THE TRANSITION TO SUSTAINABLE CONSTRUCTION IN BOTSWANA: A MULTI-LEVEL PERSPECTIVE

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Dedication

This thesis is dedicated to my family who believed in me throughout the PhD journey. Your support was immeasurable.

Abstract

Interest in sustainable construction has grown in developing countries. The Government of Botswana has over the years introduced a number of initiatives with the potential to transform the construction sector to sustainability.

It is noted from a socio-technical perspective that transition depends on changes in technologies, infrastructures, institutions, social practices, markets and regulations among others. The multi-level perspective (MLP) approach draws attention to ways in which these configurations change to fulfil societal functions. It has been used in the western world in historical case studies to trace socio-technical changes. What is less clear is how a combination of discrete initiatives can support a transition in a less economically developed country. The multi-level perspective (MLP) has been used to study transition from one socio-technical system to another. MLP in this study is applied to a single sector; the construction sector in Botswana, to analyse the contribution of a combination of different initiatives to an ongoing sustainable transition. These include a demonstration project, environmental impact assessment and a new construction board. Opportunities and challenges that have/are being created by the initiatives are examined in the process.

A mixture of in-depth interviews and document analysis were used to study the impact of the initiatives on the construction sector, the reasons for these effects and their implications for the transition to sustainable construction. It has been found that the initiatives influenced on-going efforts towards professionalization in the construction sector. Other effects include introduction of new governance techniques from abroad, produced a valuable ecological profiling of the country and transferring knowledge and technology both within and outside of BOTEC. The

MLP focus on visions, learning and development of social networks in transitions have been used to help account for these outcomes. The analysis identified a number of opportunities that the initiatives introduced, but which have yet to be fully exploited. The contribution of the thesis is a reflection on the potential of discrete innovations to contribute to a transition and the use of MLP to study an emergent transition in the construction sector in Botswana.

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Best wishes to all of them…

Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

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Abbreviations and Glossary

ABCON	Association of Botswana Building and Civil Engineering Contractors
ADB	African Development Bank
ARC	Architect Registration Council
BCIA	Botswana Construction Industry Authority
BEAPA	Botswana Environmental Assessment Practitioners Association
BHC	Botswana Housing Corporation
BIDPA	Botswana Institute for Development Policy Analysis
BOCCIM	Botswana Confederation of Commerce Industry and Manpower
BONCIC	Botswana National Construction Industry Council
BOTEC	Botswana Technology Centre
BPC	Botswana Power Corporation
CIDB	Construction Industry Development Board
CIRIA	Construction Industry Research and Innovation Association
CSO	Central Statistics Organisation
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
ERB	Engineers Registration Board
IAIA	International Association for Impact Assessment

IMF	International Monetary Fund
IUCN	International Union for Conservation of Nature
KCS	Kalahari Conservation Society
LGLH	Local Government Lands and Housing
MFDP	Ministry of Finance and Development Planning
MIST	Ministry of Infrastructure, Science and Technology
MLP	Multi-level perspective
NCSCA	National Conservation Strategy Coordinating Agency
NEPA	National Environment Policy Act
QSRC	Quantity Surveyors Registration Council
RIBA	Royal Institute of British Architects
RICS	Royal Institute of Chartered Surveyors
SADC	Southern African Development Community
SD	Sustainable Development
SNM	Strategic Niche Management
TIS	Technological Innovation System
TM	Transition Management
UN	United Nations

Chapter 1: Introduction

1.1 Background

The Botswana construction industry has been subject to legislative directives and state interventions in the form of programmes and public policy instruments aimed at promoting change in the construction industry. Some of the programmes and policy initiatives were aimed at giving citizen-owned construction firms an advantage to compete with international firms based in Botswana (Palalani, 2000). The other policies were aimed at changing procurement practices by increasing participation of local contractors (Adolwa, 2002) while some of the initiatives were aimed at moving the construction sector towards sustainable construction. The common denominator for all these programmes was that it was the Government that had to act as the driving force for change. It is the latter policies aimed at moving the construction industry towards sustainable construction that are the subject of this investigation; to understand how change unfolded due to the introduction of the initiatives.

There are challenges of introducing policies for sector-level change in developing countries such as Botswana. The challenge is to do with the governance and institutional-related issues that has to oversee the introduction of the policy initiatives. Governance is used to refer to institutionalized modes of social coordination [relating to introduction of policies for sector level change] to solve collective action problems and provide binding rules and regulations, as well as public goods and services (Börzel and Risse, 2010). According to Börzel and Risse (2010) governance consists of both structure and process. Governance as structure relates to institutions and actor arrangements and as a process relates to how actors engage in rulemaking and implementation and in the provision of collective goods.

The governance and institutional issues in developing countries include the lack of proper planning and insufficient funding support for the change initiatives (Emodi and Ebele, 2016), absence of a clear pathway and leadership especially from government (Kaboyakgosi and Marata, 2013), lack of stakeholder engagement and unclear roles and responsibilities among the major stakeholders (Emodi and Ebele, 2016). Another factor is that some organisations tasked with the responsibility of introducing the policies do not possess the requisite manpower or skills to effectively implement the change process (Kaboyakgosi and Marata, 2013).

There is a failure by most theoretical literature and in particular transition theories to address the governance issues in developing countries such as Botswana. Supported by a transition theory and concepts, this research aims to explore the process and transformative potential of three government initiatives in accelerating a change to sustainable construction highlighting the governance issues that shaped the development process of the initiatives. The initiatives include: development of BOTEC demonstration project, the introduction of Botswana Construction Industry Authority and Environmental Impact Assessment Act.

The provenance and contribution of the initiatives to transition the Botswana construction sector towards sustainability has not been empirically investigated. Such an understanding of their contribution and potential is important for the Botswana construction sector. The Botswana construction sector has been saddled with problems including lack of electricity, poor delivery of construction projects resulting in time and cost overruns, quality problems of the finished product, and pollution problems. While the research focused on Botswana, the analysis produced findings which are relevant to other developing countries in their efforts to transform construction and other industry sectors.

The research adopts a case study approach to empirically investigate government policy initiatives and their transformational potential. Data was mainly gathered by interviewing relevant key actors involved in the three initiatives. A key finding of this study concerns the critical importance of improving organisational capabilities and professional competences to complement the change initiatives.

1.2 Aim and objectives

The aim of this research is to explore the role of Government policy initiatives in Botswana's transition to sustainable construction. The research explores the development of three Government supported initiatives. The multi-level perspective (MLP) is used as a lens to explore the process of development, account for the driving forces for the implementation of the initiatives and their contribution to change towards sustainable construction.

The specific objectives are:

1. To analyse the on-going contribution of the three government initiatives to sustainable construction
2. To use the analysis of the specific initiatives to identify the relevant institutional structures and explore their role in shaping the development of the sector.
3. To explore the influence of prior developments on the direction/nature of change
4. To consider the implications of that analysis on the move towards sustainable construction in Botswana in particular and developing countries in general

1.3 Limitations

The scope of the study is limited to exploring the on-going contribution of three policy initiatives in the Botswana construction sector. Most previous studies using MLP, assume transitions begin in 'niches'. It is the assumption of this thesis that transitions result from

multiple change processes at niche, regime and landscape levels. The research operationalised the MLP to study short term transition contrary to its normal use focusing on long term historical transitions. MLP was used to explore the short-term contributions of the initiatives to a transition of the construction industry in Botswana to sustainable construction. However, the use of MLP to study short term transitions could have led to the premature conclusion that some of the initiatives were not successful. It takes time for policy initiatives to work their way through and this study has not examined the long-term effects.

1.4 Theoretical approach

The Multi-Level Perspective (MLP) is used to develop an analytical framework which is able to analyse the interactions between multiple elements within socio-technical transition processes. The MLP transition theory uses concepts of niche, regime and landscape. The regime represents the deep structure of a socio-technical system and contains its basic logic of functioning, while radical innovations emerges in niches that challenge the established regime structures. Regime and niches are embedded in a broader landscape level, i.e. the level of external influencing factors that shape overall developments. Key concepts include visions and expectations, learning processes, development of social networks and changes in rules. The analytical framework from MLP is used to explore the interactions of policy, technology, infrastructure and knowledge in change initiatives. More specifically the framework is used to explore what happened in each initiative, and their implications for a more general understanding of the contribution of Government policy initiatives to sector level change.

1.5 Summary of research design and methods

The focus of this research is to explore the processes by which the initiatives were conceived, developed, and are contributing to a transition of the construction industry in Botswana towards sustainability. An account of what happened during the development process of the three government initiatives is essential to understand how policy initiatives develop and evolve through the process of implementation and their consequent effects. A qualitative research approach was chosen as the most suitable approach to studying these issues. The qualitative research method focus on interpretation rather than quantification and concern with the context; both of which are important in the study of a change process. A case study approach was adopted as it facilitates an in-depth investigation of a phenomenon (development of the initiatives) within its context (Botswana construction industry). Each initiative represents a case study. Data in each case study was collected from actors who were directly involved in the initiatives.

1.6 Significance of the study

Transition theories has been applied to many research problems, mostly in the western countries. While Raven et al. (2012) have suggested that countries are the appropriate unit of analysis for understanding sustainability transition, developing countries and more particularly African countries, have mostly not been considered. This thesis contributes to literature on the governance of transitions in developing countries by demonstrating that international actors influence the content of the change initiatives in developing countries. The findings of the study suggest there is potential for a misfit between bringing foreign expertise and valuable local knowledge in developing countries change initiatives. The second contribution is with regard to the influence of institutional structures in construction industry change. It is found that in

developing countries the process of change can be merged with the development of new actors such as professional associations; which don't exist in some developing countries but transition literature is assumed to be important for the transition process. The last contribution is with regard to the use of MLP beyond its traditional time scale. In this research, MLP was used beyond its normal application to historically study sector level change over a long period of time. Instead it was used to study short term sector level change.

1.7 Structure of the thesis

Chapter 2 examines the literature on change in the construction industry. Research on construction industry change is shown to focus on change drivers, while other studies focus on the process of introducing change initiatives and analyse how their development and implementation unfolds in the construction industry.

In Chapter 3, the Multi-Level Perspective (MLP) is established as the lens to be used for this research. MLP can be used to identify how humans interact with technologies, and it is able to account for the forces that make the existing regimes stable and for how events outside the regime may affect a transition.

Chapter 4 sets out the design of the empirical research, which studies three Government supported sustainability initiatives in the construction sector. These include Botswana Technology Centre (BOTEC) staff housing project, Botswana Environmental Impact Assessment Act (EIA) and Botswana Construction Industry Authority referred to as 'Construction Board' in the analysis. Data from interviews and project documents is used to explore the process of creating the initiatives.

Chapters' 5-7 presents findings of the analysis of three Government supported change initiatives in Botswana in terms of their impact on the construction sector. The analysis presents the landscape and regime level problems the initiatives were responding to, followed by an exploration of the process of development and lastly an analysis of potential influence using MLP constructs. The MLP constructs are the three niche processes of visions, learning and formation of social networks and change in rules. The three cases are used to explore the role of Government policy initiatives in Botswana's transition to sustainable construction.

A synthesis and discussion of the three cases is made in Chapter 8. The chapter discusses on the importance of improving governance and institutional structures to complement the change initiatives. The discussion of the MLP constructs highlights the influence of specific conditions on the direction/nature of change.

The conclusion in Chapter 9 presents an overview of the final conclusions from this research. The chapter reflects on the theoretical and empirical contributions of the thesis, and policy implications and recommendations. It also outlines the limitations of the research and identifies areas for future research.

Chapter 2: Construction industry change

2.1 Introduction

Researchers analyse sector level change from different perspectives. Some literature focuses on change drivers, while other studies focus on the process of introducing change initiatives and analyse how their development and implementation unfolds in the construction industry. In consideration of the drivers of change, the studies reflect on the aspects of construction process where the change takes place and where hindrances of change have been identified. These aspects relates to the organisational structure (Håkansson and Ingemansson, 2013) and the project based nature of the construction industry (Lines et al., 2015, Dubois and Gadde, 2002); and the process of construction; with projects divided into sequential activities with diverse actors which impact on implementation of change initiatives. Legislation and demonstration projects are cited as institutional mechanisms used by states to drive change (Chang et al., 2016). The Literature claims demonstration projects as representing best practice for others to follow as they trial new technologies and applicability of policies. Studies that analyse demonstration projects focus on what aspect of the construction industry changed or improved with the introduction of demonstration projects. The tangible goals of the demonstration projects are used as a yardstick to assess the changes and improvements in the construction industry due to the introduction of demonstration projects. These aspects relate to changes in practice, technology use, and change of legislation.

The literature on drivers of construction sector change often analyse the introduction of policies and technologies as mechanisms that influence change. The literature on policy as a driver purports policy provides a regulatory and other incentives to influence construction sector

change while the technological literature privilege technology solutions as an incentive for change. These literatures however are often silent on the content and process shaping the introduction of the drivers.

Studies such as Rasmussen et al. (2017) and Rwelamila (2002) that focus on the development and implementation of change initiatives analyse the process of designing the change initiative to examine how activities during development influence the content and consequently the implementation of the change initiative. This literature argues that development and implementation of change initiatives in the construction industry is a negotiation between different actors. The literature assumes the diversity of motives brought by the different actors and contextual factors shape the content of change initiatives. Studies in this area analyse how different actors and institutions are motivated to participate and how their participation shape the development of the policy initiatives and are in turn transformed through that process. Some of these studies for example Rasmussen et al. (2017) are particularly focused on the developed countries which suggest additional empirical data is needed focusing on the developing countries as they have some limitations particularly on the institutions as compared to the developed countries. Within the developing countries context, and in particular the Botswana context, actors and institutions that shaped the development and implementation of three government policy initiatives are identified and the decisions their influence in the process explored. It is the argument of this thesis that a change towards sustainable construction is not about adding another criterion to the list of what counts when designing sustainable buildings, it is also about developing and supporting organisational capabilities and professional competences that can support the change process. In addition it is about creating a balance between international and local actor involvement in the change process. The next section discusses the drivers of change.

2.2 Change drivers

In consideration of the change process, some studies such as Vass and Gustavsson (2017) focus on drivers of change and reflect on the aspects of construction process where the change takes place. This section explores the different factors or mechanisms that are introduced in the construction sector to influence change. This literature identifies and discusses the discrete drivers highlighting the goals or purposes of the different change drivers. Technologies and policies are identified in literature as mechanisms introduced from the market and state respectively as change drivers. Alternatively, some authors focus on hindrances of introducing the discrete drivers. This literature discusses aspects related to the organisational structure, the project based nature of the construction industry, and the process of construction; with projects divided into sequential activities with diverse actors which impact on implementation of discreet change drivers. The literature on discrete drivers in a change process assumes the introduction of the factors will change practices in the construction industry. As valuable as these studies are in drawing attention to the different mechanisms that can be introduced to influence change, they do not reflect on the process of development which will examine aspects including the capabilities of the organisations introducing them and the competencies and interests of the actors involved as their focus is not on the process.

2.2.1 Technological and policy drivers

This section explores research into construction industry change facilitated by an introduction of technologies and policies. The literature on construction industry change emphasise introduction of technological innovation and policies as a component to facilitate change in the construction industry. This literature tends to explore the reasons for the introduction of the technology and policies, and the challenges faced when introduced for industry change. The

studies highlight the practices that the drivers are targeting as well as reflecting on the support mechanisms needed during implementation. The studies also reflect on the aspects of construction process where the change takes place and where drivers and hindrances of change have been identified. These aspects relates to the organisational structure (Håkansson and Ingemansson, 2013) and the process of construction; with projects divided into sequential activities with diverse actors which impact on diffusion of change initiatives. The studies however useful in drawing attention to the discrete drivers of change in the construction industry, fail to account for the reasons of introducing the change drivers, and the process of introduction which shapes content.

Research on discrete drivers of change analyse the different mechanisms or strategies of influencing construction industry change (Vass and Gustavsson, 2017, Chang et al., 2016). The studies assume that change can be brought by various mechanisms some emanating from the state and some from the construction market ranging from showcasing best practice to regulation and control. The studies ask what the different ways of influencing change are and analyse the degree and variation of change in the construction industry brought by the different change drivers. The authors discuss the challenges of introducing the different change drivers. The literature on policy as a driver purports policy provides a regulatory solution to influence change in the construction sector. The technological literature privilege technology solutions. The literature however is often silent on the content and selection process shaping the introduction of the change driver.

Technological drivers

Studies have analysed the role of technologies in construction industry change. Vass and Gustavsson (2017) used a case study to understand the implementation process and associated

challenges of introducing building information modelling (BIM) in the Swedish construction industry. By focusing on the role of the client in the implementation process, the study aimed to increase the understanding of the intra- and inter-organizational challenges that arise when a public client implements BIM as a means of changing work practices of the actors in the construction industry. There was perceived lack of use of BIM in the Swedish construction. The lack of use of BIM contribute to lack of innovation and productivity (Vass and Gustavsson, 2017). The study concludes that while government clients can act as change drivers in the construction industry, there are several mechanisms that need to be understood or put in place in pursuit of the change process. The mechanisms include developing a common implementation approach, providing education and learning, developing a mutual definition of the technology, managing conflicting expectations in the implementation process, evaluating business case for the technology, creating new roles and creating incentives. The study however does not account for how these processes were achieved.

The Vass and Gustavsson (2017) did not account for the contextual factors that could affect the use of BIM as a technology as literature suggests technologies often fail to be embedded in the construction sector as change drivers (Smyth, 2010) as according to Rohracher (2001) construction is social in nature and is not primarily a technological problem. Contextual factors that need to be examined include the perception of technology by potential users and other actors. In addition to the social factors, there is need to consider technical factors such as the availability of infrastructure for the technology and learning how to use the technology. The structure of the construction industry hinders learning. Due to fragmentation, there is little incentive for project teams to learn together as it is highly unlikely that they will work together again (Bresnen and Marshall, 2000). Learning is a process of trial, feedback and evaluation and is related to previous activities and experiences (Dubois and Gadde, 2002). Studies that consider

the process of development of change initiatives considers the social and technical factors that need to be in place when introducing change initiatives. This is discussed in detail in section 2.3 below.

Policy drivers

Studies have identified and analysed policies and regulations through which the state can support change including through regulation and control, providing economic incentives and supporting activities (Chang et al., 2016, Manoliadis et al., 2006). Policies have also been identified as one of the drivers of change in the construction industry. The studies tend to focus on the types of policy initiatives that are introduced to influence industrial change, neglecting the process of introducing such policies.

Chang et al. (2016) studied the role of the Chinese government in facilitating change towards sustainable construction with more emphasises on the different types of policies that were introduced. Faced with challenges of urbanisation and depletion of natural resources, the study found that the Chinese Government enacted laws, policies and regulations aimed at regulating and control; as well as providing economic incentives and supporting activities to the construction stakeholders to change practices. The different types of policy initiatives supported activities including strengthening technology innovation, improving standards and evaluation, establishing demonstration projects, and providing publicity towards sustainable construction (Chang et al., 2016). Accordingly, the study concludes that the introduction of the laws, policies and regulations changed the behaviours of the stakeholders in the process of change towards sustainable construction. Similarly, Manoliadis et al. (2006) found that land use regulation and urban planning policies precipitated change towards sustainable construction in the Greek construction industry. The study highlights that the Greek construction industry wanted to move

from the use of tradition construction methods of construction and technology to sustainable construction.

These studies document a projected successful implementation of policy change initiatives. However, these studies do not engage with the actual processes of developing and implementing such policy initiatives which will highlight the institutional dynamics as well as role of different actors who took part in the process. An analysis of the process will reveal the context specific factors such as motivations of actors and institutions. Creed et al. (2002) argue that practices affected by public policies are always situated in a context. This is also argued by Hoffman and Ventresca (1999), who suggest that existing institutional arrangements structure debates on policy initiatives with consequences for how they are designed and subsequently implemented (Hoffman and Ventresca, 1999).

2.2.2 Role of demonstration projects

Studies that examine technological and policy change drivers highlight that despite the best efforts, some strategies still fail to influence the required change. Demonstration projects are identified and analysed as mechanisms to trial new technologies and diffuse policies in the construction industry. Demonstration projects are analysed as exemplars of best practice and a means to transfer knowledge across projects and across the construction industry (Smyth, 2010) for improvement of the construction industry. The studies analyse why and how demonstration projects are useful in a change process. These studies assume demonstration projects are useful to showcase best practice the construction stakeholders. Other studies build on this to examine the influences of demonstration and how the knowledge of the best practice is passed on to the construction industry.

Studies on the purpose and goals of demonstration projects analyse what prompts actors to introduce demonstration projects. In terms of purpose Smyth (2010) asserts that firms introduce demonstration projects as a form of corporate investment. In terms of goals, Smyth (2010) asserts that the change in the construction industry influenced by demonstration projects is related to the tangible goals that are set at the start of the demonstration. This finding suggest that failure to set the objectives of the demonstration projects could lead to limited influence. Studies therefore have analysed and ascribed various purposes and goals of demonstration projects in change process. Demonstration projects are used by firms as a mechanism to diffuse technologies. They are used as an instrument to remove obstacles in the innovation process (Hendry et al., 2010) and serve as testing grounds to evaluate application of technology (Zhou et al., 2015). At later stages, demonstrations projects can serve as field trials to improve performance and reduce costs before commercial rollout (Heiskanen et al., 2015). Some of the success that is highlighted is in terms of commercialisation of technologies (Zhou et al., 2015). These studies are biased towards technology development. Rasmussen et al. (2017) is an exception and contends in their study in the Danish construction that demonstration projects were used by government as a strategy to diffuse policies. The Rasmussen et al. (2017) study and the other studies however are focused on the developed countries which suggest additional empirical data is needed focusing on the developing countries as they have some limitations particularly on the institutions that can support demonstration projects as compared to the developed countries. As these studies suggest, demonstration projects are critical in the development and showcasing of technologies and diffusion of policies in the construction sector to influence change.

Another approach on the influence of demonstration projects account for how best practice is passed on to the construction industry. This reflects on the capability of organisations to

communicate the learnings from the demonstration projects. In a study in the UK, Smyth (2010) analysed the influences of demonstration projects introduced under the continuous improvement programme. The study concluded that there were improvements in the UK construction industry through demonstration projects. However, the improvements seem not to have been continuous. The lessons learned in the demonstration projects did not cumulatively contribute to continuous improvement in the sector. The study found that there "*was insufficient description of what has been done and how it has been done in demonstration project write-ups to facilitate direct comprehensive knowledge transfer*" (Smyth, 2010 pg 268). This finding corroborates Fernie et al. (2006) argument that it should be clear how the best practice from demonstration projects is diffused within project environment, i.e. at the project level for them to be effective in a construction industry change process.

