URBAN INFRASTRUCTURE GOVERNANCE IN NAMIBIA

A multi-level analysis of urban system transitions

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Tämä pro gradu -työ on tehty Satakunnan ammattikorkeakoulun NAMURBAN (Urban Resource Efficiency in Developing Countries – a pilot study of Walvis Bay, Namibia) -projektille. Työ keskittyy nopean kaupungistumisen haasteisiin Namibiassa ja Walvis Bayssa, urbaanien infrastruktuurien hallintaan sekä vesi-, sanitaatio- ja energiasektoreihin. Työssä mallinnetaan näitä sektoreita järjestelminä ja tutkitaan niihin kohdistuvia muutospaineita. Mallinnuksessa sovelletaan multi-level perspective ja transition management -teorioita. Työ kuvaa järjestelmiä ja niiden vuorovaikutuksia kolmella tasolla: 1) landscape-tasolla, 2) regiimitasolla ja 3) teknologisella niche-tasolla, niiden välisiä vuorovaikutuksia ja asettaa järjestelmät teorioiden mukaiseen siirtymämalliin. Työ soveltaa adaptiivisen kapasiteetin viitekehystä ja kuvailee regiimitasojen jäsenverkostot, jäsenten kapasiteetteja sekä niiden näkemyksiä kestävistä kaupunkijärjestelmistä. Työssä sovelletaan kriittisenä näkökulmana poliittisen ekologian teoriaa sekä muita valtiotieteellisiä teorioita teoreettisten viitekehysten syventämiseksi.

Työn metodologia perustuu tapaustutkimukseen ja kvalitatiiviseen kenttätutkimukseen, erityisesti osallistuvan havainnoinnin menetelmään. Suurin osa tutkimuksen aineistosta kerättiin kolmen kuukauden kenttämatkalla Namibiassa. Siihen kuuluvat haastattelut olennaisten sidosryhmien ja asiantuntijoiden kanssa, epäviralliset keskustelut, kirjallisuus ja sanomalehdet sekä ulkopuolisille asiantuntijoille tehty kysely vaikuttavimmista Namibian kaupunkikehitykseen vaikuttavista tekijöistä.

Kaupunkikehityksen vaikuttavimmista tekijöistä osallistujat mainitsivat 1) vesikriisin, 2) maanomistuksen ja asumisen sekä 3) rakenteelliset puutteet. Lisäksi vastauksissa mainittiin aluesuunnittelu, julkinen liikenne sekä taloudellisia ja sosiaalisia tekijöitä. Urbaanin vesi- ja sanitaatioregiimin ominaisuuksia ovat epätasaisesti jakaantuneet vesivarannot, vanhentunut lainsäädäntö, eriävät käytännöt, eriävät näkemykset teknologian kalleudesta ja tarpeellisuudesta sekä julkisten keskustelualustojen, keskeisten valvovien instituutioiden sekä osaavan työvoiman puute. Urbaanin energiaregiimin ominaisuuksia ovat suuri riippuvuus tuodusta sähköstä, ideologinen jakautuminen kaasun ja uusiutuvan energian välillä, aktiivinen julkinen keskustelu uusiutuvan energian ratkaisuista, itsenäisten energian tarjoajien ja markkinoita hallitsevan valtionyhtiön NamPowerin roolit sekä siirtyminen yhden ostajan mallista kohti muunneltua yhden ostajan mallia. Loppupäätelmänä työssä esitetään, että veden ja energian välisen yhteyden ymmärtäminen on olennaista kaupunkikehityksessä, työssä käytetty teoriapohja voisi hyötyä valtiotieteellisten teorioiden näkökulmista ja sitä tulisi soveltaa enemmän kehittyvien maiden tapauksissa. Mallintamisen tulokset saattavat edesauttaa kaupunkisektorien kapasiteetin rakentamista.

AVAINSANAT: Namibia, urbanisaatio, infrastruktuuri, kestävä kehitys

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The research in this thesis was conducted as a part of the project NAMURBAN (Urban Resource Efficiency in Developing Countries – a pilot study of Walvis Bay, Namibia), a two-year project of Satakunta University of Applied Sciences in Finland. It focuses on the challenges rapid urban development imposes in Namibia and the city of Walvis Bay, on urban infrastructure governance and sectors of water, sanitation and energy. It models these sectors in forms of systems and adapts the multi-level perspective (MLP) and transition management (TM) approaches. The systems and their interactions are described in three levels: 1) the landscape level, 2) regime level and 3) technological niche level and situated in a transition model. The thesis describes the regime membership network of these regimes, the capacities of members and their perceptions towards sustainability transitions of the urban systems through adaptive capacity framework. It adapts the critical viewpoint of political ecology and other theories of political science to deepen the theoretical frameworks of transitions and adaptive capacity.

The methodology of the thesis is grounded on a case study and qualitative field research, especially on participant observation method. Most of the material was received during a three-month field visit to Namibia in autumn 2016. This material includes interviews with relevant stakeholders and experts, informal discussions, literature and a questionnaire posed to external experts of the most influential forces in urban development in Namibia.

As a result, the following themes are considered as the most influential forces in urban development: 1) water crisis, 2) land ownership and housing, and 3) structural deficits. Other considerable responses included urban spatial planning, public transportation and economic and social issues. The urban water and sanitation regime is characterized by an unequal distribution of water resources, outdated legislation, various practices between the regime members, varying perceptions of the need and expense of technology and the lack of public domains for discussion, key monitoring institutions and a skilled workforce. The urban energy regime is characterized by a high dependency on imported electricity, ideological division between gas and full renewable energies as means of modern electricity supply, active public debate on renewable energy solutions, the roles of independent power producers (IPPs) and market-dominating state parastatal NamPower, and the shift from a single-buyer model to a modified single-buyer model. The thesis concludes that understanding the water-energy nexus is essential in urban development; the MLP approach would highly benefit from the theoretical field of political science and should be orientated towards a developing country context. As a result, system modeling may further assist in capacity building in urban sectors.

KEYWORDS: Namibia, urbanization, infrastructure, sustainable development

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ABBREVIATIONS

CAS: Complex adaptive systems

DWA: The Department of Water Affairs

ECB: Electricity Control Board

EDI: and the electricity distribution industry

ESI: the energy supply industry

GIZ: Die Deutsche Gesellschaft für Internationale Zusammenarbeit

HIV: The human immunodeficiency virus

ICT: Information and Communications Technology

IoT: Internet of things

IPP: Independent power producer

IR: International relations

kW: Kilowatt

MW: Megawatt

IUSDF: Urban Spatial Development Framework

IWRM: Integrated Water Resource Management

MFMR: The Ministry of Fisheries and Marine Resources

MLP: Multi-level perspective

MME: Ministry of Mines and Energy

MRLGHRD: the Ministry of Regional and Local Government, Housing and Rural Development

NAMREP: Namibia Renewable Energy Program

ND: Namibian dollar

NDP: National Development Policy

NGO: Non-governmental organization

NEI: Namibian energy institute

NIRP: National Integrated Resource Plan

NUST: Namibia University of Science and Technology

PV: Photovoltaic

RE: Renewable energy

REEECAP: The Renewable Energy and Energy Efficiency Capacity Building Programme

REFiT: The Renewable Energy Feed-in Tariff system

SADC: the Southern African Development Community

SAPP: the Southern African Power Pool

SHS: Solar Home Systems

SRF: The Solar Revolving Fund

STCS: Short Term Critical Supply projects

SOE: State owned enterprises

SWAPO: South West Africa People's Organization

SWH: Solar Water Heater

SWOT: Strengths, Weaknesses, Opportunities, Threats

SWP: Solar Water Pumps

TM: Transition management

UN: The United Nations

WASSP: Water and Sanitation Policy

WDM: Water Demand Management

FOREWORDS

The research in this thesis was conducted as a part of the NAMURBAN project (Urban Resource Efficiency in Developing Countries - pilot study of Walvis Bay, Namibia), a two-year project of Satakunta University of Applied Sciences in Finland in cooperation with Namibia University of Science and Technology (NUST) in Namibia. The project seeks to develop urban resource-efficient concepts for clean water, renewable energy, housing, recycling and information and communication technology (ICT) solutions in developing countries. The project's pilot country is Namibia and the pilot city is Walvis Bay. In particular, Merlus Seafood Processors, a locally operated company in packaging and processing fresh product, is an example of a pilot company in the project.

There are currently seven Finnish companies participating in the project, whose areas of expertise include water and sanitation, renewable energy, e-waste recycling and ICT applications. Results delivered from the project are to be applied to other African countries. I came to the project in the Spring of 2016. The purpose of this thesis is to present the possible social and political ramifications resulting from the aforementioned solutions in Namibian society. My tasks were the mapping of current legislation, policies, user practices, education and other social variables that may possibly influence the adoption of technologies and services that Finnish companies were offering to local markets. This thesis is partly a result of this work.

1. INTRODUCTION

Urban centres offer opportunities that drive the population to migrate from the countryside, as they seek better services, education and job opportunities. Today, more than half of the world's total population lives in urban areas and with the current trend of development, 66 percent will be living in cities by 2050 (UN DESA 2014: 2). Urban development will impose challenges to nation states, as power and influence are gradually diffused to local urban governments.[1] This is particularly the case with a rise in the number of "megacities"[2]. Cities have become powerful economic actors. For example, the city of New York runs an annual budget of 82 billion dollars larger than most of the countries around the world (Muggah & Zapata-Garesche 2016). Cities are even playing a role in shaping international security[3] and are responsible for over 70 percent of global carbon dioxide emissions (UN Habitat 2016: 2). Thus, cities play a central role in moving the sustainable agenda forward (Ibid.: 27).

Although urbanization might push cities toward prosperity and development, many cities in different parts of the world do not have the capacity to respond to the multidimensional challenges that arise from urban development (UN Habitat 2016: 7). These cities are unable to provide for adequate services and resources, have been described as "fragile cities"[4]. This is a new sociological category in the international policy lexicon. (Muggah 2013.) These cities are predisposed towards socio-economic problems and even security risks. Furthermore, these risks may become global through the spreading of environmental hazards, migration flows and global warming. All these aforementioned challenges, illustrate the requirement in the field of international relations to consider cities as notable

[1] This phenomenon is not however new, as we might rather speak of "urban comeback". Even before the Peace of Westphalian in 1648, the city-states, such as Venice and Chengu, possessed notable power through trade. (Muggah 2013; Muggah & Zapata-Garesche 2016.)
[2] A "megacity" refers to a city, which has a total population of ten million or more.
[3] Example of the cities as actors in international security are initiatives such as "Mayors for Peace" and "Cities for Peace"
[4] There is not yet a clear definition of a "fragile city". However, these cities usually bear many similarities with those of "failed states" or "fragile states", where the city institutions are unable to adapt to the external stress. (Muggah 2013.)

players in shaping the future of international relations.[5] The forecast of future urban development, implies that in general, the proportion of urban populations will remain almost the same in developed countries, however in developing countries, it will continue to rise significantly (Potter 2008: 382). Moreover, this growth is remarkably more rapid in developing countries than in the developed countries (Potter 2008: 382 and Potter & Lloyd 1998: 14). Urban growth is centralized in regions in which socio-economic conditions are generally at their poorest. In addition, these areas are marked by limited resources. Which in turn, seriously contributes to the pressure of existing socio-economic systems and on people living in these areas. Thus, "dealing with the challenges that are presented by these fundamental changes represents one of the major tasks faced by [urban] planners and national politicians in the twenty-first century" (Potter 2008: 390). Urbanization is a global process which cannot be seen to have a straight correlation with development and modernization (Potter & Lloyd-Evans 1998: 26).

Consequently, the overall question of this thesis is; how can these cities be assisted in building their capacity to deal with these problems and at the same time, ensure their proper functioning when confronted with a rapid growth of the urban population? This highlights the need for a better understanding of the operational environment, its different components, their interactions and the capacities and norms that guide the actors in this environment especially when they seek to govern urban infrastructures. Therefore, this thesis models these environments in the form of *systems.* Due to the limited scope of this thesis, the research focuses on two sectors in urban development: 1) water and sanitation and 2) energy.

Chapter 2 of the theoretical background of this thesis begins with the discussion of systemic thinking in an urban context. Urban systems are open systems, which in addition to material urban settlements; consist of flows of people, capital and factors of production, ideas, information and innovations (Potter & Lloyd-Evans 1998: 53). In this thesis, urban systems are assured to have the objective of fulfilling their social functions, which include

[5] Though, I am not arguing these actors would exceed the power of influence possessed by the traditional national states.

aspects such as the provision of services and resources[6]. To operationalize these systems, the thesis adapts the complex adaptive system (CAS) approach. CAS's are open systems in constant change, in a state of *a dynamic equilibrium.* The main interest of this thesis is a hypothetical systemic change from the state of dynamic equilibrium, towards a new attractor and its inner dynamics during this process. This is also referred to as *transition process*. During this process, the deeper structures of a system change.

The CAS theory has set evolutionary grounds for transition management (TM) approach. TM approach treats society as a patchwork of complex systems. It places greater attention on governance, to the identification of the most influential actors for change and operates as a policy model for sustainable development. Thus, the approach delivers from a normative standpoint and seeks to model complex dynamics and interactions of systemic levels. These are the bottom niche level, the center regime level and upper landscape level.[7] A social change transition occurs in a situation in which the regime confronts changing pressure from the landscape level and from the niche level simultaneously (see Rotmans et. al 2001, Rotmans & Kemp 2003, Rotmans 2005, Brugge & Rotmans 2006, Loorbach 2007, Rotmans & Loorbach 2008; de Haan & Rotmans 2011). Although this approach takes into consideration the dynamic interactions of different layers in society (regime level) as well as, different timescales of change and the various variables and actors affecting this change, it is also a rather ambitious approach in the research of complex phenomena. In addition, as the theory emphasizes engaging the main actors in the regime in the process of transition management, it does not address the issue of groups and of people excluded from the process.

The multilevel perspective (MLP) on transitions (further referred to as socio-technological transitions) is rooted in innovation and technological studies. Thus, unlike the aforementioned TM approach, it takes a more technologically orientated approach to transition process. The MLP emphasizes novel technologies, which have traditionally been

[6] To this definition one may also include the provision of adequate living conditions to citizen, including the clean and a safe environment.

[7] Also in the earlier work referred to as micro-meso-macro levels. However, to avoid further confusion with terminology, the thesis adapts the division of niche-regime-landscape, adopted by both approaches.

considered to be delivered from the bottom-up from the micro-level until gradually reaching the status of dominant practices in the regime. The MLP studies have based their research models predominantly on historical case studies (see Rip & Kemp 1998; Geels 2002, 2004, 2005, 2005b, 2011; Smith et al. 2005; Smith 2007). In contrast to TM theory, MLP theory has been criticized for not taking into consideration the wider perspective of the society in which these novel technologies are to be embedded and especially for not considering the role of politics as an enabler or hinderer of such transition processes. Moreover, the greater part of the studies in MLP have focused on Western countries and have thus inherited a certain "European bias" (Markard et al 2012: 961). Finally, the niches that are selected for observation are usually determined by the researcher and thus, the research tends to inherit certain biases.

Both of these approaches have evolved alongside, as both TM and MLP researchers (such as Rotmans, Geels, Kemp, Loorbach and Rip) have conceptually developed these theories in joint publications, resulting in similar terminology, an innovation-orientated approach and in a link to sustainability, especially in the case of *sustainability transitions*. This thesis adapts the theoretical framework of a combination of the two approaches, a framework by Rotmans on different transition phases; the pre-development phase, the take-off phase, the acceleration phase and the stabilization phase. Other possible transition phases include the stages of lock-in, backlash and system breakdown. The Geels' model on the other hand, provides a more niche-orientated focus in the study and to the model by Rotmans, as technologies are a vital part of the thesis. This thesis seeks to interpret phases the urban systems may be placed in, according to the transition phase model.

As already mentioned, the focus of this thesis is to understand how the actors govern city systems when faced with influences confronting these systems in terms of *urban infrastructure governance*. Thus, the additional focus of this thesis is on the regime level, drawing some similarities to the political system defined by Kaplan and international relations (IR) theory on regimes. The regime level consists of regime member networks and laws, legislation and norms guiding these members. The aim of this thesis is not to offer

policy recommendations to local decision makers, but through modeling of these systems, raise overall discussion on the issues where capacity building might be needed.

Finally, based on adaptation literature, this thesis draws an analytical framework for further analysis of the systemic adaptive capacity, opposite to the examination of the adaptive process itself. This thesis adapts a modified version of the framework used by Smith et al. (2007) on governance of sustainability transitions further by examining the articulation of selection pressure, regime membership and resources, interdependency and the visions and expectations of these members. Interpretations and expectations construct certain discourses which together with the regime members' capacities determine the direction of possible transitions.

However, mental simulations and human understanding of complex systems have a tendency to be highly defective (Holtz et al. 2001: 44). Thus capturing the overall complexity of a system, especially within the frame and methods of this thesis, is impossible. However, a simple and well-chosen model may be a better option than to "jump in the middle of complexity" and try to catch the entire essence of it (see Kaplan 1968: 32 footnote 1). A systemic presentation of key system elements as well as its outputs and interacting networks, facilitates learning about the systems and further makes the present understanding of transitions more explicit, less ambiguous and more interlinked (Holtz et al. 2011: 42). This notion demonstrates that modeling supports the overall aim of the thesis. However, in this thesis it is acknowledged that only some initial interpretation on future trajectories can be presented, as the future itself is marked by multiple uncertainties.

In conclusion, the study asks the following questions:

1. *What influences urban development in the Namibian context in the future and how do such factors interact with urban water, sanitation and energy systems?*
2. *Who are the main actors in the urban sectors of water, sanitation, and energy in Walvis Bay and on the national level in Namibia, how are the actors inter-related and what kind of capacities do they possess?*

3. How are the systems situated within the transition model?

However, as Kaplan (1969: 58) presents, a system can be stable or unstable from two different standpoints. For one actor, a system may seem to be on the "edge of chaos", whereas for the other, this system may seem to be in a state of equilibrium. Thus, one must question the true omnipresence of the systematic equilibrium and in addition to this point, understand that the state of stability always has reference to the framework of inquiries. (Kaplan 1969: 60.) Moreover, factors such as the degree of disturbance towards the system and duration of time in general, are arbitrary elements in systemic stability (Kaplan 1957/2005: 22). Thus the study seeks to understand different visions and expectations the regime members have towards solving the current problems, if they even consider them as problems. Hence, the study asks: *What kinds of (possibly differing) visions and perceptions do the regime members have towards the generally defined sustainability niches and towards the pressures influencing the systems?*

This question is related to the different possible perceptions or ideas of how a sustainable city system could be realized. Sustainability in this thesis is defined as a state of balance between the social, economic and environmental imperatives[8] (Berkes & Folke 1998: 348). Sustainability encompasses normative aspects, which are in many cases conflicting among the actors (see Gallopin 2006: 299). Moreover, sustainability transitions are accompanied by politics in all the aforementioned systemic levels, as politics further serves as the arena, enabler, obstacle and the manager of repercussions (Meadowcroft 2011: 71). One might even ask, if the deep structures of the system are in fact political by nature?[9] The deep political structures interact dynamically with social and cultural constructions, which are partly determined by historical circumstances.[10] However, social, cultural and historical backgrounds form politics and politics form social constructions and represent certain

[8] Further, these imperatives are described as follows: 1) the social imperative refers to meeting basic social needs and cultural sustainability, 2) the economic imperative refers to meeting basic material needs and 3) the environmental imperative refers to a form of living which is ecological (Berkes & Folke 1998: 348).
[9] I want to thank Professor Juha Vuori for bringing up this notion regarding the CAS's
[10] Some even argue these deep structures are economic (see Rotmans & Kemp 2003: 9; the study by Rostow 1960).

constructions of problems, crises[11] and facts (Bryant 1998: 88; the study by Rigg & Scott 1998). This notion is also at the heart of the field of political ecology. The field of political ecology offers a critical view in transition examination, as it notes that the formulation process of a political agenda may leave some marginalized groups outside of the process (see Bryant 1998: 88).

In chapter 3, the thesis presents the data and methodological underpinnings. The methodological background of the thesis is grounded on a case study. It is also delivered from qualitative field research, especially from participant observation, as it utilizes the data collected from Namibia during an internship period of three months in autumn 2016. The data collection process included: 1) the mapping of possible external driving forces affecting urban development, with a focus on the landscape level, 2) the mapping of internal factors, with a focus on the regime level, especially on the visions and expectations of the key actors in the fields and on factors influencing the adaptive capacity of the systems and 3) the general mapping of the possible rising niches, current technologies, key actors and their roles and current regulation, policies, practices and other cultural and social aspects in the society. In addition, the study used a questionnaire form, general discussions, interviews and other material available to reach the overall aim of the thesis.

In chapter 4, the thesis sets the state for system modeling by introducing a general background of Namibia and general trends in urban development in the country. It then proceeds to chapters 5 and 6 and an analysis of urban water, sanitation and energy sectors. Finally, the thesis draws general conclusions of the modeling process.

[11] The field of political ecology refers to the "politics of knowledge", which further denotes the political process of articulation of (environmental) crises and problems (see Bryant 1998: 88).

2. THEORETICAL BACKGROUND

As mentioned in the previous chapter, the city systems are facing numerous challenges in provision of services for their residents, and in governance of infrastructures and resources. This governance also entails the management of common resources and prevention of unsustainable use of these commons (Armitage 2008: 8). The multi-level perspective on governance has been emphasized by the scholars of "resilient socio-ecological systems" (see for example Folke et al. 2005; Berkes & Folke 1998) and has been criticized by the field of political ecology (see for example Armitage 2002; Bryant 1998).

2.1 Infrastructure governance and ownership

In terms of its narrow definition, governance is defined solely as a synonym for government. The term government in Anglo-American political theory refers to the states formal institutions and their monopoly to legitimate coercive power. Government is able to make decision and has capacity to enforce them. Moreover, the term government refers to "the formal and institutional processes, which operate at the level of nation state to maintain public order and facilitate collective action". (Stoker 1998: 1.)

Public infrastructures are defined as "facilities, structures, networks, systems, plant, property, equipment, or physical assets – and the enterprises that employ them – that provide public goods, or goods that meet a politically mandated, fundamental need that the market is not able to provide on its own". Thus, in most countries, public infrastructures are considered as primary components in ensuring public services. (OECD 2015: 2.)

In the context of infrastructures, governance means the processes whereby governmental organizations and their counterparts use tools (material and immaterial), decision-making and monitoring in order to ensure that infrastructure services are available to the public and to the public sector. This process of interaction occurs between government institutions internally and between these institutions and users, citizens and the private sector. (OECD 2015: 2.) Furthermore, governance in this context may be defined as structures and

processes which enable the society to share power and reshape individual and collective actions (Young 1992: 162; Brockhause et al. 2012: 202).

Ownership is conceptualized through property rights. Right to property is an exclusive authority to decide how the resource is used and whether the resource is owned by the government or private entities. The absence of these rights, especially in the governance of natural resources, may be associated at worst, with the tragedy of the commons[12]. (Alchian 1993: 69.)

The creation of state owned enterprises (SOEs) in many African countries been considered as part and parcel in the process towards independence of these countries. SOEs have been considered to have important development objectives by providing the impoverished citizens with access to social services such as education, health, housing, electricity and water in post-colonial Africa (Jauch 2002: 4). This strategy to extend domestic ownership and control over the economy has in many cases surpassed foreign ownership and control. Although various African countries have since then shifted to extensive privatization processes, Namibia has remained an exception. Namibia, considered as the one of the view among the African countries, has not shown interest in privatization. (Harsch 2000: 15.) To date, most of the sectors in the country incorporate state owned enterprises. As will be later discussed, this historical development reveals the current way infrastructure governance is organized in Namibia.

The recent discussion of infrastructure governance has mainly focused on changes in governance and owner structures from the public sector to the private sector and on the blurred lines between the two. Whereas the aforementioned classical viewpoint of governance has considered governance as a synonym for government, the latter discussion has resulted in an approach referred to as "governance without government", a concept particularly presented by the supporters of network governance or polycentric governance.

[3] The tragedy of commons refers to a situation within a shared-resource system, in which individual users act accordingly to their self-interest and behave contrary to the common good of all users by depleting that resource through common action (see Hardin 1993: 88-91).

