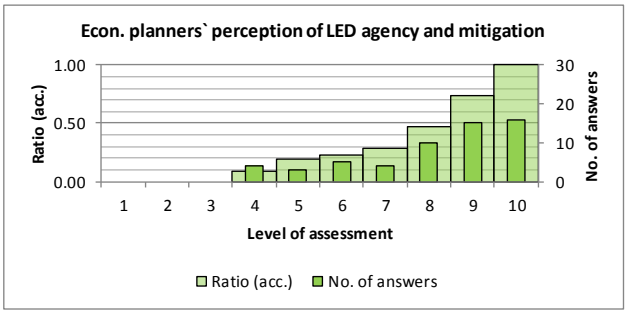
LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 67 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the idea of including mitigation projects in LED strategies

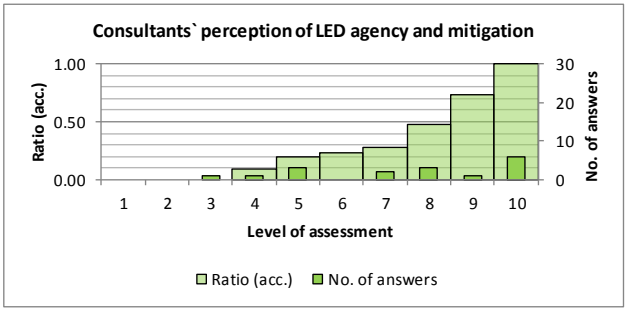
Chief executives		1st. Quartile	6.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	0	0	0.00
5	2	2	0.08
6	7	9	0.36
7	3	12	0.48
8	5	17	0.68
9	6	23	0.92
10	2	25	1.00



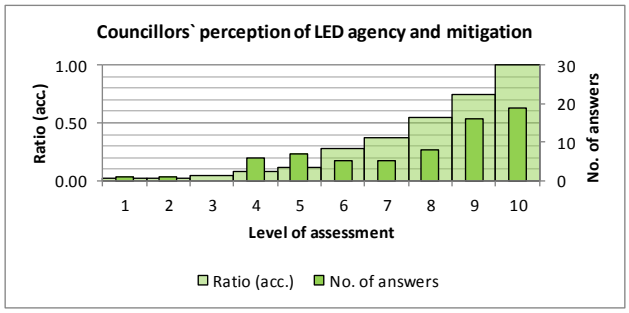
Economic planners		1st. Quartile	7.00
		Median	9.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	0	0	0.00
3	0	0	0.00
4	5	5	0.09
5	6	11	0.19
6	2	13	0.23
7	3	16	0.28
8	11	27	0.47
9	15	42	0.74
10	15	57	1.00



Consultants		1st. Quartile	5.00
		Median	8.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	0	0	0.00
2	0	0	0.00
3	1	1	0.06
4	1	2	0.12
5	3	5	0.29
6	0	5	0.29
7	2	7	0.41
8	3	10	0.59
9	1	11	0.65
10	6	17	1.00



Councillors		1st. Quartile	6.00
		Median	8.00
		3rd. Quartile	9.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	1	1	0.01
2	0	1	0.01
3	2	3	0.04
4	2	5	0.07
5	3	8	0.12
6	11	19	0.28
7	6	25	0.37
8	12	37	0.54
9	14	51	0.75
10	17	68	1.00



Other stakeholders		1st. Quartile	6.00
		Median	8.00
		3rd. Quartile	10.00
Level of assessment	No. of answers	Accumulative	Ratio (acc.)
1	1	1	0.02
2	3	4	0.07
3	0	4	0.07
4	1	5	0.09
5	4	9	0.16
6	7	16	0.28
7	6	22	0.39
8	10	32	0.56
9	9	41	0.72
10	16	57	1.00

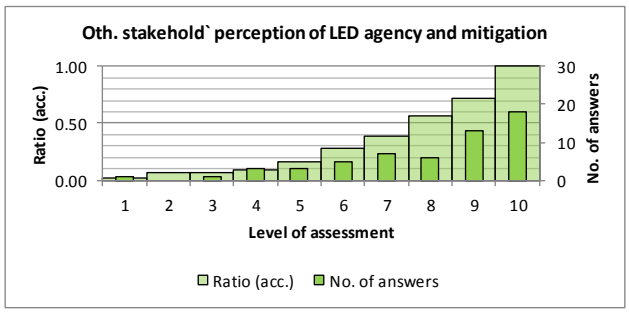


Table 68 Stakeholders` assessment of the feasibility of including mitigation projects in the service portfolio of an LED agency

Chief executives (n1) – Economic planners(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	5	3	0	15
5	2	6	9.5	19	57
6	7	2	18	126	36
7	3	3	25.5	76.5	76.5
8	5	11	36.5	182.5	401.5
9	6	15	55	330	825
10	2	15	74	148	1110
Σ	25	57		882.0	2521.0
U1		868.0	$\sigma_{U\,corr}$		97.48
U2		557.0	z value		1.60
μ_U		712.5	**p value**		**0.11068**

Chief executives (n2) – Consultants(n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	0	0	0	0
2	0	0	0	0	0
3	1	0	1	0	0
4	1	0	2	3	0
5	3	2	5	28.5	19
6	0	7	11	0	126
7	2	3	17	51	76.5
8	3	5	23.5	109.5	182.5
9	1	6	31	55	330
10	6	2	38.5	444	148
Σ	17	25		691.0	882.0
U1		193.5	$\sigma_{U\,corr}$		38.52
U2		231.5	z value		0.49
μ_U		212.5	**p value**		**0.62179**

Chief executives (n1) – Councillors(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	0	0.0	0.0	0.0
3	0	2	2.5	0.0	5.0
4	0	2	4.5	0.0	9.0
5	2	3	8.0	16.0	24.0
6	7	11	19.5	136.5	214.5
7	3	6	33.0	99.0	198.0
8	5	12	46.0	230.0	552.0
9	6	14	64.5	387.0	903.0
10	2	17	84.0	168.0	1428.0
Σ	25	68		1036.5	3334.5
U1		988.5	$\sigma_{U\,corr}$		113.49
U2		711.5	z value		1.22
μ_U		850.0	**p value**		**0.22232**

Chief executives (n1) – Other stakeholders(n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	3	3.0	0.0	9.0
3	0	0	0.0	0.0	0.0
4	0	1	5.0	0.0	5.0
5	2	4	8.5	17.0	34.0
6	7	7	18.5	129.5	129.5
7	3	6	30.0	90.0	180.0
8	5	10	42.0	210.0	420.0
9	6	9	57.0	342.0	513.0
10	2	16	73.5	147.0	1176.0
Σ	25	57		935.5	2467.5
U1		814.5	$\sigma_{U\,corr}$		97.81
U2		610.5	z value		1.04
μ_U		712.5	**p value**		**0.29701**

Economic planners (n2) – Consultants (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	0	0	0	0
2	0	0	0	0	0
3	1	0	1	1	0
4	1	5	4.5	4.5	22.5
5	3	6	12	36	72
6	0	2	17.5	0	35
7	2	3	21	42	63
8	3	11	30.5	91.5	335.5
9	1	15	45.5	45.5	682.5
10	6	15	64	384	960
Σ	17	57		604.5	2170.5
U1		517.5	$\sigma_{U\,corr}$		76.16
U2		451.5	z value		0.43
μ_U		484.5	**p value**		**0.66480**

Economic planners (n2) – Councillors (n1)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	0	0.0	0.0	0.0
3	0	2	2.5	0.0	5.0
4	5	2	7.0	35.0	14.0
5	6	3	15.0	90.0	45.0
6	2	11	26.0	52.0	286.0
7	3	6	37.0	111.0	222.0
8	11	12	53.0	583.0	636.0
9	15	14	79.0	1185.0	1106.0
10	15	17	109.5	1642.5	1861.5
Σ	57	68		3698.5	4176.5
U1		1830.5	$\sigma_{U\,corr}$		197.92
U2		2045.5	z value		0.54
μ_U		1938.0	**p value**		**0.58703**