Chang et al. (2016) study which discussed the role of Chinese government policies to facilitate change towards sustainable construction is an exception as it highlights how best practice from demonstration was transferred to the construction industry in a change process. The study found that the Chinese government made efforts to popularise the demonstration projects. The Chinese government issued two documents in 2012 namely Notice on Organizing the Demonstration of Photovoltaic Applications in Buildings and Notice on Organizing the Demonstration of Renewable Energy Applications in Buildings. The studies on influence highlights that for demonstration projects to act as change agents, knowledge gained from the demonstrations should be passed on the broader construction industry.

As these studies suggest, researchers look at the influence the completed demonstration projects have on sector change. The studies do little to highlight the processes within the demonstration that shape their influence. The review of these studies shows that in studying demonstration

projects, there is need to consider the whole process. In doing so particular care should be taken to consider how contextual issues could shape the way the innovation is perceived in the construction industry. The analysis shows that most previous studies analysed demonstration projects in terms of their success. The success of the demonstration project in change process is highlighted in terms of ability to help in commercialisation of technologies, shape future policies, brings potential funders of new technologies together, highlight barriers to use of new technologies and increasing knowledge and practical experience of handling new technologies.

The approaches described above describe the different mechanisms through which studies suggest construction industry change is facilitated and what challenges hinders that process. The studies suggest drivers of change include technologies and policies. Technologies are normally introduced by the construction market whereas policies are the prerogative of the state. In addition the studies suggest that demonstration projects are usually used to showcase best practice. To examine that role of showcasing best practice, the studies suggest goals for the demonstration projects should be tangible. In addition the studies suggest knowledge gained from the demonstration projects should be passed on to the broader construction industry to influence change. However analysis of the change drivers is not sufficient for understanding the context specific factors that shape the development and implementation of change initiatives. In contrast the studies that analyse the development and implementation of change initiatives puts agency and contextual issues at the centre of the analysis of change process.

2.3 Development and implementation of policy change initiatives

This section explores the literature on development and implementation of government policy initiatives. This literature places emphasises on the content of the policy and assumes the content is influenced by context specific factors that manifests in the process of developing the

policy initiative which consequently influences the implementation of the policy. The factors include institutional mechanisms, political support and support from the construction industry itself, that influence the development of the policy initiative (Rigby et al., 2013). An analysis of the process of development of change initiatives calls for an examination of activities that emerge as actors support or counteract attempts to change the sector, reject or replace existing institutions. The studies places emphasis on the design phase of the policy initiative where competing tensions in the change process are visible from the actors. The aspects that receive the most attention are actors and institutions. Actors are studied as potential leaders in change process. According to Rasmussen et al. (2017), actors produce strategic activities that affect the implementation of changes in their institutional environment. However an analysis of change initiatives starts with an account of the context specific problems that need to be addressed.

2.3.1 **Purpose of policy change initiatives**

Studies of design of change initiatives generally start from an assumption that implementation is context dependant and is a culmination of the process that highlights the original reasons for introducing the change initiative, competencies of the actors involved and their commitment. The design of policy initiatives in the construction industry usually is a response to the systemic problems the industries face, which are context specific. Studies that analyse the process of development of change initiatives examine the provenance of the policy initiatives (e.g. Rwelamila, 2002, Adamson and Pollington, 2006, Rasmussen et al., 2017). The studies show that the problems develop into visions for the change initiatives which in turn can be used to analyse the change in the construction during implementation of the change initiatives.

Researchers who analyse the development process of policy initiatives reflect on the purpose of the initiative. These authors examine how the intentions of the initiative are shaped which

consequently impacts on their influence in construction industry change. For example, Rwelamila (2002) explored the process to create an effective strategy for South African construction industry within a national agenda of social and economic transformation. The development of the policy initiative was prompted by challenges in the South African construction industry. The challenges included shedding of direct labour has given rise to the use of unregulated labour-only subcontracting, the limited capacity of the public sector to manage its procurement and the government regulatory framework which inhibited innovation and initiative.

The study particularly focused on the role of the South African government to initiate and carry out the change process. The process initiated by the South African government that led to the establishment of the Construction Industry Development Board (CIDB) included the publication of the Green Paper, the appointment of the Task Team, the publication of the White Paper (Rwelamila, 2002). The intention for the change initiative was for the South African construction sector to contribute to social and economic transformation of South Africa. According to Rwelamila (2002 pg 444) "*an early breakthrough in the policy development process, was the recognition that the construction industry is a national asset which helped achieve consensus amongst all South African construction industry stakeholders"*.

The loss of confidence in the UK construction industry, its underperformance, poor image and a host of institutional challenges (such as poor leadership, lack of people commitment, and a culture of poor quality) led to development and implementation of many change initiatives in the early 1990s (Adamson and Pollington, 2006). The changes that happened in the construction industry as a result of the initiatives tried to address the problems that were noted. For example, the reforms included a number of new professional bodies. Primary among these were the

formation of a Construction Industry Board (CIB) and the establishment of a Construction Clients Forum (CCF) (Adamson and Pollington, 2006) to improve on the aspect of leadership and performance of the construction industry. The formation of the CCF was aimed at:

- Encouraging clients to achieve value for money through best practice;
- Securing major and measurable improvement in the performance of supply side of the industry including cost reduction; and
- Promoting policies which can achieve a healthy, stable and skilled industry which is competitive, well capitalized and competent.

The CIB was formed as a statutory organisation with the aim to deliver improved construction performance, measured in terms of its quality, productivity and competitiveness; reduce conflict and increase trust; improve security and payment throughout the construction process; and secure a 30% cost reduction in real terms through the approved productivity and procurement processes by the year 2000 (Adamson and Pollington, 2006). The UK Government declared support encouraged the industry stakeholders to embrace the idea of the establishment of the CIB. It is noted by Adamson and Pollington (2006) that some industry stakeholders were not in support of the establishment of the CIB. However due to the influence of Government, they did not object publicly. The previous studies highlight a process where there were limited tensions in setting the purpose of the change initiative.

Rasmussen et al. (2017) is an exception as it shows there were tensions in shaping the purpose of the policy initiative which lead to different visions of the policy change initiative. The study assume that actors within a given context produce strategic activities that affect the implementation of changes in their environment. The study uses a qualitative approach to analyse the contextual factors that shaped debates to introduce benchmarking as a solution in

Denmark. Data was collected through interviews and document review. The study found the construction industry was characterized as a domestic market where malfunctioning and inexpedient competitive conditions existed. The four problems, that were considered to counteract the industry's competitiveness on the international market, were the inadequate coordination of the efforts put into research and development, the lack of incentives for private actors to engage in research and development activities, the market's inability to explore and exploit new knowledge and the lack of consistency between the knowledge that the supply side produces and what the market requests. The prescribed cure to this problem was to introduce benchmarking as a solution. Government was proposed as an actor capable of leading the change initiative as they could coerce other actors to be part of the initiative.

The Rasmussen et al. (2017) study concludes that the instrumental purposes and overall objectives for benchmarking were both changing and ambiguous due to the participation of different public and private actors. Three different visions for benchmarking were formulated representing what the actor's thought was the purpose of benchmarking. Benchmarking was envisioned as a tool to generate transparency in performance areas of construction by the Government. Private and public clients envisioned benchmarking as a tool that creates competition and drives companies to better performances whereas contractors, consulting engineers and architects envisioned it as a tool that identifies best practices and provides improvement proposals.

The studies identified above describe how the purposes of change initiatives are shaped by the problems in the construction industries. However, the studies do not reveal how actors engage to reveal those problems. In contrast, the studies on the role of actors reveal how their engagement shape change initiatives.

2.3.2 **Role of actors in policy change initiatives**

Studies that analyse the role of actors in development and implementation of policy initiatives highlight/focus on the impact of the decisions that different actors bring in the process of development and implementation of change initiatives (Adamson and Pollington, 2006, Rasmussen et al., 2017, Pries et al., 2004) which drive the initiatives in certain direction. Actors are studied as potential leaders in change process. Studies examine actor's engagement in change initiatives, how they are mobilised in change initiatives and their intentions or objectives during the development and implementation of the change initiatives. Actors includes public and private actors and organisations. The assumption of the studies is that the motives and interest of actor decisions can highlight or obscure certain things within the policy initiation process which can have an influence on their development and implementation.

Studies show that the involvement of different actors in a change initiative is imperative. Actors are categorised into public and private actors. Within the many actors, literature emphasise the importance of a leader in the change process (Pries et al., 2004). Rwelamila (2002) study reveals that various actors were involved in developing a construction policy to reform the construction sector in South Africa. In the process, a task team was constituted comprising of government, private sector and non-governmental organisations. Government was represented by the Ministries of Transport, Housing, Water Affairs and Forestry, Constitutional Development and Public Works while there was consultant and construction firms representing the private sector. The Department of Public Works led the process. The department provide the terms of reference for the initiative (Rwelamila, 2002). A key observation is the absence of international actors in the process.

The work of Rasmussen et al. (2017) in the introduction of benchmarking in Denmark reveal the state, private and external actors were involved in the change process. The data is based on interviews with people who were involved in the initiatives and archival data. The study shows that local actors were at the forefront in shaping the benchmarking policy in Denmark. Notably, this study assessed the engagement of the actors through the lens of institutional theory, thus does not reveal the impact of external actors in the change process. Studies that adopt this analysis therefore lose focus of other factors outside the local context of actors that equally can cause sector level change by providing supporting or counteracting mechanisms for change. In developing countries however, external actors are critical in change processes. These includes international donor agencies such as the World Bank (Hansen et al., 2018). Literature reveal that their intervention more often shape change initiatives (Hansen and Nygaard, 2013). This thesis explores change process in a developing country which necessitates the need to explore further the role of international experts in shaping the change initiatives.

Actors influence visions for change initiatives. The different actors in a change process set different ambitions for the change initiative (Adamson and Pollington, 2006, Rasmussen et al., 2017). Some studies reveal that the non-alignment of interests can lead to multiple visions for the change initiative. For example Rasmussen et al. (2017) found the government set ambitions for the benchmarking policy. The Danish government saw benchmarking as a tool to generate transparency in performance areas of construction. Government therefore supported the creation of an Evaluation Centre to coordinate, gather and disseminate knowledge in the construction industry. In contrast, contractors, consulting engineers and architects viewed benchmarking as a tool to identify best practice and to provide improvement proposals.

The studies identified above describe how different actors engage to shape the content and direction of change. However, the studies do not reveal how institutional arrangements change during the process.

2.3.3 Role of institutions in policy change initiatives

Studies analysing the process of change analyse the role that institutions play in facilitating change. Institutions enable, constrain and shape behaviours and practices of actors (Twomey and Gaziulusoy, 2014). The studies that examine the role of institutions assume that actors configure their institutional settings differently and thus drive change differently. The institutions are themselves transformed during the change process (Adamson and Pollington, 2006). Institutions are examined for as they serve as a source of knowledge on how an institutional framework operates and allocate incentives and resources in construction industry change process. The works of Rasmussen et al. (2017) and Adamson and Pollington (2006) emphasises this assertion. Studies that examine institutions in a change process analyse the influence of people and organisations.

The influence of an institutional framework was at the forefront in the development of a construction industry policy in South Africa. The success of the change process was attributed to Government support and issuing a Green Paper to start the process (Rwelamila, 2002). The Department of Public Works was mandated to lead the process thereby allocating resources for the process. Similarly, the Rasmussen et al. (2017) study, which illustrates an institutional mechanism was the formation of a political task force in 2000 by the Government through Ministry of Housing and the Ministry of Trade and Industry. The task force among others criticised the construction industry as an underperformer.

Another dimension pertaining to institutions is the changes in organisations during the process of transition. Adamson and Pollington (2006) considers the changing institutional framework while implementing reforms aimed at improving the UK construction industry. New organisations were established and given roles including industry bodies (Construction Industry Council (CIC), the Construction Industry Board (CIB), and the Movement for Innovation (M4I) and the Strategic Forum for Construction) and the establishment of a forum to represent clients (the Construction Clients' Forum (CCF) and the Confederation of Construction Clients (CCC)). Similarly, the work of Rasmussen et al. (2017) explores changes in organisations which shaped the design and implementation of benchmarking. An Evaluation Centre was established as a central actor in the future coordination, gathering and dissemination of knowledge in the Danish construction industry. The aims of the organisation included to coordinate and evaluate experimental and urban renewal projects, gather experiences and key performance indicators from new building projects, disseminate knowledge concerning experimental projects, urban renewal projects, benchmarking, and good construction practices. To give it capacity to share knowledge thereby influencing change, the Evaluation Centre was to be managed by a "*balanced group of providers, customers and researchers*" (Rasmussen et al., 2017 pg 314). Knowledge sharing is particularly important in a change process.

Professional associations are identified as key agents in construction industry change. Literature suggests they have specialist knowledge that allows them to criticise technical details of the construction industry and propose alternative courses of action for change. According to Van De Poel (2000) professionals possess engineering and scientific knowledge which they use to impact on developments that require engineering and scientific knowledge. In the Rasmussen et al. (2017) study, the presence and contribution of professional associations was instrumental in shaping the content of the benchmarking policy. They rejected the proposed design of the

benchmarking policy arguing that the system "*poorly reflected the criteria that characterize the performance of consulting engineers and architectural companies as it (1) focused too much on financial performance rather than quality performance, (2) would constitute another administrative burden when bidding on building projects as it would not replace, but only supplement, existing procedures and (3) would give preferential treatment to foreign bidders due to the less strict requirements placed on these in terms of providing benchmarks from completed project*" (Rasmussen et al., 2017 pg 317).

The above-mentioned studies illustrates the role institutional structures play in construction industry change. It was highlighted that Government can issue directives for implementation of change initiatives. It was also highlighted that organisations themselves change during the change process which suggest the process of change can be merged with the development of institutional structures where they are not available. In exploring the process of introducing three government supported initiatives, this thesis examines the professional competencies within Botswana construction industry, the capabilities of organisations tasked with the policy initiatives and the role and influence of international actors in the change process.

2.4 **Summary**

In this chapter, the literature examining the different discrete drivers of change including both from the state and private firms was reviewed. The literature draws attention to the different mechanisms that can be introduced to influence change. The literature however does not account for the process of development which is argued shapes the content and influence of change initiatives. The literature review further examined studies that explore the process of development of policy initiatives highlighting that contextual factors shape the content of policy initiatives. The studies highlight the influence of actors who engage in policy initiatives. Actors

provide expertise and resources in a change process. Building on to those studies that consider the influence of actors in a change process, this thesis analyses the roles of different actors, distilling how their influence mattered. A particular focus is on the role of international actors. Following on studies that analyse the role of institutions, this thesis further explores the roles of organisations in a change process when faced with the influence of international actors. This thesis uses the Multi-level perspective (MLP) to analyse the interaction of actors with technologies, and the forces that make the existing regimes stable and the events outside the regime that affect a transition. The next chapter introduces MLP which affords a framework to analyse the interaction of actors, institutions, cultural practices, knowledge, and technologies in a change from socio-technical system to another and the conditions necessary to facilitate the change.

Chapter 3: Theoretical approach

3.1 Introduction

This chapter discusses the theoretical framework that has been adopted for this study. The multi-level perspective (MLP) can be used to study transition from one socio-technical system to another. In this thesis it has been used as a road map to reflect on the potential of discrete innovations to contribute to a transition. As the discussion below suggests, MLP is an ideal theoretical framework to adopt because it can be used to analyse the interactions between multiple elements within socio-technical transition process. Many of the early studies using MLP focused on how changes at the level of the landscape or at the level of specific niches affect the regime. The latter studies tend to focus on how a specific technical innovation transforms the regime. MLP is used in the thesis to analyse the process of introducing government supported initiatives introduced into the Botswana construction sector and their contribution towards change to sustainable construction. The initiatives include: BOTEC demonstration project, the introduction of Botswana Construction Authority and Environmental Impact Assessment Act. MLP uses some concepts that other transitions frameworks that are unsuited for use in the current study. It is useful to comment on those frameworks and discuss why they are unsuited for use. The following section presents and discusses theories that are used to analyse transitions. The theoretical framework adopted (Multi-level perspective) for this thesis is then presented.

3.2 Transition theories

Research in transition studies is currently dominated by four related theoretical frameworks (Markard et al., 2012). These include the multi-level perspective (MLP) which addresses the

long-term transformation of socio-technical systems (Geels, 2002a), strategic niche management (SNM), which focuses specifically on processes through which inventions develop into new socio-technical configurations (Kemp et al., 1998), transition management (TM), which focuses on the governance of unfolding large-scale change (Rotmans et al., 2001), and the technological innovation systems (TIS), which focuses on emerging technologies and accompanying institutional and organisational changes (Bergek et al., 2008). These will be discussed in turn beginning with SNM, TM and lastly TIS. This will lead to a detailed discussion of the MLP framework.

The strategic niche management approach (SNM) shares some elements of the multilevel perspective (MLP) but it focuses on the niche level and the necessary conditions for a technological innovation to make a breakthrough in the regime level. Studies that use SNM framework, suggests that new innovations need to focus on several prior developments both within the niche community and outside to be successful and grow out of the protected spaces (e.g. Smith, 2007, van der Laak et al., 2007). These developments include the articulation of visions and expectations, the building of social networks and learning (Schot and Geels, 2008). These developments also figure in the niche concept of the MLP framework.

The current study draws on these concepts of visions, social networks and learning to analyse the development of the BOTEC demonstration project case study. The research explores how and by whom the initial vision for the project was set, how the actors mobilised social networks during the development phase and how learning was achieved at the development stage. The study further analyses the mainstream practices that the demonstration targeted. In addition, the thesis explores on the external effects that prompted the development of the demonstration project.

The criticism and shortcoming of SNM stem from an overly niche-focused approach as imperative for broader societal changes which neglects paying attention to the meso and macro levels dynamics. The MLP adopted for the thesis and discussed in detail in later in the section avoids such a shortcoming by postulating that both meso (regime) and macro (landscape) levels dynamics are imperative factors in transitions.

Transition management (TM) is concerned with the dynamics of structural change in society and the nature and timing of the transformation to be initiated, facilitated and shaped. TM focuses on the process of steering and guiding desired transitions. It is in this way similar to SNM. Whereas the SNM approach argues for articulation of visions and expectations, networking, and learning as preconditions of construction, empowerment and upscaling of niche innovations, transition management (TM) goes beyond this approach by focusing on a cyclical process of managing transitions. The focus is not only on experimentation in niches, but also to steer transition towards desirable social outcomes by creating shared visions and problem perceptions across a broad range of actors, and on up-scaling niche experiments and constant monitoring of the process as a whole (Loobarch, 2010). The framework provides insights on the design of a governance structure that can support transitions asking when and how transitions can be initiated, facilitated, and shaped (Twomey and Gaziulusoy, 2014). The transition management approach is not suitable for use in this thesis as it is interested in the management aspect of a transition and how to influence the speed and direction of a transition process (Kemp et al., 2009).

The technological innovation system (TIS) is concerned with successful diffusion of a particular technology or product (Twomey and Gaziulusoy, 2014). It focuses on the prospects and dynamics of a particular innovation (technology). Empirical examples of technologies

studied included photovoltaics (Dewald and Truffer, 2012), biogas (Markard et al., 2016) and fuel cells (Musiolik and Markard, 2011). For instance, Heptonstall et al. (2012) identified the high costs associated with wind energy while Jacobsson and Karltorp (2012) identified technical challenges in terms of infrastructure and institutions to wind energy in the European Union countries. The TIS approach is not suited for use as this thesis does not focus exclusively on technologies.

3.3 Multi-level perspective

This section discusses the Multi-level perspective (MLP) as the chosen theoretical framework for this thesis. MLP conceptualizes change in socio-technical systems as a process across three levels. The regime represents the deep structure of a socio-technical system and contains its basic logic of functioning, while radical innovations emerges in niches that challenge the established regime structures. Regime and niches are embedded in a broader landscape level, i.e. the level of external influencing factors that shape overall developments. The MLP will be discussed in more detail later in the section. Before embarking on the detailed discussion of the MLP, it necessary to review other frameworks that are used in transition studies so as to demonstrate that MLP is the most appropriate choice to answer the primary research question.

The multi-level perspective (MLP) framework in transition studies is an analytical tool used to understand a wide range of historical and hypothetical/future innovation driven processes of change in a given system (Geels, 2010). MLP conceptualises a socio-technical system as made up of three levels. MLP suggest that transitions or change come about through interactions between processes at three levels: (a) niche-innovations build up internal momentum, through learning processes, price/performance improvements, and support from powerful groups, (b) changes at the landscape level create pressure on the regime and (c) destabilisation of the regime

creates windows of opportunity for niche innovations (Geels and Schot, 2007). A depiction of the interaction between landscape, regime and niche levels is shown in Figure 3-1. As it will be elaborated with empirical examples, one of the strengths of the MLP is that its regime concept enables researchers to explain the stability related forces of existing institutions and practices, and how these often hamper or promote processes of change (Avelino et al., 2017). In addition it allows an analysis of multiple change processes which challenges the linear understandings of transitions (Avelino et al., 2017). The MLP framework therefore enables an analysis of both stability and change as inherent parts of transition processes (Avelino et al., 2017).