Network governance refers to the process through which public services are provided by numerous independent, self-regulating and self-organizing networks (see Brockhause et al. 2012; Dunn-Cavelty & Suter 2009; Bevir & Rhodes 2001).

Though governance studies further present critical viewpoints for the network governance approach, these are not examined within the scope of this thesis. However, one critical approach to multilevel infrastructure governance may be drawn from the field of political ecology, which gives the political aspect the primary role in the understanding of human-environment interaction (Bryant 1998: 80). Especially in the case of natural preservation and sustainability, it is important to recognize inequitable power structures within the systems, unclear legal frameworks and administrative agendas, which support more powerful resource interests (Armitage 2002: 214; Bryant 1998: 84). Especially in the third world context, societies are marked by unequal power relations, conflicts and historical influences, such as colonial past, and the transformation of locally owned resources into state-run utilities (Bryant 1998: 85).[13] This viewpoint will be examined through this thesis.

2.2 Complex adaptive systems

Systems theory and "systems thinking" refer to universal language used to address different forms of interaction between components in complex interactions (Loorbach 2007: 54). Systems theory has gained popularity in various fields, such as evolutionary disciplines, biology (Gould & Eldredge 1977), physics (Tang & Wiesenfield 1987), social sciences and philosophy (Kuhn 1977). Systems theory has a long tradition in the field of political science, rooted in the widely recognized input-output model by David Easton (1953). Other considerable theoretical developers on the field have been Karl Deutsch (1968) and Morton Kaplan (1957/2005; 1968; 1969).

A complex adaptive system (CAS) is an open system, which in "normal" circumstances is in a dynamic equilibrium with its environment. It constantly adapts its structure and organization to external and internal pressure. (Loorbach 2007: 55.) The state of dynamic

[13] In the beginning of the end of 1990's, political ecology scholars have developed the approach to integrate the theory to urban space in urban political ecology (UPE) (see Angelo & Wachsmuth 2015).

equilibrium connotes constant configuration, incremental change and self-organization inside a certain *attractor or attraction basin* in which it is not easily able to get out. Self-organization in its purest sense, means the emergence of order without external control or manipulation (Nicolis 1989; Jensen 1998: 3). However, the incremental changes do not affect the general structure or the 'deep structures' of the system (Loorbach 2007: 56). CAS's are systems that incorporate large number of components. These components are for example agents that interact, adapt or learn. A system as a whole adapts to changes as the individual components inside the system have the capacity to individually respond. (Holland 2006: 2.) This response occurs through *feedback.* The large number of these components and their constant interaction make the system complex by nature. The systems also *co-evolve,* which refers to a state whereby change affects one component and in return, this component affects other components in the system.[14] The system is in relation, either cooperation or competition, with other similar systems in the environment.

An urban system is a good illustration of a complex adaptive system. Urban systems are *open* due to dynamic relations with other systems, especially as they incorporate boundaries crossing engineered infrastructures and a flow of other sources, such as people, who migrate to the city. These systems are entities consisting of multiple elements, such as natural spaces and social networks of actors. (cf. Ramaswami et al. 2012: 801.) In the networks within systems, multiple decisions are made daily, which makes prediction of future trajectories uncertain. Urban systems are constantly in a state of incremental change and dynamic equilibrium, as infrastructures are being constructed, old buildings are being demolished and new ones built. A change in a single component of the system, for example the construction of pipelines, creates changes in other components, such as an in an improvement of sanitation. Thus, urban systems tend to *co-evolve.*

Between relatively long periods of dynamic stability, the system encounters short periods of radical (or profound) changes, referred to as punctuated equilibrium (Eldredge and Gould 1972; Gersick 1991; Loorbach 2007: 58; Bak 1997) or to as *self-organized criticality*

[14] Or as Gros (2015: 126) explains in evolutionary terms, in the evolutionary progress an evolution of one species will trigger the process of another in the same ecosystem.

(Tang & Wiesenfield 1987; Jensen 1998; Bak 1997). A profound change refers to a change that affects the deep structures of the systems. According to Kaplan (1969: 59), a political or a social system changes temporarily, when the disturbance does not result in a permanent change of behavior. In the case of a profound change (or as Kaplan refers to as systemic change), the change in behavior persists even after the disturbance is removed. In the case of city systems for example, the disturbance delivered from a need of water in the city of Windhoek led to the establishment of a water reclamation plant, which further established its position as a commonly used technology and practice even after responding to the sudden growth of demand at the time (see more on page 31). As will be later discussed, a profound change is a pre-condition for the transition of a system.

According to the principles of punctuated equilibrium, only when a system develops a crisis[15], where outside pressure is too high, a shock incurs and there is a possibility for the general structures to break, which leads to chaotic behavior of the system and structure. This chaotic pattern only holds back when an evolutionary way is found, a new pattern emerges[16] and "the system self-organizes towards a new attractor". (Loorbach 2007: 56.)

This idea of a revolutionary change in systems has gradually replaced a traditional, rather pervasive Darwinian paradigm of development, which is characterized by a gradual linear development. In other words, in which small scale events result in small systemic changes. The recent developments in CAS theory indicate that a system does not evolve from one phase to another and not necessarily from a worse system to a better system. The development is thus *non-linear* in the sense that even small rapid occurrences may result in massive systemic changes.[17] Non-linearity also refers to an uncertainty of the trajectory of

[15] Loorbach (2007: 56) refers to these rapid changes as "crises" or "catastrophes", which are a precondition for the transition of complex adaptive systems. The idea of a "crisis" or a "catastrophe", as having a fundamental role in the system's change, might bear some philosophical questions on its justification in the case of societal systems. Normally never does a catastrophe refer to a positive occurrence. Thus, the thesis refers to a less controversial term of "rapid activity" in transition.

[16] The ontological question of emergence has been studied among philosophers (see for example the framework by Christen & Franklin (2002)). This thesis does not go deeper into this ontological question, but adapts the idea of "hierarchical realism", whereby the system is divided into hierarchical levels. However, the conceptualization and the separation of these levels will present a challenge to the thesis, as will be noted later.

[17] An extreme example of this would be exposure to a nuclear attack.

the change (Holling et al. 1998: 352). Still, the traditional Darwinian paradigm has not lost its explanatory power, quite the opposite, as is emphasized by Eldredge and Gould (1972) and Gersick (1991).

Either way, one should separate the concepts of hazards, that are "a major spike in pressure" outside of the systems normal operating scope, such as a hurricane and stress and those which refer to a slow change or pressure influencing the system, such as pollution of the environment (Turner et al. 2003: footnote i). This thesis adapts the approach by Gallopin (2006: 295), in which influences (internal or external) towards the system, potentially changing the systems deep structures, are called *perturbations*, regardless if they impose a sudden or slow change.[18]

As was already noted in chapter 1, the state of the system may vary depending on the perceptions of the members of the system and depending on the positions they take in them. For example, an urban waste management system may seem to be in dynamic equilibrium to a person living in a rather wealthy area, where waste collection operates without disturbance and the residents have the capacity to recycle. In contrast, a person living in a slum with limited or nonexistent waste management services, might consider the system near chaos. As will be later discussed, the transition process reveals similar characteristics.

As the need for a deeper understanding of the inner dynamics of the system becomes relevant, the thesis first distinguishes three different operating levels: 1) the niche level, 2) the regime level and 3) the landscape level. These levels are used in the analysis of societal systems[19] and TM approach as well as in the analysis of socio-technological systems and MLP approach.

[18] Of course, it should be noted that different levels of pressure create different needs of response and thus different degrees of governance capacities (see Gallopin 2006: 296). However, this thesis does not go deeper into this subject.

[19] As technological solutions are a vital part of this thesis, it adapts the approach of socio-technological systems.

2.2.1 System levels

As the study focuses on urban infrastructure governance, the regime level plays an essential role in the analysis. A regime, in a narrower definition, is referred to as a set of regulations, norms and cultural as well as cognitive rules which guide and orientate actors (Geels 2005b: 449). In a broader context, a regime may be defined as a socio-technological regime which incorporate the deep-structures of socio-technological systems and are led by the social actors (Geels 2004: 905). However, the operationalization of the regime concept and its application on an empirical level has been the topic of discussion among the critics of MLP (Geels 2011: 31).

In the discipline of IR, regimes are defined as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations" (Krasner 1982: 186). In an international regime, the states are the main members of the regime and, with some rare exceptions, sovereignty prevails. Thus, in areas, where sovereignty is not applied, the regimes are vulnerable, or there are no such regimes at all. (Ibid.: 202.) However, international regimes do not inherit such restrictive governmental institutions as is the case with domestic regimes (Keohane 1982: 332). Also, they are characterized by a two-step procedure in which implementation of the terms of international regimes occurs both at the international level (states) and at a domestic level (such as companies or banks) (Young 1982: 277). The views of regimes presented in this thesis are those of the conventional structural realist view (see for example Waltz 1979: 118) and a modified structural realist view (see for example Keohane 1982), which both emphasize the states characterized as self-interested actors operating in a "self-help system". In contrast, in the Crotian view (see for example Young 1982), regimes are a "pervasive phenomenon of all political systems" and "a fundamental part of all patterned human interaction, including behavior in the international system". (Krasner 1982: 192.) A change within regime occurs through changes in rules and decision-making procedures, whereas a change of a regime occurs when the norms and principles in regime alter.[20] A

[20] Cf. the Kaplan's definition of a system change on page 12 of this thesis.

regime becomes weak when incoherency between different components in the regime rise or there is inconsistency between the regime and related behavior. (Ibid.: 189.)

Rules, regulations, norms and cognitive ideas always deliver from a source, from a human mind, and are a causal result of the matters acting on the regime (or agency) level.[21] Social actors are an inseparable part of a regime, as the regime is according to the MLP and TM approaches considered as the level, which responds to external and internal changes through self-organization. Thus, the study inherits the conceptualization of the regime as a set of rules, regulations, norms, cultural and cognitive rules produced and reproduced by networks of actors. These actors represent the civil society, private sector, markets as well as governmental institutions and are in a constant interaction with one another. Further by shifting the focus on the actor-networks of the regimes, this thesis takes a special viewpoint on *regime membership* (see Smith et al. 2005). Here socio-technical members of the regime possess certain resource capacities, material and immaterial and act according to a variety of unwritten norms and rules. Moreover, delivering from Kaplan's (1957/2005: 28) definition on a political system, the rules of decision-making as well as the specification of decision making roles are delivered by the regime.

In this thesis, the regime operates in its surroundings marked by forces affecting the general urban development. Infrastructure is considered as a part of the regime through the material value it constitutes to the participants of the regime and as an important component in achieving the regime's aim of fulfilling its societal functions. In contrast, the role of environment plays an important part in the analysis of sustainable city systems and should be considered an objective space or structure outside the network of actors. In other words, environment should not be taken solely as an instrument of achieving a regime's societal functions, that is, only as a source of capacities the members possess, but rather should also

[21] This assumption is in line with Young's (1982: 279) notions that "[regimes] are human artifacts, having no existence or meaning apart from the behavior of individuals or groups of human beings". In general, the definition of the regimes in this thesis adapts the Crotian tradition on regimes as the conventional and modified structural realist views both tend to undermine the role of a regime in a process of change (see Krasner 1982: 194).

have a self-standing value. It should be noted that the historical and environmental constraints bind the actors into the systems they operate (Kaplan 1968: 44). Finally, the environment also has the tendency to adapt autonomously, which occurs "without conscious decision by the agent", but influences the agents and their actions[22] (J Reilly & Schimmelphenning 2000: 257).

However, conceptualization of the operating regimes in the case of this thesis is not as simple as it may seem. The system levels of water, sanitation and energy include current technologies, infrastructures and environmental aspects and moreover, the regimes of these systems govern actor-networks, ownership, regulations as well as norms and cultural practices influencing the systems' functioning. However, as the situation of the water, sanitation and energy sectors need to be considered broader, including national and international levels, this thesis cannot solely concentrate on the level of a certain city system on the urban city system of Walvis Bay. Transition process is thus understood as a multi-level process between nested systems; local, national and global levels. It is understandable that due to the limitations of this thesis, certain generalizations in the modeling of the regimes need to be made. In conclusion, the boundaries of the studied regimes are left partly open ended.

Niches are defined as "protected spaces", such as laboratories, projects or small market niches, where users with special demands are willing to support novel innovations (Geels 2011: 27). Niches thus offer protection to these innovations, as they are not expected to survive in normal mainstream markets. Moreover, niches are crucial for radical innovations, as they offer locations for the learning of processes regarding technical specifications, user preferences, public policies and symbolic meanings (Geels 2004: 912). According to MLP approach, niches are crucial for transitions as they are the initiators of systemic change. (Geels 2011: 27.) Niche actors, such as entrepreneurs, start-ups and spinoffs, work on radical innovations that differ from existing regimes. Niche-actors aim for a situation, in which their novel technologies would become a part of the dominant

[22] Perturbations, such as change in climate do not usually affect the human systems, regimes, straight but through natural and environmental components in the system.

practices of a regime. However, because niche-innovations may collide with existing regime dimensions (e.g. lack of appropriate infrastructure, regulations or consumer practices), this may be proven to be a difficult task. (Ibid.)

However, niches do not work solely as importers of new technology into regimes. Rotmans (2005: 10) draws a differentiating approach to niche innovations by referring to "organization-transcending innovations". These systemic innovations develop inside niches but alter the relations between the participants of the system (Rotmans 2005: 11; Rotmans & Kemp 2003: 7). Unlike normal 'innovations', system innovations span a much longer timeframe and affect a wide range of fields, such as social, economic and environmental (Rotmans 2005: 12). In other words, niches do not solely constitute of technology nor bring influences in the forms of technology, but also influence through soft innovations, such as norms and practices related to the technology. In this thesis, this approach is in line with the "sustainability niches", which aim to create sustainable outcomes. Changes in technology, such as a shift from traditional vehicles consuming petrol to electric vehicles, does not guarantee an overall sustainable outcome, particularly, if the form of individual, material-intensive mobility continues to possess a role as a dominant norm in the society (Kemp & van Lente 2011: 122).

Moreover, I argue that more emphasis should be given to the possibly differing perceptions that the incumbent regime actors may have towards these niches, as politics[23] influences the selection of niches through special programs and legislation set by the government (Meadowcroft 2011: 71). Politics plays a special importance in the case of sustainable transitions as most of the sustainable solutions might not offer obvious (or immediate) user benefits (cf. Geels 2011: 25). This results in the need of economic and regulatory frameworks, concretized in the form of taxes and subsidies. Moreover, the governmental actions are not the only determining components in niche selection, but also the dynamics between the different members in the regime, their capacities and forms of power as well as

[23] However, politics should not be defined solely as an action of the state, but further influencing the different levels of the society. As Du Pisani (2010: 50) states "To delimit politics to the state is to restrict the reality of politics".

visions have an influence on how these niches are perceived in the regime over a longer period of time. Niches thus inherit aspects of politics and power. Furthermore, technologies have a tendency to constitute political effects, as they may even prohibit some user groups in pursuing certain actions (Geels 2004: 903).

The critics of the MLP theory have focused on the rather one-sided approach of niche development in a bottom-up matter, referred to as the "bias towards bottom-up change". In this development trajectory, the radical innovations develop in niches, then enter the small market niches and gradually replace the system (Geels 2011: 32). Transition theorists have generally overlooked the possibility of a niche development to evolve in a different way, for example through cooperation of the regime and niche level actors. The cooperative trajectory would indicate to a situation, whereby the incumbent actors could adapt these niches as 'add-ons', or instruments to solve local problems (Ibid.). As will be later discussed, this development may occur especially in situations, in which additional niche-options are a prerequisite of a sustainable transition. To address possible biases delivered from the pre-determined niche selection, a problem presented in chapter 1, this thesis seeks to justify this selection through other written sources from experts of the sectors and briefly considers other possible niches outside of the scope of this thesis.

The socio-technological landscape level is an external environment or a space that affects the interactions between niche(s) and the regime (Geels 2011: 26). Moreover, it consists of deep structural trends external to the regime. Landscape level is out of reach for the regime actors, in other words, it is impossible to affect to the landscape level at will (Geels 2005b: 78). The niche and landscape are described as "derived concepts", in relation to the regime. Furthermore, they incorporate practices or technologies that differ substantially from the existing regime. (Geels 2011: 26). Thus, the landscape level is an external space which enables the analytical separation between the three levels.

The socio-technical landscape level is a heterogenetic category which might consist of factors such as economic decline, environmental trends as well as cultural and normative values. Even large scale material context of the society, such as the spatial arrangements of

cities, factories, highways and electricity infrastructure have been categorized as part of the landscape level (see Rip & Kemp 1998: 334-335). Due to its heterogenetic nature, critics of MLP approach have claimed that the level of socio-technical landscape is nothing more than a residual category that comprises a large variety of contextual influences (Geels 2011: 36).

However, the analysis should not be left solely to the national level and the articulation of the landscape level should not exclude the international level from the analysis. Modern states are inevitably deeply linked to the international community, such as the case of Namibia to the SADC, the African Union and the UN. As Namibia's economy is based on natural resources and its currency is linked to the South African rand, its economy is deeply impacted by South Africa's economic development. It also shares all its perennial rivers with neighboring countries. Global problems, such as climate change and disturbances in economic structures, have an influence on the regional and local levels. Moreover, the international level delivers normative influences, related to democratic ideas and Western governance frameworks to developing countries (Erasmus 2010: 101). Thus, even though the socio-technical landscape is considered as an external space, its relation with the regime level is not necessarily hierarchical (Geels 2007: 37-38). This seems to support the idea of abandoning the concept of hierarchy entirely (see Geels 2011: 38).

To address these issues, this thesis will focus on pressures which may have a profound impact on the deep structures, both political and social, of the system and the regime, thus resulting in a potential, transition. The focus is then set on the perceptions held by regime members towards these pressures, which will later be discussed in depth, in the case of *articulation of selection pressures*.

The post-industrial societies and regimes usually face various pressures, some of them pushing in opposing directions. Sometimes these selection pressures become stronger, imposing challenges on the regimes to respond (Elzen et al. 2005: 64). Thus, the coherent articulation of these pressures is a precondition for regime change. In practice, this means that the pressures should orientate coherently in a particular direction and towards a certain

problem. As a result, these pressures translate into a form that pushes and enables the regime to respond. Examples of the articulation of selection pressures is the realization of the impacts of climate change which are further articulated in the form of mitigation actions (Smith et al. 2005: 1495). However, these pressures depend on the level in which they are being examined, as well as, who are the "clients" of the process (J Reilly & Schimmelphenning 2000: 256). Moreover, whether these perturbations are internal or external by nature depends on the scale and the definition of the regime (Gallopin 2006: 295). For example, floods in an agricultural village in Southern Africa are considered among the local community as internal perturbations, as these floods cause the loss of crop yield, but external among the urban residents, who might suffer indirectly in the form of price increase of food. It is possible, however, that the selection pressures are poorly articulated and hence the responses to these pressures become uncoordinated. This may be due to the fact that "the public realm is crowded with interests (industry, civil society and government), each with different ideas and visions about what their sectional and collective futures ought to be" (Smith 2005: 1494). Moreover, it should be noted that the response not only requires that the actors would respond to the pressure in an appropriate way, but whether they have the desire to do so (Kaplan 1969: 66).

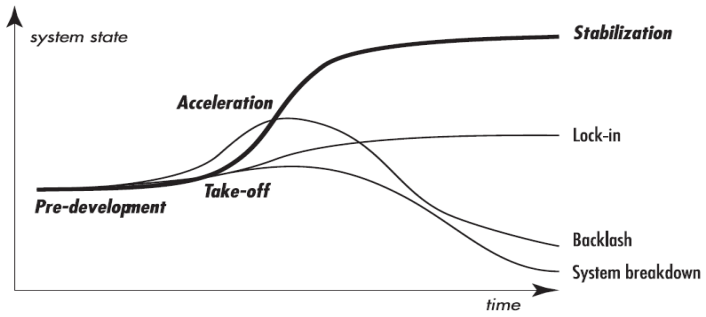
2.2.2 System transition

Social systems are defined as systems which fulfill certain societal needs. Fulfilling these needs is called their function (de Haan & Rotmans 2011: 92). The transition process begins when the regime of a system is not able to fulfill its needs due to changing circumstances in its environment. The multi-stage concept by Rotmans describes the sustainable transition in terms of four stages or phases.[24]

The graph demonstrates the following phases: first, in a *pre-development* phase, the system is in a dynamic equilibrium as described earlier in the chapter. In a *take-off phase*, the process of the regime's self-organization gets under way due to emergent phenomena

[24] The further work of de Haan and Rotmans (2011) separates the transition pathways into 9 different phases from bottom-up models (reconfiguration, substitution and backlash), down-up models (radical reform, revolution and collapse) and squeezed models (teleological, emergent and lock-in).

between the micro-level and macro-level. (Loorbach 2007: 58; Rotmans & Kemp 2003: 12 and Rotmans 2005: 23.)



Graph 1. Different phases of a transition (source Rotmans 2005: 64).

This is a result of emerging innovations from the niche level and destabilization of the existing regime (Brugge & Rotmans 2006: 254; cf. Gersick 1991: 21) For example, in an urban system, increasing electricity prices on a local level may influence the way the regime is able to fulfill its functions. It then needs to seek other ways to provide electricity and meet the demand. In this examination and in the case of scarce resources, the take-off phase would refer to a situation in which the actors would be willing to broaden their aspects on different ways of providing services and resources (see Bettini et al. 2015: 57).

The dynamics of a dominant regime constantly adapt to micro-level innovative experiences. In this high level of uncertainty, these innovations need to break through, or the system ends up suffering from a lock-in, or a backlash due to early response and a lack of public support. (Rotmans 2005: 27.) A backlash is described as a situation in which the new innovation is adopted to the system, but is later abandoned due to an unforeseen risk (de Haan & Rotmans 2011: 99). For example, a new sustainable energy innovation might break through in the market, but later be abandoned, as it is not accepted as functioning or as an affordable option over a longer period of time. It may even bring out cultural and social problems previously unconsidered.

A lock-in[25] occurs when an emerging niche is not considered as viable as the current options in the dominating regime that is used in fulfilling its societal functions, but which are usually claimed unsustainable through scientific research (cf. Geels 2011: 25). As such, the niche might not be able to replace an unsustainable technology or practice related to it. A lock-in may also refer to stagnated governing paradigms by the regime members (see Bettini et al. 2015: 50). As will be later discussed, the idea of sustainability is an arbitrary concept and different beliefs and capacities influence the way sustainability is considered.

The acceleration phase refers to a process in which the structures of a system change visibly through "an accumulation of socio-cultural, economic, ecological and institutional changes that react to each other" (Rotmans et al. 2001: 5). In the acceleration phase, the regime changes as a result of self-organization. The regime thus enables the change by using a huge amount of capital, technology and information. (Loorbach 2007: 58.) Finally, in a stabilization process, the self-organization process slows down and a new regime forms. The stabilization phase offers a new (relative) equilibrium and the system is able to once again, turn towards a new attractor. The new system has a new structure, new resources and its structure has become more complex.

Alternatively, the system is not able to recover from the external and internal pressures and eventually breaks down (Brugge & Rotmans 2007: 255; de Haan & Rotmans 2011: 100). In the case of an urban system as a whole, the system which is not able to fulfill its functions, might lead to a situation of total depopulation of the city due to inadequate resources, or a state of total pollution leading to unbearable living conditions in the city. The latter may not be an extraordinary result in the case of future city systems.

The four previously mentioned levels of a successful transition (pre-development, take-off, acceleration and stabilization) offer a simplified, yet clear conceptualization of the transition pathways and processes. The merit of this particular approach is that it takes into

[25] Lock-in might also refer to the state of dynamic equilibrium, in which the system has set itself in a certain attractor (see for example Geels 2005: 447). However, in this thesis, a lock-in refers to a state, where a system is set to follow scientifically claimed unsustainable practices.