Economic planners (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	3	3.0	0.0	9.0
3	0	0	0.0	0.0	0.0
4	5	1	7.5	37.5	7.5
5	6	4	15.5	93.0	62.0
6	2	7	25.0	50.0	175.0
7	3	6	34.0	102.0	204.0
8	11	10	49.0	539.0	490.0
9	15	9	71.5	1072.5	643.5
10	15	16	99.0	1485.0	1584.0
Σ	57	57		3379.0	3176.0
U1		1523.0	$\sigma_{U\,corr}$		173.12
U2		1726.0	z value		0.59
μ_U		1624.5	**p value**		**0.55767**

Consultants (n1) – Councillors (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	0	0.0	0.0	0.0
3	1	2	3.0	3.0	6.0
4	1	2	6.0	6.0	12.0
5	3	3	10.5	31.5	31.5
6	0	11	19.0	0.0	209.0
7	2	6	28.5	57.0	171.0
8	3	12	40.0	120.0	480.0
9	1	14	55.0	55.0	770.0
10	6	17	74.0	444.0	1258.0
Σ	17	68		716.5	2938.5
U1		592.5	$\sigma_{U\,corr}$		89.45
U2		563.5	z value		0.16
μ_U		578.0	**p value**		**0.87123**

Consultants (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	0	1	1.0	0.0	1.0
2	0	3	3.0	0.0	9.0
3	1	0	5.0	5.0	0.0
4	1	1	6.5	6.5	6.5
5	3	4	11.0	33.0	44.0
6	0	7	18.0	0.0	126.0
7	2	6	25.5	51.0	153.0
8	3	10	36.0	108.0	360.0
9	1	9	47.5	47.5	427.5
10	6	16	63.5	381.0	1016.0
Σ	17	57		632.0	2143.0
U1		490.0	$\sigma_{U\,corr}$		76.37
U2		479.0	z value		0.07
μ_U		484.5	**p value**		**0.94259**

Councillors (n1) – Other stakeholders (n2)					
LoA	n1	n2	Rank	ΣRank n1	ΣRank n2
1	1	1	1.5	1.5	1.5
2	3	0	4.0	12.0	0.0
3	0	2	6.5	0.0	13.0
4	1	2	9.0	9.0	18.0
5	4	3	14.0	56.0	42.0
6	7	11	26.5	185.5	291.5
7	6	6	41.5	249.0	249.0
8	10	12	58.5	585.0	702.0
9	9	14	81.0	729.0	1134.0
10	16	17	109.0	1744.0	1853.0
Σ	57	68		3571.0	4304.0
U1		1958.0	$\sigma_{U\,corr}$		198.27
U2		1918.0	z value		0.10
μ_U		1938.0	**p value**		**0.91965**

LoA = Level of assessment
n1 = no. of observations sample 1
n2 = no. of observations sample 2

Table 69 Results of Mann Whitney U tests for differences among stakeholders groups with respect to the idea of including mitigation projects in the service portfolio of an LED agency

Sector	No.	Project/Initiative	Responsible (lead)
Agriculture	1	Support to communal farmers (financing, revolving scheme of livestock)	OCFU
	2	De-bushing of agricultural land in region	MAWF
	3	Outreach of existing skills development programmes	MAWF
	4	Database development on skills development programmes for farmers	MAWF
	5	Development of regional marketing calendar for livestock	MAWF
	6	Regional livestock marketing workshop	MAWF
	7	Marketing infrastructure upgrade and maintenance in constituencies	MAWF
	8	Rangeland management training for communal farmers	NNFU
	9	Virgin land development for agricultural production	OTRC
	10	Water infrastructure development in prioritized targeted communal land	MAWF
	11	Prioritize resettlement needs of people with livestock on town lands	LAs
	12	Horticulture production on resettlement farms	MLR
	13	Charcoal and wood production	Private sector
	14	Urban agriculture (horticulture) initiative on settlement and town lands	LAs
	15	Up-scaling of MAWF pilots in region	MAWF
Tourism	16	Product development for tourism in the region	OTRC
	17	Marketing agency establishment	OTRC
	18	Establish regional tourism forum and revive local tourism forums	OTRC
	19	Hospitality infrastructure in targeted urban localities	Private sector
	20	Training of tourism operators	OTRC
	21	Training institutions development in the region	CCF
	22	Support to communal conservancies	OTRC
	23	Guest accommodation in targeted locations	LAs and OTRC
	24	Safety and security coordinating mechanism in region	NAMPOL
Manufact. and processing	25	Charcoal production exploring value addition	Private sector
	26	Regulation and control of charcoal industry	MAWF
	27	Encourage the introduction of entrepreneurship in school syllabus	OTRC
	28	Vocational and technical skills	OTRC
	29	Procurement of local products and services by public services	OTRC
	30	Database development of manufacturers and other business in region	OTRC
	31	Incentives package development for industry in region	OTRC
	32	Marketing initiatives for manufactured products in the region	OTRC
Services	33	Skills development for local authorities and settlements	LAs and OTRC
	34	Strengthen regional education forum	OTRC
	35	Strengthen local stakeholder platforms	LAs and OTRC
	36	Establish regional LA platform	OTRC
	37	Development of standardized LA profiles	LA and OTRC
	38	Support/strengthen attachment programmes of technical and vocational skills training facilities	OTRC
	39	Regional trust fund establishment	OTRC
	40	Develop strategies for improving revenue collection for LAs and settlements	OTRC
	41	Explore support towards PPPs for servicing land in targeted LAs	OTRC
	42	Engage TRANSNAMIB/MWT on prime land in LAs	OTRC
	43	Engage TELECOM/MTC/LEO/CENORED/NAMWATER on service provision issues	OTRC
	44	Explore incentives for business and industrial development in LA area of region	OTRC
	45	Explore PPPs on health services in targeted LA areas	LAs
	46	Identification of champions for local opportunities	LAs
Mining	47	Establish regional trust fund	OTRC
	48	Engage mining companies on possible PPPs for developing declared settlements and nearby LAs	OTRC
	49	Engage respective mining company and MRLGHRD on Kombat proclamation to settlement or village	OTRC
	50	Engage Ohorongo Cement on opportunities for SMEs	OTRC
	51	MOU with Ohorongo Cement on cooperation with Otavi Town Council	OTRC
	52	Research on small-scale mining activities in Otjozondjupa and follow-up activities	OTRC
SME and informal sector	53	Formalization of marketing structures in settlements and LAs	LAs and OTRC
	54	Training and mentorship support for SMEs and informal sector	OTRC
	55	Assessment of formal business opportunities in targeted localities	LAs and OTRC
	56	Support formalization of informal companies	LAs
	57	Regional fund for supporting SME	OTRC
	58	Explore zoning solutions for SMEs	LAs
	59	Incubation facilities for SMEs	OTRC
	60	Representation of SMEs and informal sector	LAs
	61	Advocating for procurement criteria and practices that make participation of local SMEs possible	OTRC
	62	LAs, regional councils and other public agencies procure from local SME suppliers or contractors	OTRC and LAs
	63	Develop regional database of accredited contractors for local procurement preferences	LAs and OTRC

Table 70 Planned activities of Otjozondjupa LED strategy
Source: adapted from GEISEB (2011)