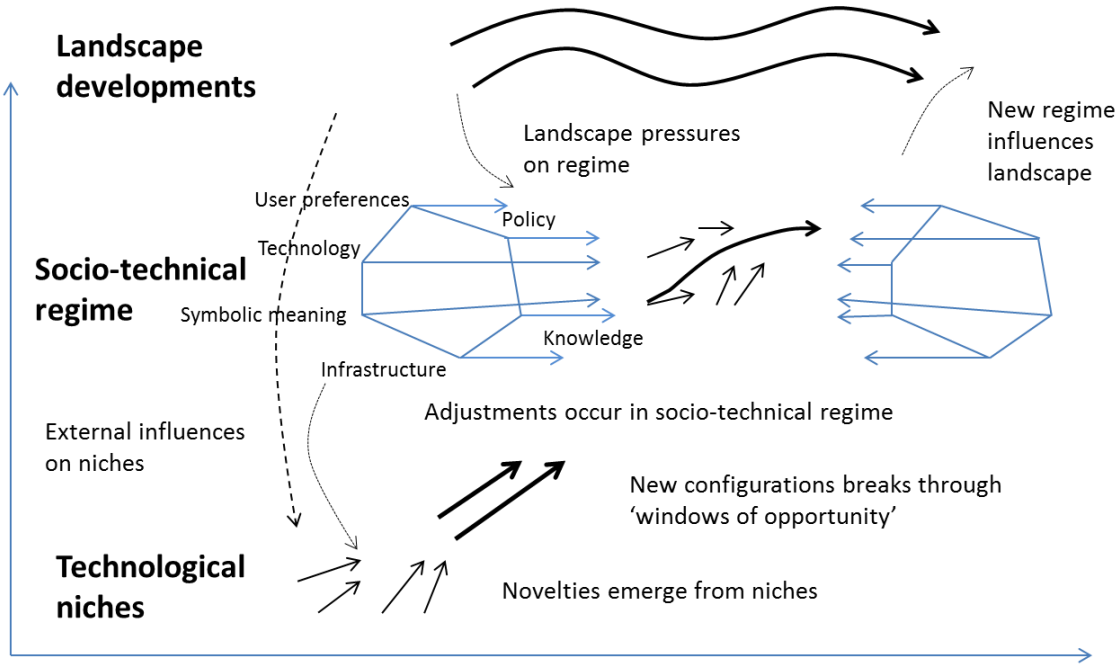

Figure 3-1: Multi-level perspective model

Adapted from (Geels, 2011)

Niches are conceptualised as protected spaces (Geels, 2002b) where specific markets provide an environment in which innovations that engender to change the regime develops (Kemp et

al., 1998). Regimes are relatively stable configurations of institutions, techniques and artefacts, as well as rules, practices and networks that determine the normal development and use of technologies (Rip and Kemp, 1998). Rules refer to some sort of shared structure (e.g. routines, norms, protocols etc.) that guide behaviour of regime members (Geels, 2004). Geels (2004) suggests that it is difficult to change one rule, without altering others. The alignment between rules gives a regime stability, and strength to coordinate activities. The landscape consists of slow changing external factors (Geels, 2002b) that provides a relatively stable environment which is not easily influenced by individuals or specific groups of actors. Some of the landscape developments include environmental problems such as global warming, demographic changes and economic growth/contraction.

MLP focus on conditions that foster the growth of an innovation such that it may successfully challenge the regime to effect change. The early studies focused more on the niche innovation as the driver for transition and less on the reconfiguration of the system or sector. The next section discusses niche development followed by regime reconfiguration.

3.3.1 **Niche developments**

MLP has been used to study the way in which innovations transform socio-technical systems. Empirical studies of this process identify several factors which support this process. Stability of the niche innovation is important for it to make impact on the regime. The stability depends on the development path the innovation follows. Niche innovation develops when there is a perceived technical problem and no readily available innovation to be used in the regime. In this situation there tends to be an exploration of different technical solutions to find the right one for the regime.

Niches create and provide protected spaces for innovations to develop. In Geels' account of the transition from horse-drawn carriages to automobiles (Geels, 2005), the non-existence of suitable options of travel in the market helps to explain the success of automobiles in transforming the transport sector. Expansion of cities created pressure on the transport regime. The expansion resulted in increased distances between people. The increases in distances were hard to meet with horse-drawn carriages. Mindful of the need for the technical innovation to address regime level problems, actors engage in experiments to find the best design that addresses the problems (Geels, 2005) and hoped that it will eventually be adopted in the regime. According to Geels (2005), there were several niche innovations that might have developed including electric trams, bicycles and automobiles. Electric trams were supported by utility companies, and bicycles were widely used in the countryside during tours. But automobiles eventually gained popularity and became the system of transport that was widely used in the regime.

A second example is a study that examined the crucial factors for developing a biomass-to-energy niche in Malaysia between 1990 and 2011 (Hansen and Nygaard, 2014). The niche development started with high oil prices and the persistent biomass waste disposal problem. Environmental groups on the palm oil industry put pressure on the regime. Despite interventions for policy support the niche made slow progress. The paper identifies among others the reluctance to implement energy policy and the limited network formation as the main factors that limited the niche development.

This section has highlighted that niche innovations develops to address a particular problem in the regime. In the process of developing the innovations, there tends to be an exploration of

different solutions to find the right one for the regime. Therefore, identification of an issue and that issue being framed as a problem by actors is imperative for niche development.

Niche impact on regime

Within the MLP model, niche technical innovations provide an opportunity for regime level change. During that process, the stability of the existing regime is challenged and can lead to changes in standard practices, policy and regulatory frameworks and institutions. Niche technical innovations have a competitive relationship with the existing regime when they aim to substitute for key elements and a symbiotic relationship if they can be adopted as competence-enhancing add-ons in the existing regime to solve problems and improve performance (Geels and Schot, 2007). Niches are important because they provide locations for *learning* by doing, using and by interacting (Geels, 2002b). In addition, niches provide space for the actors in the niche network to formulate visions for the innovation thereby increasing the chance for the innovation to have successful impact on the regime.

This process is exemplified in Berry et al's study of the transition to a sustainable housing sector in Australia (Berry et al., 2013). The case study of the Lochiel Park green village explored the impact of niche technical innovations on the regime; prompting a regime transformation. The South Australian regional Government took a policy decision in 2002 to have a clean and modern green Adelaide. They engaged a 'thinker in residence' who engaged with policy makers and general public to learn of what was needed. From that envisioning process, targets were set to reduce energy used, greenhouse gas emissions and potable water use from the 2004 averages. To achieve those targets, technical innovations including solar water heaters, photovoltaic and LED lighting were introduced. The introduction of these niche innovations was expected to have some impact on the regime.

The Australian housing sector was said to be conservative with lack of commitment to sustainability and designers lacked experience to design sustainable homes. This proved a challenge as designers could not go beyond what was specified as the minimum requirement in the Building Code of Australia. The local electricity provider could not envision the benefits of the energy saving innovations and provided costly infrastructure that did not make use of the self-sustaining nature of the houses. But with the introduction of the niche innovations, the local building industry became confident to design and construct sustainable homes, for example with local electricity generation.

In terms of practices at the regime level, the housing market initially advertised the properties using traditional house valuation metrics such as the number of bedrooms or bathrooms, floor area, car spaces, air-conditioning etc. (Berry et al., 2013). With learning and the adoption of new practices such as the design and installation of renewable technologies building practitioners began to communicate their products using features of energy efficient and environmentally sustainable homes (size of photovoltaic array, size of water tank, availability of recycled water, lower energy bills, etc.). In addition, they gained knowledge of using sustainability performance assessment tools. The target to reduce energy use also resulted in some industry practitioners using concrete that conformed to low embodied energy rule as opposed to what they were used to doing of ordering bricks without knowing their embodied energy. In terms of policy, the niche development resulted in a shift in policy requirements. Some agencies established sustainability standards above regulatory requirement. New house developments built after Lochiel village required 7 Stars which is above the Australian Building Code of 6 Stars. These changes in practices demonstrate the impact of technical niche innovations on the regime. The key to such a change was through a number of processes. First, there was an engagement with stakeholders (policy makers in the case and general public)

possibly to avoid tensions and assess expectations. Second, commitment to sustainability was shifted through demonstration of the technologies. Lastly, learning was transmitted through from the project and shown by change of practices.

Regime impact on innovation

Previously the niche has been taken as the basis for emerging novelties (Markard and Truffer, 2008). In MLP, however incremental innovations are usually generated in the regime. The example of the transition from cesspools to sewer systems (Geels, 2006) show, regime level changes can impact on niche technical innovations. This example also illustrates the dynamics of regime level change. This will be discussed in detail in later sections.

In the Geels (2006) study, residents used gutters to dispose waste into the street and canals. There was moderate pressure for change because of the stench that emanated from open gutters. This pressure proved to be a disruptive change to the practice of disposing waste. Residents responded to the pressure by covering the gutters with boards to stem the stench. The unintended innovation was the creation of paths for walking as well as the emergence of the niche technical innovation of underground sewers as we know them today.

From the above discussion on both niche technical development and its impact on regime change and regime impact on innovation, it is evident that the change in practices, policy, institutions and networks are important for niche development and subsequent impact on the regime. Landscape and regime level problems normally trigger the development of niche technical innovations. Niches develop to address specific problems on the regime. Multiple innovations can be developed and compete at the same time but because one is used more than the others, it becomes dominant and eventually is used in the regime.

In the case of the development of biomass as a niche in Malaysia, polices were enacted to support the niche, but they were poorly implemented. In addition, there were no support networks which have been identified as important to stabilise new innovations. Policies can help shape expectations. This is evidenced in Lochiel project in Australia. Due to the impact of the project, there was a requirement of 7 Stars for subsequent new housing developments over the normal 6 Stars by the Australian Building Code.

The Lochiel village project also brought about change in practices. Niche technical innovations were introduced in the market as a result of the success of the project. The innovations were to conserve more energy and water. Conformity to 6 Stars by practitioners seems to suggest there were sustainability requirements already in use with institutional enforcement. Because of increase in sustainability design knowledge and benefits, practitioners adopted the niche technical innovations. It became possible to aim for a higher standard, thereby changing practices. In addition, there were changes in perceptions about sustainability in general which resulted in designers becoming adept with sustainable design techniques. Similarly, the transition from cesspools to sewer systems exemplifies a regime having impact on the development of a niche innovation. Underground sewers came as a result of changes in practices in the way waste was disposed but niche technical innovations are not the only path to transitions; regime transformations are also important.

Interactions of processes at the different levels are important to bring about change. The need for innovation comes from problems that emanate from the regime and landscape levels. An introduction of innovation at niche level can possibly trigger transition. However, normally the innovation requires support may be in form of regulations and policies that make it possible to overcome resistance from the dominant regime.

The discussion above suggests that changes in regime practices, policy, knowledge, institutions and networks are all important for niche development. A change in any of these elements can trigger developments in the niche.

3.3.2 **Regime reconfiguration**

Recent studies focus on the reconfiguration of a regime. Verbong and Geels (2007) study of the transition of the Dutch electricity system between 1960 and 2004 gives an example of a reconfiguration of a regime.

A reconfiguration of a regime is characterised by interaction of process between the regime and niche levels, which may interact synergistically or antagonistically. In the Verbong and Geels (2007) study, there were changes in the way electricity was produced and distributed in Netherlands. Landscape developments such as oil scarcity, economic recession, and climate change prompted change in regime rules and the stimulation of niche technical innovations which overall influenced system transformation. The electricity regime was composed of the utilities, the Arnhem organisations, households, large industrial users, national government and large municipalities. The Arnhem organisations and utilities had complete control of the regime. Government wanted more direct role in the system.

The introduction of natural gas in 1960 led to changes in regime. Government took a leading role in the introduction of natural gas, which led to the involvement of new actors in the regime. A cooperation of Government with private sector was created to exploit natural gas which led to the creation of Energy Distribution Company (EDC) and the separation of production and distribution of electricity. Moreover, Government's increased role resulted in a policy white paper which outlined provision of cheap energy and reliability of supply as the guiding goals

of the energy sector because of the oil crisis of 1973. There were also changes in rules as the final say in fuel use in power stations and the purchase of nuclear plants was transferred to the Minister of Economic Affairs. Previously, the role was left to utility companies. How destabilisation of the regime leads to changes in rules was evident when Government gained control of the system. For example, the Government restricted the use of natural gas in power stations which the electricity sector was accustomed to and enforced increased use of oil which was expensive. The second white paper changed the goals of the energy regime with energy saving becoming the top priority because of the oil crisis in 1979.

The third Government White Paper in 1995 formulated ambitions that by 2020, 10% of energy in the system should be renewable energy. Government introduced an energy tax in 1996. The tax exempted renewable energy sources and there was a reduction in the price between non-renewable electricity and renewable electricity, stimulating demand for renewable electricity. Second, Energy Distribution Companies campaigned to boost their green image, and this increased market demand for renewable energy. In the new regime, Government has active control through regulation. The creation of Energy Distribution Company (EDC) led to the separation of production and distribution of electricity.

The study demonstrates that the reconfiguration of the energy system encompassed many processes including changes in roles and policies. The Dutch Government was initially not directly involved in energy issues, but it changed when they took a leading role in the introduction of natural gas. Also, the energy white papers led to changes in goals from providing cheap electricity to consideration for sustainability through energy saving. In addition, there was creation of new actors thereby increasing networks i.e. the creation of Energy Distribution Company. The company campaigned for green electricity. The need for green electricity led to

niche innovations like photovoltaic for renewable energy gaining opportunity to enter the regime.

In this example, sector change depended on a number of developments; firstly, the introduction of policies provided clear goals of what they are addressing. This created a clear vision for the Government introducing the policies and for the energy sector. Once introduced the policies were given time to be implemented to avoid constant shifts which would have created uncertainties in the energy sector and practitioners not having actually learned the benefits of the said policies. There were tensions in social networks at times which resulted in the way electricity was produced and distributed. The change in policies introduced tax reductions which led to the emergence on renewable energy as a niche.

Secondly, there needs to be active participation of key actors in the system. In most developing countries Government is the key participator as such they have to have direct role to play say to advance sustainability in the construction sector. Lastly networks are important as they give those in the networks to advance the innovations as they have direct interest in the development of the innovation.

This account documented a number of changes that happened in the energy system. A key point that can be relevant for the study of the construction sector involve specification of roles. Through changes in the system, the role of Government (policy) and that of production and distribution companies was clarified. The construction sector has many active participants that need clarity of their roles. The construction sector has distinct links with the wider political, economic and environmental context, which are reflected in the discussion. For example, there were economic issues reflected by changing of goals from providing cheap electricity to consideration for sustainability through energy saving.

3.3.3 **Conditions for regime level change**

Some studies focus on the transformation of a regime. For example the transition from cesspools to sewer systems in the Netherlands between 1840 and 1930 (Geels, 2006) and the transition towards sustainability in the Swiss agri-food chain between 1970 and 2000 (Belz, 2004) focus on the regime and try to understand the dynamics of regime level change.

To understand regime level change dynamics, Geels (2006) argues that regime transformation can be due to pressure from outsider groups and adjustments in cognitions, norms and formal rules, enacted by regime insiders. According to Smith et al. (2005) regime change is a function of two processes: (1) shifting selection pressures on the regime, (2) the coordination of resources available inside and outside the regime to adapt to these pressures. This usually involves conflicts, contestations or power struggles (Geels and Schot, 2007) which arise because of the need to provide solutions for problems on the regime. But these are broad characterisation of regime level transitions. They do not specifically highlight the processes that are in play during regime transformation.

In looking at empirical studies, the process of regime transformation can become clear. This is illustrated by the study of the transition from cesspools to integrated sewer systems in the Netherlands (Geels, 2006). Actors who were involved in the system included private contractors, farmers, city Government, city authorities, department of public works, local health inspectors, national drinking water commission, hygienists and specialist engineers. Some were regime insiders while others were from outside putting pressure on the inside regime actors for reforms. Regime insiders included private contractors, municipal governments, municipal authorities and departments of public works. For example, private contractors were active actors who emptied cesspools for middle and upper-class families while farmers utilised the

waste as fertiliser. Government was involved to promote public life, public health, hygiene and social life. Municipal authorities were involved in issuing regulations for proper conduct of waste disposal from the community.

There were problems of indiscriminate waste disposal from overflowing cesspools. Private contractors cleaned the cesspools and either sold it or dumped it on streets creating problems of stench. Residents as well channelled the waste from their cesspools on to the streets and canals through pipes connected to the cesspools. They demanded better options to deal with human excrements. There were contestations between the public and inside regime actors about whose responsibility waste disposal was and its effects on general health. Bad smells from decaying matter were seen as possible cause of diseases but regime actors downplayed this and took little action. To them health was seen as an individual responsibility. Public investment in waste disposal facilities was low.

Hygienist doctors criticised the inside regime actors for this problem. They based their criticism on evidence found in the 1850s between infectious diseases and filthy environmental conditions. There was however little response from Government saves for municipal authorities publicly expressing concern with little changes to waste disposal practices or sewer systems. Municipal authorities argued the sewer systems proposed were expensive and there was little knowledge on the actual cause of diseases. Regime actors only implemented incremental changes. Public works department dredged the canals to ensure sufficient water circulation and remove deposits on the gutters used by residents. Municipal authorities issued regulations against public waste dumping.

This example illustrates a transformation path of a regime. Problems emanating from the regime and some landscape pressures prompted regime actors to find solutions for those problems. In

the process of finding solutions, regime rules were gradually adjusted. The gradual change was a result of different elements which came together to effect change. For example, people were used to disposing waste in open gutters into the canal, but they found a way to cover the gutters which led to new innovation of covered sewer systems. City authorities on the other hand contested providing solutions citing the expensive nature of providing sewer systems and the not so clear link between diseases and waste disposal. Hygienists put pressure on the regime to effect change citing evidence of ill health and filthy environments. With time this coalition of actors putting pressure on the regime which started with small changes leading to even broader changes. In addition, perceptions of diseases and waste and new knowledge of diseases, roles of public authorities, and waste-disposal practices gradually changed. The conflicts, contestations and power struggles between regime actors and outsiders and other landscape developments were important to bring about these changes.

From the example, catalysts for regime transformation include a link-up of dynamics at landscape, regime and niche levels. There needs to be a *coalition or network* of actors who will act promptly to address problems and find the right innovation to do that. Further because of their expertise, the alliance or network of actors could either put pressure on the regime for transformation or act inside to provide solutions to regime problems. Furthermore, those who provide resources be it financial or knowledge will likewise be needed to transform the regime. But solving regime problems with technological innovations is not always enough. Technological innovations can work or be hindered by other conditions.

Other conditions supporting regime transformation include regulations and social organisations. Changes in regulations can effect regime transformation. For example, positions of local health inspectors were created with the Health and Medical Laws regulations of 1865

in the transition from cesspools to integrated sewer systems in the Netherlands (Geels, 2006). These local health inspectors' positions were filled by hygienist doctors who until then were outsiders putting pressure on the regime to effect change in waste disposal methods. With their knowledge on infectious diseases, they were able to lobby Government for stricter regulations following on the Health and Medical Laws of 1865. This illustrates that a gradual change in regulations can have effect on the transformation of the regime and that expertise and commitment are important to see policies and regulations implemented.

Regulations may also influence the transformation of the regime through legally binding contracts, standards, or Government subsidies. According to the study on transition towards sustainability in the Swiss agri-food chain between 1970 and 2000 (Belz, 2004), industrialised agriculture was the dominant regime driven by Government policy (Belz, 2004). The Government policy was to increase agriculture yield after the Second World War to improve self-sufficiency and reduce dependence on food imports. The Government was willing to pay farmers subsidies and guaranteed minimum price on their products. The policy resulted in overproduction of yields as farmers used fertilisers and pesticides in their production. This caused environmental problems which brought a rethink in the regime of other ways of producing in an environmental friendly way.

Social or professional organisations or groups can have effect on regime transformation. Geels and Schot (2007) note that they may have specialist knowledge that allows them to criticise technical details of regimes and propose alternative courses of action. An example of the role played by social and professional groups is illustrated by the study on the transition from cesspools to integrated sewer systems in the Netherlands (Geels, 2006). The hygienic doctors criticised the waste disposal regime about the poor methods of waste disposal and suggested

alternatives. Likewise, the specialist engineers developed detailed technical sewer designs, even though most were never implemented. The two groups however acquired insider positions which allowed them to pass on new knowledge to the regime.

The study of the transition towards sustainability in the Swiss agri-food chain between 1970 and 2000 (Belz, 2004) is another that exemplifies the role of organisations to effect change in the regime. Organic farmers registered a Swiss organic farming organisation called Bio Suisse. The network consisted of a small number of farmers who knew each other personally. The Bio Suisse introduced the 'bud' as the official label for certified organic food products in Switzerland which helped potential buyers to recognise them from fraud ones. This trickled down and changed the willingness of people to buy organic products from them, hence changing the regime rule of using products from industrialised agriculture.

From these examples, there are some important points to consider about conditions for regime level change. There needs to be a *coalition or network* of actors to provide expertise, and resources. In previous studies internationally, professional associations were present and provided the necessary expertise in change processes. There is need to analyse who the relevant actors are in change processes. It is evident that government regulations are important considerations in a change process. In previous studies, government provided subsidies to use certain products meant for change.

3.4 **MLP Application to Construction Sector**

MLP studies look at how transitions come about from interactions of processes at different levels of landscape, regime and niche. The approach focuses on how developments at the levels co-evolve with each contributing to (or hampering) the transformation of a socio-technical

system. The examples cited in the preceding sections identify a wide range of mechanisms and processes which link the different levels together and facilitate the effect that one has on the other. A number of researchers have used MLP to analyse transitions in the construction sector. Studies focused on cumulative changes in the Norwegian construction industry from 1998 to 2013 (Nykamp, 2017), the role of actors in stimulating a transition to a green building sector in the UK (Gibbs and O'Neill, 2015) and an examination of how structural changes in the Australian construction industry influenced by landscape pressures was shaped by the developments at the niche level (Berry et al., 2013). The review of these studies highlights that MLP is a useful framework to study transitions. Although it has proved to be useful, it is not without criticism. This section discusses some studies that used MLP framework where possible highlighting the conceptual and methodological limitations of using MLP in construction industry change studies.

Nykamp (2017) used MLP to explore changes towards sustainability in the Norwegian construction industry. The study used a longitudinal, single case study method to provide insights into the cumulative changes in the Norwegian construction industry from 1998 to 2013. Specifically, during the different phases considered, the study investigates the extent to which there is a dominant design along with a coherent vision of sustainability. Secondly the study explores the build-up of a constituency of actors and their attitudes to green building. Lastly the study explores regime change in terms of market, policy and regulative changes as well as changes in attitude towards green building. A methodological limitation of the MLP when analysing historical cases; for example horse-drawn to automobile transport systems from 1860 to 1930 (Geels, 2005) is the use secondary data. The use of secondary data is criticised as flawed and as Genus and Coles (2008 pg 1441) concludes; secondary data come with "*uncritically accepted accounts*". This thesis does not study long-term historic transitions. The author's

analysis of development of coalition of actors and regime change in terms of market, policy and regulative changes provides insights into an analysis of the process of development and contribution of government policy initiatives to sustainability in this thesis. The thesis uses primary data and secondary from a shorter time span to explore current practices that are dominant and how networks were built during the development of the policy initiatives.