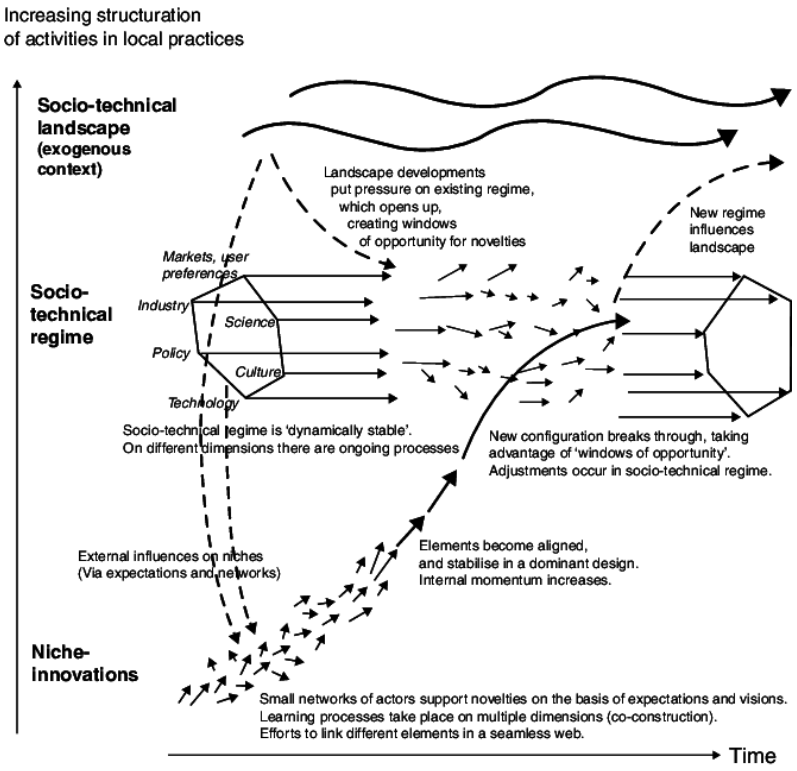
consideration the differing phases of development. In other words, different societal processes take effect during different phases of transitions. As a result, changes do not necessarily occur in all domains at the same time and hence, all transitions contain periods of slow and fast development. Transition process may not be a rapid change, but rather a gradual, continuous process, typically spanning at least one generation (25-50 years) (Rotmans & Kemp 2003: 11). However, this transition model does not consider the "cyclical" nature of the transition process, but rather demonstrates these phases as definite end-points of the process. For example, it is unclear, what may occur after the system results in a state of lock-in, whether the system could be able to return to a pre-development phase and if so, how this process could occur.

Even though this sort of conceptualization and the use of typology may carry a risk of over simplifying the complex and unique processes of transition, they may work as the first step for a deeper analysis and discussion (de Haan & Rotmans 2011: 96). The study will apply the preceding framework of transitions in conjunction with the framework by Geels on socio-technological transitions.

The logic of socio-technological transitions and the MLP is in accordance with the aforementioned transition process. However, it further focuses on the relations between the niche, as a protected space for radical innovations and the regime. Although each transition is characterized by unique developments, the following pattern is common for all transitions: a) niche-innovations build up internal momentum, b) changes at the landscape level create pressure on the regime and c) destabilization of the regime creates windows of opportunity for niche innovations (Geels 2011: 29).

As the graph below demonstrates, radical innovations build up a momentum in niches (pre-development). As the elements are gradually linked together, the internal momentum increases and simultaneously the regime creates a window of opportunity (take-off phase). These windows emerge when tensions arise in the socio-technological regime between different elements due to social, economic or cultural changes in the landscape level and

secondly, because the existing regime is hampered by increasing problems inside the regime which cannot be solved with gradual improvements (Geels 2005: 452).



Graph 2. Socio-technological transition (source Geels 2005: 452; Geels 2005b: 87 and Geels 2002: 1263).

In summary, the previous sections have presented some key concepts and views in transition management (TM) and multilevel perspective (MLP) in socio-technological transitions. These approaches add new layers to traditional systems thinking. The external forces not only pave the way to the inner transition of the regime and the system, but the regime is capable of managing some of these forces internally, either by building *resilience* against these forces or by adapting influences from them, thus *transforming* towards a new regime. The distinction of these two will be examined in more detail as this thesis examines the processes inside the regime, through the concepts of adaptability and adaptive capacity.

2.3 Adaptability and adaptive capacity

Although adaptive capacity has been a subject of many recent studies, significant gaps still remain in the conceptualization of the term (Bettini et al. 2015: 47). Moreover, the broad application of the concept and its mixed heritage has led "to crossover and confusion with other terms" (Bettini et al. 2015: 47; see also Gallopin 2006: 294; Hinkel 2011: 199).

Adaptation capacity is usually perceived as the system's capacity to respond to the perturbations it is facing. Moreover, it is "the system's ability to adjust to a disturbance, moderate potential damage, take advantage of opportunities and cope with the consequences of a transformation that occurs" (Gallopin 2006: 296). Most of the studies examining the adaptive capacity of these systems have focused on the impacts of climate change[26]. Especially in these cases, adaptive capacity is related to the qualities of knowledge, dependency and experience. Therefore, adaptive capacity has been considered as a scale dependent concept (Adger & Vincent 2005: 400 and J. Reilly & Schimmelpfenning 2000: 255). Thus, the determinants of adaptive capacity are specific to the system in adaptation process and to its characteristics (Adger & Vincent 2005: 404 and J. Reilly & Schimmelpfenning 2000: 255). However, it is possible to characterize some general analytical tools for further analysis. However, first to address the issue of conceptualization, one must recognize the differences in outcomes of adaptation.

The outcomes of adaptive capacity may be divided into resilience and transformation. Whereas resilience refers to the system that absorbs shocks and perturbations without changing the system's objectives (see Bettini et al. 2015: 48; Berkes and Folke 1998: 11; Walker et al. 2004: 6), a transformed system is reconstructed to meet fundamentally different objectives (see Bettini et al. 2015: 48; Walker et al. 2004: 7; Folke et al. 2005:

[26] See for example IPCC (2001).This discussion usually includes the notion of "sensitivity" "the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli" and "vulnerability", which refers to "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes." (IPCC 2001: 27). Adaptive capacity forms a part of the latter. Due to the scope of this thesis, these definitions are left to be further studied and the focus is concentrated on the resilience, transformation and adaptive capacity of the system.

443). In some cases, the transformative property is considered as a natural part of a resilient system (Folke et al. 2005; Bettini et al. 2015: 48).

In the case of urban regimes, adaptive capacity is related to the qualities which support the system in retaining its social functions when it is confronted by external influences. In one way, this refers to the resilience of the system. Which in this case, is defined as the system's capacity to filter disruptions and self-organize as it goes through changes, in order to restore its functions, structure and identity (Folke et. al 2005: 443). However, in this process, the regime may transform as a result of the emergence of new niches and innovations. This thesis thus adapts the following definition of adaptive capacity by Bettini et al. (2015: 48):

> The ability to mobilize and combine different capacities within a system, to anticipate or respond to economic, environmental, and social stressors, in order to initiate structural or functional change to a system and thereby achieve resilient or transformative adaptation.

It should be noted that anticipation refers to certain measures of the system that it imposes while not being directly impacted by perturbations, such as ensuring energy efficient housing through green building legislation, awareness-raising campaigns or constructing water pipeline infrastructure.

Before proceeding to a framework for analyzing adaptive capacity, these points related to CAS should be recalled: 1) the system as a whole adapts to changes as the individual components inside the system have the capacity to respond to these changes, 2) these actors compose different capacities of response to these forces and the actors inside these systems interact to adapt either through cooperation or competition, 3) the system is facing numerous pressures and without the articulation of these pressures the regime level cannot change and 4) the system is simultaneously resilient towards the forces affecting to it and transformative as it incorporates influences from outside innovation. As the thesis operates on a regime level, it concentrates especially on the regime member networks and the rules

and norms which guide them. Thus, the classification of analysis falls under three headings, in accordance with Smith et al. (2005): 1) regime membership 2) resource interdependency and 3) visions and expectations.

The thesis operates on an institutional level. Institutions are understood as organizations rather than as set of rules and these institutions represent various levels of norms, practices and relations of power and frame political interactions. They may shape the frontiers towards sustainability but also enable (or disable) reforms. (Meadowcroft 2011: 73.) Agency is considered as the "ability to the access, influence, and the capability to harness and combine these system attributes" (Bettini et al. 2015: 47). In this thesis, the relation between the agent and the system is considered as a dynamic process, in which agents, or regime members, influence the structures of a system and in turn, the system influences the interactions of these members. This approach is in line with practice theorists, who regard this relation dynamic (Dougherty 2004). Practice theory is strongly associated with Pierre Bourdieu and for example his field theory (1977).

Regime membership, albeit being neither homogenous nor clearly bounded, may be conceptualized through a "degree to which different actors [are able to] participate in carrying out functions reproducing the regime" (Smith et al. 2005: 1505). Those members, who are able to contribute intensively to the reproduction, are called the core members of the regime. Whereas those members who are able to contribute less, are called the peripheral members of the regime. In the reproduction of the regime, the agency of the core members is not the only determining factor in the effective development process, but the norms and procedures which govern their structured relationships and interdependencies also play an importance. (Ibid.) Thus, regime membership is bound to social inclusiveness, as well as who is included and heard in the process of social learning (Bettini et al. 2015: 55).

As previously discussed, the debate on the role of government has generally shifted from governance being solely a synonym for government to the concept of network governance, whereby governance is gradually shifting to an idea of self-organizing networks of actors.

However, the governmental institutions are still considered as the main protectors of the societal functions, thus the most influencing members of the regime. For example, the government has an important role in bridging organizations and sharing knowledge (Armitage & Plummer 2010: 297). Secondly, as will be discussed in the next section in more detail, government traditionally enjoys substantive sources of legitimacy for its actions.

One may still ask, whether the capability of an actor to maintain the societal functions of a system is a sufficient measure to ensure the sustainability of the particular system. Kaplan (1968: 35) argues the opposite by claiming that the actors (or as he refers to "regulators") are capable in doing more than only reducing or eliminating external or internal disturbances. In addition, these regulators are capable in changing the environment in such a way that the disturbance will no longer occur or repeat. In order for an actor or an institution to do so, it needs to possess certain regulatory capacity.

Resources may become a source of strategic influence over the regime. However, the regime members are dependent on the capacities of the other members, as a single regime member's resources are not sufficient to coordinate responses to pressures influencing the regime or to build adaptive capacity. Thus, agency and power depend on the structuring effects of resource interdependency and the regime is transformed through "networks of resource-interdependent members". (Smith et al. 2005: 1504.)

The resources for systemic adaption can be divided into material and immaterial forms. Material forms may include such capacities as technology, infrastructure and finance. However, it is impossible to explain the structure and functioning of the social world unless one takes into consideration these resources in all forms, not solely in the form of economic capacities. (Bourdieu 1986: 15). Immaterial capacity can further be divided into social capital, regulatory, professional capacity and into certain capacities of beliefs and cognitive frames, discourses and learning.

Social capital, according to Bourdieu, refers to the possession of a durable network of more or less institutionalized relationships with mutual acquaintances or membership in a group (Bourdieu 1986: 21). Further, social capital refers "to features of social organization such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated actions" (Putnam et al. 1994: 167). The key question is, whether the definition is bound to the aspect of *bonding*, delivered from the spirit of shared norms and cooperation, which help the individual and groups to protect them from external perturbations or *bridging*, where these groups or individuals possess different interests (Panth 2010). The social capital is thus operationalized in the capabilities of groups to work together and coordinate their actions, even in the case of differing interests. Social capital is closely related to the flow of information in the system, that is, to the access of quality information, data collection and reporting (Bettini et al 2015: 51). Generalized reciprocity on the other hand refers to a "continuing relationship of exchange", which delivers mutual expectations "that a benefit granted now should be repaid in the future" (Putnam et al. 1994: 172). Trust lubricates cooperation and cooperation, on the other hand, enhances trust (Ibid.: 171).

Resources possessed by the regime members and other relevant actors in regime transition do not only consist of physical resources such as funding, but also of human resources, such as an adequate and skilled workforce and knowledge. Professional capacity is related to the aforementioned aspects of social capital in the form of trust, networks and working relationships. Moreover, professional capacity[27] refers to skills, knowledge and general workforce capacities, which support the management of infrastructures (Bettini et al. 2015: 51). In addition, access to this knowledge and relevant information for all regime members is an aspect to be considered when analyzing the preconditions for the adaptation.

The definition of governance capacity refers to the ability of actors to take political and economic reforms, without taking a normative stand on the best practices on how to achieve these reforms. Governance capacity denotes a capability for political leadership,

[27] In literature, the professional capacity is sometimes closely linked to the concept of human capital.

which may further be divided into capabilities such as a commitment to the reform policies, effectiveness against corruption an optimal use of resources, consensus building and international cooperation (Brusis 2003: 2). Further governance capacity is bound to the governance settings, such as legislation, regulatory processes, formal structures and organizations within their areas of response. The aspect of consensus building is closely related to discoursers, here referred to as the informal discussions, either professional discourses or public debates (Bettini et al 2015: 51). Furthermore, effective governance capacity may in practice operate as a quick response to the perturbations the system confronts. A slow response to the perturbations, on the other hand, may increase the adjustment costs of the system (see J Reilly & Schimmelphenning 2000: 262).

Finally, the capacities may be separated into different beliefs as well as cognitive and problem frameworks and the values and logic behind the governance of infrastructure in front of problems and perturbations (cf. Bettini et al. 2015: 51). These frameworks are often closely linked to the historical and cultural past of the system. One aspect of the cognitive frameworks among the regime members is represented through vision and expectation.

It should be noted that different pursuits of the government, whether it seeks to maintain the control of its citizens, to reduce the vulnerability of the most vulnerable groups or to maximize welfare, leads to "different weightings of the elements of adaptive capacity". Thus governance is an uncertain component in adaptation process (Adger & Vincent 2005: 403-404). This notion is also in the interest of the political economy theorists, as power relations "may be reflected in conflicting perceptions, discourses and knowledge claims about development and ecological process" (Bryant 1998: 87). Thus, understanding possibly differing ideas over regime change, the different visions and expectations about how the regime could build its resilience against perturbations, becomes a vital part of the analysis. These different ideas influence the way responses among the members are coordinated and adaptive strategies are realized and expressed (Smith et al. 2005: 1503). Moreover, various issues are competing for the attention of decision makers, most of these issues having immediate and concrete consequences, which may lead to the prioritizing of certain sectors and setting aside for other projects. As a result, regime members may be

divided strategically into opposing groups and some issues, which were not urgent at the time of decision making, may raise severe consequences later. Especially in the case of sustainable solutions, which might not offer immediate benefits for the economy or the users, the decision-making incorporates hard choices. (Meadowcroft 2011: 72.)

As stated by Armitage & Plummer (2010: 298), when the current system becomes untenable and most importantly, a sufficient number of actors agree on this development, it marks a beginning of a system adaptation. Although this view does not specify the "sufficient number of actors" and further takes into consideration the capacities they possess, this view is in accordance with the explanation of pressures presented in the earlier chapters. Some form of agreement on the unsustainability of the operating regime is generally required before the regime may enter the phase of adaption.

In summary, adaptability may be defined as systems resilience towards the forces threatening its capability of fulfilling social functions and when necessary, as a system's ability to transform. The adaptive capacity of the system is determined by the relative positions of a regime's immediate and peripheral members, by the capacities they possess (e.g. economic, social, governance and cognitive) and by their vision and expectations, mutual and conflicting, towards the regime development. These are the analytical grounds for the further examination of the system's adaptation.

2.4 Reclamation in the city of Windhoek – an example of system adaptation and transition

The emergence of water reclamation in the city of Windhoek in 1968 demonstrates an example of a classical 'bottom-up' transition trajectory. Windhoek was settled by hot and cold water springs. As result of the population growth in the area, the exploitation of these resources in forms of additional digging of wells became a concern. Until 1933, groundwater had remained the only source of water for the city, but the construction of the Avis Dam marked a change to this practice. A second small surface reservoir, the Goreangab Dam, was built in 1958 and a conventional treatment plant was constructed to

treat the water from this reservoir to potable quality. (Du Pisani 2006: 80.) In addition, this treatment plant was converted to treat the final effluent from the city's Gammans wastewater treatment plant in 1969 and thus, the Goreangab reclamation plant was born. (Ibid.: 80-81.)

The population of Windhoek began to grow at a rapid rate after independence in 1990. Together with increased investments and development projects around the city, this resulted in an increased demand of water and pressure on the water supply. As the easily accessible natural resources were been extensively exploited and the demand for management of water successfully implemented, water recycling was considered as a viable option to fulfill the demand. The city of Windhoek obtained a loan from European financial institutions to construct a new reclamation plant and today, this plant is capable of providing 35 percent of the daily potable requirements of the city. (Du Pisani 2006: 82.)

In terms of transition, this trajectory may be explained as follows: the niche, here water reclamation turning water into potable quality, slowly evolved into a small market niche (a gradual pre- development phase) beginning from the year 1958. In the pre-development phase, this technology was improved in the form of new processes and simultaneously, the social acceptance of the technology gradually improved. After the independence in 1990, the pressure towards the urban regime created a window of opportunity for the niche, which at the time was 'mature' enough to finally break through. The investments imposed by the regime paved the way for the acceleration phase. On the other hand, another interpretation would suggest that the niche already broke through in 1969 during the construction of the Goreangab reclamation plant and further experienced a prolonged take-off phase, gradually shifting to the acceleration phase after independence in 1990.

The system was able to successfully adapt to external landscape pressures and the increasing water demand after the year 1990. This became feasible due to different reasons, financial capacity in the form of a loan, professional capacity in the form of gained experience and skills in water reclamation over the past 30 years and due to changed cognitive frameworks towards drinking reclamation water, as it gained more social

acceptance in comparison to the early years of the process. On the other hand, it took decades before the consumption of recycled water was considered socially acceptable. In other words, the social change in the regime has been notably slower than the technological change. The city's efforts in awareness-raising as well as continued improvement in the standards of water quality and monitoring, which both refer to the governance capacity of the city system, played the utmost importance in gaining social approval. Still to date, rumors on poor water quality remain persistent and the city is now encountering another severe water crisis.

Next, this thesis presents the methodological background and the data collection process in Namibia in autumn 2016 to address the research questions presented in chapter 1 and to illustrate an analysis of the water, sanitation and the energy systems in chapter 5 and 6.

3. METHODOLOGY

Based on the aim of this thesis and the theoretical framework presented in the previous chapter, the data collection process included: 1) the mapping of possible external driving forces affecting urban development, with a focus on the landscape level, 2) the mapping of internal factors, with a focus on the regime level, especially on the visions and expectations of the key members of the sectors and on factors influencing the adaptive capacity of the systems and 3) the general mapping of the possible rising niches, current technologies, key actors and their roles as well as current regulation, policies, practices and other cultural and social aspects in the society. Further, the research of this thesis used questionnaire form, general discussions, interviews and other material available to reach the aims described in chapter 1. The methodological background of the thesis is grounded on a case study and it delivers from qualitative field research, especially from participant observation.

The primary source of data consisted of interviews with relevant stakeholders, experts and actors both in Finland and Namibia. In the beginning, detailed information was obtained of the technologies and services the Finnish companies participating in the project were planning to offer to the Namibian markets. This work had already begun before the internship period and continued during the company visits in Namibia in September 2016. Other data consisted of interviews with experts and governmental officers in Namibia as well as statistics and other quantitative data available. The research also benefited from the presentation on operational environmental mapping of the Namibian business environment, created in cooperation with the Namibian and Finnish project participants. The file consisted of future beneficiaries of the project, SWOT analysis, environmental and social aspects as well as governmental laws, regulations and plans concerning energy, water, sanitation, housing and waste management sectors. Other sources included governmental documents and different governmental development plans, such as the Vision 2030 and the National Development Plans (NDP's) Harambee Prosperity Plan in addition to the policies and plans of Walvis Bay municipality. As the broader discussion in civil society was an inherited aspect of the research, it became important to follow current discussion via newspapers, informal discussions and seminars as well as discussions between the Finnish

stakeholders and their Namibia counterparts during the visit of the Finnish delegation to Namibia in September 2016.

Initially, the research aimed at conducting scenario mapping in accordance with the scenario methodology tradition. However during the data sampling, it was revealed that when the methodology was related to the social and political phenomena in particular, did not succeed in describing these phenomena with enough versatility. Lately, theories and methodologies have addressed this issue to some extent (for example the field of process tracing), however, many still focus on matrix techniques.[28] The methodology excluded too many possibly important drivers of the change and would have given a limited picture of the developments on multiple system levels. However, the research benefitted from Maack's (2001) methodological framework on future expectations and visions of actors, the framework by Elzen et al. (2002) on socio-technological scenarios and the questionnaire form developed by Wulf et al. (2010: 6). The time-spatial dimension was also considered problematic; as noted earlier by Rotmans, different components in the system (that is, economic, social and cultural components) all change within different timespans. Whereas economic components might experience rapid change, social changes usually occur slower; within a decade or more (Rotmans & Kemp 2003: 11).This aspect is not adequately addressed in scenario modeling.

The first phase of data collection was the mapping of the most relevant external specialists who responded to a survey on the most influential driving forces affecting urban development in Namibia during the time period of 2017-2030. This aimed at defining a general urban operating environment of the regimes under analysis. A medium scale timeframe was chosen to set an easily readable frame for the survey and was also based on the timeframe set by the Vision 2030. In order to address the multiple dimensions the operating systems were facing, the questionnaire was structured based on six dimensions; political, economic, societal, technological, ecological and legal influence factors

[28] In this method, two main driving forces are being drawn into the matrix and scenarios sketch in accordance to this division.

(PESTEL).[29] The survey form of the research was based on the survey form developed by Wulf et al. (2010: 6). Initially, the process by Wulf et al. was meant to be a two-step process; the participants were the external experts (for example think thanks, consultants and research institutions), key stakeholders (for example company's key employees)[30] and external stakeholders (customers, suppliers and shareholders), were first supposed to name the most important drivers of urban development and their indicators. After that, the questionnaire-administrator was to cluster and synthesize the results according to common features, like the number of citations of specific influencing factors. Finally, these grouped and synthesized influence factors were to be sent to the participants for the second round, in order for them to rate each factor based on their performance of impact and uncertainty. Due to a different organizational approach of the thesis and also fewer resources, this process was modified to better suit the research's aim.

Some challenges were experienced in finding key participants for interviews. As the research went on, it became clear that there was not enough time to identify these participants, despite that, the project offered a good social network. This is strongly related to the Namibian culture, where relations and face-to-face meetings have the utmost of importance in interaction. In practice, this signifies the need of having the right contacts, which may in turn assist contacting other relevant stakeholders in the network.[31] As it took a lot of time to integrate into the society, map the key actors in the research fields as well as their roles, not to mention the possible strenuousness of requiring the stakeholders first to answer to the questionnaire and then ask about their future expectations of the development, the questionnaire was finally only sent to the participants considered as external specialists.

[29] This is also noted by Elzen (2002: 17 footnote 1), who states that multiple dimensions should be considered when examining the relations of the landscape-regime-niche level and Maack (2001: 69) who refers to the SEEPT (Social, Economic, Environmental, Political and Technological) framework in his work.
[30] Of course, in this research the operating level was different than a level of single company, which made the process overall more challenging and stressed the need to modify the research setting accordingly.
[31] Thus, the companies entering Namibian markets are advised to have a local partner before starting their business activities in the country.

Other cultural differences were encountered in cases of online communication. Even though the difficulty of this method was already marked in an early phase, the possible participants were approached initially by email and the questionnaires were sent with a letter from the university introducing the project and its aims, the percentage of responses remained relatively small. An explanation for this could be that interest in answering the survey was relatively small in the beginning and the fact that many participants indicated they did not have relevant expertise in urban- related issues. The questionnaire was sent to 15 participants via email, after which follow-ups were made by calls and visits to nearest institutions.

In the end, five responses were received. Despite a small number of answers, some of the respondents offered other useful material such as literature, booklets and additional contact information for the researcher's use. In addition, the respondents were represented by different professions, such as researcher, city developers (both in the city of Windhoek and Walvis Bay), an economist and a policy analyst. Hence, the answers given were considered of high in quality. Most of these interviews were done casually, face-to-face and usually during events or other meetings. Which only confirm the aforementioned cultural factors and serves as a good case for further activities in the Namibian environment.