Mitigation project idea	Identified		Included in LED strategy (with priorities)
	By consultant	During brain-storming	
Fuel efficient biomass cook stoves for use in households and institutions	✓		✓
manufacture of transportable charcoal retorts	✓		✓
LPG fuel switching for vehicles owned by the Otjozondjupa Regional Council and municipalities and towns in the Otjozondjupa	✓		
Biogas digesters for households to produce gas cooking fuel	✓		
Conversion of invader bush to pelletized biomass fuel suitable for export to international biomass power plants	✓		✓
Biogas digester to convert animal waste at commercial livestock and poultry farms and slaughterhouses into biogas and agricultural fertiliser	✓		✓
Energy efficiency improvements at the Namib Mills plant in Otavi	✓		
Hybrid biogas-diesel electricity generation for off-gird settlement (Gam)	✓		✓
Biomass power plant (encroacher bush) to be constructed in the region	✓		
Reforestation project/programme which would plant new trees in areas cleared before year 1990		✓	
Programme to clear invader bush from agriculture land and allow grass to grow in its place		✓	
A charcoal briquette manufacturing plant		✓	✓
A programme to promote energy efficiency in building throughout Otjozondjupa		✓	
Programme to replace diesel water pumping with solar-powered water pumping		✓	
Establishment of municipal recycling programmes		✓	
Establishment of municipal composting programmes		✓	
Capture and utilization of biogas at municipal wastewater treatment facilities		✓	
A combined photovoltaic power production facility with a combined vegetable garden		✓	
Affordable clay house development using sun-baked clay bricks	✓		✓
Composting of municipal organic waste and collection of recyclable municipal waste	✓		✓
Community fruit orchards that use treated municipal wastewater for irrigation	✓		✓
Solar revolving fund to promote photovoltaic power technology for off-grid electricity	✓		✓

Table 71 Proposed and discussed mitigation and CDM projects
Source: adapted from CONSULTING SERVICES AFRICA (2012)

Item		Possible Score	Qualification
Financial requirements		0	Greater than N$ 25,000,000 estimated initial investment (including paying for first year of salaries if needed)
		2	N$ 10,000,001 – N$ 25,000,000
		4	N$ 4,000,001 - N$ 10,000,000
		6	N$ 1,500,001 – N$4,000,000
		8	N$ 25,001 – N$1,500,000
		10	N$ 0 – N$ 25,000
Economic sustainability	Job Creation	0	0 jobs created
		2	1 – 10 jobs created
		4	11 - 25
		6	26 – 50
		8	51 – 100
		10	Greater than 100
	Contributes to the development of valuable new skills	0	No skills development
		5	Low quality skills development
		10	High quality skills development
Social sustainability	Improved Living Conditions	0	No improvement in household living conditions
		5	Moderate improvement in household living conditions
		10	Significant improvement in household living conditions
	Household Energy	0	No improvement in household energy
		5	Moderate improvement in household energy
		10	Significant improvement in household energy
	Consistent with local cultural traditions and practices	0	Significant conflicts with local cultural traditions and practices
		5	Moderate conflicts with local traditions & practices
		10	No conflicts with local traditions & practices
Environmental sustainability	Wise use of natural resources	0	Wasteful, unsustainable use of natural resources
		5	Moderate, beneficial use of natural resources
		10	Large-scale, beneficial use of natural resources
	Greenhouse gas emissions	0	Increase in Namibia's GHG emissions profile
		5	No increase in Namibia's GHG emissions profile
		10	Reduction in Namibia's GHG emissions profile
	Supportive of local ecosystems	0	Negative impact on local ecosystems
		5	No impact on local ecosystems
		10	Beneficial impact on local ecosystems
Influence (project can be carried out at local level without dependence on national institutions and regulations)		0	Significant risk of the project not being approved for implementation by national institutions and regulations
		5	Moderate risk of the project not being approved or significantly delayed for implementation by national institutions and regulations
		10	Practically no risk of the project not being approved or significantly delayed for implementation by national institutions and regulations
Project type (quick win, catalytic)		0	Not a quick win and little or no chance of replication in the future
		5	Quick win, but little or no chance of replication in the future ((note that a quick win would be a project that can begin implementation on the ground within approx. 12 months)
		10	Quick win with good opportunities for replication in the future

Table 72 Scoring criteria for mitigation and CDM projects
Source: adapted from CONSULTING SERVICES AFRICA (2012)