Gibbs and O'Neill (2015) investigated the role of policy makers in stimulating a transition to a green building sector in the UK. The study conceptualises green building sector as a niche innovation made of actors including architects, building companies, materials suppliers and policy makers. This is in contrast to the use of niche as technology innovation in previous studies discussed in previous sections. The consistency in applying the MLP theory concepts has been highlighted as one of the criticism of MLP (Genus and Coles, 2008). The study used a survey method with respondents drawn from businesses in the green building sector and support organisations including finance and policy staff, consultants, builders, architects, building material suppliers, and energy consultants/installers made up the sample. Participants were identified from exhibitors at events such as EcoBuild and GreenExpo, online membership databases of organisations like the Association for Environment Conscious Building (AECB), internet searches and snowball sampling. While the Gibbs and O'Neill (2015) study analyses the role of niche innovations in transitions by conceptualising green building sector as a niche, this thesis uses a different conceptualisation of a niche as for technology development. Actors such as architects, building companies, materials suppliers and policy makers are regime members which is the construction industry. Landscape level factors include the domination of foreign construction firms in Botswana and climate client.

Berry et al. (2013) used MLP to examine how structural changes in the Australian construction industry influenced by landscape pressures was shaped by the developments at the niche level. The aim was to find how the creation of the Lochiel Park Green Village demonstration project allowed individuals and organisations to gain a practical understanding of sustainable housing so as to change industry practices, government policies, and regulatory standards. This research used a critical case study method, with respondents sampled purposively from both government and industry people who were involved in the creation of the project. A set of 8 semi-structured interviews with actors actively involved in the creation of the Lochiel Park Green Village were conducted. The data collected from the interviews was triangulated with material from published and unpublished State Government policy development documents detailing specific aspects of the creation of the demonstration project.

The study used MLP concepts of visions, learning and networks to analyse how these concepts were shaped in the change process. In terms of visions, the South Australian regional Government took a policy decision in 2002 to have a clean and modern green Adelaide. They engaged a 'thinker in residence' who engaged with policy makers and general public to learn of what was needed. From that envisioning process, targets were set to reduce energy used, greenhouse gas emissions and potable water use from the 2004 averages. An example of learning was the sharing of experiences with the broader building industry through training sessions held at the demonstration project and specific presentations by those involved with the development to the building industry. Networks were built through an engagement of policy makers and general public to avoid tensions and assess expectations. The study is found relevant to this thesis in that it studies a process of creating the Lochiel Park Green Village demonstration project. However the use of a single, critical case design is limited in studying transitions. According to Avelino et al. (2017) understanding transitions requires an analysis of

multiple change processes to overcome the limitations of the linear understandings of transitions. Most previous studies using MLP, for example Berry et al. (2013) and Gibbs and O'Neill (2015) studies discussed above, assume transitions begin in niches. It is the assumption of this thesis that transitions result from multiple change processes at niche, regime and landscape levels.

As the discussion above suggests, at the niche level, a key condition for innovations to effect regime level changes is an initial *envisioning* of the purpose of the innovation. According to MLP, having a vision for the innovation will communicate a clear expectation of the niche innovation to the regime actors. This will support regime actors in developing a vision for the regime which incorporates that innovation. Visions are created for the innovation and used by interested actors in the regime. In the context of Botswana, this raises a question of what the vision was of the innovation(s) that were introduced at the BOTEC demonstration projects. In addition, it is imperative to find what the conditions would need to be for a genuine niche market to develop.

The other key conditions for niche innovation to effect regime level changes are the formation of support networks around the innovation. Support networks could be through actors building *coalitions* that can learn and advice about potential innovations in the niche level as well as promote, provide knowledge and resources to the regime level actors for the innovation to flourish. *Coalitions of actors* can therefore coalesce around a niche innovation at the niche level and coalesce around a problem at the regime level. It is imperative therefore to find whether there are any support networks that were formed around the innovations and how much they could mobilise resources and commitment. Reflecting further on the innovation support networks it is important to find who those actors are and what their interest is. Were they the

right actors who could have potentially supported the innovations? Clear *innovative advantages* of technologies could lead to formation of niche markets. Niche markets increase the chance of innovations to impact the regime. It is important therefore to find the innovative advantages of the technologies and whether a niche market has developed around the innovation(s) and technology(s) through increased customer awareness and removal of institutional barriers?

The other key condition for niche innovation to impact regime level is the learning process within the niche. Learning could be about the technical performance of the innovation or its economic feasibility. Niche innovations produce results which actors learn from the results and make adjustments to improve the innovation or societal embedding, in this case embedding in the construction sector.

3.5 Summary

This chapter has discussed the MLP used as a theoretical lens to analyse the cases. The chapter started with a conceptual description of the MLP approach; which conceptualises a socio-technical system as made up of three levels and argues that transitions come about through interactions between processes at three levels: (a) niche-innovations build up internal momentum, through learning processes, price/performance improvements, and support from powerful groups, (b) changes at the landscape level create pressure on the regime and (c) destabilisation of the regime creates windows of opportunity for niche innovations. Empirical studies were used to illustrate its usefulness to analysis of the three cases. A discussion of MLP use in the construction followed.

In conclusion to this chapter, there are some important points to consider about conditions for regime level change. It has been shown that the transitions literature places significant emphasis

on *guiding visions*. It has been shown visions act as problem-defining tools by pointing to the technical, institutional and behavioural problems that need to be resolved and serve as a common reference point for actors collaborating on its realisation. Secondly, there needs to be a *coalition or network of actors* to provide expertise, and resources. *Coalitions of actors* can therefore coalesce around a niche innovation at the niche level and coalesce around a problem at the regime level. Lastly it was shown that niches are important because they provide locations for *learning* by doing, using and by interacting.

Chapter 4: Research design and methods

4.1 Introduction

This chapter explains the research approach used to explore how policy initiatives drive change towards sustainability in the construction sector. The aim of the research is to explore the role that Government policy initiatives play in transitions towards sustainable construction. It also aims to better understand the conditions in which the different initiatives are likely to succeed and contribute to a transition in general and in Botswana in particular. The Multi-level perspective (MLP) approach is applied to three Government initiatives that include the BOTEC staff housing project, the Botswana Environmental Impact Assessment (EIA) Act and the Botswana Construction Industry Authority. The analysis is used to reflect on the potential of the policy initiatives to contribute to a transition by examining opportunities and challenges that have/are being created by the initiatives. This chapter sets out the scope of the inquiry and describes the steps taken to collect, interpret and analyse relevant data.

The initial section 4.2 introduces the research design and the following section sets out the data collection process. Following on the data collection, the way the data was analysed and ethical issues of the study are outlined. Finally, a summary concludes the chapter. The following sections provide a description of the research design.

4.2 Research Design

A research design describes the ways in which data is collected and analysed in order to answer the research questions posed (Fellows and Liu, 2008). The literature review indicates that

institutional structures are critical in a change process. The aim of the study is to explore the role of Government policy initiatives in Botswana's transition to sustainable construction.

Previous related studies on sector level transitions (Nykamp, 2017, Berry et al., 2013) used a qualitative case study method to explore the process of change. The focus with these studies was to understand how and why the change occurred in the respective construction industries. They premise the justification of the choice of a qualitative approach to the possibility of providing a "*more in-depth examination of the interactions between systems, actors and rules*" during the change process (Berry et al., 2013 pg 648). Two defining characteristics of the qualitative research method include the focus on interpretation rather than quantification and concern with the context (Creswell, 2009), both of which are important in the study of a transition process.

The focus of this research is to explore holistically and in a real-life context, the processes by which the initiatives were conceived, developed and are contributing to a transition of the construction industry in Botswana towards sustainability. The research takes into cognizance that reality is socially constructed by subjective interpretations of the actors involved in the initiatives. It is for this reason that a qualitative research underpinned by an interpretivist approach are deemed appropriate for this research. Interpretivist approach tends to be subjective as it depends on dealing with participants directly in their context and social reality can be understood and explained from the point of view of participants themselves (Bryman, 2012).

This research adopts a case study approach as case studies are more suitable for exploratory studies, bounded by time and place (Creswell, 1998). A case study offers the researcher the chances to explain holistically and in a real-life context, the process of development of three Government supported initiatives which are intended to move the construction sector towards

sustainability. A case study approach was adopted as it facilitates an in-depth investigation of a phenomenon (development of the initiatives) within its context (Botswana construction industry) (Fellows and Liu, 2008). It can involve single or multiple cases and numerous levels of analysis (Yin, 2003). The next section discussed the rationale of adopting a multi-case study design.

4.2.1 **Rationale for multiple case study design**

One of the methodological weaknesses of the transitions studies is the high reliance on single technology, single country case studies (Geels, 2011). The studies tend to focus on bottom-up change models which emphasise processes of regime change begin with initiatives within niches. What is less clear is how a combination of discrete initiatives can support a transition in a less economically developed country. According to Avelino et al. (2017) analysis of multiple change processes would challenge the linear understandings of transitions. Within the studies, regimes are framed as barriers to be overcome (Geels and Schot, 2007). However Geels (2002b) emphasise the importance of alignments with broader developments. The study suggest that the bottom-up change models which emphasise niche innovations needs be considered with other regime and landscape level factors in transition studies.

To challenge the linear understanding of transitions, a multi-case study design was deemed the most suitable and adopted for this study. The cases selected, namely, Environmental Impact Assessment Act, BOTEC demonstration projects and Botswana Construction Authority show ongoing processes at the niche, regime and landscape level. The cases were analysed in an iterative way involving different data collection approaches at different stages of the research to gain understanding of its multifaceted perspectives including expectations of the projects and roles of different actors.

4.2.2 **Selection of cases**

The research is concerned with exploring how policy initiatives drive change towards sustainability in the construction sector, and to better understand the conditions in which the different initiatives are likely to succeed and contribute to a transition in general and in Botswana in particular. It was reported in Chapter 1 that a number of policy initiatives have been introduced over the years by the Botswana Government. Some of the policy initiatives were aimed at giving citizen owned construction firms an advantage to compete favourably with international firms based in Botswana (Palalani, 2000). Other policy initiatives were aimed at changing procurement practices by increasing participation of local contractors (Adolwa, 2002) while some of the initiatives were aimed at changing the construction sector towards sustainable construction. It is the latter policies with sustainable construction as the focus which are the subject of this investigation to understand how change unfolded due to the introduction of the initiatives.

The following basic criterion were used to select the cases for inclusion in the study. To be included, the initiative must;

1. Be a Botswana Government initiative or have support from Government
2. Aim to contribute to sustainability/sustainable development in the construction sector

The number of cases is limited by the number of initiatives that Government of Botswana has undertaken over the years on sustainable construction. Three policy initiatives with a focus on sustainable construction as per literature were identified. BOTEC projects and the Environmental Impact Assessment Act were mentioned by respondents as sustainability initiatives in a study by Ntshwene et al. (2014) which investigated the level of knowledge and awareness of the role of environmental building assessment tools in the Botswana construction

industry. The Botswana Construction Industry Authority is a new initiative that culminated from a study (Ssegawa-Kaggwa et al., 2013) that the researcher was involved in.

The three initiatives exemplify three distinct ways that MLP suggests governments have supported sustainable transitions. The first case involved a demonstration project. The BOTEC staff housing project has fostered many innovations, some of which have the potential to support niche market developments. As a technology development organisation, BOTEC used the project to show the benefits of the technologies to the construction sector. For example, some of the technologies were for efficient energy use in houses. The success for the technologies depends on the articulation of visions and learnings of the innovation and the support networks that promote them. As such, it appeared to play a technological niche development role in transitions to sustainability (Figure 4-1). It had the potential to develop technologies that could be used in the construction sector.

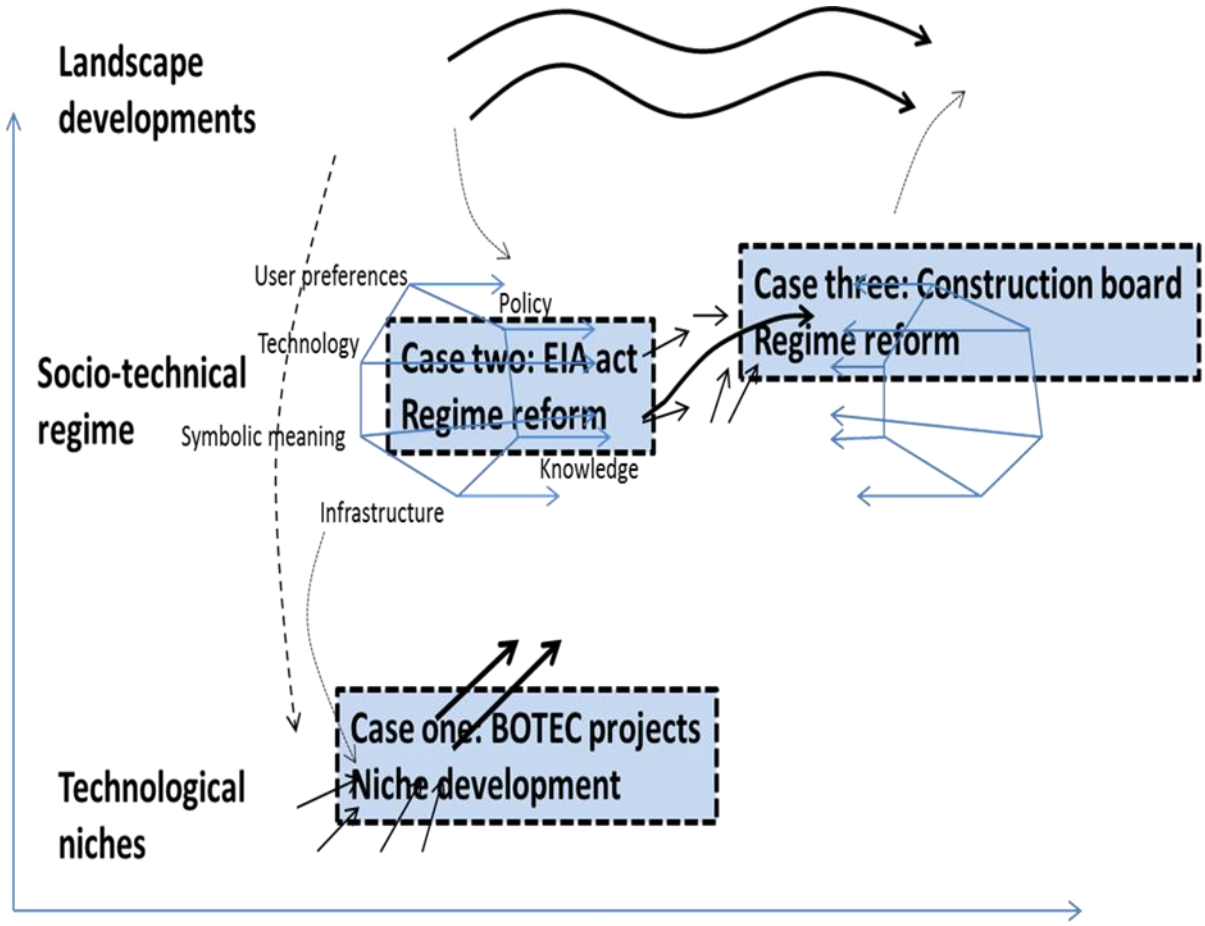

Figure 4-1: Basis for selection of cases

The second initiative, the legislation of Environmental Impact Assessments, appeared to play a regime reform role in transitions focusing on the environment. The EIA was developed as an all-encompassing policy on environmental protection. The policy covers infrastructure developments as well as conservation of natural resources. The policy thus is not only focused on new developments. The setting of the study is in the emerging world context where policies are especially mostly non-existent or poorly articulated when available. An existence of a policy such as the environmental impact assessment policy provides a policy environment that can effect changes in the regime.

As noted before, policy can help in niche development by providing subsidies. It is therefore important to find the kind of support that the EIA offers the construction industry and in particular does it specifically or in general make mention of the innovations trialled at BOTEC. It is important also to find the vision of the policy for the construction sector. Also, questions can be asked relating to the conditions that the policy should cover to be effective. Has the introduction of the policy changed any practices? What are the expectations of the policy on the regime and in turn what does the regime expect about such policies? Who were the actors who were involved in the formulation of the policy?

The third case, the creation of a sector wide construction board, likewise appeared to play regime reform role in transition to sustainability role with focus on the economic and social dimensions of sustainability. The Botswana Construction Board is a professional organisation made of representatives from Government and the private sector. The board is not fully operational yet, though it has been established. Its importance could only be speculated based on previous studies which highlighted the roles professional or social boards in transitions. In previous studies, researchers studied actors who had grouped themselves and formed organisations which pressured the regime actors for changes notably in regulations. Actors in the organisations provided technical knowledge to solve regime problems among others. They formed part of the regime or provided their knowledge and expertise from outside the regime.

As argued by Kemp and Loorbach (2003 pg 8), "*transitions are the result of endogenous and exogenous developments and there are cross-over effects and autonomous developments*". A researcher should look for process explanations of the multiple causalities rather than individual causal patterns (Kemp and Loorbach, 2003). The chosen cases exemplified technical, social and cultural/practices changes. At the landscape level, the Botswana construction market has

changed dramatically over the last years. The market used to be dominated by regional firms most notably South African construction firms. Recently however, many international firms mostly Chinese have found a way into the market. Though there are citizen preferential policies, these are meant for the small firms. The policies reserved certain construction works for citizen construction firms.

Climate change is the other notable landscape development in the Botswana construction sector. Climate change has resulted in long droughts in Botswana with shortage of water as a consequence. The lack of water has affected the construction sector so much that at some point construction projects were shelved citing the shortage as the cause. This problem looks set to continue as Botswana generally is a dry country prone to droughts. In line with the changing face of the construction market, it is important to find the efficacy of the existing reservation policies. In addition, how the shortage of water has affected existing policies and what is the response from policy point of view. The next section gives an overview of the data collection methods.

4.3 Data collection methods

Several approaches were used for collecting data, including interviews and documentary analysis as primary data sources. There is generally a lack of secondary data and public records on sustainability in Botswana. A summary of the different sources of data that were used are provided in Table 4-1. It was difficult to get the information in the cases. In the BOTEC case, most of the people who started the project had left Botswana. All the relevant documents were stored in a store-room without being achieved properly. It was difficult therefore, when given access, to search through scores of improperly labelled documents. It was the same with the EIA as most of the people had left Department of Environmental Affairs. It was however

possible to contact some of them. In the case of the Construction Board, some potential interviewees refused to participate citing that the Board was still in the process of establishment and they were constrained to speak about a Government initiative still being developed.

Table 4-1: Overview of data collection sources

Methods	Sources
Interviewing	32 individual interviews
Document analysis	• BTC Experimental staff housing project design and construction assessment report • Thermal monitoring program report • Report on workshop on environmental impact assessment legislation (1992 and 1995 reports) • EIA legislation (2005 and 2011) • EIA pamphlets • Draft Botswana Construction Industry Bill

4.3.1 **Sampling**

The three initiatives are relatively small, so effort was made to interview as many people as possible who were directly involved. Specifically, effort was made to interview people who were involved from the start of the initiatives. They could have given insight into the reasons for the creation of the initiatives. Access to people was gained through personal contacts.

The first step involved going to the organisations that developed the initiatives and asking for people who were involved in the process. The people who were involved were identified by the first contact made in the three initiatives. In the BOTEC staff housing project, the initial contact was made with the Lead Researcher. Thereafter the Lead Researcher provided the contacts of other people who were involved with the initiative. In the case of the EIA, a manager within the Department of Environment Affairs directed the researcher to the environmental officers.

In the case of the Construction Board, contact was made with the executive director of a construction organisation. The initial idea was to gain access to people who had participated directly in the development of the initiatives.

4.3.2 **Interviews**

Qualitative data was preferred for this research as it allows the researcher access to the original thoughts of the respondents. Interviews are a major technique in gathering data for qualitative research. Semi-structured interviews were preferred instead of structured or unstructured interviews. This was to provide some degree of focus for the questions while maintaining the ability to probe emerging trends or insights that were not envisaged at the time of preparing the interview protocol.

The interviews were conducted with people who were involved in the development of the initiatives. This was to solicit the perceptions of the interviewees on the development process of the initiatives and the actors' perspectives and experiences including their expectations of the initiatives. The choice of people directly involved allowed for the exploration of the participant's perceptions and expectations for being involved in the initiatives, as well as the challenges and opportunities that have/are being created by the initiatives.

In total 32 semi-structured interviews were conducted but only 26 were used for the analysis. The other six interviews were excluded on the basis that the interviewees were not directly involved in the three case studies analysed. For example, two interviewees were involved directly in the construction of the BOTEC Headquarters which was not chosen as one of the cases. Table 4-2 shows a list of interviewees with their position and the dates for each interview.

Interviewees were interviewed once but in some cases they were contacted many times to ask for more contacts.

Table 4-2: List of interviewees

BOTEC		**EIA**		**Construction Board**	
Position	**Date**	**Position**	**Date**	**Position**	**Date**
Lead Researcher	31/08/15	Environmental Officer 1	03/09/15	Executive Director	09/09/15
Electronic Engineer	01/09/15	Environmental Officer 2	03/09/15	Senior Research Fellow	20/07/16
Director: Corporate Services	07/09/15	Environmental Officer 3	17/09/15	General Manager: PPC	16/09/16
Architect	08/09/15	Environmental Coordinator	04/09/16	Deputy Permanent Secretary	25/08/16
Principal Energy Engineer	09/09/15	Contractor	12/09/16	Chairman: Botswana Quantity Surveyors Association	30/08/16
Principal Energy Engineer	11/09/15	Environmental Consultant	21/0916	University of Botswana Researcher	16/05/17
Senior Architect 1	14/09/15	Senior Government Officer	22/09/16		
Senior Architect 2	15/09/15	Government Officer	23/09/16		
Head of Architectural Unit	25/09/15	Environmental Practitioner	28/09/16		
Principal Electronics Engineer	17/09/16				
Principal Architect (Telephone interview)	23/11/16				

The following sections highlight the specific steps taken in each case study to get data.