As Wendt notes (1999), the visible actions of agents are mainly determined by the culture and further the ideas behind these actions, not solely by the material base of the system. This thesis seeks to emphasize this notion as in the end, especially in the case of governance, the question remains how the differences in these ideas are reflected at the agency level. As such, the scenarios were eventually drawn mainly based on these sometimes conflicting ideas and visions. First, the research formed the best and the worst case scenarios based on interviews, questionnaires, general discussions, background information and newspapers.

For the scenarios, the key regime members where mapped based on the available literature and other material, as well as through interviews and informal discussions. After this, the key actors where contacted and based on the framework by Maack (2001: 83), interviewed

about their future expectations and about the worst and best future outcomes for the institution or instance they were representing. Here the research focused mainly on the quality of the answers. This means that the person should have been as well informed as possible about the future aspects and strategies of the represented institution. Again, the data collection process faced similar challenges which were discussed previously. Additional challenges were also faced; first, in some cases data collection process might have been hampered by participants' unwillingness to answer these questions, especially if the questions were closely related to the participants' strategies. This is why the role of external experts was so important. Second, the culture in Namibia emphasizes spontaneous meetings rather than meetings booked well advance,[32] which set challenges within a restricted timetable. As especially the ministry officers claimed their busy schedule, a useful strategy would have been attendance to the relevant seminars, conferences, work-shops and events, which were usually advertised in a local newspaper. These were usually open access and offered time for face-to-face discussions. As in some cases interviews were not possible, secondary sources like reports and news articles, were used to complement the scenarios. Some of the documents, statements, reports and plans, had to be obtained from the institutions and organizations, as these documents were not available online or as the necessary websites were not updated. This was a remarkable challenge in data collection due to the limited timeframe and resources of the research. The results of phase two and three will be discussed later in the cases of the water, sanitation and energy sectors. However, some general conclusions may be drawn based on results of the questionnaire.

Despite the small number of replies, the responses reflected well with the general discussion in Namibia (e.g. platform discussions such as seminars and workshops, interviews and newspapers). The most commonly mentioned driving force was related to the current water crisis and the availability of water in the future. Four participants mentioned themes related to housing, land ownership, legislation related to land ownership as well as housing and devolvement of communal areas, the latter of which was considered even as a potential security risk in the future. In addition, the participants mentioned such

[32] Of course, this was not always the case as the strategy of "just popping by" to the institutions usually ended up in a request to appoint a formal meeting.

factors causing an increase of migration to cities or urban sprawl as family ties in the cities, economic conditions in the region, construction of the desalination plant, less access to water and a reduction in agricultural productivity. Other themes the participants mentioned were structural. Such as a lack of a skilled workforce, unemployment, inequitable distribution of wealth, the tax deficit, highly politicized governing system (in comparison to an expertise based system) and the lack of tertiary institutions (higher education). In addition, some of the respondents mentioned the lack of adequate public transport services as one of the drivers affecting the way cities might evolve in the future. Only one participant mentioned energy as one of the driving forces influencing urban development; however the small rate of responses should be taken into consideration before further conclusions. Especially important for the development of the city of Walvis Bay, participants mentioned irresponsible mining activities, the threat of sea-level rise and the construction of the desalination plant.

In conclusion, results show that according to the respondents, the forces affecting urban development in Namibia may be arranged in the following groups: 1) water related themes, 2) housing and land and 3) structural factors. Some natural difference could be found between the city of Windhoek and Walvis Bay, such as the fact that Walvis Bay is a coastal city and thus possesses other challenges than the city of Windhoek, which is situated inland. These differences will be addressed in more detail in chapter 5 on water and sanitation. However, the value of the questionnaire lies in finding relations between different multidimensional levels. In the next chapters these factors will be examined in more detail. Before that, the next chapter will introduce general background knowledge of Namibia and its society.

4. BACKGROUND

Namibia is a country in Southern Africa whose western border is the Atlantic Ocean. Namibia also borders Angola in the north, Zambia and Zimbabwe in the northeast, Botswana in the east, South Africa in the south, and the Atlantic Ocean to the West. The geographical size of Namibia is 825 615 km^2 and its total population is 2.1 million. In the capital of Windhoek, the population was estimated at 325 858 in 2011 (GRN 2011: 7), approximately seven times the size of the second largest urban centers Walvis Bay and Swakopmund (Frayne & Pendleton 2002: 1). The population density in 2015 was 3 inhabitants per km^2 (World Bank 2017).[33]

Due to the fairly inhospitable Namib dessert, Namibia was first explored by traders and missionaries only as late as in the late 18th century. In 1878, the United Kingdom annexed Walvis Bay on behalf of the Cape colony, the rest of South West Africa eventually fell under the rule of Germany. (Ruppel & Ruppel-Schlicthing 2016: 1.) The new German South West African state encountered resistance among the native tribes Herero and Nama that resulted in wars of anti-colonial resistance (Amoo & Skeffers 2009: 17). However, Germany held its control until the First World War, when South Africa occupied the area. Finally on 17th December in 1920, the administration of South West Africa was taken over by South Africa in accordance with the 1919 Peace treaty of Versailles. (Ruppel & Ruppel-Schlithing 2016: 1.) The area then became a Mandate Territory of South Africa.

Under South African rule, Namibia was exposed to the legal and political rule of apartheid, which was characterized by flagrant human right abuses, such as the suppression of basic rights and freedoms of the black majority. The laws of apartheid were not in accordance with the rule of law and apartheid justified policies that supported racially unequal policies. (Amoo & Skeffers 2009:17.) The South West People Organization (SWAPO) led by Sam Nujoma, began the process of pressuring the South African government in 1966 for independence, eventually taking an armed struggle with the intention of liberating Namibia.

[33] To understand the scope of low population density of Namibia, in comparison, the countries with the roughly similar geographical size like Mozambique (36), Venezuela (35), Niger (16) and Pakistan (245). The population density of Finland (338 424 km^2) is 18 (The World Bank 2017).

During the 1970's, the political and social unrest in Namibia increased and was frequently confronted by the colonial administration (Ruppel & Ruppel-Schlithing 2016: 1). It took 12 years before Namibia was declared independent on 21 March in 1990 and Namibia's deep water sea port Walvis Bay was ceded to Namibia in 1994 (Ruppel & Ruppel-Schlichting 2016: 2). After independence, SWAPO became the ruling party of the country and Sam Nujoma its first President.

The historical factors, especially Namibia's colonial and apartheid past, have left a mark on the governance and legislative practices in Namibia. Although the Constitution of Namibia, drafted and adopted in 1990, did repeal some of the legislation inherited from the previous apartheid system, some legislation is still applicable in independent Namibia (See Amoo & Skeffers 2009: 28). For example, issues such as legislation of land division stem deeply from the colonialist and apartheid eras[34] and have had a profound influence on the inequality still persistent in the society, the unequal distribution of resources and even on the development of the economic sector.[35] The issue of land division and current governmental measures to address this issue through a land-reform initiative form an important field for further research and understanding for stakeholders willing to contribute to the capacity building of the country.

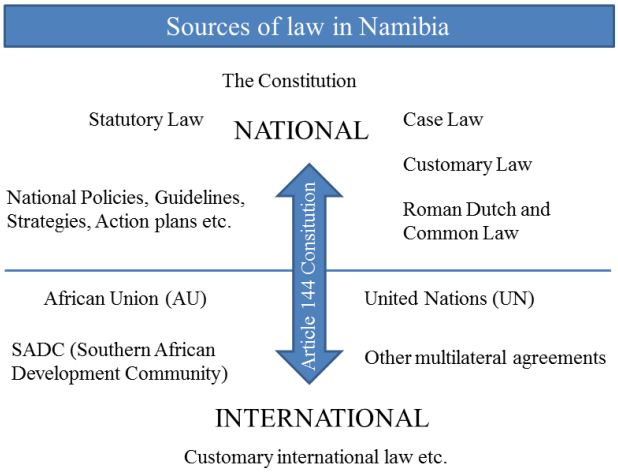
As the graph below demonstrates, Namibia's legal setup is still marked by historical influences. The Roman Dutch law, a fusion of Roman law and Roman Dutch customary law, is still affirmed by the Constitution[36], historically stemmed from the Dutch colonization at the Cape of Good Hope and was further developed by South African courts

[34] Already under the rule of Germany, the mining sector received most of the capital investments, whereas agricultural farming became attractive among German and South African settlers. This resulted in cheap land provision for these settlers, as the former inhabitants had to leave their lands in order for the new European farmers to settle. These practices continued under the governance of South Africa. After the independence, the minority of European farmers still possessed 42 percent of the land. (Carcia 2004.) Despite the efforts by the government after the independence to address the issue of unequal land distribution through land reform, this process has been slow (USAID 2010).

[35] The historical perspective, especially the influence of colonial past in third world countries is also noted by the field of political ecology (see Bryan 1998: 85).

[36] Article 66(1) states that "Both the customary law and the common law of Namibia in force on the date of Independence shall remain valid to the extent to which such customary or common law does not conflict with this Constitution or any other statutory law" (GRN 1990).

(Ruppel & Ruppel-Schlichting 2016: 3). Internationally, according the article 144 of the Constitution, international law forms a part of the law of Namibia, unless otherwise provided. Namibia's memberships of Southern African Development Community (SADC), the UN, and the African Union have an influence on the legal settings of Namibia in urban development.



Graph 3. Sources of law in Namibia. Modified from Ruppel & Ruppel-Schlichting (2013: 7).

The Constitution of Namibia has been described as the "supreme and the fundamental law of the land" (see Ruppel & Ruppel-Schlichting 2016: 3; Amoo & Skeffers 2009: 17). Through the Constitution, Namibia has been established as "a democratic and unitary state founded on the principles of democracy, the rule of law and justice for all" (GRN 1990: Article 1 (1)). This guarantees the separation of legislative and executive powers and the system of checks and balances.

The decision making process in Namibia is further marked by the fact that there are currently 23 different ministries[37] operating in the field of implementation and regulation of the country, some of which are overlapping in their fields of authority and decision-making. In addition, SWAPO has pushed for a decentralization policy before independence and it was incorporated into the Constitution under chapter 2 "Regional and local government". In practice, local government has the right to establish regional councils under the

[37] For the list of active Ministries see http://www.gov.na/ (retrieved 16th of April 2017).

Constitution chapter 12 article 103 and under article 108, the right a) to elect members to this council and to "to exercise powers, perform any other functions and make such by-laws or regulations as may be determined by Act of Parliament" and finally, under article 108 c) "to raise revenue, or share in the revenue raised by the central Government within the regions for which they have been established.".[38] In practice, the government operates through the Presidential Cabinet and the Ministry of Regional and Local Government, Housing and Rural Development (MRLGHRD), which further communicates with the Local Authorities. The ministry needs to be consulted before decisions on budgeting, regulations and assessment rates may be implemented (Tötemeyer 2010: 118).

The non-governmental actors, such as NGOs, free media and especially in the African countries, the Ombudsman, are the key watch dogs of good governance and the rule of law.[39] The Constitution guarantees free civil society participation under chapter 3 "Fundamental rights and freedoms". However, as strong governmental action becomes a priority under the situation, in which noteworthy development measures are needed, this may result in a decline in participation of civil society (Erasmus 2010: 95). Moreover, absolute poverty has a tendency to paralyze participatory democracy, which is also true in the case of Namibia (Tötemeyer 2010: 30). Still in Namibia, local NGOs have addressed issues such as HIV, human rights, gender equality and in the urban context, affordable housing[40].

The role of the office of the Ombudsman in Namibia is to act as an independent body to address "the state for the rights of the individual citizen". In practice, it offers a platform a citizen to report a complaint free of political interference. The mandate of the ombudsman

[38] In the case of cities such as Walvis Bay and Windhoek, which are defined as "category 1 municipalities". The government offers either loans for development projects, which need to be paid within 20-30 years with interest and, subsidies, which are paid by functions performed by the municipality on the behalf of the central government. (Tötemeyer 2010: 119.)

[39] Civil society is here defined according to the classic Western tradition, whereby two distinct features may be observed: first, the civil society is considered autonomous (though not independent) entity from the state. Second, the "civility", which includes norms such as tolerance, trust and rule of law, define the relations between groups, organizations and between the state and these groups. (Du Toit 1995: 36, 38; Keulder 2010: 6.)

[40] For example the Shack Dwellers'Association was established to provide ways for urban dwellers to save money for houses.

includes three categories: human rights, administrative practices and the environment. (Ruppel & Ruppel-Schlichting 2016: 8.) However, the office is considered to be understaffed and lacking economic resources and thus barely able to respond to its mandate (Ruppel 2016b: 493 footnote 92).

Development plans and policies play a crucial role as guides of decision making in Namibia. In general, the National Development Plans (NDP's)[41], The Vision 2030 published in 2004, and the Harambee Prosperity Plan, published in 2016, are the most well-known development plans and policies in the country. The current fourth National Development Plan of 2012/2013 – 2016/2017 has focused on high and sustained economic growth, increased income equality and on employment creation (GRN 2004). The fifth NDP on the other hand, will focus on inclusive, sustainable and equitable economic growth, human resources, environmental sustainability and good governance (GRN 2017: iv). The Vision 2030 is designed to work as a broad and unifying idea, which will further serve to guide the country's five-year development plans. (GRN 2004: 7.) The Harambee prosperity plan 2016/17 – 2019/20 was later launched to complement the Vision 2030 and the national development plans. The Harambee prosperity plan focuses mainly on five areas; effective governance, economic advancement, social progression, infrastructure development and international relations and cooperation (GRN 2016). Altogether, the plans and strategies demonstrate the way the government tends to implement its policies during the period of 2016-2030 and are thus a vital part of this thesis.

Namibia may be characterized as a country, which enjoys a relatively stable political rule.[42] Since its independence, the country has been ruled by the SWAPO party with a majority in the Parliament and in the Presidential Cabinet (cf. Boer 2004: 18). Despite its past as a socialist party[43], since independence SWAPO has taken a rather centrist social-democratic

[41] There are currently four National Development Plans. The first NDP was launched in 1995, the second in 1999 and the third in 2007.
[42] Namibia was on the fifth position among the African countries in the political stability index of 2015 (The Global Economy 2015).
[43] Boer (2004: 3) argues that this position was mainly pragmatic and influenced by global trends. Still, as it will be later discussed, this political stance does still have practical influences in the country (see for example page 8 of property rights and ownership).

stance on socio-economic issues, such as a view on mixed economy, unity and human rights and freedoms for all Namibian people. From an ideological point of view however, the party still remains Afro-nationalist (Boer 2004: 4).

The SWAPO party might be difficult to separate from the government, as all the cabinet ministries are selected by the ruling party. The opposition remains weak in Namibian politics and the agendas of the opposition parties usually tend to look similar to that of the ruling party. (Boer 2004: 18-19.) When the opposition does suggest new ideas for development issues, they rarely include further studies on procedural guidelines or cost estimations. Thus one could say that particular issues do not play as prominent a role in Namibian politics as would be in the case of a country with a stronger political opposition. Moreover, personality and liberation credentials play a more significant role in politics. (Ibid.)

Even though Namibia is portrayed as generally stable and an upper middle income country, the percentage of population living below the poverty line is estimated as high as 28.7 percent (The World Bank 2016 b). Over half of the country's income accumulates in the top 10 percent of the population, thus illustrating the country's high levels of social and economic inequality, which are the deepest in the world[44] (World Bank 2016 c). According to Hedden (2015: 3) the average data of Namibia, which might draw a rather optimistic view on such measures as income per capita and other non-monetary measurements such as access to water and electricity, is misleading due to high levels of inequality. Despite the efforts of the current government in addressing issues by land-reform initiatives, resource subsidies and taxation to provide for the underprivileged and the poor, the government is still facing various issues which compete for the attention of decision-makers. In conclusion, it seems unlikely that the government will reach its main development goals set by the Vision 2030 and the current NDP 4 (Hedden 2015). One of the reasons for this, in addition to problems in governance, is that the country is faced with tackling various problems simultaneously and has limited funding capacity. As a result, some sectors are

[44] Namibia remains one of the most unequal countries in the world measured in Gini coefficient of 0.597 (World Bank 2017).

being better funded over others and spending on one sector might hinder the development of another.

Namibia's economy is in general, deeply interlinked to external developments. The country's main income sectors are mining, tourism, livestock meat production and fisheries are all seasonal and volatile to external economic shocks,[45] as well as at risk to weather conditions and climate change (Hedden 2015: 3-4). The mining sector is an important provider of employment and contributes between 8 and 16 percent to the GDP but in addition, creates dependency between Namibia's economy and to economic development in India, China and South Africa, the latter which is linked with Namibia's currency (Ruppel & Ruppel-Schlichting 2016: 3; Mapaure 2016: 352). The country's advantages have been political stability and robust microeconomic management (AfDB/OECD/UNDP 2016: 306). However, Namibia's economy is characterized by a relatively small manufacturing sector and from an economic point of view; the low density of population is generally considered as a hindrance, as the growing population offers a wider consumer market and workforce. Despite the volatile nature of income in the country, the World Bank (2016 a) predicts Namibia's economy to continue growing greater than the 4.3 percent long term trend.

Namibia suffers from high-levels of unemployment, especially among youth[46] and women. For example, in Walvis Bay, both in urban and rural areas respectively, the unemployment rate was considerably higher among women (40 percent in urban areas and 56 percent in rural areas) than men (29 percent in urban areas and 32 percent in rural areas) (Van Zyl & Biewenga 2010: 12). This could be explained through traditional gender roles, but also due to the patriarchal culture, which is deep-rooted within the society. However, enhancement of women's participation in society creates various benefits in the overall development of a country. For example, seeing women as active agents instead of passive receivers, through providing them with education and employment outside the household, may have many

[45] For example the disasters like the Fukushima Daiichi nuclear disaster in 2011 represents one of the factors that has influenced to the lower demand of uranium and thus lower the prices of uranium.
[46] The issue of youth unemployment will be further addressed in chapter 6.

positive development impacts in society, such as lower child mortality rates, birth rates and even economic advantages (Sen 1999).

In Namibia, post-independence migration can be related to many historical factors, such as a restricted atmosphere of South African governance. Prior to 1990, urban centers which were situated in the communal areas of the country, served primarily as administrative centers of the colonial rule. Migration was not in itself prohibited in the country, but occurred under strict rules of South Africa and largely served military purposes (Pendleton & Frayne 1998: 7). In addition to the regime change after independence and to the rise of new opportunities, people have responded to environmental stresses in rural areas and to other socio-economic forces of urbanization. This has resulted in an increase in migration movement. In Namibia, migration from rural to urban areas occurs mainly due to better employment opportunities, education and better services (Indongo et al. 2013: ii). An estimated 43 percent of the population in Namibia inhabits urban areas. Furthermore, urban growth has been significant in the country due to a substantial increase in rural-urban migration since its independence in 1990. The urban percentage of the population increased from 28 percent to 40 percent between the years 1991 and 2011 and continues increase in a rate of 4, 5 percent per year. (AfDB/OECD/UNDP 2016: 306.)

Walvis Bay is considered as the future hub of transportation due to its advantageous location on the Atlantic Coast, with connections to Southern Africa and Europe. The rapid urbanization experienced by Walvis Bay is partly a response to a growing tourist industry. More importantly, it seems to be the result of the creation of an economic export-processing zone (EPZ) and extension of the port, which along with the developed fishing industry, stimulated urban growth in the area (Pendleton & Frayne 1998: 7). The urban growth of Walvis Bay is expected to double by 2030 to an estimated population of 180.000 (IUSDF 2014: 7), therefore bringing additional demands for natural resources and services.

As this chapter demonstrates, there are many deep-rooted social factors influencing not only the constructions of the society, but also to the economic situation of the country and to the current state of national and urban development. These issues are also dynamically

linked to the two systems this thesis examines next, to the urban water, sanitation and energy systems.

5. WATER AND SANITATION

As noted in chapter 3, the current water crisis is influencing some parts of the country more severely than the other parts; this was recognized as the most influential factor in future urban development. The result seems understandable, as urban development is considered the second most water consuming activity after irrigation in the agricultural sector (Van der Merwe et al. 2010: iii; Kgabi & Mashauri 2014: 50). Urban areas rely primarily on bulk water and the availability of bulk water supply is further determined by the availability of dams, transport and storage technology. In contrast, rural water supply utilizes small-scale technology such as local boreholes and does not include water transport to longer distances. (Lange 1998: 303.) The main focus of this thesis is especially on urban water provision and the aspects of sanitation that are related to water pollution and the possible health hazards this pollution imposes.

Namibia is one of the most arid countries in Sub-Saharan Africa due to its low and varying rainfall. Water runoff only constitutes 2 percent of the precipitation and approximately 1 percent is used as recharge for ground water. Most of the water is lost due to evaporation[47] and transpiration[48], the latter is aggravated by bush encroachment (Van der Merwe et al. 2010: ii). Due to a lack of surface water, the country relies heavily on ground water reserves that recharge slowly due to low rates of regular rainfall,[49] and on ephemeral flows (NPC 2001: v; Kgabi & Mashauri 2014: 48). Low and varying rainfalls, in conjunction with high rates of evaporation, create severe problems for water availability and delivery in Namibia (Ruppel-Schlicting 2016: 25). In addition, during the next 30 years, the need for water will rise rapidly in all growing urban areas, many of which are situated far from the actual sources of water (NPC 2001: v).

[47] Evaporation occurs when liquid water transforms into water vapor.
[48] Transpiration is a process whereby water is taken up by the roots of a plant and becomes water vapor through via pores in the leaves (Van der Merwe et al. 2010: 12).
[49] Namibia's rainfall is skewed. This implies that the northeast getting more than the west and south-western parts of the country.

The Kuiseb River can be identified as a westward flowing ephemeral river[50], which flows for a short period of time following a heavy rainfall. The river has good groundwater flow and large aquifers[51] situated in the lower basin area. The stored water is abstracted by means of boreholes or shallow wells, which supply water to the people and livestock living close to the river (MAWF (n.d.): 5). The large aquifers in the lower Kuiseb River; Rooibank and Swartbank, provide water for Walvis Bay and surrounding areas through a network of boreholes, reservoirs and pipelines**.** Water that is not required by Walvis Bay is transferred to Swakopmund. (IWRM 2010: 23.)

The most common methods[52] used in water collection are groundwater abstraction, collection of surface and flood water, water conservation and waste water recycling. Groundwater abstraction has obtained its position as one of the most relevant forms of fresh water provision in Namibia, as people inhabiting over 80 percent of the countries land area, rely on ground water reserves. (Van der Merwe et al. 2010: 46.) However, the severe dependency on these resources may at worst, lead to water pollution and over abstraction of the reserves (FAO 2005: 4). The collection of surface water from ephemeral and perennial rivers constitutes 22 percent and 27 percent of the total water provision respectively (Lange 1998: 303). On the other hand, the collection of surface and flood water is considered inefficient as unpredictable river flow usually results in poor performance of dams (Van der Merwe et al. 2010: 60). In addition, this method may result in environmental degradation (Iiyambo 2010: 9; Lange 1998: 301).

Waste water recycling is a viable option of water provision in city centers and in the mining industry (Kgabi & Mashauri 2014: 52; Iiyambo 2010: 19). At least 8 towns in Namibia recycle waste water, but only the city of Windhoek recycles water into potable quality[53]. Other recycled waste water, not fulfilling the requirements of potable water, is used for irrigation. This is currently the case in Walvis Bay (Walvis Bay 2014: 29). Proper treatment

[50] Ephemeral river refers to a river that only flows after heavy rainfall.
[51] Aquifers are geological formations, in which groundwater is found. This water is abstracted through boreholes.
[52] Methods, such as fog harvesting, are not considered further in this thesis (see more Iiyambo 2010: 20).
[53] Potable quality refers to water source which is safe to drink.

of waste water also involves issues relating to improved sanitation and hygiene, which is a serious problem in Namibia. Even though the situation of sanitation is generally considered better in urban areas than in rural areas, in cities and towns, only 57 percent of the urban households are able to use proper sanitation facilities. This further exacerbates considerable hazards to health. (AfDB/OECD/UNDP 2016: 306.)

Water conservation measures can have a substantial impact on the amount of water consumed by industry and residents (Iiyambo 2010:3, 24). Due to worsening situations in cities such as Windhoek, local authorities have declared a water crisis after years of scarce rainfall and proceed to take various measures to restrict water use in accordance with the city's drought management plan. One of these measures, "the zero tolerance policy", prohibits watering of lawns, flowers, vegetables and restricts water use to 90 liters per person per day. All in all, the city has declared a mandatory water saving percentage of 40 percent to avoid running dry. (CoW 2016: 7.)