Attachment II Figures

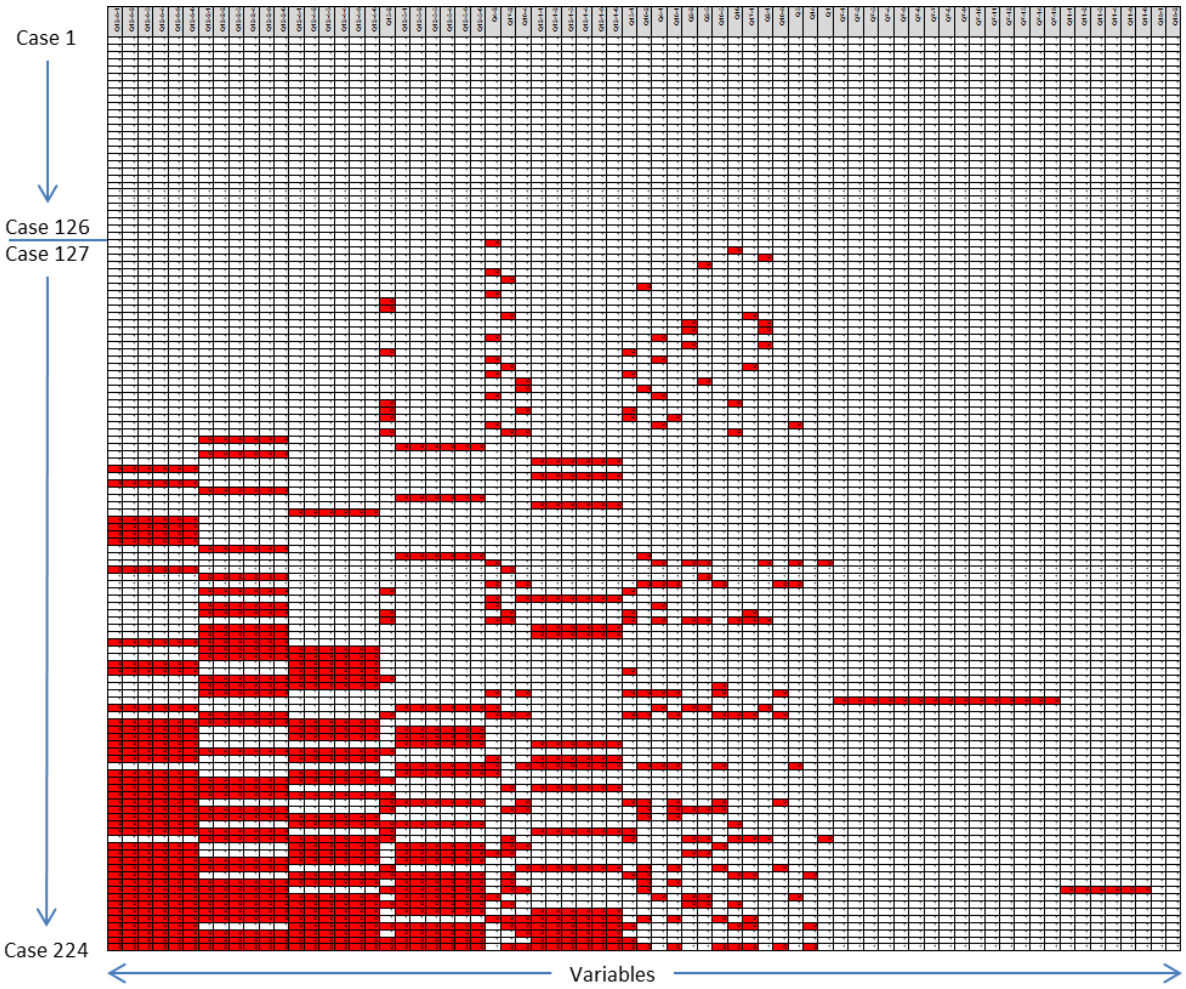
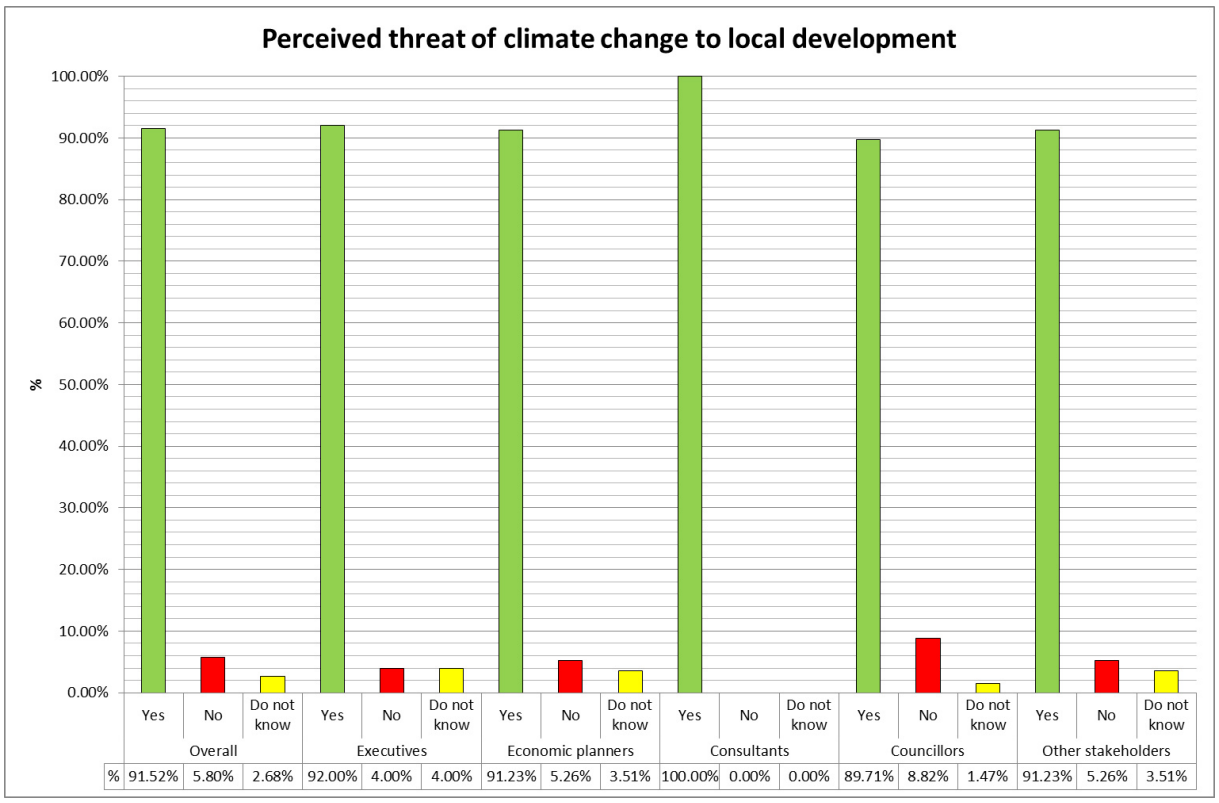
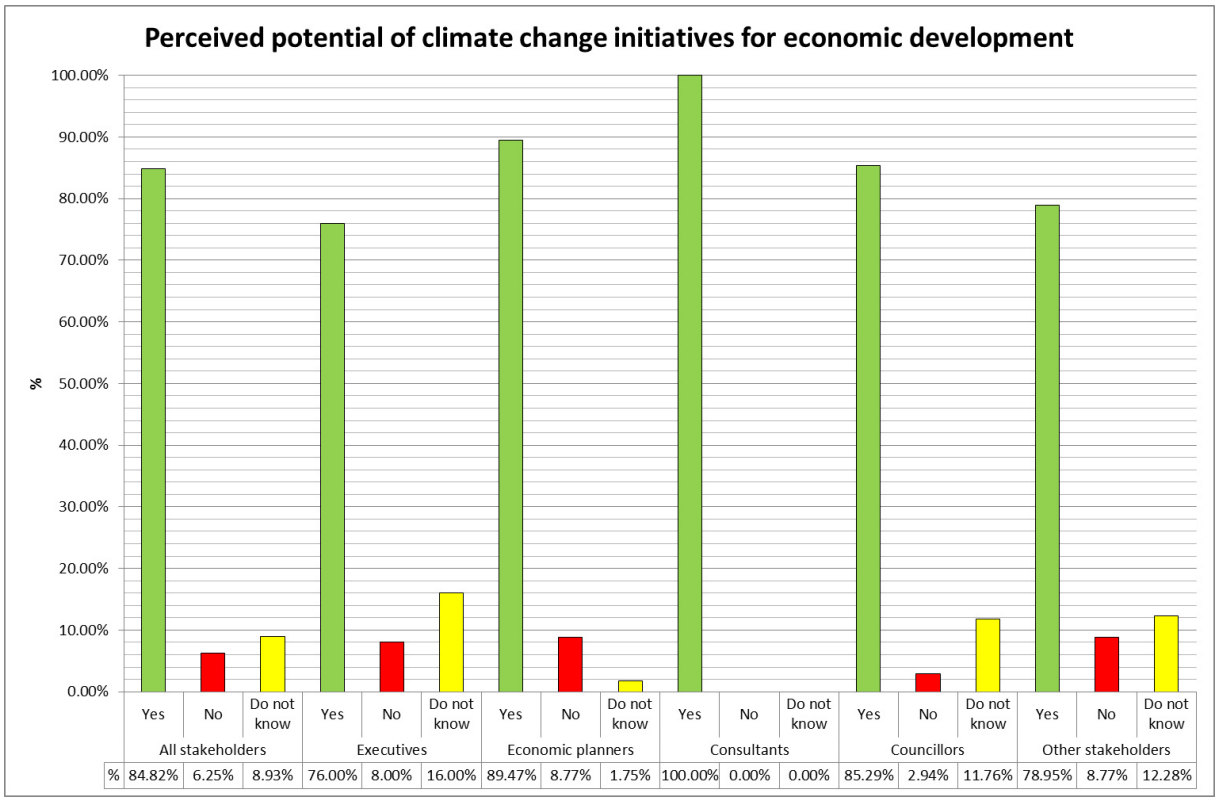


Figure 10 Missing data pattern
Question 5, 6, 8, and 9 were not considered. Red fields symbolize missing data



	Overall			Executives			Economic planners			Consultants			Councillors			Other stakeholders		
	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know
%	91.52%	5.80%	2.68%	92.00%	4.00%	4.00%	91.23%	5.26%	3.51%	100.00%	0.00%	0.00%	89.71%	8.82%	1.47%	91.23%	5.26%	3.51%

Figure 11 Stakeholders` perception of the threat of climate change to local development



	All stakeholders			Executives			Economic planners			Consultants			Councillors			Other stakeholders		
	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know	Yes	No	Do not know
%	84.82%	6.25%	8.93%	76.00%	8.00%	16.00%	89.47%	8.77%	1.75%	100.00%	0.00%	0.00%	85.29%	2.94%	11.76%	78.95%	8.77%	12.28%

Figure 12 Stakeholders` perception of the economic development potential of climate change initiatives