BOTEC project

Not all participants in the projects could be interviewed. The demonstration project was completed in 1993 and most of the project team members were international workers and most left after the completion of the project. A lead researcher who knew some of the participants in the project was first interviewed. The lead researcher was formerly a Senior Research Civil Engineer with BOTEC. He joined BOTEC after the project has been completed but he was the best person to interview as he continued with some of the research that was started by the people who had left. The discussion with him yielded further actors who were involved in different capacities with the projects. In total 11 interviews were conducted with people who were involved with the BOTEC projects. Access to participants was slow at the beginning of the data collection period. Some of the participants' had already left Botswana. Online social network LinkedIn was used to track some of the participants. An architect who now resides in Australia was traced through LinkedIn and interviewed telephonically. The analysis of the case is based on eight interviews with actors who were directly and indirectly involved with the development of the BOTEC staff housing project. In addition, project reports including BTC experimental staff housing project design and construction assessment and thermal monitoring program reports were used in the analysis. Interviews were held with a researcher, electronics engineer, director, project architect, principal energy engineer, head of unit, principal architect who joined the team in 1993 and principal electronics engineer.

EIA

The researcher went to the Department of Environmental Affairs (DEA) where a request to see people who are involved with the implementation of Environmental Impact Assessment was

made. The researcher was directed to the office of environmental officer where an appointment for an interview was made. The environmental officer was not involved from the beginning of the process to establish the Act. He however was involved with its implementation. He directed the researcher to other contacts that were either involved from the beginning or involved with the implementation of the act. The analysis of the case is based on nine interviewees with people who were either involved in the development of the legislation, implement it or are affected by its implementation. The nine interviews included three with environmental officers who implement the Act; environmental practitioner; environmental consultant; environmental coordinator; two Government Officers and a contractor. In addition public documents which included EIA legislation and reports were used in the analysis.

Construction board

The researcher went to the offices of Association of Botswana Building and Civil Engineering Contractors (ABCON). The Executive chairman of ABCON was approached for a possible interview. Though the contractor association is voluntary, it represents many of the construction firms in Botswana. Through personal contacts, the researcher was directed to him as the most relevant person who was involved from earlier attempts to establish the professional association for contractors. The analysis of the case is based on six interviews with people who were involved in the initiative to establish the Botswana Construction Authority and documents, including a Draft Government Bill. The interviewees included: a representative of ABCON; a BIDPA researcher; manager of a manufacturing firm; senior Government officer, Chairman of a construction association who is a BOCCIM member and a University of Botswana researcher.

4.3.3 **Interview procedure**

Interviews were conducted in Botswana. Every effort was made to conduct the interviews in person, but due to time limitations and the fact that international workers who were involved with the BOTEC case study had returned to their home countries after completion of the initiative, some interviews had to be conducted over the telephone. The face-to-face interviews were held in the participants' offices.

The first round of interviews was held from August to September 2015; the second round was held from July to September 2016. The interviews lasted on average between forty five minutes and one hour. Prior to commencing each interview, participants received an explanation about the project. The title of the project was introduced as "*sustainability initiatives in the Botswana construction sector"* to participants. This strategy was useful to increase the level of participant's engagement to the topic, which resulted in more effective conversations during the interview.

To facilitate the interviews, an interview schedule was developed that listed important areas to be covered but which allowed for some probing to follow interesting lines of inquiry (Bryman, 2012). The interview schedule was tailored for each case study initiative and further refined for each interviewee to reflect on their role in the initiatives. Some interviewees were not present at the start of the development for the initiatives. The interview schedule covered the main thematic areas of the process of development of the initiatives.

To start each interview, respondents were asked an open question on "*how the initiative came about and how and when they got involved*". This allowed the respondents to freely discuss their participation and why they participated in the development of the initiatives. In addition, this line of questioning allowed the respondents to guide the discussion with probing where

necessary. However, there were more directed questions that were asked in order to get the information that was needed. For example, for the first case on BOTEC projects, probing questions were crafted to explore on three issues; the visions and expectations for the project, the learning processes that took place and how the different actors were mobilised to build the networks around the development of the initiative. For the second and third cases on the EIA and construction board respectively, interview questions were crafted to expound on visions, changes in rules and development of social networks around the development of the Act and development of the construction board. Interrogations such as "what were the main motivations for you to be involved in the project(s)" and "how did the projects develop" were used to probe more information of the respondent's participation on the initiatives.

All interviews were audio recorded with the interviewees' permission. This allowed me to listen actively as the discussion unfolded rather than being disturbed with taking notes. Participants were given an option to request transcripts of the interviews. At the end of the interviewee, interviewees were asked for relevant documents of the initiatives.

Documents represent a valuable data source because they can be used to validate and complement information from other sources (Sarantakos, 2005). The interviewees were asked to provide documents where possible relevant to the discussion during the interview. These documents focused on bringing clarity to the account of circumstances under investigation through identification of key incidents and formal processes followed.

For the BOTEC case, access was granted to the organisation's archives and documents made available for use in the analysis. Some of the documents provided information about the BOTEC organisation and the timelines of the initiative. This included when BOTEC was set up and the mandate that it was given when it was set up. Other documents provided the

background to the demonstration project and this include the BOTEC experimental staff housing report. The report was produced by the civil engineering and architectural units of BOTEC in 1995. The report details the design and construction process of the project.

For the EIA case, most of the documents that were used are public documents such as policy and Government papers on environmental protection. The documents that were used include the 2005 Environmental Impact Assessment Act and the 2011 Environment Assessment Act. The Acts were extensively reviewed as they highlight the implementation process for the act. In addition two workshop reports on produced by the National Conservation Strategy Coordinating Agency were used. The first reports on a workshop that was held in December 1992 while the second reports on a workshop that was held in March 1995. The workshop documents were brought by one interviewee to the interview.

These documents were useful for piecing together the descriptive picture of the initiatives from inception to the present. The documents were also useful for subsequent interviews with other respondents. They served as a point of reference to corroborate the information obtained from the subsequent interviews and mitigating against recall biases.

4.3.4 **Limitations of data collection process**

Limitations in this research came from two factors. First, the research relied on accounts of individual perceptions of what happened and how it happened in the course of the development of the initiatives. This means that some aspects of the initiatives might have been forgotten by the interviewees. The documents that were provided during the interviews were used to complement such information.

The second factor involved the time lag and problem of availability. This was especially evident in the BOTEC case which was developed in the late 1980's. By the time of conducting this research, most of the key people (Principal Architect and Principal Engineer) who started the project and prescribed the materials had already left Botswana. Consequently, their input was missed. Effort was taken to try and locate them but it was all futile. Because key actors in the BOTEC case were not available to be interviewed, this research relied on project documents to account for the early processes in the initiative. Since the documents were produced by the members of the construction team, it is possible that they carried some bias by not reporting the events as they unfolded.

The other factor was related to the time for collecting the data. It was planned to access archives of the BOTEC case as most of the people who were directly involved had left Botswana after the project was completed. Request for access was submitted in time but access was only granted a day before I had to return to the UK. Though some documents were collected, the time was limited to search for more other relevant documents.

In the Construction Board case potential interviewees who were directly involved in the process declined to be interviewed. They cited that they were constrained to comment on a Government initiative that was still under development.

4.4 **Data analysis**

This research employed a thematic analysis method as the method of data analysis. Thematic analysis is a method that allows examination of data to extract core themes (Bryman, 2012). This is carried out by means of a systematic classification process of coding and identifying themes and categories that are recurring and drawing descriptive or explanatory conclusions around the identified themes and categories (Bryman, 2012).

The analysis and interpretation of empirical materials was an iterative process. Preliminary analysis was conducted in parallel with the data collection phase. The early stage analysis assisted the researcher to improve and to refine the interview questions. Furthermore, this strategy was useful to ensure that the topic being studied was adequately covered.

The data analysis process was conducted in stages. In the first stage, the recorded audio was listened to get familiar with the issues that were discussed by the different interviewees. The audio materials were later transcribed verbatim to enable reading through the transcripts in full. This also made it possible to return to them several times to gather more information that was overlooked the first time round. Cutting of sections of the speech to illustrate a point on the final thesis was also made possible by the availability of the transcripts.

Data coding was carried out in stages. In the first instance, transcripts were read line by line. This allowed the researcher to familiarise himself with the data. When reading through the transcripts, issues that appeared interesting were annotated by hand. This was helpful to pick what appeared to be recurring themes in the data. The information was coded manually. Each interviewee was assigned a unique code to make reference to their quotes in the findings chapter so that they could not be individually identified. Names of people and places were replaced with the use of pseudonyms in transcripts.

The transcripts were read several times with the reiterative process of aligning assigned codes to the highlighted passages continued. Transcripts were compared line by line to see if previously assigned codes reflected the same concept throughout. As the process progressed, the codes became more refined, and some of the initial codes were subsumed by other codes while others were relabelled. The codes developed were subsequently grouped into categories.

The analysis within each case study was carried out in steps. First, the research traces the historical context of the case exploring the landscape level factors that influenced the development of the initiative. This included noting how those landscape factors had an effect on the regime. Once those we established, the analysis shifted to how the regime responded to the pressure exerted by the landscape factors.

Then the regime level problems that the initiative was responding to were analysed in the second step. The exploration traced the process that was followed in the development of the initiatives. This included identifying the actors who were part of the process and documenting their influence in the development of the initiative. Features of the initiatives were identified which had an influence on the impact of the initiatives. For example, in chapter 5, the selection of materials and the thermal monitoring program were the key features of the initiative. In chapter 6, implementation challenges which led to the review of the 2005 EIA Act were critical stages.

The process of tracing the initiatives leads to an analysis of the impacts of the initiatives. The impact was analysed in terms of success and failure of the initiatives on the construction sector. The success or failure was analysed in comparison to what the initiatives set out to do. This included comparing with where the objectives for the initiative were stated and whether those were achieved or not.

Lastly, MLP concepts are used as a lens to analyse the initiatives. The concepts that are used for the analysis include visions and expectations, learning processes, change in rules and development of networks. Analysis with these concepts was to answer the question why visions, networks and learning matter in sustainable transitions.

4.5 Ethical considerations

One of the criticism of qualitative research is that it allows close contact with respondents which can lead to ethical problems (Sarantakos, 2005). Necessary measures were taken to avoid inconveniencing participants. The measures were taken also to avoid any circumstances that could pose a risk to the participants because of participating in the study.

Prior to commencing the study, ethical clearance was obtained from the School Ethics committee. The ethical approval followed the requirements set out by the School Ethics Committee at the University of Reading. The procedure requires the identification of ethical issues and how they will be managed. The procedure also requires the submission of the interview schedule for approval before the commencement of the data collection. A copy of the interview schedule was submitted along with the ethics application form. During data collection, participants were fully informed about the research and were given the opportunity to give their consent. A copy of the information sheet and a sample consent form that participants signed is shown in Appendix A. The research also received approval from the Ministry of Infrastructure, Science and Technology in Gaborone, Botswana (Appendix B).

Most research at the minimum guarantees participants' confidentiality in order that identifying information will not be made available to anyone who is not directly involved in the study (Mason, 2002). There were confidentiality issues in this research as people who were involved in the initiatives were asked for their individual accounts of what happened in the initiatives. There was therefore potential of revealing data deemed confidential or politically delicate and thereby likely to get them in trouble with their superiors. There were suggestions of corruption in some aspects of the initiatives which the respondents did not want to be quoted on. Confidentiality and anonymity needed to be guaranteed.

To manage the potential ethical issue identified, first, the names and identifying features of participants and organizations were anonymised so their identities remained confidential. Second, all interviewees were told that audio tapes and any notes taken from the interview was to be used only for academic purposes and in accordance with the wishes of the interviewee. Third, interviewees were told that they could refrain from answering any interview question if they chose. This procedure was communicated in writing to each interviewee through an information sheet, and each signed a consent form to document his or her understanding. Finally, interviewees were given the option to review their interview transcripts and make changes as they saw fit.

All the data that was collected was treated with confidentiality and storage requirements in line with the University of reading Ethics requirements of data storage. Hard copies of interview notes and consent forms were stored in a locked drawer at the researcher's workplace. Original recordings and transcriptions were stored in a password protected computer file.

4.6 Summary

This chapter has reviewed the methodological choices of the study. The initial section discussed the research methodology with justification for the choice of the research philosophy, approach and how studies have approach similar research. This was followed by the research design with justification for the choice of a case study method. The section was then followed by the discussion of research methods with emphasis on the interviews and how they were structured to elicit information to address the research objectives. The chapter concludes with a discussion of the ethical issues that were considered for the study. The following chapter introduces and discusses the first of the case study research findings.

Chapter 5: Botswana Technology Centre

5.1 Introduction

This chapter analyses the activities of the Botswana Technology Centre (BOTEC) staff housing project. More specifically, it follows a demonstration project for sustainable construction. The aim of the demonstration project was to provide thermally comfortable accommodation with the least amount of energy and experiment with new building materials, building systems and building processes. The design and construction of staff houses by BOTEC can be analysed in terms of two stages; the selection of construction materials for Phase I and Phase II of the project between 1989 and 1991, and; the thermal monitoring program in 1993. An account of what happened at each stage is presented reflecting in each on the role of international workers.

The aims of the chapter are first, to analyse the development of the demonstration project and reflect on its ongoing contribution to change towards sustainable construction. Secondly, to evaluate it in terms of the three niche processes of visions, learning and formation of social networks and their implications for transition to a sustainable construction sector. The case of the BOTEC project also provides an opportunity to explore the role of demonstration projects in Botswana's transition to sustainable construction. The lack of sustainability knowledge in the construction sector and organisational tendency to privilege international professionals at the expense of the local experts reduced BOTEC potential to capture and disseminate results to a broader audience.

The followings sections give a brief description of the BOTEC organisation which is then followed by a narrative account of what happened during the development of the demonstration

project. The chapter concludes with an MLP analysis of the BOTEC demonstration project. The following section gives a background on the BOTEC organisation.

5.2 Purpose of BOTEC

Efforts to develop technology appropriate for construction in Botswana were being made as early as 1975. At that time many organisations were interested in industrialisation and appropriate technology but, according to Selaolo (2008), their efforts failed because there was lack of coordination of research and development projects. This set-in motion the process to have a technology centre that would facilitate the identification, investigation, development and application of appropriate technologies.

BOTEC was founded in 1979 to meet the Botswana Government's new policy objective of technology promotion and innovation to promote economic development and improvement of quality of life in Botswana (Selaolo, 2008) in the fields of science, engineering and technology.. The vision of BOTEC was "to be a leader in harnessing innovative science and technology for the transformation of Botswana into a globally competitive nation" (Selaolo, 2008 pg 3). Its proclaimed functions included developing technologies for local use, assessing technologies for actual and potential impact on development in various sectors and the development of prototype technologies. The institute pursued research in many areas including renewable energy, sustainable architecture, water and environmental technologies, information communications technologies (ICT) and technology management and transfer (BOTEC, 2004).

BOTEC was registered as a not-for-profit organisation wholly controlled by the Government of Botswana. It was funded by the Government through the Ministry of Finance and Development Planning (MFDP). The organisation was headed by a board of directors with a managing director who oversaw the daily running of the organisation (BOTEC, 2004).

Appointment of the board and managing director was the prerogative of the MFDP. The organisation was divided into departments for technology development, technology information and finance and administration (BOTEC, 2004).

A pamphlet authored by the Chief Executive Officer of BOTEC lists some of the projects or technologies they have undertaken or developed (Selaolo, 2008). The purpose of the newsletter was to update the public about the niche technologies developed and promoted between 1979 and 2008. The niche technologies that were developed or their applicability and suitability for Botswana tested includes; borehole water level sensor, Motshegaletau photovoltaic power station, hand water pumps, Mark 4 and Mark 6i photovoltaic charge controllers, Masa florescent light, Photon 128 hearing aid, automatic weather station, solar thermal testing facility, Kgalagadi sand building block, the solar chimney and solar photovoltaic street light. Based on this list, BOTEC projects would seem to have been biased towards technology development. The housing demonstration project seems to be an exception as it included a technology application dimension.

From the above discussion, BOTEC developed and tested applicability of various technologies. In the construction sector, they developed two projects- the BOTEC experimental staff housing project and the BOTEC headquarters buildings. The experimental staff houses were designed to test and demonstrate the applicability of various types of construction materials for a residential market.

Of the two projects, this thesis focuses on the staff houses. The project exhibits some of the characteristics which MLP studies suggest matter to effect a transition in the construction sector. There was experimentation with different types of niche technologies. It was during that experimentation that processes of articulating visions and expectations, building networks and

learning were evident. The next sections analyse the landscape level problems that necessitated the construction of the houses. In the following sections, regime level problems are analysed. Finally the development of the BOTEC project as a niche is made in the following section.

5.3 Drivers for developing BOTEC staff housing project

The following section explores the landscape and regime level factors, which influenced the decision to develop the project. The analysis highlight that the landscape issues included rapid urbanisation while regime level factors included changing contours of the house regime, sustainability knowledge, reliance on external sources for electricity and the current material practices.

5.3.1 Landscape factors

According to MLP, landscape provides a relatively stable environment which pressures and thus challenge existing regimes (Geels, 2002a). In the BOTEC case, it seems that rapid urbanisation in Gaborone in the late seventies and early eighties was a key driver for the development of the project and subsequent choice of the niches. Pre-independence under the British rule, Botswana had no capital city of its own (Krüger, 1994). During that time, the country was governed from Mafikeng, South Africa (Silitshena, 1984).

The rapid urbanisation of Gaborone has been attributed to the end of colonial rule from Britain. Silitshena (1984) notes that during the entire years of colonialism; Botswana was governed in Mafikeng, South Africa. With the gaining of independence in 1966, Botswana needed to find a site for the capital. Gaborone was chosen. Gaining independence gave impetus to rural-urban migration.

According to Krüger (1994), in 1966 Gaborone was planned for twenty thousand inhabitants by 1990. The number was reached after only six years and was almost seven times higher in 1990 (Krüger, 1994). The unplanned population growth of Gaborone led to shortage of accommodation within the city. Data adapted from Silitshena (1984) show that just before independence in 1964, the population of Gaborone was 3,855 inhabitants. In 1971, five years after independence, the population has grown to 18,436, signifying a 378% increase. Further, in 1981 the population was 59,656, signifying a 237% increase from 1971 population. The data reveals that the number of inhabitants projected in 1990 was far outstripped in 1981 (Krüger, 1994). Krüger (1994) suggest that Gaborone has grown by 8.4% on average since 1991. This put pressure on the supply of residential houses. Where housing was available, it was expensive for the majority of the population.

The rapid urbanisation of Gaborone put pressure on the house and electricity sectors. The BOTEC staff experimental staff housing project developed out of that pressure for more accommodation in the city. These pressures and how they influenced the BOTEC project are discussed in the following sections.

5.3.2 **Regime factors**

The previous section highlighted the challenges or rapid urbanisation of Gaborone post-independence. That landscape development created problems at the regime level. This section analyses how due to pressure from the landscape, the regime created windows of opportunities for the niche innovations at BOTEC demonstration project. In addition, the discussion identifies social, economic, technological and institutional factors that could have helped the innovations at the demonstration project to link up with the existing regime. Housing and electricity sectors are identified as the relevant regimes. The analysis focuses on identification of specific

problems and other characteristics which impacted on the success of the BOTEC project. The other characteristics include sustainability knowledge and the current construction practices in regard to use of materials in the regime. The following section reflects on the changing contours of the housing sector in Botswana.

Changing contours of the housing sector in Gaborone

Prior to independence, Gaborone which is the capital now, was underdeveloped (Krüger, 1994). There were houses, but they were of poor quality (Wilsenach, 1989), but on reflection they were sustainable because they were built of mud which was readily available as a construction material.

Table 5-1: Type of houses (CSO, 2009)

Type of House	**Percentage**
Traditional	13.2
Mixed	16.4
Detached	43.6
Semi-detached	2.3
Terraced	0.4
Flats	0.4
Part of commercial building	0.1
Movable	0.3
Shack	1.8
Rooms	18.7
Traditional modified	2.7
Total Number	**100**

Recent statistics (Table 5-1**Error! Reference source not found.**) show that Botswana has a conventional building stock of 415,432 of domestic buildings made up of traditional[1], detached, semi-detached, terraced and flats (CSO, 2009). Halliday (2008) note that terraced and flats

[1] A traditional house is made of mud brick walls with a thatch (grass) roof

apartments are intrinsically more thermally efficient than detached dwellings as they share walls. In Botswana however, majority of the buildings are detached. This presents a problem of energy efficiency and is analysed as one of the regime problems that needed attention.

After independence in 1966, housing in the capital Gaborone became a priority for Botswana Government (Harvey and Lewis, 1990). A policy decision was taken in 1970 that Government would be responsible for the provision of all housing for all income sector groups in the capital city (Wilsenach, 1989). Botswana Housing Corporation (BHC) was created in 1970 as a public sector institute to implement the policy. Since then it has become a key actor in the local house regime. BHC has since moved away from construction of traditional houses.

Sustainability knowledge

In the view of industry practitioners, sustainability knowledge is relatively small in Botswana and in particular in the house regime. A senior architect from BHC has this to say about sustainability knowledge in Botswana construction sector:

> Generally sustainability in Botswana is rare but I would say certain quarters of the country they know like I said I think people need to do models that actually people can appreciate, but few professionals who have access who have knowledge about these things its often very difficult to make changes (Senior Architect 1, 2015).

The limited sustainability knowledge could have had impact in the adoption of some of the sustainability principles that were introduced by the BOTEC staff houses.

Reliance on external sources for electricity supply

Botswana depends on imported electricity mostly from South Africa. This suggests that electricity infrastructure in Botswana is poor. Figure 5-1 show that as of 2012 the country was

producing only 7% at Morupule Power Plant while 70% of electricity was sourced from Eskom in South Africa.