Desalination, the process in which salt is being removed from water, is still a relatively marginal measure to increase fresh water resources. The Erongo desalination plant, also known as the Areva desalination plant, was built in years 2009 and 2010 and was one of the first of its kind in Southern Africa (Kgabi & Mashauri 2014: 53). This plant operates near Wlotzkasbaken north of Swakopmund. The desalination plant provides water for the mine and in addition sells it to the state owned parastatal NamWater, which then further sells it to the other mines and consumers such as to the municipalities of Walvis Bay and Swakopmund.

5.1 Future and past projects

Discussions on the construction and ownership of another desalination plant have been ongoing already for several years. In 1998, NamWater announced its initiative to build a desalination plant in Walvis Bay to appease the crowing demand of fresh water in the area. However, five years later this plan was abandoned. The reasons for such a decision were publicly announced due to the decreased water consumption in the area and water

resources, which were larger than previously expected. In addition, the project was said to have “faced hesitancy from the outside sources”. The project was then frozen indefinitely, though was never officially cancelled ("Swakopmund Desalination Plant", n.d.). However, smaller scale initiatives in water recycling and desalination have been conducted by projects, such as the German-Namibian partnership project CuveWaters (2006-2015), which has built smaller scale desalination and water treatment plants in three different villages ("CuveWaters", n.d).

Currently the city of Walvis Bay is not recycling its water into potable water quality, but uses it mainly for irrigation purposes. Moreover in 2015, the company Xaris Energy Namibia proposed to utilize semi-purified effluent from the Walvis Bay waste water treatment plant as a potential water source for the power plant’s needs in Walvis Bay. The assessment report concluded that the required volume of water from the waste water treatment process could be obtained for the operations of the power plant. However, measures should be taken to avoid an overly reduction of the size of the city’s wetland, which would pose a risk for the bird life populating these wetlands. (Botha et al. 2015: 10.)

The city of Walvis Bay focuses its future plans on upgrading pipelines for bulk water supply as well as constructing a new 500 mm diameter bulk supply pipeline by 2018 (IUSDF 2014: 36). According to the Integrated Urban Spatial Development Framework (IUSDF), the two new bulk water pipelines will adequately cater for all the new townships in Walvis Bay and Naraville over the next 10-15 years (IUSDF 2014: 37).

5.2 Regulations and laws in water sector

The government of Namibia has drafted several guidelines and regulations in order to reserve and manage valuable water sources. These approaches have included stricter policies in water pricing and protection of water resources, international contracts and water re-use and collection strategies.

The development of Namibian environmental law is due to its history of being strongly bound to environmental law in South Africa. The article 140 of the Namibian Constitution

states that "all law in force immediately before the date of Independence shall remain in force until repealed or amended by Act of Parliament". Thus, the South African legislation has played an important role in Namibia even after its independence (Ruppel 2016: 41; GRN 1990: article 140). One of such laws, inherited from the South African legal system, is the Water Act No. 54 of 1956. The Act grants the Minister the power "to investigate water resources, plan water supply infrastructure, develop water schemes, control pollution, protect, allocate and conserve water resources, inspect water works, levy water tariffs and advice on all matters related to the water environment in general". (Bethune & Ruppel 2016: 165.) Most importantly, according to the Act, the department of Water Affairs, under the Ministry of Agriculture, Water and Forestry (MAWF), is responsible for the use, allocation, control and conservation of Namibia's surface and groundwater resources (Ibid). In the case of ground water drilling through boreholes and the ownership of such boreholes, an individual actor is prohibited to operate (for instance to sell or deliver water) without the permission and given license of the government (GRN 1956: chapter 11).

The Water Act of 1956 thus gives a strong position to the government on water related issues. On the other hand, the Act distinguishes between private and public water, whereas the Constitution considers all these assets public and thus state owned unless otherwise lawfully owned (Bethune & Ruppel 2016: 165). According to the Constitution, the government of Namibia sovereignly and lawfully owns all the sources and resources of water. Furthermore, in the Namibian constitution article 100 states that "Land, Water and Natural resources, below and above the surface of the land and in the Continental Shelf; and within the Territorial Waters and the Exclusive Economic Zone of Namibia, shall belong to the State, if they are not otherwise lawfully owned" (GRN 1990: article 100).

The Water Act No. 54 of 1956 remains in force until the new Water Resources Management Act of 2013 comes legally into force. Until the date, the new Act has been passed by Parliament, signed by the President and published in terms of Namibian Constitution (Ruppel 2016: 44; GRN 2013: 1). Still, it has not yet come into operation, as the Minister has yet to determine the date in accordance with the requirements of the section 134 of the Act (Ruppel 2016: 44). However, more importantly, this Act does not

apply to Namibia in its entirety and does not cover all the areas of the country's water law. These areas are instead covered by the Water Supply and Sanitation Policy (WASSP) of 2008 (Bethune & Ruppel 2016: 164).

Even though the government is the sole owner of water resources within the borders of Namibia, municipalities are the only authorities with the mandate to deliver water to their residents within their borders. According to the Local Authorities Act of 1992, a local authority council has the mandate to supply water to the residents for household, business or industrial purposes in its area and to provide, maintain and carry on a system of sewerage and drainage in its area (GRN 1992: 30(1) a & b). It may also "establish, acquire or construct, maintain and carry on, any waterworks or water-main whether within or outside its area" (GRN 1992: 30(1) c). A local authority council may, "if it is of the opinion that the health or lives of the residents in its area or any part of such area are threatened on account of a water shortage due to a condition of drought or a disruption of the water supply prohibit, restrict, regulate or control the supply use of water in such area or part" (GRN 1992: 36 a & b). Important policies related to the municipality of Walvis Bay's water management are currently the Walvis Bay water and sewerage master plan and the urban spatial development framework (IUSDF) of 2014.

The Water Resources Management Act, (WRMA) No. 24 of 2004 was drafted to replace the Act of 1956. However, the document was seen as inefficient in addressing the different responsibilities of the actors in the water sector and in accomplishing the goals represented in the document. Thus, the Water Resource Management Act No. 11 of 2013 (WRMA 2013) replaced the Act of 2004 in December 2013. The general goal of the WRMA 2013 is to regulate administrative, protectoral and developmental water usage and regulations to the protection of these resources and introduce the substantive regulations and monitoring instruments for water services. (GRN 2013: 2.) The WRMA 2013 stresses, like the previous Act of 2004, the need to establish the Water Advisory Council, which would act as an advisory body for the ministry on water policies. In addition, it stresses the need for the establishment of the Water Regulator, which would determine the tariffs of fees and charges that may be levied by a water services provider, or that are payable by license

holders for the abstraction of water, the discharge of effluent or the supply or re-use of effluent. The Water Regulator would also perform other functions regarding water service providers, which have to be licensed under the Act. Finally the Act underlines the need for the establishment of Basin Management Committees. All these reforms were planned to further fulfill the government's objective in achieving an integrated management of water resources. (Ruppel 2016: 45.)

The Integrated Water Resources Management Plan (IWRM) was drafted in year 2010. Its long-term strategy in Namibia has been to accomplish a sustainable water source management system, which would contribute to social equality, financial efficiency and environmental resistance. The already existing policy programs, such as the National Water Policy White Paper (NWPW) of 2000 and the Water and Sanitation Policy of 2008 (WSASP) are in harmony with the IWRM strategy, but the practical level of implementation of these two policies has not been accomplished. (IWRM 2010: 8). In addition, the act on water resource management has not yet been put into force. In practice, the monitoring of tariffs and service providers is non-existent or minimal (Ibid.).

In the management of water and sanitation sector the Water Supply and Sanitation Policy (WASSP) was adopted in the year 1993. This policy paper was later replaced by the WASSP of 2008, which promises to secure the essential water sources and sanitation services for every Namibian with affordable prices and a strong focus on water demand management (GRN 2008: 1). According to the plan, the local council represents the users and the council owns, maintains and manages infrastructure whereas the government acts solely as a facilitator rather than as a provider of these services (GRN 2008: 8-9). According to WASSP the tariff structure should support progressively increasing rates in water consumption and support a fixed, low price for a minimum lifeline volume of water or a rebate on usage by residential consumers and if possible, provide subsidies for those who cannot afford water services (GRN 2008: 12). In the case of urban areas, sanitation tariffs were created to encourage to ecological and dry sanitation facility use or the use of such systems, which would ensure water safety, would reduce waste or reuse wastewater.

The Namibia Water Corporation Act No. 12 of 1997 established the water utility company, NamWater and places an obligation towards it to allocate water through a permit regulatory system with an obligation to conserve and protect the environment. Further, the Act states that "NamWater is entitled to apply for a permit to impound surface runoff in ephemeral rivers and to abstract water from perennial rivers as well as groundwater". The act will be amended by the Water Resource Management Act No. 11 of 2013. (Bethune & Ruppel 2016: 170.)

The international borders of Namibia in the north and in the south are marked by the Kunene River in the northeast, the Okavango River in the north central region and the Zambezi and Kwando rivers in the northeast. The Orange River also flows along the Southern border of Namibia. The rivers present the only viable option to collect annual surface water. Namibia shares these rivers with its neighbors and the management of these resources is defined by international water law (IWRM 2010: 2-3).

To summarize the purposes of the various policies and reforms in the water sector, Remmert (2016: 3) divides the relevant themes into three interlinking aims; 1) insurance of an equitable supply and access to potable water (and sanitation services) to all citizens, 2) a shift from water supply approach to a Water Demand Management (WDM)[54] and 3) the protection of water resource utilization towards a sustainable and environmental use. Also, additional themes presented by the Food and Agriculture Organization of the United Nations are the maintenance of water quality and pollution prevention, secure access to water from perennial rivers, the achievement of full participation of all stakeholders in water-related issues and the development of a strong institutional capacity from the local to the national level (Remmert 2016: 3-4; Barnes 2012: 2).

In summary, the water sector is characterized by various different policies and legislative initiatives. At least in theory, the Water Act of 1956 is the recent Act legally binding the

[54] Water demand management refers to the management approach aiming at conserving water by influencing demand.

actors in the sector. However, the practical implementation of the legislation, policies and reforms differs from the operative legal framework, as will be discussed later.

5.3 The main urban water regime members

The main actors in the water sector, with special focus being on urban systems, in Erongo area and Walvis Bay, are the parastatal NamWater, the Department of Water Affairs and Forestry (DWAF), especially under the Department of Water Affairs (DWA), local authorities and the private sector, especially in the fields of tourism, fishing and mining industry.

Ministry of Agriculture Water and Forestry: The MAWF is responsible for the supply of water to rural areas, management of the sector and under **The Department of Water Affairs (DWA)** all in all responsible of delivering water to municipalities. In very rare cases, local authorities are responsible of maintenance and operation of water infrastructure, such as in the case of the City of Windhoek and Walvis Bay.

NamWater The Namibian Water Corporation limited (NamWater) is a governmental parastatal. As stated before, under The Namibian Water Corporation Act, the corporation has a legal responsibility to deliver bulk water and large amounts of water to bigger entities, such as mines and other industries (GRN 1997: 6 part 3). Many municipalities are dependent on bulk water delivered by NamWater, which can regulate the usage of water through tariffs or by offering fewer water supplies. The five biggest customers (based on the revenue income) are the city of Windhoek, Rössing Uranium, Langer Heinrich Uranium (Pty) Ltd, Swakop Uranium and the municipality of Walvis Bay (NamWater 2015: 24). The five biggest suppliers to NamWater are Erongo Red (electricity), Uramin (desalinated water), NamPower (electricity), Zhong Mei (contactor) and Cenored (electricity) (NamWater 2015: 26).

Ministry of Environment and Tourism (MET): The MET, especially acting under the Environmental Management Act of 2007, is overall responsible for safeguarding the

environment and promoting biodiversity ("Ministry of Environment and Tourism Namibia", n.d.). For example in the mining sector, prior to mining licenses being issued by the Ministry, all applicants may be required to complete an environmental contract with the Department of Environment and Tourism. In the case of potential environmentally damaging activities, Environmental impact assessments (EIA) must be undertaken. ("Ministry of Environment and Tourism Namibia - Environmental Impact Assessment", n.d..)

Local Authorities (LA's): Municipalities, which receive their water supply from NamWater, as mentioned before, are responsible for water retail through pipelines to the end users, the maintenance of the infrastructure and collection of tariffs. Also, in accordance with the Local Authorities Act, local authorities are responsible for providing affordable sanitation services to their residents.

Other water operators and end-users: The fishing industry joins the mining and tourism industries as the main economic reasons for the high capita income in Walvis Bay (Van Zyl & Biewenga 2010: 9). Moreover, the industry is also a major pull factor for the population due to the job opportunities fish processing factories provide (Ibid.: 12). However, the practices in the industry, especially the way the end products are processed, are in straight correlation to the prevention of marine pollution. The mining industry, although being a significant employer in Namibia and Erongo area, is one of the main influencers of the growing demand of fresh water (Iiyambo 2011: 26). On the other hand, as discussed before, water recycling is common in the sector.

The Ministry of Fisheries and Marine resources (MFMR): The MFMR is responsible for managing capture fisheries and aquaculture. Marine capture fisheries, which mainly produce fish for export, are considered to be an important pillar of the Namibian economy (Ruppel 2016b: 432).

5.4 Scenarios

Based on the results of the questionnaire, water crisis was considered as the main driver of urban development in Namibia, as it was mentioned in some forms by all the respondents. Water was related to other themes such as climate change, the scale of drought and floods and in the case of Walvis Bay, to the sea-level rise. Some of the respondents mentioned food security one of the aspects related to the availability of water. Water scarcity has an influence on agricultural productivity and has an impact on employment and food production. Drought was also mentioned to lead to animal deaths and diseases. For the indicators, the respondents mentioned the number of boreholes and desalination plants and continued maintenance and upgrade of infrastructure.

Based on the questionnaire and general observation from the field, three conclusions may be drawn: first, water related problems and scarcity will dominate the direction of the future of urban development in Namibia. Second, urban systems are interlinked to rural systems through food production and security and further through employment opportunities and migration. This will be discussed later in the case of the water-energy nexus. Research on this relation might turn out to be crucial for further urban development. When it comes to means of water provision, desalination seemed to be seen as the most potential means of resolving the future water scarcity in a sustainable manner.

5.4.1 Water and sanitation worst case scenarios

From the government's point of view, the worst case scenario would be the failure of achieving its strategic goals summarized in chapter 5.2. In practice, this would lead to the increasing use of water for low value purposes, water depletion and hence extreme supply prices, polluted water, loss of water biodiversity, reduced livelihood, economic development options, poverty, increased health problems and possible conflicts with neighbor countries (GRN 2004: 138). Government would also fail in its initiative of strengthening its WDM approach and institutions. This could further hinder the effective monitoring of the sector and effective revenue collection.

For the parastatal NamWater, the growing demand of fresh water from the individual customers[55] threatens to hamper the corporation's business model, which until now has mainly focused on bulk water supply. The company keeps on battling with an increasing pressure, demand and financial problems, coming from the challenges facing revenue collection, funding for the replacement of old water supply infrastructure and a lack of human resources inside the company. (NamWater 2015: 21.)

In the case of the city of Windhoek, the water crisis may take a turn for the worse. This might lead to more restricting measures and cuts in water service, which may further hamper industrial development and current construction projects of the city (Haidula 2016: 2). Poor management of infrastructure and aging infrastructure due to insufficient funds could result in disruptions of service delivery. The ill-management of water delivery may force people to move out of the city and thus create more migration pressure to other cities and areas. There is also a severe risk of additional pollution of the damns. For example, the various scrap yards opening up alongside the Klein Windhoek River, at the back of Van Eck power station, have already contributed significantly to hydrocarbon contamination in the stream, especially during rainy seasons (NamPower 2016: 77).

Walvis Bay, in the worst case scenario, may suffer from a rise of sea-levels, which would severely influence urban planning. Flooding of the damns might also result in increasing water pollution, even though the water quality is currently considered good. What poses a serious risk in the city is the condition of its water service infrastructure. First of all, the city has emphasized the construction of pipelines in order to ensure water supply in the future to provide water to all its households. Another issue is the sewerage network. Despite of efforts in investing to the infrastructure, in the worst case scenario, this infrastructure might not bear the increasing pressure and might collapse. Until now, the municipality has been able to supply water corresponding to the need.[56] If the quantity of

[55] The NamWater report does not clearly identify these "individual customers", but presumably they may be identified as companies and even individual persons.
[56] In 2013, NamWater abstracted water from the Kuiseb river 6.8 Mm3/a, while the 2008 consumption of Walvis Bay was 4.9 Mm3/a. The water NamWater abstracted clearly exceeded the demand of Walvis Bay (WRM 2010: 23).

water becomes an issue and restrictions might be needed, this could affect the economic development of the city severally. Restrictions might have an influence on the price of water and in turn, influence tariffs and subsidies. Due to a lack of funds the costs of desalinated water from the mines might become unbearable to NamWater and to the city of Walvis Bay. If the consumption of water in Walvis Bay from the Kuiseb dam increases, soon the supply of water will be insufficient for all consumers. (A. Berger, personal communication, 7th November, 2016.)

For the mining and fishing industries, the lack of water may result in a loss of work and employment in the sectors. Moreover, in the case of the fishing industry, the need for a more coherent approach for water recycling was mentioned as one of the future challenges as the main focus of policy development on waste water recycling has been concentrated mainly on the mining industry (Merlus staff, personal communication, 29th September, 2016).

5.4.2 Water and sanitation best case scenarios

The Harambee Prosperity Plan (2016: 63 & 72) mentions its vision as the following: "To increase access to water for human consumption [that is safe potable water] from 50 percent to 100 percent of the population by 2020; ensure that there is sufficient water reserves for industrialization and land servicing and housing development purposes." In practice, this suggests the successful implementation of the following actions: the establishment of the Cabinet Committee on Water Supply Security, implementation of a national water resources monitoring system, the development of infrastructure to use the newly discovered underground water resources in the north of the country, the implementation of Windhoek Managed Aquifer Recharge concept and the focus of the desalination by using renewable energy at the coast. (GRN 2016: 51.)

In the case of the city of Windhoek, the worsening water crisis could be prevented with effective restrictions in the form of the use of aquifers and tariffs. Moreover, the city is emphasizing the city's aquifer recharge project to ensure the sufficient water supply. It relies on increasing amounts of precipitation, which would fill-in the aquifers in the future

(Haidula 2016: 2). In the best case scenario, the city would implement a successfully more decentralized city plan, where the population would be encouraged to migrate, to other cities or to country side (J. Botha, personal communication, 5th October, 2016).

In the case of Walvis Bay, the urban development framework of the city clearly states that the two new bulk water pipelines will adequately cater for all the new townships in Walvis Bay and Naraville over the next 10-15 years. However, according to the expert Andre Berger, in the best case scenario the establishment of another water desalination plant in the area and possibly the discovery of other underground water options, further the discovery of new resources and borehole drilling, will cater for the potential growing demand. The new water treatment plant would also be constructed, either by the municipality or the private sector. In the best case scenario, the municipality enjoys success in the maintenance of the infrastructure and no water restricting measures are needed (A. Berger, personal communication, 7th November, 2016).

NamWater mentions its goals to be in accordance with the targets set by the NDP 4 in a more economic focus, as it concentrates especially on providing water to the mines in order to provide economic growth. The best case scenario for NamWater is determined by economic circumstances, such as economic growth, job creation and decreased income equality (NamWater 2015: 17). In addition, the strategic objectives (listed by the chairperson Ms. Esther N. Akwaake) are to lay the foundation for long term water security, striving to achieve 100 percent access to portable water, to improve and maintain infrastructure in excellent condition and to own a desalination plant (NamWater 2015: 18).

As mentioned, water scarcity has a severe influence in the further operation of the industries in Namibia. Thus, it may be in the great interest of these industries to consider additional means of securing their water provision in the future. These means may include water recycling, as was already mentioned in the case of Merlus, and also, water desalination, as the mining industry has shown growing interest towards this method (see Kgabi & Mashauri 2014: 55).

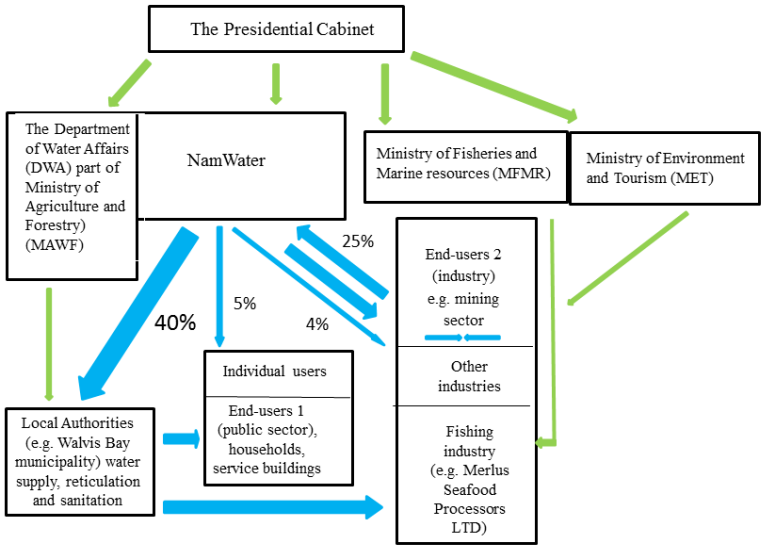
5.5 Urban water regime and the membership network

The thesis has presented the main urban water regime members and their responsibilities and next proceeds to the modeling of an urban water membership network. The network chart only presents a simplified demonstration of the reality on an institutional level and more research is required for a deeper understanding of the dynamics inside these organizations. As this thesis mainly concentrates on the provision of fresh water and sanitation services for the growing urban population, the roles of the members such as MFMR and MET are not considered in-depth in the analysis. In addition, the role of the Ministry of Regional and Local Government and Housing is excluded from the analysis, though its supporting role in relations between the government and LA's is generally noted. Finally, revenues and loans that the municipality obtains from the government are not included in this graph.

In this case, it is convenient to define the regime according to geographical lines, consisting of the city of Walvis Bay and the Erongo area. In this case the regime formed by the city of Windhoek is considered as another competing or cooperating regime and the nationwide water governance regime (such as the DWA, ministries and NamWater) operates as a layer of urban water regime. The urban aspect clarifies the boundaries of the regime, although these boundaries are left partly open. In this case, the urban aspect covers the task of the regime, which are the fulfillment of its social objectives and the achievement of the sustainable city system which includes the provision of water to a growing population, industry and access to affordable sanitation services. In addition to access of water, the provision of water includes such aspects as the affordability of water and water quality.

The regime consists of numerous and varying set of policies and legislation. Also, in the core of the regime, the city of Walvis Bay is implementing its own the urban spatial development framework and the city's water master plan. Actors are also guided by the Harambee Prosperity Plan (HPP), the Vision 2030 and the National Development Plan number 4 (NDP 4), soon NDP5. The regime is dominated by ad-hoc responses, nationally

and locally. In the case of this particular system, environmental biodiversity is exceptionally rich.



Graph 4. Urban water regime member network. Colours (arrows): blue: supply (and tariffs) Green: permits, legislative authority and licenses. The percentages present national level distribution (NamWater 2015).

In this case, the members of the regime operate in the field of scattered responsibilities. Water is mainly delivered from aquifers and the system is dependent on underground water options and pipelines. Walvis Bay currently purchases fresh water from NamWater (40 percent of the total water delivery), which source water from the Kuiseb Water Supply Scheme. The graph demonstrates that the starkest dependency relation is formed between NamWater and the municipality of Walvis Bay, as Walvis Bay is strongly dependent on water resources by the parastatal. The municipality on the other hand possesses many responsibilities to public end-users, such as provision of sanitation services and water.

The price and demand of water influences various members in the regime. Since November 2013, the mines such as Rössing Uranium mine have been using desalinated water supplied by NamWater, which buys this water from Areva desalination plant. The costs of desalinated water consist 16 % of NamWater's cost composition (NamWater 2015: 26). As mentioned before, the municipality of Walvis Bay sets water tariffs and fees annually and

these tariffs and fees are dependent on the tariffs and fees determined by NamWater. Furthermore, the amount of tariffs is determined by the development in the price of water and the demand. The increase in demand correlates with the increase of tariffs. As will be later discussed, this creates inequality between the ones who are able to afford water and those who are not. Related to this, it should be noted that 5 percent of the water delivered by NamWater is consumed by individual users and this percentage is increasing.