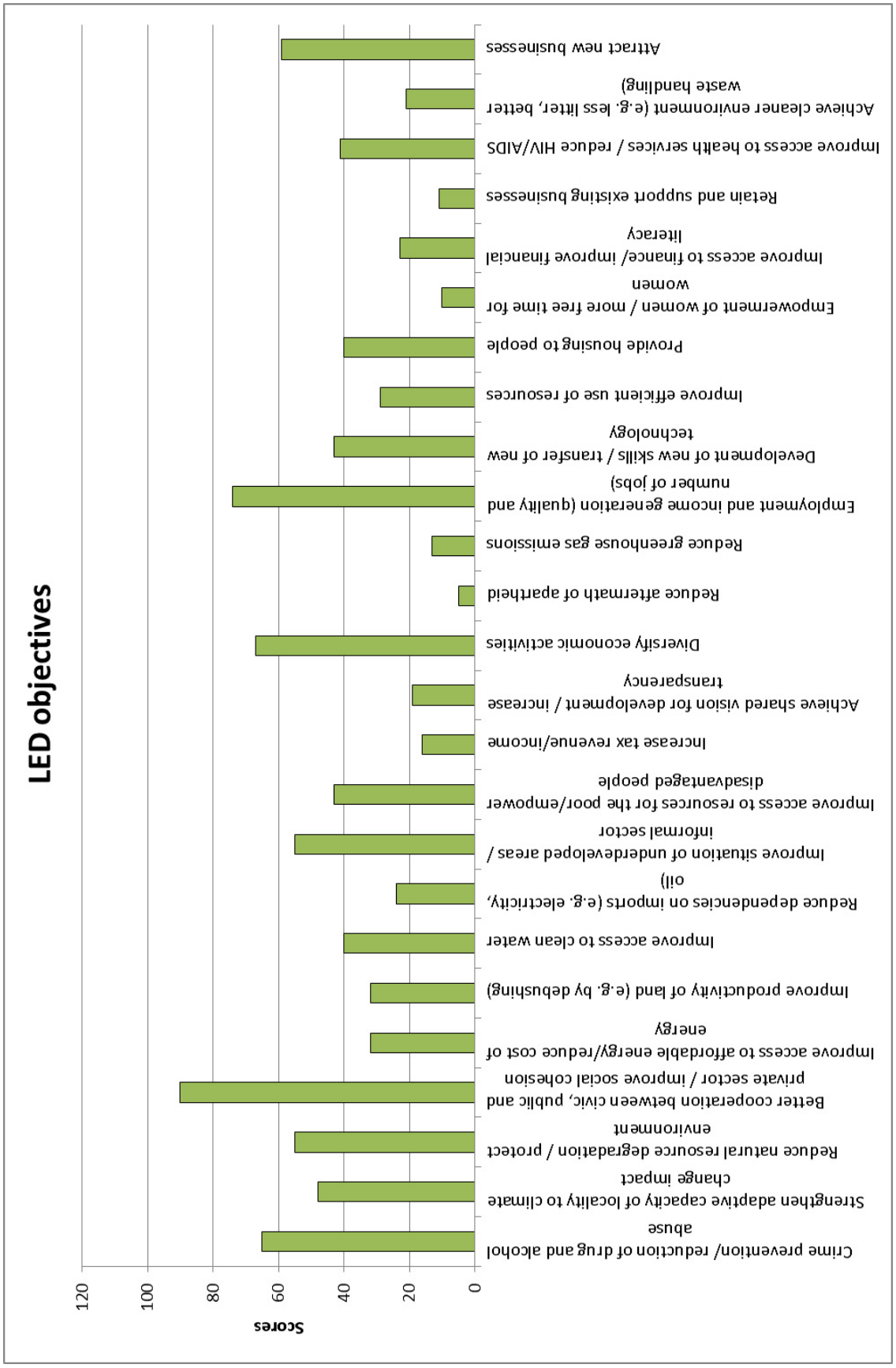


Figure 13 Stakeholders` LED objectives

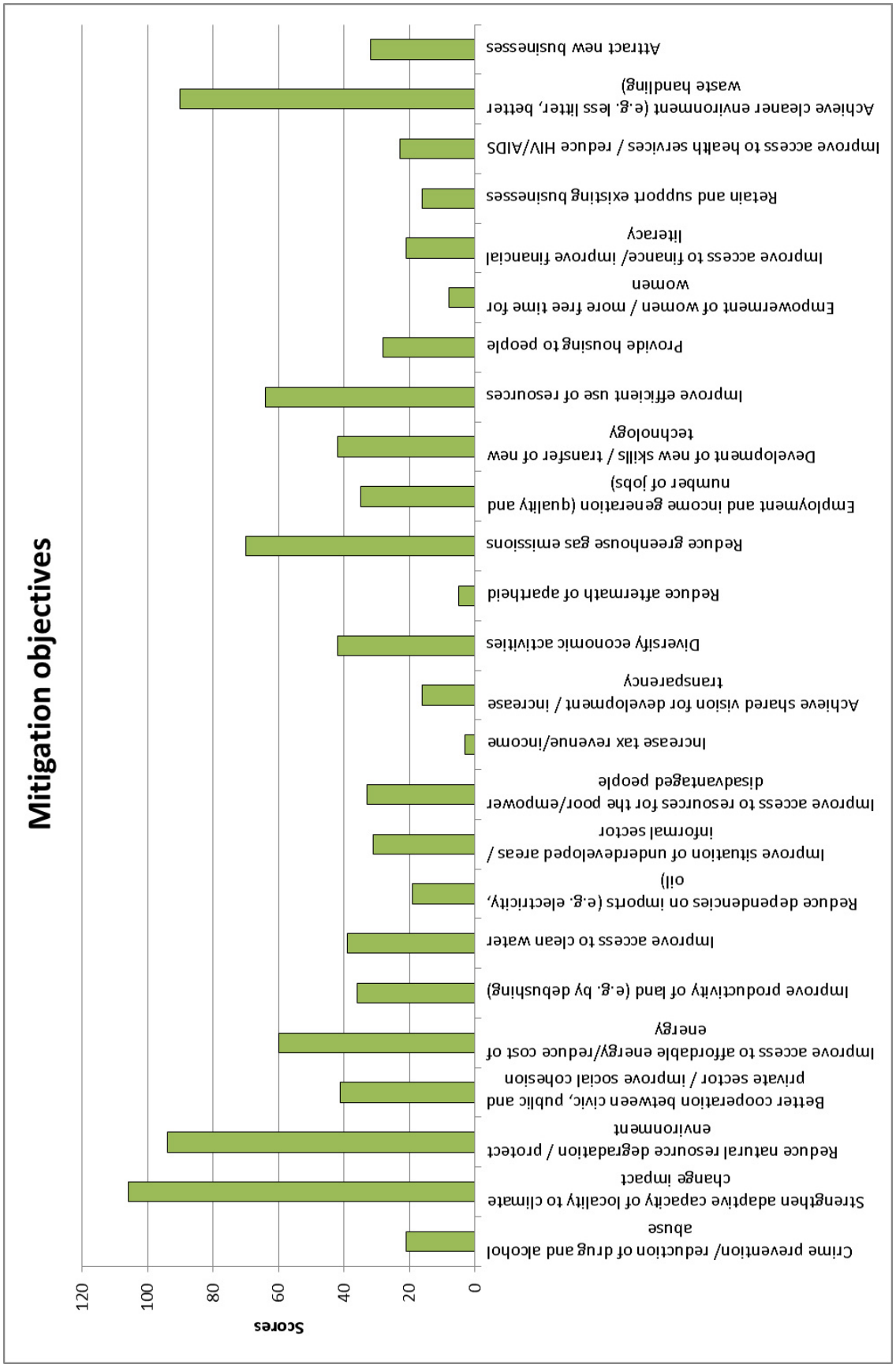


Figure 14 Stakeholders` mitigation objectives

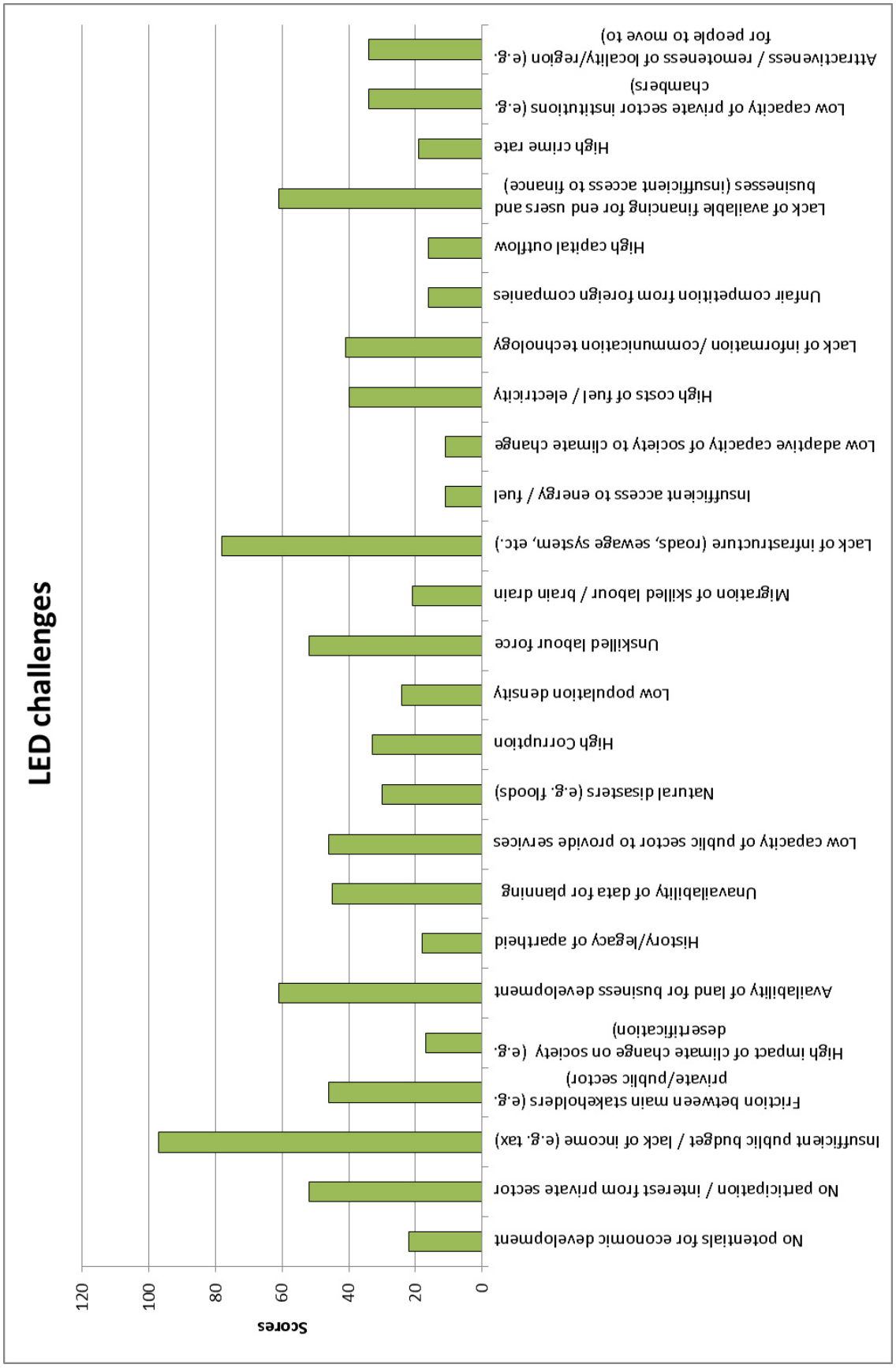


Figure 15 Stakeholders` perception of LED challenges

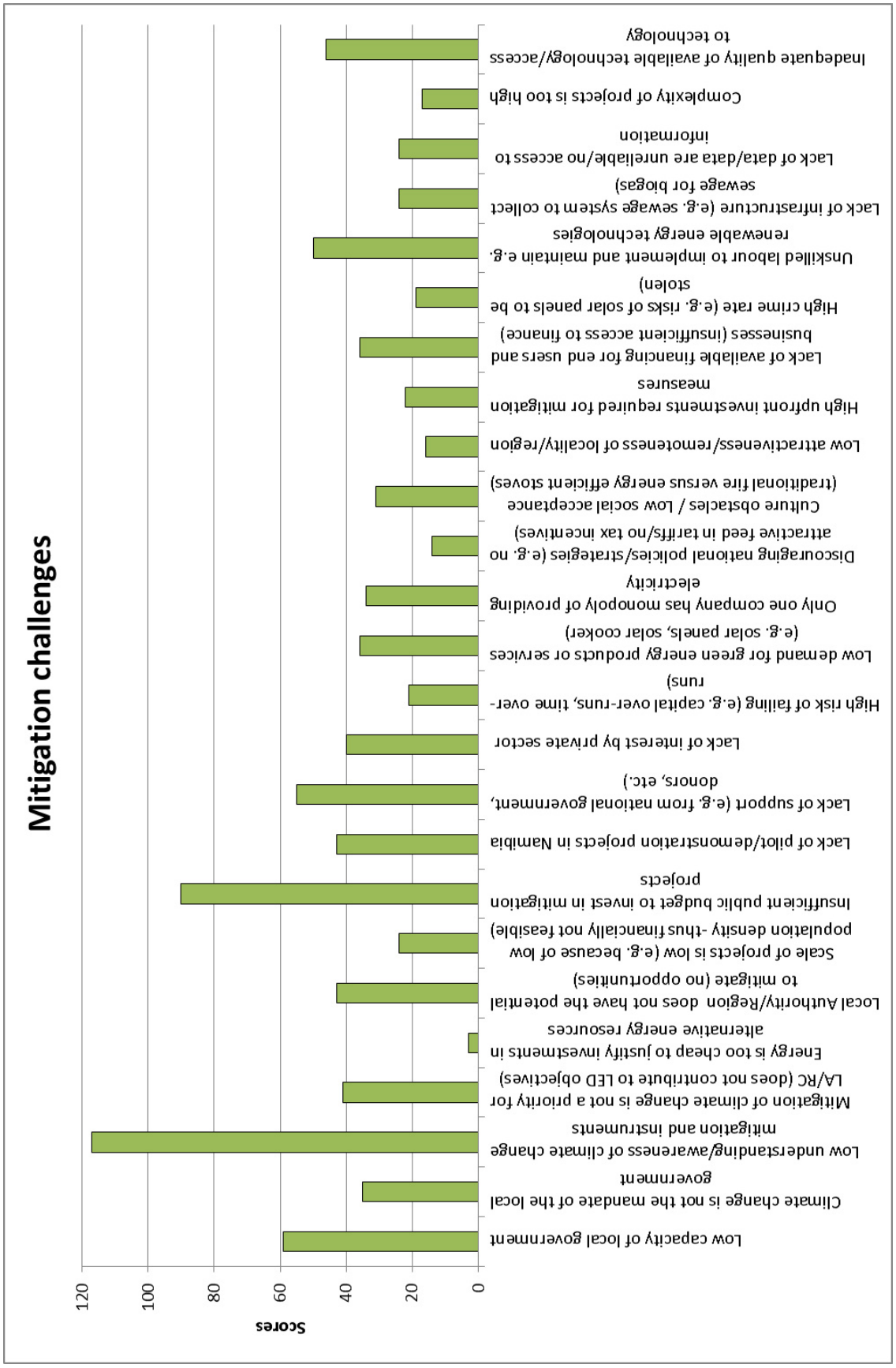


Figure 16 Stakeholders` perception of mitigation challenges

Attachment III Questionnaire

Questionnaire on Local Economic Development and Climate Change

Dear Madam / Sir

To continuously improve the services of its Local Economic Development Agency (LEDA) the Ministry of Regional and Local Government, Housing and Rural Development (MRLGHRD) kindly requests you to fill out this questionnaire, which will take approx. twenty minutes of your time. Please consider the following:

- **Before answering a specific question pls. read through all the given alternative answers first**
- **Be aware that the alternative answers are intentionally not coherently grouped together**
- **The term "Region" refers to Namibian political regions, like Karas, Hardap, etc.**

Be assured that your answers will be kept strictly confidential and that your opinion is highly appreciated. Please email back the questionnaire.