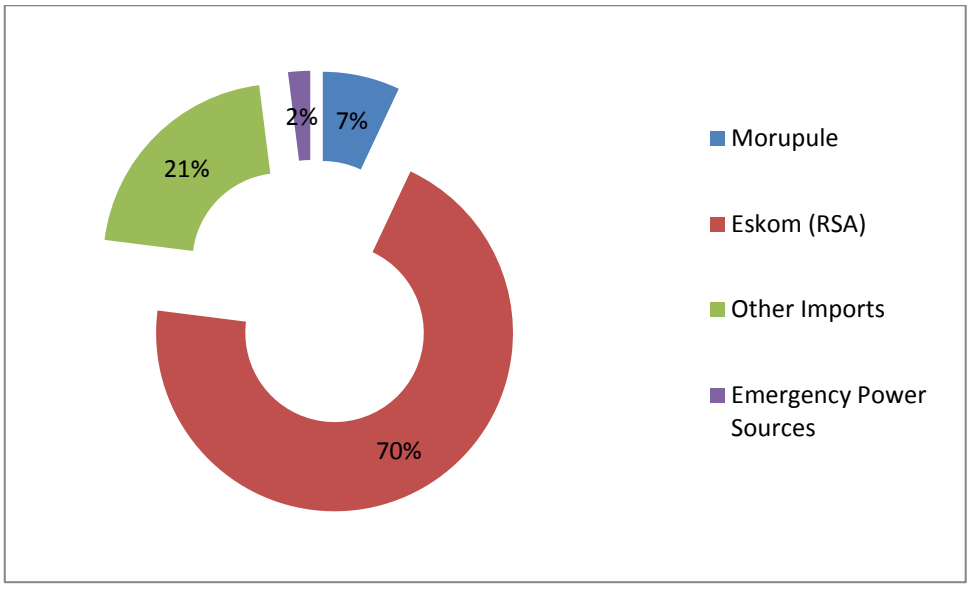

Figure 5-1: Electricity supply sources in Botswana (BPC, 2012)

There has been an attempt to be energy self-sufficient in Botswana. Capital investment is seen as a way to address the problem. The Botswana Power Corporation (BPC) in 2007 and 2008 invested 343.4 million pula (approximately 28 million pounds) and 17.3 million pula (approximately 1.44 million pounds), respectively in electricity infrastructure (BPC, 2007, BPC, 2008). The money was used in the refurbishment of the Morupule Power Plant. Even though there has been capital investment to improve Morupule Power Plant, BPC still imported 63% of electricity from South Africa as of 2016 (BPC, 2016). The shortage of capacity for the country to meet its electricity demand without relying on South Africa is a sustainability challenge. The electricity problem was long discussed at the regional level. It was predicted that there will be shortage of electricity in Southern Africa because of urbanisation. A researcher said this:

> What motivated them firstly it was energy saving. There was recognition that there is need to maximally save energy. As a matter of fact this followed a Southern African Development Community (SADC) conference in 1998 in Harare, Zimbabwe where energy experts of the region predicted that there would be a serious energy crisis within 10 years in SADC because the pace at which energy infrastructure was being built was far lower than the pace of energy consumption aggravated by aggressive migration, rural-urban migration (Researcher, 2015).

From the quote, it seems there was a conscious recognition that there was a problem with regard to electricity that needed attention. The problem of electricity to be discussed by SADC at the regional level while identified at the local level creates an impression that it was critical and that there was growing awareness about the problem. The problem was adopted by the government as policy issue. According to the SADC website, SADC was formed in 1980 to 'advance the cause of national political liberation in Southern Africa, and to reduce dependence particularly on the then apartheid era South Africa' (SADC, 2017). The main objective of SADC is to 'achieve economic development, peace and security, and growth, alleviate poverty, enhance the standard and quality of life of the peoples of Southern Africa, and support the socially disadvantaged through regional integration' (SADC, 2017).

Current materials and practices

The analysis in the previous section suggests that the house sector is burdened by a lack of sustainability knowledge which may make it difficult for professionals to appreciate the contribution of the BOTEC demonstration project. Analysis in this section suggests brick making as one of the potential regime level problems that needed attention. Conventional bricks are commonly used in the Botswana construction sector. Individual people often prefer to mould their bricks when they build their own houses. They mix cement and sand and use simple moulds which are not expensive. According to Gurusamy et al. (1995) there were concerns regarding the conventional design and construction methods in Botswana and the Southern African region. The concern in this process is the quality of the bricks is not certified by any

standards (Gurusamy et al., 1995). Normally there are no trained individuals in brick making involved or the standards office to certify the quality. Other than the poor quality, the time taken to mould the bricks was also long. The process of making the bricks was problematic which presented an opportunity to rethink the procedure that will safeguard quality and sustainability. A researcher commented:

> Here we do either in-situ concrete we can afford that with the time and the climate permits it or more popularly we use masonry units. So we targeted that (Researcher, 2015).

From the above quote, brick making was identified as a problem that needed to be addressed. Many people in Botswana mould their own bricks especially for domestic houses. BOTEC made it a policy decision to target the production of bricks to improve quality and efficiency.

Another issue confronting the housing sector in general and in relation to sustainability was the minimal use of locally available construction materials in use in the housing sector. According to Ssegawa (2004) where construction materials were available, there was always a challenge of knowing their quality to produce durable structures.

The most common types of building materials used for wall construction in Botswana are conventional bricks and blocks accounting for 80% of use (Table 5-2). The conventional bricks and blocks are made of cement. The second commonly used material is mud which accounts for almost 16%. Other materials like timber (wood) (0.2%) are not commonly used in the house building regime. The most commonly used material for floor is cement (79%) Table 5-3 while for roofing is corrugated iron (74%) Table 5-4 . These materials are mostly sourced from outside Botswana.

Table 5-2: Type of material used for wall construction (CSO, 2009)

Type of Wall	Percentage
Conventional bricks/blocks	79.9
Mud bricks/blocks	11.6
Mud and poles/cow dung/thatch/reeds	4.5
Poles and reeds	0.7
Corrugated Iron/Zinc/Tin	2.1
Asbestos	0.3
Wood	0.2
Stone	0.1
Other	0.7
Total Number	**100**

Until 1996 with the opening of a cement blending and packaging operations in Botswana, cement was sourced mainly from South Africa. With 80% of the buildings in Botswana using cement bricks or blocks for their construction, this presented a sustainability challenge.

Table 5-3: Type of material used for floor construction (CSO, 2009)

Type of Floor	Number	Percentage
Cement	327,277	78.8
Mud/Mud and Dung	63,118	15.2
Wood	704	0.2
Brick/stones	767	0.2
Floor tile	18,340	4.4
Other	5,326	1.3
Total Number	**415,532**	**100**

Table 5-4: Type of material used for roof construction (CSO, 2009)

Type of Roof	Number	Percentage
Slate	3,896	0.9
Thatch/Straw	60,126	14.5
Roof Tiles	38,374	9.2
Corrugated Iron/Zinc/Tin	308,630	74.3
Asbestos	1,967	0.5
Concrete	474	0.1
Other	2,100	0.5
Total Number	**415,567**	**100**

With regard to the use of the materials, the analysis suggests that there was an opportunity for change by introducing locally made materials. The researcher says:

> So the challenge with Botswana was the most acute of all the nine countries in the sense that for the purposes of needing anything from your dwelling to institutional buildings in most of Botswana you had to import materials. As you know in construction import does not necessarily mean from abroad…. So those considerations posed a greater challenge to Botswana to say okay is there no way of localising this, localising means using this material which we have here (Researcher, 2015).

However there was always a potential for the practitioners to reject the use of new materials as they are conservative to change. This captured by the Senior Architect who opined:

> The challenges in general without referring to BHC is that like any new concept; ok sustainable construction may not necessarily be new but people have been schooled to build their house or building in an particular way for many years so if you say would like to start using this material you have…., I mean you must just accept that you should start doing slowly until it get acceptance (Senior Architect 2, 2015).

The quote though representing the architect's views of the industry, points to a potentially a widespread problem that could have had an impact on the use of the innovations from BOTEC staff project. In addition to limited sustainability knowledge in the sector, it is suggested that industry professionals are conservative to change.

Due to the challenges of urbanisation leading to shortage of accommodation in Gaborone, lack of electricity in Botswana and poor brick construction techniques in the construction sector exerted pressure for a response. As indicated in section 5.2, BOTEC was created to respond to these problems. The discussion which follows analyses the institutes' use of a demonstration project to address some of these issues.

5.4 **Development of BOTEC staff housing project**

This section explores the intentions of the BOTEC staff housing project. A key aim for the project was improving use of locally sourced materials; however the experts in charge of the

project lost sight of this aim as the project progressed. While the demonstration project introduced a number of opportunities, these were not taken advantage of due to lack of knowledge.

In response to the shortage of accommodation, the Managing Director (MD) of BOTEC developed an idea to build houses for their staff. The MD had a vision to construct staff houses that were energy efficient. As indicated above, BOTEC had a broad mandate of technology development and in particular energy efficient technologies. According to Gurusamy et al. (1995), BOTEC thought it was prudent to respond to their mandate by using some of the energy efficient technologies they were investigating for possible use in Botswana on their own site. The project began in the late 1980s in Gaborone. It contained a mixture of different residential housing units.

As indicated above, an important motivation for the project was the shortage of adequate houses in the major towns of Botswana at that time (Gurusamy et al., 1995). In addition, there were concerns regarding the conventional design and construction methods in Botswana and the Southern African region (Gurusamy et al., 1995). Further to that, the researchers noted the poor thermal comfort offered by existing conventional buildings due to seasonal variations, the lack of good quality locally produced building materials and the problem of housing delivery on time (Gurusamy et al., 1995).

5.4.1 **Description of the project**

The masterplan for BOTEC staff houses was configured to have 47 residential units of different sizes (1, 2, 3 and 4 bedrooms) (Gurusamy et al., 1995). Some houses were detached while others semi-detached. The houses shared certain design features- a north facing long facade, clerestory windows which provided for stack effect ventilation and construction materials (BOTEC, 2000)

for energy efficiency. According to the BOTEC (2000) report, different types of materials were used in their construction; two types of lightweight highly insulated panel systems (Sagex and Prolith) and two types of high thermal capacity stabilised earth blocks (Ceratec and Hydrablock). In addition there were timber panels sourced from Sweden. Besides the houses, the masterplan included space for a garden centre on site for plants to be planted and supplied to residents. In addition there was a swimming pool area. The construction of houses was done in phases. The provision of a garden centre to sell plants to residents was novel in Botswana.

Initiative

The project brief was started in 1989. According to the electronics engineer who was interviewed, the MD identified at the brief stage that energy efficient design principles and use of new building materials should be the main objectives of the project.

Based on the vison of the MD, the objectives of the project were drawn. According to Gurusamy et al. (1995), the objectives of the project were to;

- Provide adequate staff accommodation,
- Provide thermally comfortable accommodation with the least amount of energy and,
- Experiment with new building materials, building systems and building processes.

Phase I design and construction process

The BOTEC managing director led the design process for the project at the beginning from 1989. He produced the project programme. The other team members were the principal architect and the principal civil engineer who joined and were involved in the project between 1990 and 1993. The principal architect and the principal civil engineer were internationals from the US and Malaysia who had come to BOTEC with experience in energy efficient architectural design and building materials respectively (Gurusamy et al., 1995). External architectural and

civil engineering firms were contracted to produce the design plans. Traditional form of contract was used where design preceded construction.

Building works started in November 1989 and was completed in July 1990. Phase I site works consisted of partial site clearing, construction of new site roads, sewer, water and electrical installation, and the construction of site boundary wall. Individual plot fences were also done. The installation of sewer, water and electricity was done in a conventional manner according to local authorities' requirements.

Building works included the construction of seven pre-fabricated high cost houses, seven low cost houses and a guard house. The seven low cost houses were built from locally available conventional building materials. The seven high cost houses were designed and prefabricated in Sweden using the BEGUS timber frame system imported from Sweden. The total cost for this stage of the project was Botswana Pula 790,700 (Approximately £60,823).

Phase II design and construction process

Phase II comprised an additional twenty four housing units. The principal architect and principal engineer took the role to design the project programme. Design for building works started in December 1990. Site works started in January 1991 and was completed in July 1991. Architectural design and quantity surveying services were done by external firms. Contractors for site works, building construction and landscaping were locally based firms. The main activities included site clearance, construction of new roads, main sewer connection, water and electrical connection, construction of swimming pool and garden centre, and construction of a boundary wall around the compound. The total cost was Botswana Pula 577, 770 (approximately £44, 450).

A contract for construction of the Phase II buildings was entered into in January 1993. Construction was completed in April 1993. The building programme comprised of construction of five high cost units, twelve medium cost units and seven low cost units. The total cost for the five high cost units was Botswana Pula 655, 300 (approximately £50, 410) while that for the twelve medium cost houses was Botswana Pula 898, 730 (approximately £69, 133). The total cost for the seven low cost houses was Botswana Pula 275, 620 (approximately £21, 201). Traditional form of contract was also used for this phase.

Selection of project team

To achieve the vision, expertise in sustainability was needed. Most of the researchers who were involved in the project were international workers. It is not clear how the rest of the project team was hired, but an account of how one Principal Architect ended up working in Botswana perhaps gives an indication of how the researchers were recruited. The Principal Architect was from Australia and had been working for more than ten years in Australia prior to joining BOTEC. As part of his training for a degree in architecture, he took courses in environmental design and environmental science. That training developed in him an interest in sustainability. The project architect applied for a job as a volunteer through an Australian volunteer organisation. He did not specify any particular country. The organisation linked him with BOTEC and he started to work with them in 1993. The architect worked specifically on the thermal monitoring program. The thermal monitoring program started in 1993 after the completion of construction of Phase II buildings.

5.4.2 **Building construction materials and technologies**

Selection of building material was considered to be one of the important aspects of the project. One of the objectives of the project was to experiment with new building materials, building

systems and building processes. It was pointed in section 5.3.2 that bricks and blocks made from cement were the commonly used materials for wall construction. This seems to have motivated the selection of the materials for the project, though there were other factors considered during the selection. The other factors included assessing the physical and mechanical properties of the materials. The interest in this section however is on how the materials were selected and who led the process. It seems the selection was influenced by the knowledge and experience of the experts who were involved. The international experts took a lead role in the construction phase of the project and subsequent thermal monitoring program.

The starting point for the selection of the materials seems to have been made based on what was common practice in the construction of houses in Botswana. This included choosing materials for the experiment that were commonly or were similar to what was common in the construction industry. A researcher who was not directly involved with the project but studied it to take forward some of the experiments said:

> Popularly in this part of the world we use masonry units because we can afford to build at our pace any time of the year unlike in Europe where they use mostly pre-fabricated panels because of the weather where you need high speed construction. Here we do either in-situ concrete we can afford that with the time and the climate permits it or more popularly we use masonry units. So they targeted that because that is what we can use it for as a source of material and that's what people use here as blocks or bricks (Researcher, 2015).

Prior to the materials being chosen, studies were conducted by the Principal Architect and the Principal Civil Engineer who were involved between 1990 and 1993. According to Gurusamy et al. (1995), they considered characteristics including speed of construction, fire protection, rainwater penetration, thermal performance, durability, buildability and cost implications. This is reinforced an architect who joined BOTEC after the project was completed:

> The alternative materials trialled actually has to do with reducing the cost of construction. Right now all that we are using is imported mostly from outside but also what is happening locally is that we do not have enough river sand (Architect, 2015).

Material used had different specifications. Some materials required insulation while others did not. The view of one BOTEC project architect interviewed is that:

> There was an experiment to assess the benefit of insulating a house in Botswana (Project Architect, 2016).

Two insulated panels and two mass based materials were used. For example, Sagex panel system comprised 75 mm thick expanded polystyrene with sprayed skim coat on both sides. It had a combination of thermal mass and insulation. It was manufactured in South Africa. Prolith panel used was a composite material comprising of an inner core of 75 mm polystyrene, a 50 mm woodwool layer on either side with a 15 mm plaster finish on the external surfaces. Ceratec is a block made from a mixture of cement and soil in the ratio 1:10. The machine used to manufacture the blocks was developed in Belgium. It is used as a single skin during construction. Both Prolith and Sagex were used to demonstrate the benefits of insulation whereas the soil based Ceratec and Hydraform were used to compare with mass based materials. A researcher who was interviewed about the project had this to say about the reasons for choosing these materials:

> So it was a case of saying we will use different building materials and or building technologies to put up residential units to house our own staff and we will monitor the performance of those buildings in terms of the micro climate inside the houses, how much there is need for artificial heating or cooling or no need for the same and how durable are these materials against the elements (Researcher, 2015).

The researcher further said this regarding what he thinks motivated importing materials from outside Botswana:

> As I said the researchers at that time were predominantly expatriates. As a person who has been in research for quite some time myself, the first consideration a researcher has in mind is not so much the cost but whether or not it can be done (Researcher, 2015).

It appears the choice was motivated by the performance of the materials including thermal and durability properties. It however suggests that the researchers started from a baseline of materials they were aware of from previous experiences rather than those with ability to be produced locally even though it was stated clearly in the project report that 'a major criterion of selecting an appropriate material was the ability of that material to be produced locally' (Gurusamy et al., 1995 pg 5).

The materials that were selected for the project differed from the conventional materials. The two insulated panel materials (Sagex and Prolith) differed with the conventional bricks and blocks. The panels are insulated at manufacture, while bricks' insulation is provided for during construction. But the biggest challenge was the fact that the insulated panels were procured from South Africa, bringing in an element of cost to regime actors if they wanted to adopt and use them. With the soil based materials (Ceratec and Hydraform) there were some similarities with the conventional materials. Ceratec made of cement and soil was similar to traditional mud brick made of soil and cow dung, the only difference being cow dung was free and accessible to anyone who had cows. In terms of technique, the process of manufacture was almost similar to the conventional bricks except for the machinery used. Conventional bricks and blocks needed cheap moulds while the Ceratec and Hydraform needed a special mechanical machine which again was at odds with the prevailing practices of manufacturing bricks.

As reported by Gurusamy et al. (1995), certain attributes were required in the selection of brick making machines. The researchers wanted a machine that was purely mechanical which suggest that they wanted to address the low technical knowledge in the regime. Selecting a mechanical machine was also intended to improve the output of bricks made by the locals. The Project Architect remarked:

> Certain it was to use a technology that could be repeated in Botswana on a mass scale…It was also similar to the traditional building methods (Project Architect, 2016).

Ceratec and Hydraform blocks were somehow familiar to the standard practices (standard practice for house building uses bricks and blocks). It seems the technologies were seen as a means to improve the brick making process. The moulds that were used for Ceratec and Hydraform blocks were mechanically operated but not too complicated. In addition, many bricks could be moulded which could have improved performance if the machines were used. The lead researcher had this to say about the technologies:

> Hydraform for instance, people actually liked it. It's actually you know mortar you just put mortar after certain courses just to tie the building together. It is interlocking blocks (Researcher, 2015).

It seems the project team and in particular researchers who proposed materials, focused on what worked internationally rather than looking at what was available locally or trying to merge the two. For example, Hydraform requires laterites type of soil. But it appears the researchers did not consider that it was not easy to get laterites types of soils in Botswana as they are available in small quantities. The researcher remarked:

> The challenge with Hydraform is the soils that you need are very rare in Botswana. The gentleman who had his double storey house built using Hydraform technology had to source the soils somewhere beyond Mochudi. We have these pockets of laterites, they are called lateritic soils. That's what you need; you can't use it with Kalahari sand type of soil. So that is a limitation. I even know certain small and medium scale industries that were set up to exploit this technology. They ended up using crusher dust because there is no soil. It's difficult to find that soil. Hydraform would spread very easily in Zimbabwe for instance because laterites are plenty there (Researcher, 2015).

The other emphasis for the project with regard to materials was to promote the use of timber. Seven high cost houses were designed and prefabricated in Sweden using the BEGUS timber frame system imported from Sweden. The components of the BEGUS housing system including wall panels, timber window and door frames and timber roof trusses were fabricated in the BEGUS factory in Sweden and shipped to Botswana for assembly on site. The Principal

Architect states that “there was a grant or aid package from Sweden to construct the timber framed houses” (Principal Architect, 2016). All the necessary components of the system were therefore unavailable in the local construction market. It was mentioned that a local subsidiary of BEGUS Sweden was to have been established in Botswana. That expectation could not materialise due to closure of BEGUS Sweden. This again highlights the seemingly diversion from the original intentions of the project. In this case however justification is that timber was already not commonly used. Getting prefabricated timber houses was perhaps seen as the right move to highlight timber use and its benefits.

Building regulations were waived to allow for Swedish standards to be used for electrical installation in the BEGUS house system. In this system, mains electrical conduits and plumbing were run under the raft foundation slab. This was in contrast to the normal practice in the construction sector. Strip foundations were commonly used and the normal practice was to run electrical conduits and plumbing on the walls. The project however was not only about the choice of the materials as the lead researcher alludes:

> But it was not only limited to materials and technology of buildings. There was also the architectural aspect. If you were to go to that compound, you will find that the shapes of the houses some of them are pretty unconventional because what the architects did was to follow the zenith of the sun, to trace the trajectory of the sun and shape and orient the buildings in such a way that at a …, when it’s cold; when its winter, then the sun’s rays are allowed to penetrate the house to warm it and when it is summer, then the sun rays are not allowed to penetrate so that the house remains cold (Lead Researcher, 2015).

Orientation of the buildings was critical as it directly led to the thermal monitoring program that was started after construction of the houses.

5.4.3 **Thermal monitoring program**

The thermal monitoring process started after the houses were completed. Of the 42 houses completed, only six were monitored. Houses representing distinct types of materials were selected for thermal monitoring. The project was headed by the Principal Architect who started his work in 1993.

The intent of the thermal monitoring program on site was to compare and assess the seasonal and long-term effect of each building design and the different building materials that were used on the project. The comparison was based on the similarity of the design, as well as various insulation levels and wall material thickness that exist in the different building systems. Monitoring was proposed to be conducted for a period of three years. Internal temperature, relative humidity and external climatic conditions were the parameters in which data was collected for. Two data-loggers (Squirrel Loggers) were purchased from a UK based company which had representatives in South Africa. The two were used for Phase I of the project.

According to the project architect who oversaw the program, the aim was to analyse the actual performance of the buildings in relation to predicted results. The principal architect said the specific aims were to see:

> Whether using predictive software was valid, whether it will give you an accurate prediction of how a house could perform and then you could use it as a basis for designing other houses and to see the difference in the different building materials – the stabilised soil blocks had little insulation in the walls, the Sagex panel were highly insulated and to see if you insulate the house what benefit will it give and what difficulties could you get (Principal Architect 2016).

Existing houses in Botswana constructed by Botswana Housing Corporation (BHC) were used as benchmark. Thermal simulations using a computer software package CalPas3 were conducted on the BHC houses. Calpas3 software is thermal prediction software which was

developed in California. The software is ideal for examining the effectiveness of passive solar designs (BOTEC, 2000). Besides being not user friendly, it uses weather data for various regions California which is built in the software (BOTEC, 2000). The user of the software then selects weather that is closest to the area of concern- in this case weather that was deemed closest to Botswana was selected.

The monitoring equipment was developed by BOTEC electronics unit (BOTEC, 2000) and comprised dry bulb temperature and humidity sensors. Data was recorded at hourly intervals by data-loggers. The data was downloaded at two week intervals.