The thin arrows between the MET and the mining sector and MFMR and the fishing industry, demonstrate the issue of implementation of environmental legislation. Namibia does not yet have a central environmental statute, which would cover all the environmental sectors and determine clearly the principles of environmental policies, their aims, objectives and the control mechanisms. The latter play the outermost importance in law enforcement. For example, in the case of EAI licenses and the mining sector, the inspections of these activities have until now, been inadequate to ensure the observance of environmental law (Koep & Van der Berg 2016: 126). Thus, the impact of the environmental preserving measures may be characterized generally weak, which imposes threat to the rich biodiversity of Walvis Bay.

5.5.1 Niches

This thesis focuses on two niches: on water recycling into potable quality and on water desalination. In the transition terminology, the niche focus on desalination has not yet been considered as one of the dominant practices or technologies in the regime. At the moment, this niche could either already have found its window of opportunity, or is still waiting for it, due to lock-in mechanisms imposed by inconclusive negotiations of the technological ownership and high cost of the technology. In addition, the idea of establishing these sorts of facilities has faced opposition from some local communities due to environmental impacts[57] (Tsiourtis 2008: 115; Kgabi & Mashauri 2014, 54). The expenses of desalination depend on the condition of the target area, such as ground salinity, water quality

[57] The environmental cost of desalination may be divided into two aspects: first, the desalination plant may kill small ocean creatures, such as plankton and baby fish, further resulting in an imbalanced food chain. Second, the end product of the desalination process, the separated salt, when pumped back to the ocean may harm the biodiversity of the sea (Peter, n.d.).

requirements and the existing infrastructure (Tsiourtis 2008: 114). Most importantly, desalination requires lots of energy, which is a notable issue in Namibia. However, the niche could break through also on a household level or individual level in a smaller scale, as the CuveWater initiative has demonstrated.

The use of aquifers divides different writers in its efficiency. As the current project of the city of Windhoek has been seen one of the most viable source of water, some studies criticize the approach for being mainly an emergency measure (see Remmert 2016: 10; Iiyambo 2010: 64; Lange 1998: 301). Thus, at least in accordance to some experts and actors, desalination has been considered as a viable option for a long term sufficient source of water supply (see for example Iiyambo 2010: ii; Van der Merwe et al. 2010: 48). The city of Walvis Bay is a coastal city, which indicates that the use of desalination technologies could be considered logical among the members, as this technology would save water transportation costs. On the other hand, the cost of the desalination plant, technology and the current need of it, have previously been a concern for the government as well as for the municipality of Walvis Bay (A. Berger, personal communication, 7th November, 2016). As was already mentioned, the urban development framework of the city clearly states that the two new bulk water pipelines will adequately cater for all the new townships in Walvis Bay and Naraville over the next 10-15 years, which might indicate a certain perception of adequate water supply. As the city of Windhoek is placed inland, the question remains, what kind of additional capacity and infrastructure would be needed to export desalinated water to the city. This might add the transition costs of the technology compared to the situation in Walvis Bay. All in all, it seems unlikely that the niche on water desalination would actually replace the current practices in the system, but merely work as an addition to the current set of practices and technologies.

Water recycling is widely considered as a viable option for fresh water provision. However, currently only the city of Windhoek is recycling its water into potable quality. Thus, the niche is still not considered widely as an option for urban water provision. As discussed earlier, the rise of water treatment in the city of Windhoek demonstrates one way of transition in which the niche on water recycling into drinking quality first encountered

lock-ins in the system, such as technological and especially social reluctance, and finally became a part of user practices and the regime. Whether this niche could be one option to provide potable water for the urban population in the future, would also depend on the current Xaris project, whose future is still unclear. As Smith et al. (2005: 1500) note, the past experience will guide decisions over future technological choices and the transformation process tend to be incremental and path following. If this is the case of Walvis Bay and the niche on water recycling in the future, some similar patterns and obstacles might be discovered in the niche development.

However, as discussed in chapter 2, niches do not only consist of technologies but also sustainable user practices. This is further related to the way water is seen and valued. In the case of environmental pollution, governmental actors such as MET and MFMR are in an important role in monitoring practices in mining and fishing industries, as these industries might seriously affect the rich biodiversity of the city.

5.5.2 Selection pressures

As already mentioned, the water crisis, moreover, the unequal distribution of water resources, disruptions in service delivery and the threat of pollution, have been seen as the dominating driving forces influencing urban development. Although this force has not yet been considered to strongly influence urban development in Walvis Bay, the situation might change in the future due to the future port extension, the developing of the Walvis Bay port a transportation hub of 2020 and the increasing urban movement. In addition, projections towards the development of mining industry have been generally optimistic and a new mining company has recently begun its operation in Walvis Bay. This sort of development would place more pressure on the demand of water. The urban water systems of the city of Windhoek and the national level have tended to a some extent; articulate these pressures with policies, plans and regulations to ensure the comprehensive and environmentally sustainable access to water and sanitation services for all. However, as will be examined later, responses to the crisis in reality have been varied, the implementation work of these plans and policies has not been adequate to respond to the growing demand

in many cases and actions and roles of regime members have not been fully coordinated or defined.

On the other hand, it is possible to identify some forces which could stabilize the current regime. For example, some factors might increase the water supply of the regime temporarily, like the discovery of new water resources and sufficient amount of precipitation to cater the needs of the city. Also, temporary forces influencing the water demand, such as the decrease in water demand due to migration from the cities to other areas where water is available, or the negative development of the uranium market and thus the decline of the mining industry, could support the stability of the current regime.

5.6 System adaptive capacity

As discussed earlier, the operating regime consists of multiple plans and regulations that seek to guide the water sector. However, even in expert circles there appears to be considerable uncertainty which act and regulations are legally in force and which should be applied in practice (Remmert 2016: 4). This is noted at the governmental level, as the IWRM states that the incapability to lawfully enforce the New Water Act has resulted in a situation in which "a variety of ad hoc interventions are undertaken by government and other stakeholders, together and separately, all heading in the same general direction" (IWRM 2010, 1). The Water Act of 1956, which was promulgated under the rules of apartheid, seems not to suit the current ecological reality of Namibia and still emphasizes the use and control of water in a centralized and racially unequal manner. In reality, the Water Act of 2013 is widely practiced, even though it does not legally bind the practitioners. However, the lack of officiated regulations and outdated laws result in difficulty for the government to enforce these policies in the case of malpractices, for example in the case of unsustainable groundwater abstraction. (KPMG 2014: 17-18; Remmert 2016: 4.) This further signifies that instead of having access to clear and legally sound regulations communities, businesses could find themselves unknowingly confronted by constantly changing bureaucratic interpretations of policy and at worst by lengthy and costly legal battles. Thus, the unclear policy environment poses a barrier to investment in

Namibia. Businesses both local and foreign, especially those dependent on a regular and safe water supply, could evaluate the country's water policies as too risky for business resulting in less business engagement and expansion. On the other hand this could pave the way for some companies to exploit the policy vacuum resulting in environmental damage without any accountability. (Remmert 2016: 4.)

The incapability of enforcing updated legislation has resulted in an overall incapability in establishing key regulative public institutions, such as the Water Regulatory, the Water Tribunal[58] and Water advisory council outlined in the Water Act of 2013. Moreover, unlike the energy sector, water sector clearly lacks regulated public debate forums, as there are no formal institutions maintaining these forums. (Remmert 2016: 10.) The lack of support for official forums not only prohibits the exchange of ideas about potential novel technologies, but also undermines the participation of the most vulnerable groups in water-related issues. As there is a lack of such forums, the civil society's participation becomes difficult and moreover, this understates the democratic principles proclaimed in the Constitution. In addition, if such forums were to be established, in general, they should support interaction with researchers, governmental officers and other relevant stakeholders in the matter. Moreover, the lack of adequate public monitoring institutions leads partly to the incapability of revenue collection, which is currently the case for NamWater. This may create a vicious cycle; if the country does not have adequate economic capacity to provide water, this may reflect to the job sector via economic hindrance due to water scarcity. As a result, households cannot afford to pay for water, which results in the incapability for the parastatal to provide it. In other cases, the incapability to pay for water may be a result of lack of good governance and pure avoidance to pay for the commodity.

The establishment of NamWater was a result of a heavy subsidized water tariff system and the incapability for the DWA to provide water with cost recovery, which had no bearing on

[58] The Water advisory council was constituted as late as in September 2016. The Water Tribunal would act as a hearing and decisive body, in which appeals made to the Ministry regarding its decisions on licenses, moreover its reluctance to issue water licenses, suspension of licenses and other ambiguities related to these licenses, could be heard and contested (GRN 2013: 77 section 120). The Act especially mentions the possible conflicts over licenses regarding the discharge of effluent.

expenditures (Heyns 2005: 97). Thus, NamWater was established to commercialize bulk water supply, in other words, to establish a separate instance, which would have acted as a service provider. Thus, the aim of the reform was to separate the core business and delivery services from regulatory work, legislation, policy work and social responsibilities of the government. A commercial company was seen to be in a much better position to implement long-term planning, attract capital investments from the private sector, or to borrow money from commercial banks. Thus, the company was seen as able to establish water projects operating on a basis of full cost recovery. (Ibid.) Although the idea behind establishing NamWater was to rationalize and reduce the size of the public service, the reduction of the DWA staff resulted in the loss of professional capacity, as the government was unable to recruit young professionals, who would have taken control over technical and managerial tasks due to the vacuum left by the retirement of older management staff. (Remmert 2016: 5; Heyns 2005: 98.) This trend continues to some extent even today and reflects to the water management operations of the DWA and NamWater's ability to manage recent problems in its cost recovery. All these aforementioned aspects demonstrate the state of the governance (and financial) capacity of the regime.

Also on the local level of the regime, the city of Walvis Bay is unable to provide employees with expertise and new technology to solve a problem, in which underground sea water imposes challenges to the operation of local water infrastructure. Thus, the regime lacks a certain professional capacity also on the local level, as the experienced employees are retiring and new employees are employed straight from universities and other institutions without sufficient practical knowledge. (A. Berger, personal communication, 7th November, 2016.) This is partly related to the problem of information flow and transfer, as the challenge remains in accessing recent information and data, such as statistics, on water sector and related issues (IWRM 2010: 12). This hampers the overall decision making of actors, who now need to make decisions based on missing information. For example on a local level, the updated water tariffs for Walvis Bay still cannot be found online. Many plans and reports need to be obtained locally, sometimes even requested beforehand. There is also a huge cap in research conducted in the water sector, as the table adapted from the presentation by Professor Kuiri F Tjipangandjara demonstrates.

Table 1. Topics under-researched in water sector. Modified from the Powerpoint presentation held by Professor Kuiri F Tjipangandjara on 24th of November 2016 on IUM annual research day.

Resource management	International Waters and Relations	Equitable Allocation of Water
Pollution management	Cost Recovery Principles	Water Utility Management
Wastages	Assets Management	Subsidy Principles/Policy
Impacts of Urban Migration	Water and Land Use Nexus	Impacts Institutional Corruption
Energy and Water Nexus	Water and Sanitation	Water Security and HPP
Private Public Partnership	Privatization of Water Services	Gender and Water Security
Water Governance	Governance and Water Security	National Basin Management
Regulatory Functions	Use of Chemicals	Others, Others…

The lack of reliable information has to consider governmental actions. When it comes to the question on desalination technology, the general and dominating discussion has been about who will own the desalination plant and whether it has been necessary at all. When analyzing the different expectations the key regime members have stated, for example in the case of the government and the company NamWater, the prolonged negotiations on Avera plant and different views on the price of the technology has resulted in the situation, in which the government has been prolonging its decision making. In public discussion, it has not been clearly stated, whether the Areva plant is rejected due to its expensiveness, outdated technology or as it is not considered to fit the purposes. On the other hand, other sources suggest that the government intends to have another desalination plant along the central coast to mainly supply nearby towns. This plant would be owned by the government (The Namibian 2016: 16). In summary, the main obstacle to this process seems to be financial and thus, the government has encouraged the implementation of the project through public-private partnership (GRN 2016: 51). However, even though water related issues have been noted on multiple levels in Namibia, the questions remains, whether this is being fully noted in the governmental spending. For example, according to Brown (2016:

16) defense continues to receive relatively large allocations of funds when considering the restricted governmental budget and peaceful nature of the country and region.

In the case of Walvis Bay, the need for a new water treatment plant was found essential for sustainable water provision in the future according to expert opinion, as the current treatment plant is operating at full capacity. One of the biggest concerns was the condition of the water infrastructure, especially the sewerage system in the city, which still covers 100 percent of the city area but is under constant pressure of vandalism and environmental pressure, such as underground seawater and aging infrastructure. This might lead to the pollution of the ground water and sanitation problems, though the risk of pollution of the boreholes is smaller, as they are located further from the residential areas. In general, the condition of the infrastructure is crucial. Leakages of pipes due to poor infrastructure management result in wastage of valuable water.

Picture 1. Waterpipe near Walvis Bay (Photogredits: Minna Keinänen-Toivola).

In addition, in the year 2008, Walvis Bay faced four weeks delay in water delivery due to floods of Kuiseb delta (IWRM 2010: 13). As climate change might increase the risk of floods and sea-level rise, it is worrying that the city of Walvis Bay to date lacks policies to respond to the possible threat of sea level rise, floods and further possible water pollution delivered from these floods.

As mentioned before, the lack of policy framework and coherency among the actors in the fishing industry, were considered the biggest obstacles in the development of water recycling practices in the industry. As the Merlus Seafood Processors has indicated willingness and interest in investing in sustainable water technologies and water recycle procedures, the company representatives emphasized a partnership approach between the members of the industry. This could be one example of a coalition raised by mutual expectations and visions.

The government has traditionally supported the provision of low-cost or free water especially to rural areas, as it has been considered socially just (Lange 1998: 307). As the current Water Act of 1956 has supported the provision of cheap access to water through subsidization, this has led to the perception of the government's duty to provide water as a cheap and abundant commodity and has resulted in the lack of recognition of the true value of water and in inefficient and unsustainable water demand (IWRM 2010: 27). However, despite such unfortunate consequences, the answer may not be the termination of such subsidization policies or in more extreme measures, the privatization of water supply, due to some underlining ethical questions these measures might raise. Water provision may create inequalities as an increase in the number of individual customers of NamWater presents. Though these users have not been identified in more detail, the increase itself shows that in the future, the wealthier portion of the population may have the capacity to purchase water for their own use, whereas such right may be prevented from the less fortunate. Thus, the change in belief and cognitive frameworks through education and awareness seem to be a more viable option to support water conservation measures and thus, functions as a key element in sustainable water management. In addition, the trend, already witnessed in 1993, suggests that urban households spent three times more water than the rural counterparts (Lange 1998: 303). This could refer to a certain "consumption ecstasy", in which the improvements in living conditions reflect the feeling of spending more natural resources that may be extensively available to many dwellers for the first time.

The role of peripheral regime members, such as households, might in the end be a very important aspect to consider in the regime adaptation and transition. Households not only guide consumption patterns, but might also possess crucial human capacity for the system adaptation in the form of employment. The question is not only about accepting new technologies, but also about educating the population moving from the villages to the city on sanitation and infrastructure maintenance, especially in terms of vocational skill training. In addition, if not seriously considered, social problems such as poverty, might lead to frustration and vandalism of the current infrastructure and pollution of underground water. In this issue, the municipality has the key role as the facilitator and inhibitor of such behavior.

In the regime previously described as the Walvis Bay urban water regime, the core members (such as the municipality, NamWater, DWA and certain members of mining and fishing industry) possess different capacities to influence the future transition of the regime. The ownership of the infrastructure, such as pipelines and the sewerage system, is centralized to the ownership of NamWater and the Walvis Bay municipality, although they are in some degree lacking financial capacity and are struggling in the maintenance of these infrastructures. They also bear the most pressure in potable water service provision. The mining sector, especially Areva mining company, possesses financial capacity and is also the owner of the desalination plant.

The current water crisis has a multidimensional influence on the economy. First, the negative development in the water sector would also have a direct impact on employment, as about 60 000 people are being employed by the water sector. Due to the water crisis about 50 percent may become unemployed in the future (Uusiku 2016). This has been witnessed in the case with Coca-Cola Namibia Bottling Company that had to close two of its production lines and discharge 60 of its employees (Weatherman 2017). Second, industries such as uranium mining, in addition to job opportunities, bring in more that 50 percent of foreign earnings (The Heritage Foundation 2017). As these industries are considerably dependent on energy and water, crises in these sectors could hinder the overall economic development of the country.

5.7 Transitions

As water resources are unequally distributed in Namibia, the current water crisis places more stress to some systems over others. Until now, the city of Walvis Bay has had enough water to provide for its citizen and industrial sectors operating in the Erongo area. Only recently has the discussion risen over some problems facing the system, such as disruptions in water delivery due to floods of the Kuiseb delta. Thus the system, according to one interpretation, could be considered to be in a pre-development phase of transition. Walvis Bay has not been forced to draw similar restricting policies around the city of Windhoek, as the water resources have been noted to be generally sufficient. However, if not addressed properly, the city might face similar problems in the future as the city of Windhoek currently faces challenges such as legislative lock-in, problems in financing and the lack of a professional work force.

As desalination has almost optimal prerequisites to succeed in the city of Walvis Bay, the probability of the regime to end in a lock-in might be considered relatively small compared to the case of Windhoek. On the other hand, the city of Windhoek, where the crisis has been continuing for a while and where current practices and technologies are not sufficient enough to provide enough water to the city, the regime has ended up in a lock-in and might not be considered sustainable in the long run.

One interpretation of the situation in the Windhoek regime might not rely solely on insufficient economic and other material capacities, but also on different perceptions about the current situation, as some members might consider the system being in a state of dynamic equilibrium. This could be the case also on a national level; water crisis, though considered as a serious threat, competes with other problems the national decision makers are facing, such as poverty alleviation, inequality and economic performance of the country. Thus, water issues might not rise high enough on the decision-making agenda. Moreover, many middle-income and higher income groups tend to find access to fresh water easy (Remmert 2016: 15). This further underlines the division in perceptions between wealthier groups and the poorer, often marginalized, groups. The governmental budget

allocation demonstrates that a deeper understanding of the linkage of water in many development issues, currently drawing the attention of the government, should become a stronger mental paradigm nationwide. The establishment of formal forums, in which the decision-makers could interact with researchers and other instances to support their decision making, would be a step to address the issue.

Bettini et al. (2015) have drawn a similar system analysis of the governance between two Australian city systems, the city of Perth on the coast of South-Western Australia and Adelaide on the Eastern coastline of the Gulf of St. Vincent.[59] The governance of Perth was dominated by maintaining dynamics (lock-in) and an absence of trusted information and transparency, which led to disparate beliefs, cognitive frames and a reliance on traditional water services, which were not scientifically supported. In addition, the cognitive frames of the community were towards government's cheap and unrestricted water provision, which in a longer run was an unsustainable mental paradigm. This eventually resulted in a lock-in situation. On the other hand, in the case of Adalaide, the city's "portfolio of resources" was considered wider; the city had clear policy targets, which indicated commitment to mainstreaming novel technologies, operation on a decentralized manner and producing "new fit-for-purpose" solutions. In their research model, Adalaide was considered to be in a re-organization phase, which could be translated as the take-off phase of the transition model used in this thesis.

The city of Perth and its development in adaptive capacity highly resembles the situation on a national scale and in the case of the city of Windhoek. The key difference between Perth and Adalaide was the fact that in Adalaide, the persisting cognitive frames were to a greater extent challenged by formal avenues, in which water management was provided through "governmental setting of regional natural resource management organizations", further providing innovation, learning and professional networks on good practices (Bettini et al. 2013: 7).

[59] These two city systems shared the similar water infrastructure models, climate conditions and used underground water as a supply source (Bettini et al. 2015: 50).

Next, this thesis will turn to the energy sector, especially in the urban context of the provision of modern electricity. As will be noted, the system modeling and analysis will reveal other aspects of the transition process as in the previous case of water and sanitation system analysis.

6. ENERGY

Due to the limited scope of the thesis at hand and to a viewpoint of sustainability and urban spaces, this chapter focuses on *the access and provision of modern energy.* This chapter concentrates on electricity rather than on thermal sector[60], although the development and rational management of both sectors are considered equally important for the development in Namibia (see von Oertzen 2012: 15). Access to modern energy is defined as a person's ability (where both availability and affordability are considered as prerequisites) "to use one or several forms of clean energy, such as electricity and/or other modern forms of energy, and/or high-efficiency end-use energy technology(ies) to meet the energy requirements for cooking, lighting, communication, infotainment and heating". (von Oertzen 2015: 41-42.) This definition excludes all energy forms required for mobility, but considers such aspects of a modern society, as basic infotainment and entertainment services and a person's ability to access basic communication. Finally, universal access to modern energy in this case is defined as the ability of all Namibians to utilize such forms of energy. On a national level, this is not the current case. (Ibid.: 42.)

In general, Namibia's energy sector consists of "petroleum product imports, biomass in the form of wood, processed wood products, charcoal, coal and to a lesser degree, liquid fossil fuels, such as diesel, petrol, paraffin, liquid petroleum gas and related local fuel wood supplies and local and imported electricity" (von Oertzen 2016: 67; von Oertzen 2015: 16). Still, wood constitutes the primary source of energy for 62 percent of the population (GRN 2004: 147). Biomass fuels are main sources of energy for cooking and heating in rural areas and in some informal settlements in urban areas (GRN 2004: 84). As Namibia does not at the moment have an indigenous supply of gas and oil, all the petroleum products are imported (Chiguvare & Ileka 2016: 9 & 24). Solar energy still constitutes a small but growing proportion of local energy mix (von Oertzen 2016: 67; von Oertzen 2015: 16).

There are currently four operating power stations in Namibia; the Ruacana hydropower plant in Ruacana, the Van Eck coal-fired plant in North of Windhoek and the Anixas and

[60] Thermal energy refers to the energy that comes from heat.

Paratus diesel plants in Walvis Bay (NamPower report 2016: 7). The largest portion of the national electricity capacity of 504 MW is delivered from hydropower[61]. For example, the Ruacana hydropower plant in Ruacana is able to provide an electrical capacity of 338 MW (Ruppel 2016b: 434). However, as the Ruacana power plant is highly dependent on river run-off of the Kunenen River, the recent droughts in the area have seriously influenced the operation of the plant (von Oerzten 2012: 15). Other plants, such as the Anixas and Paratus power stations in Walvis Bay, were originally meant to function as peaking plants[62] (von Oertzen 2015: 126). Moreover, both the Van Eck power station and Paratus power plant fail to fulfill their capacity due to aging infrastructure and have become expensive to maintain and operate (von Oerzten 2012: 14-15).

Due to growing prices of electricity and the insufficient use of available energy resources, predictions regarding adequacy of the future electricity supply in Namibia are stating that the country may not be capable in responding to future demand. The current demand is mostly covered with import and it only satisfies about 44 percent of the population mainly living in urban areas (Chiguvare & Ileka 2016: 21). Namibia is rather dependent on imported electricity, as it receives up to 70 percent of its electricity requirements from the Southern African Power Pool (SAPP) through bilateral and day-ahead market contracts. (Renkhoff 2016: 233.) From a systemic point of view, such dependency might expose the energy system to additional risks and uncertainties.

However, Namibia is characterized by variable sources of renewable energy (RE). For example the country has the potential for further utilization of such RE sources as solar, wind, bio, and geothermal energy. In Namibia particularly, some renewable energy technologies, such as solar photovoltaic (PV), wind technologies and to a lesser degree biomass generation, have not yet been able to compete with fossil fuels. However, these sources of energy have globally improved their cost competiveness in the past years (Renkhoff 2016: 233; von Oertzen 2015: 96). This may be considered encouraging news, as

[61] Hydropower refers to a form of energy, which is obtained through kinetic energy in rivers and streams.
[62] The peaking power plants are important to assist in supplying electricity in short-term peak demand periods. Peaking power plants are often pumped storage hydro-powered or gas-powered generators (von Oertzen 2015: 126).

the demand for electricity continues to grow, in the Erongo region particularly, due to growing economic activities in the region (Renkhoff 2016: 233).