Thank you very much for your cooperation!

Name:

Organisation:

Function (SG) (pls. tick) :			
	☐ CEO, CRO	☐ Economic development planer	☐ Consultant
	☐ Councillor, mayor	☐ Traditional authority	☐ Private business/sector
	☐ Others: (e.g. ministry staff, NGO)	If others, pls. specify:	

Phone: Email:

Q1) I believe that the impact of climate change poses a threat to the development of **Local Authorities/Regions** (**please tick**)!	Yes	No	Do not know
	☐	☐	☐

Q2) **If you believe** that climate change poses a threat, please rate the threat in terms of (**please rate from 1 to 10**)...

	Low threat								High threat	
	1	2	3	4	5	6	7	8	9	10
...economic development (Q2-1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
...social development (Q2-2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
...environmental development (Q2-3)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q3) I believe that projects to reduce greenhouse gas emissions (mitigation) or to reduce the impact of climate change (adaptation) could foster economic development in **Local Authorities/Regions**!

Yes	No	Do not know
☐	☐	☐

Q4) **If you believe** that adaptation or mitigation could foster economic development in Local **Authorities/Regions**, please rate the potential in terms of (**please rate from 1 to 10**)...

	Low potential								High potential	
	1	2	3	4	5	6	7	8	9	10
...mitigation (Q4-1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
...adaptation (Q4-2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q5) Which of the following sustainable development goals would you like to achieve by **Local Economic Development** initiatives? (please tick only **the 5 most important** ones or **add others**)?

- ☐ Crime prevention/ reduction of drug and alcohol abuse
- ☐ Strengthen adaptive capacity of locality to climate change impact
- ☐ Reduce natural resource degradation / protect environment
- ☐ Better cooperation between civic, public and private sector / improve social cohesion
- ☐ Improve access to affordable energy/reduce cost of energy
- ☐ Improve productivity of land (e.g. by debushing)
- ☐ Improve access to clean water
- ☐ Reduce dependencies on imports (e.g. electricity, oil)
- ☐ Improve situation of underdeveloped areas / informal sector
- ☐ Improve access to resources for the poor/empower disadvantaged people
- ☐ Increase tax revenue/income
- ☐ Achieve shared vision for development / increase transparency
- ☐ Diversify economic activities
- ☐ Reduce aftermath of apartheid
- ☐ Reduce greenhouse gas emissions
- ☐ Employment and income generation (quality and number of jobs)
- ☐ Development of new skills / transfer of new technology
- ☐ Improve efficient use of resources
- ☐ Provide housing to people
- ☐ Empowerment of women / more free time for women
- ☐ Improve access to finance/ improve financial literacy
- ☐ Retain and support existing businesses
- ☐ Improve access to health services / reduce HIV/AIDS
- ☐ Achieve cleaner environment (e.g. less litter, better waste handling)
- ☐ Attract new businesses

Others _____

_____

Q6) Which of the following sustainable development goals would you like to achieve by **climate change mitigation initiatives**? (please tick only **the 5 most important** ones or **add others**)

- ☐ Crime prevention/ Reduction of drug and alcohol abuse
- ☐ Strengthen adaptive capacity of locality to climate change impact
- ☐ Reduce natural resource degradation / protect environment
- ☐ Better cooperation between civic, public and private sector / improve social cohesion
- ☐ Improve access to affordable energy/reduce cost of energy
- ☐ Improve productivity of land (e.g. by debushing)
- ☐ Improve access to clean water
- ☐ Reduce dependencies on imports (e.g. electricity, oil)
- ☐ Improve situation of underdeveloped areas / informal sector
- ☐ Improve access to resources for the poor/empower disadvantaged people
- ☐ Increase tax revenue/income
- ☐ Achieve shared vision for development / increase transparency
- ☐ Diversify economic activities
- ☐ Reduce aftermath of apartheid
- ☐ Reduce greenhouse gas emissions
- ☐ Employment and income generation (quality and number of jobs)
- ☐ Development of new skills / transfer of new technology
- ☐ Improve efficient use of resources
- ☐ Provide housing to people
- ☐ Empowerment of women / more free time for women
- ☐ Improve access to finance/ improve financial literacy
- ☐ Retain and support existing businesses
- ☐ Improve access to health services / reduce HIV/AIDS
- ☐ Achieve cleaner environment (e.g. less litter, better waste handling)
- ☐ Attract new businesses

Others _____

_____

_____

Q7). How do you rate the potential for economic development and poverty reduction in **Local Authorities/Regions (your LA/your Region)** in respect to the following **climate change mitigation** initiatives? If you do not know do not tick the respective row. (**please rate from 1 to 10)**

	Low potential							High potential		
	1	2	3	4	5	6	7	8	9	10
Solar water heaters (Q7-1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Solar ovens (Q7-2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Solar home systems (photovoltaic panels for households) (Q7-3)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Solar parks for off-grid settlements (e.g. Tsumkwe) (Q7-4)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biomass energy (electricity from bush, agricultural residue, etc.) (Q7-5)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Energy efficient woods stoves for cooking (Q7-6)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Household biogas digester (biogas from manure to use for cooking/lighting) (Q7-7)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Promote insulation of houses (Q7-8)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Switching to energy efficient lighting (e.g with CFL light bulbs) (Q7-9)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Solar water pumps to replace diesel pumps (Q7-10)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Reforestation/afforestation initiatives (Q7-11)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fire management to reduce bush fires (Q7-12)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Collecting and composting of organic domestic waste (Q7-13)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel switching of cars (to use gas (LPG) instead of petrol/diesel) (Q7-14)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Biogas from municipal waste water (to be used to generate electricity) (Q7-15)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Others (please name): _____

_____

Q8) What do you perceive as the biggest obstacles for Local Economic Development in **Local Authorities / Regions** (please tick only **the 5 most important** ones or **add others**)?

- ☐ No potentials for economic development
- ☐ No participation / interest from private sector
- ☐ Insufficient public budget / lack of income (e.g. tax)
- ☐ Friction between main stakeholders (e.g. private/public sector)
- ☐ High impact of climate change on society (e.g. desertification)
- ☐ Availability of land for business development
- ☐ History/legacy of apartheid
- ☐ Unavailability of data for planning
- ☐ Low capacity of public sector to provide services
- ☐ Natural disasters (e.g. floods)
- ☐ High Corruption
- ☐ Low population density
- ☐ Unskilled labour force
- ☐ Migration of skilled labour / brain drain
- ☐ Lack of infrastructure (roads, sewage system, etc.)
- ☐ Insufficient access to energy / fuel
- ☐ Low adaptive capacity of society to climate change
- ☐ High costs of fuel / electricity
- ☐ Lack of information /communication technology
- ☐ Unfair competition from foreign companies
- ☐ High capital outflow
- ☐ Lack of available financing for end users and businesses (insufficient access to finance)
- ☐ High crime rate
- ☐ Low capacity of private sector institutions (e.g. chambers)
- ☐ Attractiveness / remoteness of locality/region (e.g. for people to move to)

Others _____
_____
_____

Q9) What do you perceive as the biggest obstacles for **climate mitigation projects** (e.g. wind power) in **Local Authorities/Regions** (pls. tick only **the 5 most important** ones and **eventually add others**)?