Data loggers were installed with the help of the BOTEC information technology department. Measurement for variation in temperature and humidity was conducted for a period of three years. The intention was to correlate the actual measurements in the houses with the thermal comfort measurements predicted from CalPas3 software developed in California. The aim according to the Principal Architect was "to see whether the actual performance matched the predicted performance from the software" (BOTEC Project Architect, 2016). The thermal monitoring assessment was not only a means of assessing individual houses, it was also a means to see which of the houses performed better between timber framed houses, Sagex and Hydraform blocks houses.

There are differing views on whether data that was produced was made available for later use by others. This is reflected by the comments of the engineers who were involved in the project:

> I think the procedures were followed in terms of data collection and analysis but then compilation of the results I think that's where there will be a big question there. It is like an architect will liaise with the civil engineer, or they will have agreed on how they are going to use the data after they have left, instead of ending up benefiting BOTEC it will now end up benefiting them due to organisation weakness or structural weakness (Principal Electronics Engineer, 2016).

> Unfortunately I don't have those because all the data was being taken to architects and this project the monitoring actually stopped quite a long time ago because …, the monitoring if I recall the last of monitoring was done until 2006-2007, so it's a long time ago and the whole project then really stopped except for the Kalahari. The people who would have the data have actually left BOTEC. So unfortunately I don't have anything (Electronics Engineer, 2015).

> Fortunately data was being collected in terms of how much electricity they use but a report was never availed or never concluded. It was done by some Australian and then when he went away he didn't leave any data. I think he left because he had a dispute with BOTEC so when he left he went away with everything and those who came after didn't find much that was left, but those were being monitored by measuring the inside temperatures on and electric consumption's all those things were done. I believe the data is sitting somewhere since it was being collected but there was no analysis (Principal Energy Engineer 2, 2015).

The quotes reflect on the organisational incapacities of BOTEC as an organisation to have coordinated the capture and dissemination of the thermal monitoring program results. In addition it seems there were communication inadequacies between the project team members which subsequently affected the release of the results to the construction sector as a whole.

From the analysis of the choice of materials and the thermal monitoring program a number of issues can be highlighted. With regard to the choice of materials, it seems there was a deliberate effort to choose materials that were symbiotic to the existing practice in the construction regime. The choice of Prolith and Sagex was made to explore the benefits of insulation whereas the earth based Ceratec and Hydraform was made to compare with mass based materials which include the traditional mud brick. With regard to the thermal monitoring program, it appears it was carried out diligently as data was collected for three years but it seems only organisational issues affected its impact. The following section discusses the contribution of the project towards change to sustainable construction.

5.5 Contribution towards change to sustainable construction

The BOTEC staff housing project was a great opportunity to experiment with and physically demonstrate sustainable design concepts and building materials. Various designs for energy efficient buildings were show cased in the project. In addition, different types of construction materials were trialled. This section discusses the contribution of the demonstration project to change towards sustainable construction. The section covers the success of the project in terms of the knowledge and technology transfer; technical success and how the project introduced new governance techniques. In addition the section discusses its failure to transform the house and material markets as well as failure to commercialise the technologies.

Previous studies suggest that the success of demonstration projects can be evaluated in terms of commercialisation of technologies (Zhou et al., 2015), inducing funding and general market transformation. While BOTEC cannot be deemed a success in terms of market transformation, it might be deemed a success in other ways. These include introducing sustainability design principles, training and skills development on thermal monitoring, contributing to the establishment of firms which provide sustainability services and effecting policy changes in the regime.

The latter points are discussed further in the followings sections. In terms of market transformation, it was hoped that the project would change the way residential houses were designed and constructed in Botswana. For example, a transformed market would have led to new build houses being oriented in such a way that they effectively use the sun's rays to warm the houses in winter while remaining cool in summer. The other opportunity and perhaps the key one concern the use of bricks and blocks, which ultimately could have changed the house construction practice. The analysis suggests that bricks are still dominant while the use of

timber remains insignificant. This again shows the project did not transform the construction market. The lack of timber use was perhaps curtailed by the failure to set a timber manufacturing plant in Botswana. BEGUS Sweden was liquidated while they had intentions of setting a plant in Botswana.

5.5.1 **Evaluation of success**

The success of the project can be analysed based on knowledge and technology transfer, technical success and the effect on some governance issues.

Knowledge and technology transfer

There was knowledge transfer both within and outside BOTEC. For example, some of the design principles used in the staff houses was used in the design of the BOTEC headquarters. As the project architect noted;

> We did a fair bit of work…research on adaptive cooling as an appropriate technology for sort of air conditioning for the country. We did a desktop study but we were unable to secure funding to do more permanent or detailed installations. The BOTEC headquarters was going to use a technology like that using… based on the traditional wind catches from Middle East or traditional building (Project Architect, 2016).

Passive ventilation design concept used in the BOTEC headquarters where hot air is sucked out of the building by pipes is similar to the stack effect was used in the staff houses. In the staff houses project, high clerestory windows were used to remove hot air in the buildings. Similarly, some of the materials used in the project were proposed for the BOTEC headquarters. According to the Principal Architect, stabilised soil blocks used in the experimental houses was proposed for use in the construction of BOTEC headquarters. In addition the clerestory windows concept was adopted from the house development. These examples suggest that knowledge and technology were transferred within BOTEC.

The knowledge learned from the project was also used for other projects. The former head of one unit at BOTEC had this to say regarding the knowledge transfer to outsiders:

> We designed the Somarelang Tikologo cafeteria. As BOTEC we were also members of Somarelang Tikologo. We were coordinating with them environmental issues and we had sort of a memorandum of understanding. They hired us to design the cafeteria in a sustainable manner; because BOTEC was the…we had a mandate for the sustainability (Former, Head of Unit, 2015)

The quote suggests that there was indeed some success with sustainability principles learned from the project used in other projects. This is further reinforced by evidence from the Principal Architect from Australia. According to his website, the Principal Architect from Australia own and operates an architectural firm specialising in sustainable building design, new homes, residential alterations and additions, small commercial projects, environmental ratings and sustainability consulting. Assessment of thermal comfort of buildings in Australia came as the biggest learning for the architect when asked what he is doing which he learned during his time in Botswana. The architect commented:

> The main thing I am applying is… I am doing thermal comfort assessment using software. It is not the same software but it is similar process. It certainly uses software that was developed with Australian conditions I fed it. My business now is doing the same sort of thermal predictive software that we used in Botswana so that was my first experience of using that sort of software. So that is now developed in Australia to the point where all new buildings are pretty much rated using that sort of software. That is done to ensure that the right levels of insulation and the right type of glass in combination with thermal mass to suit the particular type of climate around the country. That has been a huge impact in terms of my working life; that experience (Principal Architect 2016).

This suggests that the knowledge he learned from the project prepared him for his present career. The process of assessment of thermal comfort is now standard in most Australian developments using that sort of software. It can be argued that the knowledge which the architect acquired in Botswana is now shared within Australia. The architect had this to say:

> I sit on a Government technical advisory committee that oversees the operation of that software. So I am involved at sort of that high level in terms of providing guidance in terms of how that software is used or what information should be in the software (Principal Architect 2016).

The software was developed right around the time the architect was in Botswana and when he got back to Australia he used it. In Botswana, there was potential for success. When the architect was asked about the market potential of the technologies that they used during the thermal monitoring program, he alluded to another project where they used the principles and were hoping that it will lead to commercialisation of the technologies;

> I did work on one project for the president of that time who was breeding ostriches and he wanted a building for incubating ostriches. So it had to be a constant temperature for the building housing the ostriches as they wanted it to be comfortable inside. We did model that as an exercise and we were seeing that it had potential that it could be applied on a range of buildings (Principal Architect 2016).

The quote suggests that gained knowledge in the thermal monitoring program and they were applying that knowledge to other sectors other than the construction sector. This however is an individual account of how they applied what they did after completion of the project.

Technical success

The analysis of the project suggests the thermal monitoring program was seen to be successful. The thermal monitoring program was carried out to establish the thermal performance of the demonstration houses relative to that of houses with conventional materials. The program ran for a period of three years. Interior thermal comfort levels for Botswana environment were demonstrated and assessed during the thermal monitoring period. Evidence from people who stayed in the houses indicates that thermal comforts of the buildings with the experimental materials were greatly improved over those with conventional building materials. Based on the remarks of the electronics engineer, the thermal monitoring program was a success. He says:

> Regarding the heat I would say that there was a lot of success because what we noticed …, I am one of the people who was staying in such a house as a staff member. They never installed an air conditioner in my house but in summer I would particularly feel very cool while it was very …, once I enter the house it would be cool. But remember the staff houses in addition to the design of the buildings, they also used special construction materials; probably that is what added to the success (Electronics Engineer BOTEC, 2015).

Another resident who stayed in the houses had this to say regarding the success of the project. The success is related to the use of solar heaters;

> I stayed in one of them and during the 2-3 year period that I was there in that house I remember I only switched on my electric geyser once.. just one day I do not know what had happened that was the only day I used electricity for water heating otherwise I was just using solar all the time and for those (Principal Energy Officer, 2015).

In terms of technical performance, the houses performed well. The accounts from the residents who stayed in the house point to such. Though it seems there was success based on the accounts of the residents, it is not clear which aspect of the project accounted for such success.

Introduction of new governance techniques

The demonstration project introduced new governance techniques from abroad into the BOTEC which passed on to Government. International researchers shared their experience of how quality and standards were safeguarded in other countries. From an account of the Principal Electronics Engineer, assessment of quality issues during the construction phase of the houses was done by BOTEC staff. Perhaps sensing that quality could be compromised, the international researchers suggested the concept of having an independent standard board. According to the Principal Electronics Engineer, the Botswana Bureau of Standards (BOBS) was set up due to their recommendation. The engineer had this to say about quality checks:

> Quality checks were done within BOTEC and they know in other countries they are done by standards bodies. They will then want to put them to that appropriate entity so they helped bring out the concepts of standard body. It has happened not only with

> BOBS but with Botswana Innovation Hub which I was personally involved (Principal Electronics Engineer, 2016).

The concept of standards body was borne from the expectation to develop good quality technologies. A systematic approach to assessing quality standards of materials and technologies started the process to develop Botswana Bureau of Standards (BOBS) which to date has been able to develop standards for Botswana. The experience of researchers was evident to suggest such an organisation in Botswana.

The accounts of the individuals seem to suggest the project was successful from a technical point of view. It seems however that success was only felt at the individual level rather than company level. There is no suggestion that BOTEC as an organisation issued a briefing about the results of the experiments on the projects and how they are anticipated to transform the construction industry. The point is critical as upon completion of the project, most of the people who were directly involved left BOTEC. Their individual efforts cannot be expected to effect a transformation of the construction sector of Botswana, and as was highlighted the influential researchers were international workers.

5.5.2 **Failure to transform markets**

Failure of demonstration projects can be attributed to the failure to transform relevant markets. The project failed to shift the house and material markets towards a greater use of local materials and to commercialise the materials and in particular timber products.

Transforming house and material markets with local materials

As indicated above, in the majority of new house projects in Botswana people produce their own bricks. In the process concrete is mixed with sand and the mixture is compacted manually in moulds. The process is labour intensive and produces fewer bricks at a time. The analysis

suggests that the choice of soil based blocks was directed towards changing the existing practice of brick moulding. Hydraform used soil which people were accustomed to; and were manufactured using machinery which could have increased the process of manufacture. However, the laterite soil that was found suitable for use in Hydraform blocks is not available in Botswana.

The other material that was intended to transform the house market was timber. Timber was promoted as a potential alternative construction material to the dominant practice of using bricks and blocks for wall construction. However it could not transform the market and part of the reasons are due to lack of commercialisation of the BEGUS timber system that was showcased in the project.

Commercialisation

The prospect of establishing small and medium scale industries was not successful. Analysis of the data suggests there was potential to establish such enterprises and in fact some were started but could not be sustained. For example, it is suggested that small scale industries were started to supply Hydraform blocks. However due to lack of the laterites soils in Botswana needed for the block, the small businesses collapsed. The effect of the project however was noticeable on small business owners.

The other failed commercialisation effort was with regard to timber. It was proposed to set up BEGUS Botswana to assemble timber frames supplied from Sweden. The proposal failed when BEGUS Sweden was liquidated. The collapse of that proposal to set up BEGUS Botswana led to failure to commercialise timber manufacturing in Botswana.

5.6 MLP analysis of the project

This section uses MLP to evaluate the features of the project and their implication for the envisioned policy aim of a transition towards sustainable construction. MLP suggest that the effect of demonstration project on the relevant regimes varies based on the articulation of visions and expectations, network formation and learning (Geels and Schot, 2007). In this case, relevant regimes include: house construction and brick making regimes.

Insights into the broader impacts of the project can be analysed using the lenses of visions and expectations, learning processes and development of social networks. As the discussion which follows suggests, the vision for the project to have a housing sector characterized by locally sourced materials was curtailed by the influence of international workers. In the case of learning effects, reliance on individual transmission contributed to the incapability of the Government and BOTEC to capture and disseminate the results of the project. In the case of social networks, the absence of local construction professionals from the relevant networks prevented their active participation in the selection of the materials. This led to failure to recognise materials with ability to be produced locally.

5.6.1 Visions and expectations

Visions and expectations about the future provide the legitimacy for actors to invest time and effort into a new technology that does not yet have any niche market. Actors may have different visions of the future and different expectations about the viability of niche innovations. MLP suggest that visions and expectations give direction to technology development, influence design choices and attract resources as well as new actors (Geels and Schot, 2007). The vision for the BOTEC staff housing project was to have a housing sector characterized by locally

sourced materials. Two features of the project contributed to the achievement of the vision; changes in the selection of construction materials and the thermal monitoring program.

From the beginning, key actors differed in the type of materials that they wanted the project to explore. The Managing Director of BOTEC envisioned buildings that used less active heating and cooling. Construction materials- insulated panel materials Sagex and Prolith and mass based materials Ceratec and Hydrablock - were selected to show the benefit of insulation in an effort to use less active heating and cooling. It was expected that the mass based materials will influence brick making practices. For example, Hydraform blocks were similar to the current practice of earth bricks. In contrast, the Principal Architect and Principal Civil Engineer selected the materials based on their performance properties. In the end, a lot of materials that were used in the project were sourced from outside Botswana and from as far away as Europe, suggesting that at some point the researchers lost sense of the vision during the design and construction of the project as envisioned by the MD. This betrayed sustainability principles in general and the specific aim of improving locally made materials. It appears that some materials were chosen because the researchers had prior experience working with those materials before.

The increased use of timber was partially introduced by one of the international partners for their own commercial reasons. BEGUS Sweden brought BEGUS timber framed houses from Sweden. Their goal once they were involved was to set up BEGUS Botswana as a manufacturing plant based in Botswana to supply timber framed panels to the construction industry. Their goal seems to have been aligned to that of the MD as they wanted to influence the house construction sector by promoting timber as an alternative material to bricks and blocks which were commonly used in the sector. When the commercial plan fell through, the vision to influence house construction through the use of timber fell through as well.

The second aspect of achieving the initial vision concerned the setting of thermal targets for the different houses. Energy efficiency through design and choice of materials was expected to be incorporated in the designs as per the argument of the managing director. Calpas3 software that was designed in California was used to model ideal comfort levels for houses in Botswana. Weather modelled on the software that was deemed closest to Botswana weather conditions was selected. It is striking why software built on California conditions could be selected for use when the intention was to construct energy efficient houses in Botswana. Again the influence of the American principal architect at that time is evident in this choice. The choice to use the passive design software was motivated by the fact that there was no design tool that was developed in Botswana that could have been used.

In terms of the broader transition to sustainable construction, the lack of alignment of the vision of the MD with that of the researchers resulted in lack of transformation of the house and brick making regimes. The analysis suggests that privileging international workers resulted in their word carrying more weight and hence they prescribed materials which did not have a local presence.

5.6.2 **Learning processes**

The success of niche innovations is linked to learning about the desirability of the new innovation (Kemp et al., 1998). In niche development, experiments produce the results and actors learn from the results and make adjustments to improve the niche innovation. In the transition process, learning can be related to the technical performance of innovations and how complementary infrastructures have to be set up (Smith, 2007). First-order learning refers to learning about the effectiveness of a certain technology to achieve a specific goal. First-order learning aims to verify pre-defined goals, to reach goals within a given set of norms and rules.

Second-order learning refers to learning about underlying norms and assumptions and is about questioning these norms or changing the rules. The analysis of the initiative reveals that reliance on individual transmission of the results of the project resulted in limited influence on the construction sector, at least as it related to sustainable transitions.

The discussion that follows analyses how the BOTEC staff houses facilitated learning and how that impacted on transition to sustainable construction. Government through BOTEC was expected to help communicate the findings of the project, but it appears they did nothing. The transmission of learning was thus limited to individual initiatives.

Researchers made a conscious effort to learn about the technical performance of the materials. The performance of the building materials used in the project was evaluated prior to use which suggest technical learning took place. Among the parameters that were evaluated include durability and fire resistance. The use of the different materials in construction of houses made it possible for real users- researchers and BOTEC staff to test their market potential.

The second aspect of learning was noticeable through the thermal monitoring program. The learning from the program emerged as a competence and an opportunity to shift practices in the house construction sector in Botswana. Two examples illustrate this learning about thermal monitoring of buildings, which was applied in subsequent projects by the professionals involved in the thermal monitoring program.

The analysis suggests the Principal Architect learned about measuring thermal comfort of buildings. It appears he learned how to fit thermal monitoring in buildings generally in Botswana. The learning from the thermal monitoring project by the architect was used to suggest a potential solution to a problem of keeping constant temperatures in other building types. Though it does not suggest what other potential solutions were considered by the

architect, it suggest there was potential for a shift in the broader regime towards thermal modelling and monitoring of buildings. The analysis suggests that all that the Principal Architect learned was not communicated to others before he left Botswana.

The account of the Australian project architect demonstrates the application of a process that was as a result of learning on the demonstration project, albeit at an individual level. When he went back to Australia, assessment of thermal comfort of building was taking off. He is now involved in rating of buildings. He has been accredited to do that and by sitting on a national committee, he is now influential to direct the course of thermal monitoring of buildings in Australia.

In terms of technical learning, it seems it was done poorly. It would have been satisfactorily done if the technical learning on the project was diffused across the construction sector. Through their prior research and based on Schot and Geels (2008) reasoning, first order learning occurred whereas second order learning was not possible. Conducting research prior to actually doing the project was positive as the potential of many materials was assessed before being tried on the project. The second order learning of assessing the wider implications of the choice of some of the materials however was not done. Probably limited knowledge of working in Botswana contributed to this. This suggests that had the social network been expanded to include material suppliers, they could have suggested other materials. For example, with the case of Hydraform material manufacturers could have realised that laterites soils are not easily available in Botswana and offered an alternative. So it seems that the experience of researchers took precedence even though such experience was not gained in Botswana.

In the end project reports detailing the design and construction of the project as well as the thermal monitoring process were produced for future reference. But due to poor capacity of

Government and BOTEC to disseminate the learnings, it was relied on individuals to transmit that learning. In addition, it appears communication was lost between international workers and the locals. When asked for contacts of former colleagues, in most cases it was futile to get those. A case in point is the Australian architect who was traced through LinkedIn.

In terms of the broader transition to the construction sector, the learning process suggests sustainable design knowledge was applied by individual researchers on other projects after the completion of the staff houses. At organisational and Government level, it is not clear how the learning was used to advance transition to sustainable construction. Perhaps the absence of professional associations contributed to the lack of learning. Professional associations may have specialist knowledge that allows them to criticise technical details of regimes and propose alternative courses of action (Geels and Schot, 2007). In this case they could have helped in the diffusion of the learning.

5.6.3 **Social networks**

MLP suggest that an emerging niche needs to be supported by social networks including producers, users, regulators, societal groups etc. (Kemp, 1994). These actors sustain development, attract resources, and carry expectations and articulate new requirements and demands. Users for example are important source of information in helping further to improve the technology (Kemp, 1994). Two elements are important for an effective network: the composition of the actors and their alignment within the network (Schot and Geels, 2008). A good network requires different actors with different roles and interests while alignment refers to the degree to which actors visions and expectations are in line with the niche development (van der Laak et al., 2007). van der Laak et al. (2007) asserts that regular interaction and cooperation between different actors can achieve alignment of actors. The analysis of the

initiative reveals that lack of sustainability knowledge in the construction sector resulted in limited influence of the project on transition to sustainable construction.

The network that was created around the project was poor and did not create conditions for niche innovations to influence the regime and thereby induce a transition in the construction sector. At the beginning, the network consisted of Ministry of Finance and Development Planning (MFDP), BOTEC researchers, BEGUS Sweden and the project team. The MFDP provided funding for the project. The funding was in line with the support BOTEC got from Government. The influence of the MFDP in terms of directing the development of the project and the choice of technologies cannot be ascertained save to say they provided funding for the project. Construction professionals were not involved individually or through professional organisations. It is however worth noting that at that time professional associations did not exist in Botswana. The phenomenon of establishing them is recent (see chapter 7).

One of the expectations of the project in as far as materials were concerned was to improve the use of timber as a construction material in Botswana. BEGUS Sweden expectation was to set up a manufacturing plant in Botswana. This however did not materialise. But to a greater extent BEGUS Sweden tried to align their goal (setting BEGUS Botswana) with their vision (promoting timber use in Botswana). It can be said had it not been for the liquidation of BEGUS Sweden, perhaps the expectation of improved use of timber as a construction material could have been successful. Alternatively it could have failed due to lack of sustainability knowledge and thereby lack of appreciation to change the current dominant practice of using bricks and blocks to using timber.

It was pointed out that sustainability knowledge in Botswana when the project was conceived and even quite recently was low. With poor sustainability knowledge, professionals as the first

users of the niche innovations could not articulate their expectations of the innovations on the construction sector. The composition of the networks shows it was made up of only project team members-the funder and researchers from BOTEC.

In terms of alignment of the network, regular meetings by the BOTEC researchers and project team increased alignment of the actors within the project team. While evidence suggests there was alignment internally within the project team, the lack of involvement of outsiders could not sustain the development of the innovations into a niche market. However it appears lack of sustainability knowledge by local actors at the time the projects were constructed could have contributed to the poor networks. With improved knowledge, some members could have known that some of the materials were not really ideal for the local industry. It appears BOTEC management only presented what they wanted to the mostly international researchers and it was up to the researchers to see how to achieve what the management wanted. The other network members were just there to provide funding.