6.1 Future and past projects

On a national scale, projects regarding the energy sector may be divided into Short Term Critical Supply projects (STCS) and to medium- and long term projects. The STCS's include reconstruction of the Van Eck coal-fired power plant in Windhoek and the hydro-electric Ruacana power plant, constrained by the availability of water from the Kunene River. They operate as base-load power stations, thus generating power continuously through the year (von Oerzten 2012: 14). Other STCS's include the negotiation and renegotiation of power purchase agreements with neighboring utilities[63], small scale electricity generation from renewable energy sources locally, demand side management programs[64] and the state parastatal NamPower's negotiations with independent power producers (IPPs) (Renkhoff 2016: 236).

In the case of medium and long-term projects, the national priority has been given to Kudu gas power project (Renkhoff 2016: 237). The new Kudu power station, utilizing gas from the Kudu gas plant, was originally meant to be built in the coastal area in the middle of the year 2017. Since then, the completion of the station has shifted to the year 2020. (M. Myanga, personal communication, 4th October, 2016.) According to estimations, the gas field will supply the station an estimated 23 years and half of the produced energy will be sold outside the country, mainly to other SADC countries, using long term power purchase agreements. (Renkhoff 2016: 237.) The Kudu power station is intended to operate as a base load plant and the aim of the station is to offer the most permanent part of the Namibia's electricity demand. (von Oertzen 2015: 127.) As will be later discussed in more detail, Kudu power station has become a rather controversial topic of discussion.

[63] Eskom in South Africa, Zesco in Zambia, Zesa in Zimbabwe and Aggreko in Mozambique

[64] These are programs that actively invole the people of Namibia, like the distribution of 1 million LED lights, solar water heater campaigns and public awareness campaigns.

Other significant middle and longer term projects in the electricity sector are the Walvis Bay Xaris gas to power project (already discussed in chapter 5) and the ZIZABON project. ZIZABON aims for the connection of electricity grids of Zimbabwe, Zambia, Botswana and Namibia, thus offering flexibility and capacity to the SADC region transmission network system through the second transmission corridor. This second corridor acts as an addition to the existing central transmission corridor from Zambia through Zimbabwe, Botswana into South-Africa. In addition, Bayenes hydropower station project will be implemented between Namibia and Angola. (Renkhoff 2016: 237.)

The RE projects in Namibia have been marked in the past by the government's concentration for rural off-grid electrification (Renkhoff 2016: 245). Some smaller scale programs, projects and plans[65] were already established after independence.

Today, the Solar Revolving Fund (SRF) by the Ministry of Mines and Energy offers subsidized interest rates to end-users in three categories: in Solar Home Systems (SHS), Solar Water Pumps (SWP) and Solar Water Heaters (SWH). The latter mentioned have already been installed to some houses and public institutions (such as vocational training centers) in Windhoek under the Southern African Solar Thermal Training and Demonstration Initiative SOLTRAIN 1[66], to demonstrate its profitability in comparison to solar geysers. (Jarrett & Dauti 2016: 8; Etango Magazine 2016: 6.) In addition, the 5 MW HopSol Power Solar Photovoltaic Park in Otjiwarongo, owned by a private investor and executed through a PPA between CenoRed, a local electricity distributer and the investor, has been the first of its kind of a bigger scale RE project (Jarrett & Dauti 2016: 8). Since the establishment of the HopSol Power Solar Photovoltaic Park, other similar projects have been established at a growing rate[67].

[65] To mention view, for example Rural Electrification Program (Renkhoff 2016: 245), Rural Electricity Master Plan (Renkhoff 2016: 247), Off-Grid Energisation Master Plan (OGEM) and Namibia Energy Efficiency Programme in Buildings (NEEP) (Renkhoff 2016: 249)

[66] SOLTRAIN project has until the date had three different phases. It covers Mozambique, Namibia, South Africa and Zimbabwe.

[67] Other similar projects established after the HopSol Power Solar Photovoltaic Park have for example been the InnoSun Omburu Power Plant (4,5 MW) in 2015, HopSol Otjozondjupa Power Plant (5 MW) in 2016 and Ejuva 1 and Ejuva 2 solar farms (both 5 MW) in 2017.

6.2 Regulations and laws in energy sector

The White Paper on Energy Policy, developed by the Energy Committee and formed in the year 1998, was in line with the first National Development Plan (NDP 1) of 1995 and still sets the grounds for Namibia's energy policy. The paper considers the Ministry's interests in attracting private sector investments in the energy industry, through the appropriate level of government regulation (Renkhoff 2016: 243; GRN 1998: ii). Its goals have been to achieve security of supply, social upliftment, effective governance, investment and growth, economic competiveness, economic efficiency and sustainability. For the productive sectors of the economy, the government is committed to ensure that the demand of energy is met through reliable competitively-priced energy. Competitively-priced energy is related to the government's willingness to pay special attention to those demand sectors, which have been neglected in the past, such as poor urban and rural households. (Koep & Berg 2016: 228; Renkhoff 2016: 243; GRN 1998: 2.) The White Paper is considered to be a remarkable policy for RE, as it concentrates on off-grid areas in poverty reduction, to use of decentralized PV systems and photovoltaic power pumps. However, it should be noted that the paper still misses a comprehensive national support scheme of RE (Renkhoff 2016: 245).

The White paper notes the importance of a supporting tariff structure and further discussion in order to ensure access to the grid for independent power producers (IPPs) specialized in RE. Today, these two topics are the most relevant and urgent themes in the discussion. (Renkhoff 2016: 245.) Some supporting RE legislative initiatives have been conducted through a multi-stakeholder partnership, such as the Namibia Renewable Energy Program (NAMREP) Phases 1 and 2, which were aimed at making RE services more affordable and accelerate market development for RE technologies. (Schumann 2006: 3.) Another remarkable initiative has been the REEECAP[68] initiative in 2008, in which the policy goals drafted in the White Paper were examined separately within the context of eight scenarios, each discovering the strengths and weaknesses of different policy options. The study

[68] REEECAP (The Renewable Energy and Energy Efficiency Capacity Building Programme) ran from 2006 to 2008 and was funded by the Danish Government and implemented by The Renewable Energy and Energy Efficiency Institute.

concluded that the energy generation resources would be desirable but could not be "expected to supply all Namibia's electricity needs; at least not in the short term" (Renkhoff 2016: 251; GRN 2008). These results still have an importance, as the study has operated as the precursor of all later studies seeking to find the best energy solutions for Namibia.

The White Paper of Energy of 1998 further states that the tariffs, building permissions for energy provision installations and provision of electricity are regulated through a licensing system (GRN 1998: v). For this purpose, the Electricity Act of 2007, which replaced the first Electricity Act No. 2 of 2000, provided for the establishment of the Electricity Control Board (ECB) (Koep & Van den Berg 2016: 227; GRN 2007: 2). The Act states that "Installations for the provision of electricity, including any alterations or extensions thereto, and all other electricity practices and activities by licensees, customers and other persons, must be built, operated and conducted with due compliance with the requirements of applicable laws, in particular laws relating to health, safety and environmental standards". (GRN 2007 section 33 (1) a) For example, under the Environmental management Act, the Ministry of ECB may request the potential applicant to submit an environmental clearance certificate, which clarifies the extent of any possible damage to, or pollution of the environment caused from the installation of the energy provision (Koep & Van den Berg 2016: 231 & 211; GRN 2007 section 21 (1)).

Importantly, the aforementioned White Paper underlines the commitments of the country to conduct engagement in the Southern African Development Community (SADC) and South African Power Pool (SAPP) in favor of maximization of economic benefits (Koep & Van den Berg 2016: 229). The SADC Protocol on Energy 2006 binds its members to ensure environmentally sound use and development of energy (SADC 2006, Article 2 (8)). The annexure to the Protocol sets various guidelines for cooperation between member states. However in practice very little, has been accomplished in terms of the Protocol (Koep & Van den Berg 2016: 229). It does play an importance to Namibia, as the country is engaged to longer term projects in cooperation with other members of the region, and is willing to sell its presumable surplus electricity to these countries.

Feed-in tariff refers to a tariff which obligates utilities to buy energy at a fixed price in fixed terms. It is used as the most common tariff based incentive around the world (Bjork et al. 2011: 36). In addition, Namibia is considered to be on the way to accept the REFiT (The Renewable Energy Feed-in Tariff system) (Renkhoff 2016: 256). In Namibia, this tariff means that the power utility (either NamPower or Erongo Red) and the ECB will accommodate small to medium size businesses in the generation of power in differing RE sources from 500 kW to up to the maximum of 5 MW, once officially accepted and promulgated. If the generation exceeds 5 MW, an IPP needs to negotiate a power purchase agreement (PPA) with the off-taker, in this case with NamPower or other distribution entity. (Renkhoff 2016: 256 ;von Oertzen 2015: 117.) The tariffs are different for different RE resources, the tariffs for solar being the highest at the moment (Renkhoff 2016: 257).

Similarly, net metering is a consumer based RE incentive for the consumers who are connected to the grid and own RE facilities. During the time when customer's generation of electricity exceeds the use, excess energy flows back to the grid and offsets electricity consumed at a different time. (Renkhoff 2016: 261.) Net metering is common among the solar energy industry, for example in the case of residential customers with a rooftop PV system.[69] (Gachenga 2016: 185). In 2015, the ECB published its Net Metering Rules that are currently for promulgation at the Ministry of Justice.[70] Once in operation, all distribution utilities will have to offer net metering. (Renkhoff 2016: 261.) At the moment, only Cenored and Erongo Red offer net metering to their customers. Albeit net metering does not require long term commitments nor produce additional costs for the costumer, it does not become economically viable before grid parity[71] is reached, which is currently the case for PV systems. (Ibid.: 260.)

Finally, Power Purchase Agreements (PPA's) are usually considered as long-term agreements between parties. PPA's are usually a part of the feed-in tariff structure, possibly

[69] Photovoltaic system is a form of technology which converts sunlight to electricity (von Oertzen 2012: 8)
[70] This document could not yet be found online.
[71] Grid parity refers to a point where electricity generated from solar PV is cheaper and thus financially sounder than that supplied by the electricity grid (von Oertzen 2012: 8).

attached to other designs or outside the acquisition schemes. In the latter case, the agreements are negotiated between the parties outside the regulator's rates. (Renkhoff 2016: 242; Bjork et al. 2011: 42.) Till the year 2016, 27 licenses have been issued to IPPs' on wind, biomass, solar, water and coal. However, these licenses are conditional as the activities might not lead to the establishment of a power plant, and thus a potential IPP does not yet in this state enter into PPA negotiations with NamPower. Only when such activities are decided to be put into action, does the IPP need to make an agreement with NamPower on PPA, which regulates the amount of electricity fed to the grid as well as the purchase price for it. (Renkhoff 2016: 259.)

In summary, based on recent development, some renewable energy policies and projects have been established and further implemented in the Namibian framework. However, this development cannot be interpreted to have yet reached its full potential (Renkhoff 2016: 242). However, it seems that RE resources and the utilization of these resources are improving their position in Namibian energy markets. The new National Integrated Resource Plan (NIRP) from 2013 and the recent National Renewable Energy Policy for Namibia of 2016, both address the increasing role of IPPs in the markets, through the aim of shifting from a single buyer model to a modified single buyer model[72], and underline the importance of renewable energies. The recently published RE plan of 2016 may indicate a stronger shift towards a more coherent RE legislative framework.

6.3 The main urban energy regime members

The Ministry of Mines and Energy (MME) The Ministry may be characterized as the monitoring body of the Namibian energy sector and the primary promoter of energy policy. The MME is responsible of controlling and governing legal laws and regulations. The authority for the granting, transfer and renewing of licenses lies on the responsibility of the

[72] In practice this means that Nampower would continue to import and export electricity and to be the sole buyer of electricity. However, the IPPs could within this model sell electricity directly to distributors and the "so-called contestable customers", as long as such supply arrangements operated under the approval of the ECB. (von Oertzen 2015: 116.)

MME, which exercises this authority based on the Electricity Control Board's (ECB) recommendations. (von Oertzen 2012: 17.)

NamPower The parastatal NamPower holds the monopoly status in the electricity sector, which acts as the buyer and Namibian grid operator and is responsible for electricity production, delivery and transportation. It also exports electricity to neighboring countries such as to Botswana and Angola. Further, it is responsible for the overall stability of the national electricity network. (von Oertzen 2012: 15.) The end-users pay for the electrical reserves as well as for the maintenance of the electricity infrastructure (Renkhoff 2016: 258). As already mentioned, in some cases, after a license is issued to a IPP, a PPA has to be negotiated with NamPower.

Independent Electricity Producers (IPPs) IPP is a private entity that owns and/or operates facilities to generate electricity, after which it sells it to a utility, central government buyer or an end-user ("Energypedia" 2015). IPPs generally present various fields of energy provision. However, in this thesis, IPPs are solely referred to as actors in RE sector.

Electricity Control Board (ECB) ECB is an independent regulator, whose main role is to regulate and control the energy supply industry (ESI) and the electricity distribution industry (EDI). This regulation occurs for example through licensing and oversight of generation, transmission and through electricity imports and exports. The ECB also approves electricity tariffs and is responsible for screening, preparation and recommendation of ESI and EDI licenses for approval by the MME. (von Oertzen 2015: 116.)

Regional Electricity distributers (REDs) REDs are regional electricity distribution companies, which hold licenses for electricity distribution and supply. In areas where REDs have not been established, local authorities and regional authorities are responsible for the

availability of electricity and its distribution[73]. There are three operating regional electricity distributers in Namibia: Norec, Cenored and Erongo Red. (Chiguvare & Ileka 2016: 26.) Erongo Red purchases electricity from NamPower and distributes it to both urban and rural customers in Erongo region, to Walvis Bay as well as other institutions, municipalities and town councils, which are also the share-holders of the company[74] (Erongo Red 2015: 3). It also provides electricity to Namport, fishing industries, mining and other industrial customers located in its area of operation (cf. Erongo Red 2015: 4). NamPower owns 33 percent of the shares of the company (NamPower 2016: 7).

Namibia Energy Institute (NEI), and other NGOs Namibia Energy Institute NEI[75] has a mandate to undertake research development, capacity building and awareness-raising in the energy field (Jarrett & Dauti 2016: 8). Although, NEI does not primarily act as a market actor, it has an important role in energy sector development through various policy programs (Renkhoff 2016: 234). The role of_investors and NGOs, especially actively operating foundations, is remarkable when observing the energy regime, its transition and adaptation. There are currently various foreign foundations, and NGOs operating in the field, such as the German foundations: "Die Deutsche Gesellschaft für Internationale Zusammenarbeit" (GIZ), Kondrad Adenauer foundation and Hans Seidel foundation, which have been very active in promoting RE resources.

6.4 Scenarios

Based on the results of the questionnaire, energy crisis was not considered as a dominant force influencing urban development in Namibia; of course one must take into account the low number of responses. However, the following responses, which were mentioned in the questionnaire, may be considered as strong links to the energy system: first, increased consumerism, as people have different perceptions on energy consumption, especially when they obtain a higher standards of living; second, as in the case of water

[73] For example, the city of Windhoek is responsible for the bulk electricity supply of the city and is Namibia's largest distributor (Chiguvare & Ileka 2016: 26).
[74] These stakeholders are the municipalities of Walvis Bay, Swakopmund, Henties Bay and Omaruru; the town councils of Karibib, Usakos and Arandis and Erongo regional council (Erongo Red 2015: 3).
[75] Earlier NEI was known as the Renewable Energy and Energy Efficiency Institute (REEEI).

regime demand, energy demand operates as an urban push factor and third, the lack of laws in green_building have an influence on the rate of energy savings. Also income disparities, inequality and ineffective legal laws of decentralization process are connected to the electricity sector. It should be noted that infrastructure, industrial development and the process of modernization within society indicate a future increase in demand for electricity. These aspects will be discussed later in more detail.

6.4.1 Energy worst case scenarios

The Vision 2030 emphasizes research on renewable energies, growing skilled-based industry and sustainable use of natural resources. Thus, in the worst case scenario, the country remains dependent on external resources due to a lack of research, financial capacities and exhausted natural resource base (GRN 2004: 86). Moreover, the government states that its main goal is to reach the supply of 100 percent during peak demand and the supply of 75 percent from local resources by 2010 (GRN 1998: 24). As the goal has not yet been reached, the target has been postponed till 2018.

NamPower's two key strategies, in accordance with the government, are to achieve electricity supply of 100 percent during peak demand and supply of 75 percent from local resources by 2018 (NamPower 2014: 10). Thus, for NamPower, the failure in these targets would signify at least one type of a worst case scenario. This further includes the termination of the Kudu power plant project, continuing interdependency on South Africa and increasing energy prices. As a result, NamPower could face increased pressure as an energy supplier. In the worst case scenario, it might not be capable in fulfilling its role as an electricity supplier and might face a decreasing customer base of grid electricity due to the high cost of electricity. Other challenges include the lack of resources and the capacity to maintain and upkeep infrastructure and transmission system due to the growing need of electricity (Ibid.: 14).

The city of Windhoek is responsible for distributing electricity in its area, thus it is directly affected by the possible service interruptions from NamPower. As the city is currently

facing severe water shortage, the nexus between water and electricity is demonstrated in its case. For example, in the case of Van Eck, NamPower has been forced to drill two additional boreholes on the side to keep the plant operating (NamPower 2016: 77). As the station is already running at full capacity, it remains expensive to maintain and operationalize (von Oerzen 2015: 125).

The electricity distribution in the Erongo area is solely the responsibility of Erongo Red, whose dependency on grid material brought outside the country, such as South Africa, requires longer term planning. If Erongo Red encounters rapid shocks influencing the electricity demand, this might be very damaging for its energy provision. Moreover, the financial problems and inability to invest money might result in its incapability to successfully implement projects, such as grid upgrading projects (F. Mbango, personal communication, 23rd November, 2016).

The lack of electricity might seriously influence industries like the mining and fishing industries. As the mining sector is a very energy intense sector, in the worst case scenario, the lack of electricity could hinder the operational activities of the industry. As the case of Xaris power plant, which has been investigating the use of waste water, demonstrates, the industry is also very vulnerable when confronted with the interdependence of water and energy. In the worst case scenario, if the initiated plans will not proceed into operation, the decline in mining sector activities may further hinder the economic and social development of the country.

For the IPPs, the difficulties in accessing energy markets remain, which might lower investments and interests of these actors. The risks affecting the IPPs are macro economical; they are dependent on the fluctuations of the markets and are especially influenced by the country's stark reliance on South African markets. In the worst case scenario, the IPPs remain having difficulties in obtaining licenses from ECB, negotiating with NamPower and receiving loans and land for their industries.

6.4.2 Energy best case scenarios

In the best case scenario, the government is able to secure energy provision in a sustainable way and reach its goals described earlier. One of the main goals, in addition to secure energy provision, is to become almost fully self-sufficient in energy provision. However, it seems that the means of achieving these goals have developed from the use of traditional resources more towards the use of renewable energy resources.

For NamPower, one of the best case scenarios would be the achievement of its aforementioned goals in cooperation with the ministry and the regulator and the realization of the Kudu power station project (NamPower 2014: 5). Thus, for the parastatal it is important to maintain good relations with the Ministry of Mines and Energy and the ECB. The latter is considered important, as the parastatal considers the changing environment, the deliberations in the single buyer market structure and the new electricity law, further having "far reaching impacts on NamPower". (NamPower 2014: 5.)

As mentioned before, in the case of Windhoek, the key for its adequate energy submission relies on NamPower and currently on the functioning of Van Eck. However, in the short run, if the city desires to develop its local resources, it needs to cope with the water crisis. Currently, the municipality is conducting research regarding the usage of waste from the city's reclamation plant as a source of energy which could provide addition to the city's "portfolio of resources". The use of biomass from the water treatment plant, and NamPower's initiatives to use biomass from Van Eck plant, may provide some future prospects on bioenergy utilization. (Kinne 2016: 5.)

In the best case scenario, Erongo Red continues to provide electricity to its customers without disturbances and blackouts. In addition, the company could benefit from a new desalination plant and would be able to continue the provision of a sufficient amount of serviced land with adequate funding for the growing population. The development in solar battery technology would increase the company's opportunities to store electricity. Erongo Red has been increasingly interested in renewable energy resources and has planned to implement case studies on wind generation, on the separation of waste and water, on

battery saving technologies and on projects related to better grid connectivity. (F. Mbango, personal communication, 23rd November, 2016.)

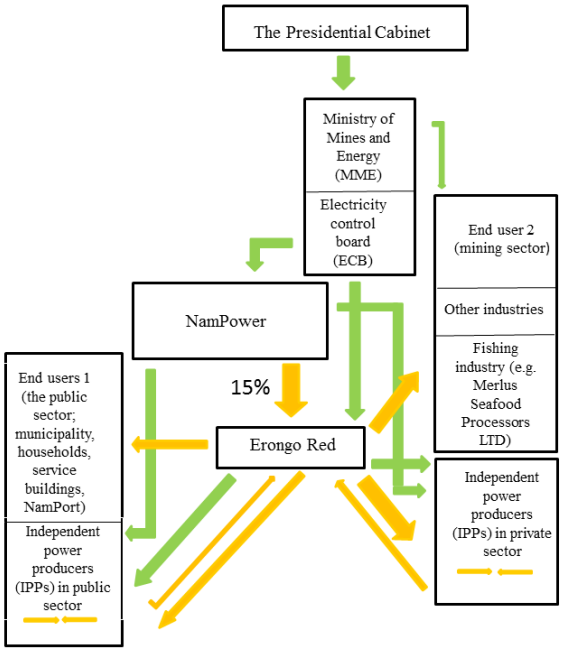
The mining industry is highly dependent on electricity provision and thus the positive future aspects of the industry are related to adequate and uninterrupted electricity supply. In addition, in the best case scenario for the both the mining and the fishing industries, the prices of electricity remain economically viable. This is highly related to the construction of the new desalination plant and to the success of Xaris power plant initiative in the Erongo region. For the fishing industry, the affordability of solar energy becomes valid and the possibility to become self-reliable on electricity (Merlus staff, personal communication, 29th September, 2016).

As mentioned earlier, the IPPs are dependent on a stable macro-economic landscape. Moreover, in the best case scenario, these actors would have a better access to the markets via structural changes in the system. One of the most important challenges is related to the lack of information, funding and training. Also, receiving loans for bigger projects has not been seen as profitable, as these loans usually have a short payback time (E. Naoxas, personal communication, 30th of October, 2016). Thus, also structural change and a mental change towards financing are needed from the viewpoint of IPPs.

6.5 Urban energy regime and the membership network

As in the case of urban water regime, the energy regime is defined here according to geographical lines, consisting mainly of the city of Walvis Bay and the Erongo area. Other city regimes, here the city of Windhoek, are compared to the operating regime. The nationwide energy regime (such as ECB, ministries and NamPower and Erongo Red) is examined as a layer influencing the operating urban energy regime. The urban aspect of the regime covers the task of the regime, which is, the provision of modern energy to the growing population and industry as well as the self-sustainability of these resources.

The regime is organized in a very centralized manner, as the power of influence is divided only for view. Electricity distribution is strongly centralized to NamPower, as Erongo Red redistributes the electricity supply obtained from NamPower and determines tariffs for this supply. If an IPP wants to enter the energy markets, it first needs to negotiate with NamPower, and in the local level, with Erongo Red.



Graph 5. Urban energy regime member network. Colours (arrows): yellow: supply, green: permits, licenses and tariffs. Nationally, the industry consumes approximately 60 percent of the total amount of electricity, the residential sector 20 percent and the public and commercial sector 15 percent (Rämä et al. 2013).

The graph demonstrates that the strongest dependency is formed between NamPower and Erongo Red, as Erongo Red purchases its electricity solely from NamPower. Erongo Red consumes 15 percent of the total electricity requirements of the country (Erongo Red 2015: 3). Currently, the system is characterized by a single-buyer model, in which NamPower has the role of all electricity trading in the country, internally and externally. Some forms of self-production of electricity may be observed (yellow arrows opposite to one another) but yet, due to insufficient tariff formulation on a national level, and in some case perceptions of relatively affordable electricity, this is still a minor activity.