- ☐ Low capacity of local government
- ☐ Climate change is not the mandate of the local government
- ☐ Low understanding/awareness of climate change mitigation and instruments
- ☐ Mitigation of climate change is not a priority for LA/RC (does not contribute to LED objectives)
- ☐ Energy is too cheap to justify investments in alternative energy resources
- ☐ Local Authority/Region does not have the potential to mitigate (no opportunities)
- ☐ Scale of projects is low (e.g. because of low population density -thus financially not feasible)
- ☐ Insufficient public budget to invest in mitigation projects
- ☐ Lack of pilot/demonstration projects in Namibia
- ☐ Lack of support (e.g. from national government, donors, etc.)
- ☐ Lack of interest by private sector
- ☐ High risk of failing (e.g. capital over-runs, time over-runs)
- ☐ Low demand for green energy products or services (e.g. solar panels, solar cooker)
- ☐ Only one company has monopoly of providing electricity
- ☐ Discouraging national policies/strategies (e.g. no attractive feed in tariffs/no tax incentives)
- ☐ Culture obstacles / Low social acceptance (traditional fire versus energy efficient stoves)
- ☐ Low attractiveness/remoteness of locality/region
- ☐ High upfront investments required for mitigation measures
- ☐ Lack of available financing for end users and businesses (insufficient access to finance)
- ☐ High crime rate (e.g. risks of solar panels to be stolen)
- ☐ Unskilled labour to implement and maintain e.g. renewable energy technologies
- ☐ Lack of infrastructure (e.g. sewage system to collect sewage for biogas)
- ☐ Lack of data/data are unreliable/no access to information
- ☐ Complexity of projects is too high
- ☐ Inadequate quality of available technology/access to technology

Others _____
_____
_____

Q10) How good is your knowledge of the below mentioned conventions, protocols, instruments or organisation. (**please rate from 1 to 10**)?

	Poor							Excellent		
	1	2	3	4	5	6	7	8	9	10
UN Framework Convention on Climate Change (Q10-1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Kyoto Protocol (Q10-2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Clean Development Mechanism (Q10-3)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Designated National Authority in Namibia (Q10-4)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
National Policy on Climate Change for Namibia (Q10-5)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q11) Who do you think should be the main drivers/responsible for climate change initiatives in **Local Authorities/Regions** (**more than one answer possible**)?

National private sector (Q11-1)	☐
International private sector (Q11-2)	☐
Donor organisations (Q11-3)	☐
National Government (e.g. MET, MME) (Q11-4)	☐
Regional Councils (Q11-5)	☐
Local Authorities (Q11-6)	☐

Q12) What functions should the different organisations take over for mitigation projects (**more than one answer per function possible**)?

	National government	Regional government	Local Authority	National private sector	International private sector	Donors
Promoting projects (Q12-1)	☐	☐	☐	☐	☐	☐
Sourcing for investors (Q12-2)	☐	☐	☐	☐	☐	☐
Financing projects (Q12-3)	☐	☐	☐	☐	☐	☐
Implementing projects (Q12-4)	☐	☐	☐	☐	☐	☐
Operating projects (Q12-5)	☐	☐	☐	☐	☐	☐

Q13) I believe that mitigation initiatives should be (**please rate from 1 to 10**)...

	Not at all								Very much so	
	1	2	3	4	5	6	7	8	9	10
...included in LED strategies (Q13-1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
...included in LEDA's service portfolio (Q13-2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q14) Have you ever been involved in climate change projects (**please tick**)?

Yes	No	Do not know
☐	☐	☐

If yes, in which one (**please write on the provided space**)?

_____

_____

_____

Q15) With respect to climate change mitigation (**more than one answer possible**)...

	Private sector	Donors (e.g UNDP)	MET	MME	MTI	MAWF	MRLGHRD
...I have been approached by... (Q15-1)	☐	☐	☐	☐	☐	☐	☐
...I approached...(Q15-2)	☐	☐	☐	☐	☐	☐	☐

Q16) Do you believe that climate change mitigation projects could be initiated by a typical bottom up, participatory LED approach (**please rate from 1 to 10**)?

Do not agree							Fully agree		
1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Q17) How would you rate your knowledge of (**please rate from 1 to 10**)...

	Poor							Excellent		
	1	2	3	4	5	6	7	8	9	10
...climate change mitigation (Q17-1)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
...climate change adaptation (Q17-2)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Thank you for taking the time to fill out the questionnaire!

Attachment IV Curriculum Vitae (German/English)

Lebenslauf

Harald Richter

geb. am 15.03.1961 in Obersalbach/Deutschland

Bildungsgang

Sept. 1978 – Juni 1980	Fachoberschule Saarbrücken
Okt. 1982 – Juni 1987	Fachhochschule Saarbrücken, Wirtschaftsingenieurwesen
23. Juni 1987	Dipl. Wirtschaftsingenieur
	Abschlussarbeit: Umstellung der kurzfristigen Erfolgsrechnung der Firma Schaeffler Wälzlager GmbH auf EDV-gestütztes System
Okt. 2002 – April 2005	Universität Rostock, Umweltwissenschaften mit Schwerpunkt ökologischer Umweltschutz
27. April 2005	Diplom Umweltwissenschaftler
	Abschlussarbeit: Naturschutz in Entwicklungsländern – eine Notwendigkeit? Dargestellt am Beispiel Ägyptens.

Berufliche Erfahrung

März 1987 – Dez. 1989	Organisationsentwickler, Aeroquip Sterling GmbH, Frankfurt/Deutschland
Jan. 1990 – Aug. 1994	CAM Ingenieur und LAN Manager, Bauknecht Hausgeräte GmbH, Neunkirchen/Deutschland
Sept. 1994 – Okt. 1996	Manager Technical Information Systems, Bauknecht Hausgeräte GmbH, Neunkirchen/Deutschland
Nov. 1996 – Mai 2000	Head Systems Design and Industrial Planning, Productivity and Standards Board Singapore, Singapur
Sept. 2000 – Sept. 2005	Senior Management Consultant, German Arab Chamber of Industry and Commerce, Kairo/Ägypten
März 2006 – Juni 2008	Senior Expert, Deutsche Gesellschaft für Internationale Zusammenarbeit, Addis Abeba/Äthiopien
seit Juli 2008	Senior Advisor Local Economic Development, Deutsche Gesellschaft für Internationale Zusammenarbeit, Windhuk/Namibia

Curriculum Vitae

Harald Richter

born on 15.03.1961 in Obersalbach/Germany

Education

Sept. 1978 – June 1980	Technical College, Saarbrücken
Oct. 1982 – June 1987	University of Applied Sciences, Saarbrücken, Wirtschaftsingenieurwesen (Industrial Engineering)
23. June 1987	Dipl. Wirtschaftsingenieur (Industrial Engineer)
	Final thesis: Automation of profit/loss calculation for a manufacturing company (Schaeffler Wälzlager GmbH)
Oct. 2002 – April 2005	University of Rostock, Umweltwissenschaften mit Schwerpunkt ökologischer Umweltschutz (Environmental Science with a focus on environmental protection)
27. April 2005	Diplom Umweltwissenschaftler (Environmental Scientist)
	Final thesis: Nature protection in developing countries – a necessity? Illustrated by the example of Egypt.

Professional Experience

Mar. 1987 – Dec. 1989	Organisational Developer, Aeroquip Sterling GmbH, Frankfurt/Germany
Jan. 1990 – Aug. 1994	CAM Engineer and LAN Manager, Bauknecht Hausgeräte GmbH, Neunkirchen/Germany
Sept. 1994 – Oct. 1996	Manager Technical Information Systems, Bauknecht Hausgeräte GmbH, Neunkirchen/Germany
Nov. 1996 – May 2000	Head Systems Design and Industrial Planning, Productivity and Standards Board Singapore, Singapore
Sept. 2000 – Sept. 2005	Senior Management Consultant, German Arab Chamber of Industry and Commerce, Cairo/Egypt
Mar. 2006 – Juni 2008	Senior Expert, Deutsche Gesellschaft für Internationale Zusammenarbeit, Addis Ababa/Ethiopia
since July 2008	Senior Advisor Local Economic Development, Deutsche Gesellschaft für Internationale Zusammenarbeit, Windhoek/Namibia