A local IPP first needs to negotiate on tariffs with Erongo Red and further proceed to the ECB in order to obtain a license. Households or clients who wish to own a solar panel, first need to fill in a form and after that obtain a monitoring intelligence meter, to ensure that the energy feed-in does not exceed the allowed limit and thus damage the system (F. Mbango, personal communication, 23rd November, 2016). As mentioned earlier, if the generation of an IPP exceeds 5 MW, an IPP needs to negotiate a power purchase agreement (PPA) with the off-taker.

6.5.1 Niches

In this section, this thesis focuses on the two following niches: on the solar energy niche and on the bioenergy niche. Namibia has taken initiatives in the installation of solar water heaters (SWH) from year 1990 onwards and as of today, the use of these collectors has become common countrywide and these collectors have consolidated their status among the locals and investors (von Oerzten, 2012: 8). Moreover, the same may be considered in the case of photovoltaic (PV) technology, as it is the only technology which reaches grid parity. This strongly indicates that the niche on solar energy technologies has already broken through in the system, although in a smaller scale and mainly in an off-grid environment, such as rural areas. The HopSol Solar Park has been one of the view exceptions of the bigger scale solar projects, but the number of similar projects has increased in recent years.

Even though at a global level, renewable energy technologies have become more affordable due to general development in technology and due to positive change in general atmosphere on a global level, there are still different perceptions among the sectors and even among the population, whether the technology is received as affordable and further profitable. Some critics mention the remaining challenges to include insufficient and expensive battery technology and long investment time. Solar energy does not provide a constant stream of electricity to the grid and may thus be considered in some cases as an unreliable source, especially among the regulative bodies. Moreover, the regulation supporting feed-in activities is not yet solely in place.

In the case of bioenergy, national studies have aimed at initiating a promotion of sustainable biomass usage in rural areas (Koep & Berg 2016: 228; GRN 1998: 2). Biogas can be generated from different sources of organic material, such as plants, dung and human waste. With technological support and guaranteed markets, abattoirs, feedlots, waste disposal facilities, water treatment plants and some farms could benefit from this source of energy. In addition to providing energy for their own needs, these instances could support in generating energy for other operators (Schütt 2016: 54). Recently a growing interest towards the use of invader push as a source of biogas has resulted in a number of studies of the subject (see for example Chiguvare & Ileka 2016: 32; von Oertzen 2015: 79).

In the case of urban environment, the bioenergy niche, in the form of a use of effluent waste from a water treatment plant, is under study. However, challenges include the separation of the waste, such as organic waste from other substance such as rubble and the insufficient amount of waste at the moment in the city of Walvis Bay. Thus, this niche might still be in the development phase in urban areas, though has been further developed in the case of farms and other rural areas where waste collection may be implemented in a centralized way.

It should be noted, though not fully examined under the scope of this thesis, that wind power technologies possess some great possibilities in electricity generation especially in the coastal side. As noted earlier, Erongo Red has been interested in possible future wind power technologies. However, in Walvis Bay, sandstorms cause challenges in the maintenance of this technology.

In conclusion, it seems that although the system may not at the moment be fully ready for let us say, to the energy system operating full on solar, it has made some remarkable shifts towards renewable technologies in general. However, for the time being, so-called hybrid solutions may be the most viable solution as an emerging type of niche. This short of hybrid solution might for example combine solar PV systems during the daytime, wind power, and biogas to fill in the gaps when these two resources cannot meet the need (Schütt 2016: 42).

6.5.2 Selection pressures

Dependency on South Africa and its own growing crisis has opened up the discussion on the need for Namibia's self-sufficiency in electricity provision. During the last decades, the South African electricity public utility Eskom has been the single largest external contributor to Namibia's electricity supplies by contributing between 38 percent and almost 53 percent to the total electrical energy sold by NamPower (von Oertzen 2012: 25). As Eskom previously has had a surplus of electricity, it has been able to sell electricity at an extremely low price. Thus, renewable energy was not considered as worthwhile (Renkhoff 2016: 234; Simasiku 2011). Since then, the situation has changed dramatically, as South Africa is suffering from national energy crisis. In the year 2010, Eskom negotiated on tariff increase of 25 percent each year for three years (Simasiku 2011). This trend has continued on annual basis.

In addition, it seems that the potentiality especially related to solar technology has resulted in a general enthusiastic atmosphere in Namibia and resulted in numerous workshops, events and seminars on the development of these technologies, usually on a weekly basis. These events have altogether increased the change of ideas between local actors, such as ministries and educational institutions, foreign experts and NGOs. As the new renewable energy policy of 2016 has recently been published and the increasing debate on the importance of energy independence has become stronger, it seems very unlikely that the current regime would not be on the way to a transition. However, the success of the Kudu power station and positive developments in neighboring countries as well as on a global scale, resulting in cheap electricity provision, are some feasible forces, which could stabilize the existing regime. In addition, as the protection of NamPower has in the past provided many advantages for the end-users in Namibia, as this protection has resulted in an international credit rating that has enabled favorable terms in agreements (von Oertzen 2015: 116). Thus, the question remains, if and to what extent, the regime would open up in the future.

6.6 System adaptation

Currently the IPPs face various difficulties in entering the energy markets in Namibia. Especially because these difficulties are related to negotiations of power purchase agreements with NamPower, which have to be negotiated if the electricity provision of these IPPs exceeds 5 MW, before the new electricity distribution business may begin. Other concerns stem from possible changes in regulations and laws and therefor associated risks. Thus for an IPP, entering the market may prove to be difficult. This all may change if the proposed modified single buyer model, would allow the IPPs to sell power directly to distributors and large users, comes into force (ECB 2016: section 2.2.). The renewable energy provision especially in urban areas may be summarized, in addition to the aforementioned decentralization, in two legal developments: first, the proper implementation of green building and net-metering regulations in growing urban centers and second, to the development of a policy framework regarding feed-in tariffs. However, despite the delays in these developments, it seems that the energy regime possesses governance capacity both on the national layer of the regime and especially on the local level, in case of Erongo Red, which already provides net-metering to its customers.

Whereas in the case of the water sector, the NEI and other foundations and NGOs together with the governmental bodies, have engage in active conversation and interaction in forms of seminars, workshops and other public debate. These instances have also provided assistance in the development of policy framework for RE. This is an illustration of the social capacity the regime possesses.

As was mentioned before, each policy goals[76] of the White Paper where examined in eight different scenarios under the REEECAP initiative. As a result of the study, no single scenario could satisfy all the policy criteria. Some options presented economic efficiency, but did not maximize the use of renewable resources. Others seemed to present affordable options, but did not guarantee the security of supply. Others maximized the use of renewable resources but were considered expensive. (REEECAP 2008: 11.) Recently

[76] These goals were the security of supply, social upliftment, effective governance, investment and growth, economic competiveness, economic efficiency and sustainability, see also page 82 of the thesis.

however, the general perceptions on renewable energy have begun to change along the improved technology and changed perceptions towards these sources of energy on a global level.

In the case of material capacity, as noted previously, technology and material needed for grid maintenance and development was in many cases imported from South Africa or from other neighboring countries. This then created a situation, in which Erongo Red needed to be aware of the future changes and developments beforehand. As the regime may operate on an ad hoc base due to lack of communication or information flow, this might have serious influence on the system's adaptive capacity. Moreover on a national level, Renkhoff (2016: 245) argues that since independence the country has made great efforts in both grid and off-grid electrification resulting in a good network coverage in comparison with other SADC countries today. However, it is contested whether the condition of this grid is sufficient enough to bear future import of electricity (Chiguvare & Ileka 2016: 3).

Currently certain cognitive frames influence the way RE technology is adapted in Namibia. For example, in addition to safety and technical issues, bi-directoral meters, which are a precondition for net-metering activities, are considered to increase the complexity of administration of accounts. Thus the utilities are not fond of them. (Jarrett 2016: 26.) Even though interests towards investments in RE technology have generally grown in Namibia, the expectations of Namibian investors are usually characterized by a requirement to gain profit as soon as possible and as a result; they are not keen to wait for a period of, more or less, 9 years before they receive their investments back. The potential IPPs may consider facing unbearable risks in entering the market, thus feeling insecure to invest generally. This may be the similar case with the regular households, who may consider technology too expensive compared to the benefits and in some cases, may not understand the long-term value of the investment. Moreover, even though solar panels have become more affordable as the technology has advanced, these panels are still considered unaffordable among underprivileged. Solar-panel theft has become a considerable issue in Namibia recent years (Renkhoff 2016: 254). Solar panels also cause operating costs related to equipment services and panel cleaning (von Oertzen 2015: 93). The latter is especially the case in Walvis Bay,

where sandstorms influence the operation of the panels. Hence, the maintenance of the panels requires professional capacity.

As mentioned above, to ensure the operation of RE technology in the area, where it is installed, there is a growing need for an increased amount of professional capacity in the form of vocational training to train workforce for maintenance.[77] This training could be profitable especially among the youth in Namibia, as one of the main reasons for youth unemployment is stemming from a mismatch of skills. An interview revealed that among the course attendees of Young Africa, a local NGO in Walvis Bay offering skill training on solar panel installation, approximately 80 percent of the graduated were employed. However challenges include, the amount of female participants in the course was seemingly smaller, the lack of teachers and their small salaries and especially attitudes of youth towards this type of education. (D. Bellens, personal communication, 29th September, 2016.)

Picture 2. Students practicing solar panel installment at Young Africa.

Certain attitudes towards skill training can be related to a more general cognitive frame of what is considered as valuable education in the society. In Namibia, university education is

[77] Skill training activities are also going to be held under SOLTRAIN 3 project of 2016-2019 (Etango magazine 2016: 7).

in many cases considered as a goal one should pursue, whereas vocational training might not hold such social status in the culture.

As the population becomes increasingly wealthy and the society modernizes the need for electricity intensifies and the consumption of electricity increases. Therefore, awareness-raising on sustainable consumption of electricity is one of the key measures to ensure adequate supply in the future. In addition, it should be noted that the switch to renewable energy from fossil fuels may also reduce greenhouse gas emissions, which have been related to climate change (Ruppel & Ruppel-Schlichting 2016: 269).

Moreover, as it has already been mentioned, there seems to still be an ideological division between those, who find that the future energy provision should be first and foremost be secured through Kudu power station, such as the MME and NamPower and those, who envision a future society solely based on renewable energy, such as many energy experts of foundations and institutions. Even if the latter would in many ways, under right and developed measures, be a more sustainable option in the long run compared to Kudu gas field with a life span of 23 years, convincing the regime members of the regime of the advantages of this solution is another matter. In addition, between these opposing poles there are various differing visions of "energy mixes", in which these resources receive different levels of emphasis. However, it seems that the shift in perceptions of the role of the Kudu power station is slowly changing. For example, the current Minister of Finance Calle Schlettwein stated a few years back that "the country does not have the financial resources to implement the Kudu Gas project that will stretch the country's borrowing to undesirable levels" ("No cash for Kudu! Finance and MME Ministers clash as project is put on ice", 2015). If the project was to be replaced by other options, the question remains, what might these options be?

As the more de-centralized model seems to become a reality, one could argue that the IPPs might become more important members of the regime in the future. However, as was discussed earlier, the protection of the state parastatal has resulted in advantages to the electricity end-users in the past. Thus, it remains open, how de-centralized would the new

regime be in practice? On the other hand, due to uncertainties of an investment environment, the influential members might be the regular consumers, who would now have more options in their energy usage or even become self-sufficient in electricity provision. According to von Oertzen (2015: 19) there are still an estimated 74 000 households located in peri-urban areas of the country that do not have an access to electricity. According to Schütt (2016: 41), even if all the households in Namibia would be technically attached to the national grid, the majority could still not afford rising prices of electricity, which is supported by the centralized energy system. Thus, a percentage of the people, who still can afford grid-bound power, might shrink, as the more well off population turns to self-generating solar power, considered cheaper than purchasing electricity from the grid. As a result, in addition to paying their own share of a price increase, the remaining minority might be left with the burden of paying the share of the ones who have left. In the end the poorer part of the population might have no other option than to leave the grid itself. (Schütt 2016: 47-48.) The forces of income disparity and inequality thus not only create challenges to the energy sector but the current structure of the energy system also deepens these forces.

6.7 Transitions

The RE technologies have been generally receiving an increased in attention in Namibia due to perceptions on the potential the country possesses towards these technologies and due to the threats of dependency on exported electricity in the future. However, there are still varying perceptions towards the sustainable options of energy provision, as the government has traditionally emphasized a single-buyer model and the success of the Kudu power station as the main electricity provider of the country. However, due to increased interest of households and private businesses towards the RE technologies, the energy regime on a national level seems to have taken steps towards the take-off phase in transitions. The strong interest of international NGOs and various mutual multi-stakeholder partnerships seems to support this scheme. As Erongo Red has locally taken initiatives in providing its customers net metering opportunities and seems to engage in activities supporting RE, this could further signify that Walvis Bay is in a take-off phase in transition

model. It could be even further onward in this development, whereas the city of Windhoek, where net-metering practices are still in a pilot phase.

However, there are some possibly hindering factors influencing the transition of the energy regime. For example, as the energy system has strong linkage to the water and sanitation system, the possibly worsening situation in water and sanitation system could have a negative impact on the energy system. This is not only the case on the national level, but also on a local level. On a regional level, as the long-term projects planned by the government were mostly founded on the cooperation with SADC members and neighboring countries, the possible threat of disputes over shared river courses might at its worst, hinder these relations. On the other hand, positive developments in the energy sector could have similar influence on the current water sector as technologies, such as water desalination, require electricity. Other possible hindering factors in energy regime transition could be drawbacks in legislative development. These might include failure in implementation of RE supporting policies, monitoring of them, possible failure, or even unwillingness, to open markets for new IPPs. In addition, the RE technologies may not be considered economically viable among investors. Similarly to the case of water system, the drop in energy demand, due to decreasing economic activity, might create a discourse of adequate supply. Also, the decrease in energy prices on a global level could further create, or strengthen, a national mental discourse of self-sufficiency. These factors may impede the decision-making process on a national scale, as well as a local scale. This in turn, could very well lead to factors which force a backlash in the system.

7. CONCLUSION

The overall aim of this thesis has been to understand the operating urban environment in the Namibian context, in order to further understand the problems influencing sustainable urban development in the sectors of water, sanitation and energy. This understanding may contribute to the future work of stakeholders in capacity building in Namibia and in developing countries. Furthermore, the thesis focused on the urban infrastructure governance of these sectors. This question was addressed by conceptualizing these sectors as "urban systems", in line with the CAS theory. As the main focus of the thesis was to understand the process of sustainability transitions, that is, how the system – at least hypothetically, would transform into a more sustainable system, this thesis adapted the frameworks of the transition management (TM) and multilevel perspective (MLP) presented in chapter 2. This thesis adapted the transition frameworks to describe the positions of these systems in the transition model, to identify the most influencing regime members of the systems and to identify possible niche technologies in the potential transition. This thesis adopted the critical viewpoint of political ecology, moreover, not only to examine the actors, who participate in the governing of resources and infrastructures, but also to focus on the actors who were left out in this process. Finally, by using a modified adaptive capacity framework based on the division by Smith et al. (2005), the thesis described different capacities the regime members possessed.

To answer the aforementioned questions, chapter 3 presented the methodological underpinnings of the thesis. The methodology of the thesis was grounded on a case study and the methodological background also delivered from qualitative field research, especially from the participant observation method, as most of the material was received during an internship period of three months in Windhoek, Namibia. This material included interviews, informal discussions and printed material, such as books and newspapers. In addition, to respond to the question influences on urban development in Namibia, the questionnaire, in line with the PESTEL approach, was drafted and further sent to external experts of the field. Despite some challenges in receiving responses, the following themes were considered as the most influential forces in urban development: 1) water crisis, 2) land

ownership and housing, and 3) structural deficits. Other considerable answers included urban spatial planning, public transportation and economic and social issues. Energy was only mentioned by one respondent. The thesis utilized other material available and informal discussions with the relevant stakeholders and experts. In addition, local newspapers were used in order to seek broader discussion in society.

To answer the different visions and expectations of the relevant actors of the two fields, the thesis used interviews, printed material and especially strategies and reports of the organizations. Even though challenges remained in distinguishing of "whose voice counts" and in reaching the deeper level of these visions and "collective minds" of the organizations, some general differing perceptions towards the niche technologies and about the future positions of the organizations in the urban development were discovered. In the thesis, the interviewees were asked about the worst and best case scenarios of their organizations, after which the thesis drew the worst case scenarios and the best case scenarios of the two sectors. This demonstrated that first, presenting the impossible nature of the forecasting of these developments in general and second, illustrated how these differing ideas of actors' position do not only influence on their actual positions in the future, but to the positions of the others. These results were discussed in more concrete in the case of the water and sanitation and energy system analysis.

Chapter 5 focused on the water and sanitation sector first by presenting the current situation of the sector. As a result of Namibia's problematic climate, high levels of evaporation and varying level of rainfall, water resources are unequally distributed among the different areas in the country. In general, the forces influencing the development of urban water sector were the water availability and climate change, the influence of water scarcity on food security, food production and further influence to the employment in rural areas, was considered as an urban push factor.

The current methods used in fresh water provision were mostly concentrated on underground water drilling, collection of surface and flood water, water conservation and waste water recycling. However, the use of aquifers and the collection of surface and flood

water were considered, at least by some experts, unsustainable from an environmental aspect.

The presented regime members in the urban water regime were the state parastatal NamWater, the Ministry of Agriculture, Forest and Forestry, the municipality of Walvis Bay, public end-users, such as households, service buildings and other individual users, the fishing and mining sectors and other industrial sectors and from an environmental point of view, the Ministry of Fisheries and Marine Resources (MFMR) and the Ministry of Environment and Tourism (MET). The urban water and sanitation regime was defined in terms of a multilevel approach to address the national situation in comparison to the local level, Walvis Bay. The regime was characterized by multiple sets of legislation, and it relied on the outdated Water Act of 1956. Moreover, from an environmental perspective, the implementation and monitoring of laws was considered in many cases inadequate. In addition, the local authority, the municipality of Walvis Bay, bears many responsibilities from water provision from service delivery and infrastructure management to sanitation service provision. The most pressure was thus centralized on NamWater and Walvis Bay. Of course, by defining the regime in such a simple manner, many concessions and simplifications had to be made in modeling and description of the regime.

Through the different perceptions of the actors it was discovered that the coastal city of Walvis Bay and the inland city of Windhoek were considered to be in different levels of transitions. The city of Windhoek, which has suffered from water shortage already for a long period of time, has been influenced with greater strength by the recent drought and various measures had to be taken to restrict water use in the city. As the city is additionally relying on unsustainable measures in water provision, it was portrayed as currently situated in a lock-in phase of the transition. However, as the most middle income or high income citizen have easier access to potable water; the perceptions of the system vary significantly among the members inside the urban system. The national level was considered to present a lock-in situation in the regime, as the government has failed to promulgate the Water Act of 2013 and it is was considered unclear among the members of the regime, which legislation was legally binding. The city of Windhoek has mainly been reliant on future rainfall and a

decentralization process of the city inhabitants, which in one way could add more pressure on the city of Walvis Bay. In the city of Walvis Bay, the overall situation of water provision has been considered generally good and there were no water saving policies or policy guidelines for climate change to be promulgated. Thus, at the local level of the regime, Walvis Bay was considered to be in a pre-development phase in the transition framework. In addition to the different perceptions of the amount of water resources, the perceptions varied towards the ownership of the future desalination plant. It seemed to both be in the government's interest to own such a plant as well as in the interest of the private sector. However, varying information was provided on the government's actions and the choices the government had implemented in practice, underlining the overall question of whether the water crisis and its broader effects are understood deeper within the political structures.

The lack of information is was further related to the lack of public domains for discussion, which further inhibited the exchange of ideas among experts and government officials and left some regime members, such as public end-users, households and marginalized groups out of discussion. The lack of professional skills was concrete in the case of Walvis Bay, where the lack of a skilled workforce threatened the condition of the sewerage infrastructure. Further education and awareness-raising became important in the case of sanitation, which was further bound to social issues and health hazards. In addition to the changes in governmental actions, the future visions and actions of the industries and their financial capacity on water technology become an issue of discussion. However, if the perceptions towards water are not changing, no matter how much water is available in the future, future generations will need to bear the price. It is argued the increasing complexity of the urban water system is questionable. On the other hand, the system is already suffering from a high complexity, where different members seem to obey different rules. Moreover, the regime lacks some key monitoring institutions such as a Water tribunal and Water regulator. In conclusion, this example of governance is not in line with the multi-level governance theorists as in this case, the government does not have the capacity to monitor the different levels.

All in all, the water crisis influences deeply to the various sectors of urban and general social and economic development. As was illustrated in the case of Windhoek, scarce water resources are already halting some construction projects and industries from operating. The question of individual users and the rising number of these imposes an alarming social phenomenon, which may lead to the increasing inequality among those who can afford water and those who cannot.

In the case of urban energy regime, the thesis further focused on the access and provision of modern energy. Namibian energy system as a whole is characterized by high dependency on imported electricity from South Africa and a single-buyer model structure, which is dominated by the state parastatal NamPower. Other members of the regime in this thesis were the Ministry of Mines and Energy, the Electricity control board, Erongo Red, Independent Electricity Producers (IPPs) and the Namibia Energy Institute (NEI) and other NGOs. Even though Namibia is blessed with abundant sources of renewable energy, still, if the use of hydro-power is excluded, the share of renewable energy in energy provision is marginal. The government has traditionally treated these solutions related to off-grid solutions. Only in recent years, the legislative initiatives have risen on the political agenda, and have opened up for the IPPs to produce and sell electricity to the single buyer. The IPPs have had difficulties in entering the market in Namibia, as a potential IPP needs to go through measures of obtaining licenses, if its electricity provision is exceeding 500 kW, and if exceeding 5 MW of electricity production, needs to negotiate a power purchase agreement with NamPower. Especially in the urban environment, the development and promulgation of feed-in tariffs and net-metering rules has been relatively slow.

What was considered as one distinguishing feature between the water and sanitation regime and the energy regime, was the willingness for the members to engage in discussion in the energy regime and the visible role of the NGOs, institutions and foundations in this development, thus increasing the social capital of the regime. The similar development was not observed to a same extent in the water and sanitation regime. There are several reasons for this, some of which were already discussed in the scope of this thesis.

Moreover, the conclusion was that the regime is characterized by an ideological division between those, who find that the future energy provision should first and foremost be secured through Kudu power station, such as the MME and NamPower and those who envision a future solely based on renewable energy, such as many energy experts of foundations and institutions. Of course, one possibility, undermined by this thesis is a future, where two of these options provide electricity side by side. It seems that the shift in perceptions of the role of Kudu power station is slowly changing. As the recent couple of years has demonstrated, the number of RE based initiatives has grown. Together with the recent developments in RE legislation and the government's willingness to shift from a single-buyer model to modified single-buyer model, the regime was situated in a take-off phase of transitions.

However, some potential hindering factors in energy regime transition were discussed. These could include failure in implementation of RE supporting policies, monitoring of them or the failure, or even unwillingness, to open markets for new IPPs. In addition, the RE technologies may not be considered economically viable among investors. Similarly to the case of the water sector, the drop in energy demand, due to decreasing economic activity, might create a discourse of adequate supply. Also, the decrease in energy prices on a global level could further create, or strengthen, a national mental discourse on electricity self-sufficiency. These factors may impede the decision-making process on a national scale, as well as a local scale. This in turn, could very well lead to factors which force a backlash in the system.

This thesis has marked the need for a deeper understanding of the relation between water and energy, as this relation is essential in urban development and for further implementation of MLP approach in a context of developing countries. In addition, as the MLP theory has been criticized for not considering the politics enough in the transition process, the fields and theories of political science may assist in developing the theoretical framework further. This is the case especially in sustainability transitions, which often incorporate normative and political aspects, require observation of the poor and marginalized groups and especially differing perceptions the regime members may hold

towards the current situation and novel technological solutions. Despite their shortcomings, such as challenges in categorizing of landscape forces and defining the regime level, the two approaches, the MLP and the TM, have supported the modelling process of the urban systems. Even though this modelling process may have left some issues examined, it has assisted in conceptualizing, naming the problems, and demonstrating a complex matter into a more understandable form. As a result, this conversation may further assist in capacity building of these sectors and possibly other sectors in a wider urban context.

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