In terms of transition to sustainable construction, MLP suggests that the network around the development of the project was not wide to advance a transition in the construction sector. There were no multiple stakeholders and critically from outside of BOTEC.

5.7 Summary

This chapter analysed the development of the BOTEC staff housing project. The chapter started with discussions focussed on the development of the BOTEC project; first discussing the drivers for the project and reflecting on the initial steps in the design and construction process. The chapter ends with an MLP analysis of the creation of the initiative.

It has been found that the lack of sustainability knowledge in the construction sector, organisational incapability which privileged international workers at the expense of the locals and reliance on individuals to capture and disseminate results of the demonstration project reduced the effect of the project to transition the Botswana construction sector towards sustainable construction.

The MLP analysis of the development of the initiative reveals the project failed to effect a transition in the construction sector highlighted by three scenarios. In the first, the vision of the project was to have a housing sector characterized by locally sourced materials. This was not achieved as it was analysed the researchers lost sense of what they were supposed to do. In the second, the analysis reveals that reliance on individual transmission of the results of the project resulted in limited influence on transition to sustainable construction. Government and BOTEC failed to capture and disseminate the learning from the project to the wider construction industry. Lastly, the analysis of the initiative reveals that lack of sustainability knowledge in the construction sector resulted in poor social network which in turn resulted in limited influence of the project on transition to sustainable construction.

Chapter 6: Environmental Impact Assessment Act

6.1 Introduction

This chapter analyses the development of the Botswana Environmental Impact Assessment Act. The discussion follows accounts for the activities that were undertaken between 1990, when the first preparatory steps were made by Government and 2011; when the 2005 Act was repealed. The development of the environmental impact assessment (EIA) legislation can be broken down into three distinct stages; the preparation of the 2005 Environmental Impact Assessment Act, the implementation of the Act between 2005 and 2011; and the review of the 2005 Act leading into the 2011 Environmental Assessment Act and its implementation since. An account of what happened at each stage is presented reflecting in each on the role of international advisors, confusion about the scope of the Act, the limited technical knowledge of environmental assessment and the involvement of local actors. This case allows exploring the role of EIAs in Botswana's transition to sustainable construction. The study argues that how EIA are developed influences their effect on the regime. In the case of Botswana EIA, international experts suggested the scope of the EIA Act which advice was not incorporated in the 2005 EIA Act. Confusion about the scope during implementation of the 2005 Act triggered a review of the Act, in the process removing arbitrary decision making from political leaders.

In the context of this chapter, the word development activity is used to refer to a construction project. The Botswana 2005 EIA Act (DEA, 2005) and the 2011 EI Act (DEA, 2011) uses the term to refer to a construction project, programme, plan or policy. The followings section give description of the purpose of the Botswana EIA Act followed by a narrative account of what happened in each stage of the development process. The chapter concludes with an MLP analysis of the development of the Act. As the discussion which follows suggests, in the

development and implementation of EIA Act in Botswana, the lack of a defined scope hindered DEA to effectively implement the 2005 Act prompting the 2011 review of the Act.

6.2 Purpose of the EIA Act

The first EIA law in Botswana was introduced in 2005; the EIA Act of 2005. The National Conservation Strategy Coordinating Agency was initially in charge of the EIA before that mandate was moved to the Department of Environmental Affairs (DEA). The objectives of the EIA Act are:

- To provide for environmental impact assessment to be used to assess the potential effects of planned developmental activities
- to determine and to provide mitigation measures for effects of such activities as may have a significant adverse impact on the environment
- to put in place a monitoring process and evaluation of the environmental impacts of implemented activities
- And to provide for matters incidental to the foregoing (DEA, 2005).

The 2005 EIA Act was reviewed in 2011 and replaced by the EA Act of 2011. The objectives of the Act did not change with the review. The major changes that were incorporated in the 2011 Act were on the scope of the Act and this included development of a list of projects for which an EIA is required and the establishment of the Botswana Environmental Assessment Practitioners Association (BEAPA). Before the review of the 2005 Act, EIA was mandatory for all development projects except where they were exempted by the Minister of Environment, Wildlife and Tourism. The 2011 Act specify a list of development projects for which an EIA is required.

The discussion which follows analyses the reasons why the Act was reviewed in 2011 and the implications of such a review. It answers the question as to why there was a need for a review.

This section on the development of the 2005 EIA Act covers the initial preparations by Government. The development of the EIA Act involved a number of different actors at different stages of the process. At the initial stages, the key organisations were the National Conservation Strategy Coordinating Agency (NCSCA) and Ministry of Local Government Lands and Housing.

6.3 Drivers for enacting EIA legislation in Botswana

The following section explores the landscape and regime level factors which influenced the decision to develop the EIA Act. The analysis highlight that the landscape issues included climate change and the regime level factors included pollution and depletion of resources when development projects were done.

6.3.1 Landscape factors

Climate change

The emergence of climate change and agenda on sustainable development was an influential factor in the development of the Botswana EIA system. 1990 marks the beginning of Government recognition of environmental management by introducing the National Conservation Strategy Policy on Natural Resource Management. The policy recommended the concept of EIA as part of its implementation.

In 1992 there was a United Nations conference in Brazil to help Governments rethink economic development and find ways to halt the destruction of irreplaceable natural resources and pollution of the planet (UN, 1992). The conference was attended by Government and non-Governmental organisations to deliberate on themes of sustainable development. The Government of Botswana sent a delegation to the conference.

The conference recommendations called on Governments among others to consider social and economic dimensions; conservation and management of resources and to strengthen the role of major groups and means of implementation as they pursue the state of sustainability (UN, 1992). Governments agreed to sign the non-binding agreement to uphold the recommendations reached by the conference participants. 1992 marks the beginning of Government process on development of EIA.

The conference was the catalyst for the development of the environmental assessment legislation in Botswana. Botswana signed up to the convention. According to an environmental practitioner, "one of the imperatives of that United Nations convention is that you must undertake environmental assessments where you will be destroying the bio diversity" (Environmental Practitioner, 2016).

Requirement by international funders

In the 1980s the focus for Botswana Government was on infrastructural developments. Some of the developments were financed by international funders while most were financed by Government through the National Development Plan. According to some respondents, as a condition for best practice, some international funders insisted on environmental impact assessment prior to the start of the projects. As two of the respondents indicated;

> There were still other projects that were subjected to the EIA process even though we did not have the act by then. Those were particularly big projects that were funded by international funding organisations. One of the things that were a requirement was that when we fund you …, for us to fund you or the African Bank to fund Botswana you will need to prepare an EIA which they will look at. So basically because of that requirement by international funding organisations including the IMF actually drove the country to move towards developing the EIA act (Environmental Officer 2, 2015).

> The first EIA in Botswana was prepared in the 1980s as a condition of the African Development Bank (ADB) to finance the Trans Kgalagadi road construction project (Senior Government Officer, 2016).

What the quotes suggests is that environmental impact assessment in Botswana was done on a project-by-project basis as a demand by international development assistance agencies to sponsor development projects. The ad hoc nature of the EIA proved problematic especially for projects funded through the Government National Development Plan. The former director further says:

> So we were doing it just to satisfy donor requirement not that it was a legislative requirement in Botswana, until we realised that for those of our NDP plans and programmes we need to start thinking how we can administer the impact assessment act to regulate the conduct of use of the natural resources (Senior Government Officer, 2016).

Based on the quote, there was no legal basis for conducting EIA in Botswana. Requirements from funding agencies created that demand for the development of the act in Botswana. The demand for EIA was indirect, but it acted as a prompt for the Botswana Government to act. The reason for acting was perhaps due to the state of development for the country at that time; where it relied on some funding from international agencies for developments. These funding requirements coupled with an emerging sense of environmental management worldwide were the landscape catalysts.

6.3.2 **Regime factors**

Statements from the opening address made by the Assistant Minister of Local Government, Lands and Housing (LGLH) highlighted some of the problems in the regime that needed to be addressed. Regarding the overall challenges of developmental growth in Botswana, the Assistant Minister commented:

> National Conservation Agency has responsibility to ensure that development does not erode the natural resource base which supports it either through overutilization of resources or through pollution (NCSCA, 1992).

Based on the statement by the Assistant Minister, Government was concerned about pollution and depletion of resources when development projects were done. Pollution was manifested in different ways. The Assistant Minister says regarding specific pollution problems that were prevalent in Botswana;

> Pollution is becoming a significant problem in this country as is shown by widespread littering and the inadequate management and disposal of waste. Development projects too may reduce available resources (NCSCA, 1992).

Littering could have been attributed to individuals while inadequate management and disposal of waste could have been attributed to companies or organisations. In essence Government thought changes were needed to be made to address the problems. The Assistant Minister further said;

> While we appear to have large amounts of natural resources, there is a discernible decline in their quantity and quality. This decline results from the cumulative impacts of many small individual actions and from those of few large ones. The actions of thousands of individuals are difficult to deal with except through education and improvements to living standards. For the larger institutions and projects, standards, regulation and legislation are required in addition to education. For them it is important that where possible, potential impacts should be studied in advance and alternatives considered (NCSCA, 1992).

By implication most of the impacts emanated from actions of individuals more than organisations but that collectively, environmental regulation and legislation, education and awareness was needed to address the problem. The thinking behind environmental legislation and regulation was to potentially know in detail the nature of impacts in Botswana. According to the Assistant Minister, Government "did not know the precise nature of the impacts" from the utilisation of natural resources and could not know if "sustainable development is not jeopardised" (NCSCA, 1992).

Climate change and the requirement by international funders to undertake environmental assessment for developmental projects put pressure on the regime. The EIA Act developed out

of that pressure for more consideration on the environment when undertaking developmental projects. These pressures and how they influenced the EIA Act are discussed in the following sections.

6.4 Development of the EIA Act

The design of the Botswana EIA involved a variety of actors and processes. The process evolved over stages and it appears that at some of the stages, advice of international actors was not taken into consideration when drafting the legislation. The input from these advisors was technical in nature and could have resulted in a different content of the Act and possibly different implementation outcomes. International advisers suggested that the National Conservation Strategy Coordinating Agency (NCSCA) specify the type of projects requiring an EIA, but the NCSCA ignored the advice.

The process of crafting the legislation resulted in the production of reports from workshops that were held as part of the consultation process. Before providing an account of the development of the EIA, it is important to highlight what was then standard policy design process in Botswana.

The principle of consultation in reaching decisions has been an integral part of policy making in Botswana. According to Harvey and Lewis (1990), many of the major policy initiatives in Botswana included extensive consultations processes- mainly through Kgotla[2] meetings, establishment of presidential commissions or public workshops, with the aim to gather evidence country-wide to support proposals;

[2] A Kgotla is a public meeting place where public meetings take place and deliberations are chaired by the tribal leaders called Dikgosi. Every village in Botswana have a Kgotla.

> The process of enacting an act here in Botswana normally starts with consultation. It is generally representative in that you go to institutions and you then go to parliament where you have representatives. So there was no public consultation in the traditional sense that we know it where you go to the Kgotla and say this is what we were thinking of and this is the draft and what do you think about it (Environmental Practitioner, 2016).

From the statement, policy initiatives are marked by Government invoking in-house machinery to design the contents of the policy. The general public is involved at the latter stages of the process to legitimate the policy or act through public consultations. The public consultations are used as part of the process to announce the contents of the policy followed by deliberations. This process suggests that authority for developing contents of policies rests with the Government.

In the case of the EIA legislation, a different process was followed. People who were considered experts were consulted to provide options for the Act and help in its drafting into a law. There was also a staged consultation process between professionals and Government to decide on the EIA. Workshops were used to solicit the views of professionals on what should be the scope and content of the EIA legislation in Botswana.

The National Conservation Strategy Coordinating Agency (NCSCA) convened the first workshop in December 1992. The workshop was attended by 40 participants from government, non-government and international organisations. Government representatives came from a number of departments including Department of Civil Aviation, Local Authorities, Department of Town and Regional Planning, Department of Meteorological Services, Department of Surveys, Ministry of Commerce and Industry and Ministry of Agriculture. Other participants represented organisations such as Debswana Mining Company, University of Botswana and Water Utilities Corporation. Participants from Kalahari Conservation Society represented the

non-Governmental organisations. There was a representative from the International Union for the Conservation of Nature.

At the beginning of the workshop the then Assistant Minister of Local Government, Lands and Housing proclaimed "at the end of the workshop, we should be able to come with what we consider to be the key components of an EIA process for Botswana" (NCSCA, 1992 pg 2). The announcement suggests that, at this point, nothing had been decided for the contents of the policy. This is in contrast with the normal practice where Government would have drafted the contents and brought those for deliberation with the professionals.

During the workshop, presentations were made on environmental impacts of construction projects on different sectors. The presentations covered water, urban development, manufacturing, road transport, tourism, mining, aviation and agriculture sectors.

6.4.1 Defining EIA legislation

Advice from international advisors was not taken into consideration when drafting Botswana EIA system. The International Union for Conservation and Nature (IUCN) representative used his presentation to introduce the elements of an EIA system. In the workshop report (NCSCA, 1992), Dr Driver of the IUCN noted that an EIA system must include:

- Legislation to introduce the statutory requirement for EIA
- A responsible authority (or authorities) to administer the EIA system
- A defined procedure to be followed in the conduct of EIA. That procedure should include screening to determine whether EIA is necessary, preliminary assessment/initial environmental evaluation, scoping of the EIA study (including public participation), terms of reference for the EIA, the EIA study and report, review of the EIA study (including public participation), approval of the EIA and project and monitoring and evaluation of the project after implementation (NCSCA, 1992 pg 99).

The summary of the presentation was to affirm that legally, an EIA can be introduced in a number of ways. First it can be introduced by a new act. The Environmental Policy Act introduced in 1969 in the USA was cited as an example of a new act. It can be introduced as addition of EIA requirements to existing planning legislation by regulations or Executive Orders. The addition of EIA requirements to UK planning Acts was given as an example. EIA can be introduced as modification to existing procedures. An example was given that in Oman the process was modified to require EIA approval from the Ministry of Environment in addition to the approval from other relevant ministries.

Critically, Dr Driver emphasised that whatever system is chosen, it should always be clear what department of Government is responsible for demanding and or receiving the EIA. In addition the types of developments for which an EIA is required should be specified. The latter point proved prescient in the Botswana case, where the failure to specify types of developments for which an EIA is required in the 2005 EIA Act threatened to undermine the Act. In terms of the responsible authority, Dr Driver argued that institutional arrangements tend to dictate the EIA process. He pointed out that in some cases a single authority is involved while in other cases, two or more authorities may be involved.

In terms of procedure, the steps mentioned above about the process are presented in an almost linear pattern from screening to monitoring and evaluation. It is worth highlighting some of the stages which are important for implementation. In the presentation Dr Driver mentioned that screening is conducted to determine whether an EIA is necessary for a given proposed development. He emphasised further that a single list or two tier list approaches could be adopted. In a single list approach, there are projects that it is mandatory for them to have an EIA while a two tier approach combines a mandatory list with another list that, depending on the project details and environmental circumstances, may be required to do EIA.

To define the scope of the tool, it was noted that the IUCN had prepared a list of mandatory projects which require EIA for Botswana during the consultation process. However it was emphasised that the list was to be reviewed before the EIA legislation was introduced.

The key components for the EIA in Botswana were shaped through deliberations by professionals who were at the workshop following on Dr Driver's presentation. One of the issues raised by a Government representative was about public consultation. The representative noted that there was low environmental consciousness in the country and asked how this would affect the EIA process. It was highlighted that in essence it is the role of the developer to sensitise the public to environmental issues relevant to the project and later the public is expected to respond. Public participation should be a two way process.

One point that emerged during group discussions was in regard to the projects that required an EIA. A Professor from University of Botswana emphasised that if all projects are subjected to an EIA, it will become too much and therefore become unenforceable. The Professor suggested there should be a priority list of projects that should have EIA. This suggestion however was not taken into consideration even by the IUCN representatives. At the end of the workshop, a reference group was set to further look into the scope and content of the EIA legislation in Botswana.

The reference group was set up with representatives from Government, academic and civil society. Organisations which had members in the reference group included Government; National Conservation Strategy Coordinating Agency, Ministry of Local Government, Lands and Housing and Attorney General; University of Botswana, and IUCN and Kalahari Conservation Society representing the civil society. Due to limited technical knowledge from NCSCA employees, consultants were hired from the University of Botswana to research on the

scope and content of the Botswana EIA legislation. The consultants reported back to the reference group.

A second workshop was convened in 1995 by NCSCA to deliberate on the findings of the university consultants. The workshop was attended by hundred and sixty seven participants from Government, Government, private, not for profit organisations and international agencies. The workshop was convened to allow the participants to input into the scope and content of the legislation.

As with the first workshop, there was an opening address by the Assistant Minister of Local Government, Lands and Housing followed by the presentation of the consultants from the University of Botswana. Their presentation followed the steps in the EIA process.

6.4.2 **Defining the scope and content**

The role of the consultants was to distil from international experiences what could work for Botswana in terms of the content and scope of the EIA. Hence their presentation was arranged to depict the stages of the EIA process to gather opinions from the participants. The consultants presented options of what the content and scope could cover and let the participants to offer suggestions on those options.

On screening, the consultants mentioned different methods that could be used. The methods included the general description, the list, the project threshold, sensitive area and initial environmental evaluation method. From their presentation, the consultants recommended the list method, which requires that there should be a selection of projects for which EIA is required. They further recommended that this should be made part of the legislation. However this suggestion as shown later was not implemented by the DEA.

On scoping, the consultants highlighted some of the issues that should be included in scoping. They mentioned the inclusion of social issues, the timing and extent of analysis that is required, the sources of relevant expertise, suggestions for mitigating measures and the physical environmental issues that should be considered. The consultants however did not elucidate on which of the issues should be included in the EIA. The list though suggest that was a measure of thought put into determine what should be included rather than leaving it open to include anything possible.

On administration, the consultants proposed that the National Conservation Strategy Coordinating Agency should be given responsibility to administer EIA. Dr Driver of the IUCN made mention of these options; creating new agencies or using existing agencies to administer the EIA. The latter option was proposed by the consultants.

There are some elements that are worth commenting on which were proposed by the consultants but were not incorporated in the final Act. The first is on the requirement for EIA. The consultants recommended that it should be a mandatory list of projects that shall be subject to an EIA. This list was never developed and instead the Minister of Environment, Wildlife and Tourism was tasked with the responsibility to decide which projects should require and EIA. The second aspect was on public participation. Perhaps considering the limited knowledge on environmental issues, the consultants recommended that the competent authority or DEA in the case of Botswana should ensure that impact statement or information about the project is available to the public. In the Act, it is the responsibility of the developer to provide such information.

Throughout the consultation process, the NCSCA commissioned two consultation reports. The second of the two reports formed the basis for drafting of the EIA legislation. A wide variety of stakeholders contributed to the reports reflecting on EIA in their respective fields.

6.4.3 **Implementation process of 2005 EIA**

This section covers the implementation of the 2005 EIA Act highlighting how limited technical knowledge and confusion about the scope of the Act effected the implementation of the Act. In addition, the discussion highlights attempts by international advisors to improve the implementation process.

The 2005 Act legislated that any developer who wishes to undertake a project must apply for authorisation. The process starts with the project proponent or developer submitting the documents to the competent authority; being the Department of Environmental Affairs (DEA) for authorisation. Authorisation according to the Act means getting approval after assessment of environmental impacts of the project. The next step in the process, the developer submits the application for screening. The application has to include a preliminary environmental impact assessment which shall include a description of the project. The other stages include: advertisement for public participation during scoping done by consultants, submission of terms of reference, preparation of environmental impact statement, public review of the impact statement, public hearing, approval of impact statement, authorisation of impact statement, preparation of monitoring programme and evaluation report and environmental audit by the competent authority. In terms of application, only projects prescribed by the Minister of Environment, Wildlife and Tourism after screening them may require an EIA. Based on the Act, regulations prescribing activities and projects which when conducted would require an EIA were supposed to be developed.

There seems to be a gap between the stated intention of the Act and implementation. The intention of developing and implementing the Act was to ensure that people's livelihoods are not adversely impacted socially, culturally and economically by developments. But this seems to contradict what the Government is doing during project implementation based on the view of one of the interviewee. Government department sometimes submit project proposals for EIA evaluation at the Department of Environmental Affairs (DEA). Some Government departments then apply for their projects to be exempted from EIA which goes against the original vision of ensuring peoples livelihoods are not adversely affected;

> You see applications for exemptions coming from the Government which is still not echoing right with the initial intention of why we need to have this legislation (Environmental Coordinator, 2016).

However, even when EIA is applied, there were neither guidelines of how the process should evolve nor the list of projects that required an EIA. This coupled with the fact that the developer bears the responsibility for supplying all the relevant information required in the EIA report, led to concerns about the overall quality of the EIA process. According to respondents, the regulations were not developed until 2011 when the Act was reviewed. This affected the implementation of the Act as developers were forced to submit application for screening for every project that they undertake adding to the pressure on the department to act on many applications submitted some of which end up not requiring an EIA after all;

> And one of the challenges that we had then was that when that act was passed, there was a clause which talked about the minister would prescribe a list of activities or come up with regulations. The challenges that we had then been under the 2005 act those regulations were never developed. So it was difficult for us as a department to actually implement the act (Environmental Officer 2, 2015).

This was reinforced by another officer who even implied the illegality of implementing the legislation;

> There were no regulations which make it very difficult to implement the Act without the guidelines and regulations and in fact the legal opinion we got was really it is unlawful to implement an Act without the regulations (Environmental Coordinator, 2016).

For consultants the lack of guidelines affected the quality of reports they had to submit to the DEA;

> The quality of the output of those that were in the practice of the environment before the 2011 was not satisfactory and therefore if you looked at it all round, the intention of coming up with the 2011 instrument was to actually seek to improve the quality of the output by the environmental practitioners (Environmental Practitioner, 2016).

The issues that were raised about the quality of the output included the quality of the reports that consultants produced. The reports sometimes were produced by consultants who were not qualified even though there was no prescribed measure of the qualification that was required for one to conduct an EIA;

> let me give you an example err, we used to get away with it as me, water resources person specialist; I can go and do EIA on my own, I do from investigations, scoping report, EIA itself, drafts and….. I go through environmental affairs, here it is. They go through, perfect, now go ahead. You see that's how it was that time (Environmental Consultant, 2016).

> You see that is one of the issues that I said the 2011 act wanted to correct. We had everybody and everyone was doing the EIA, people that were not properly qualified and in the process between, up to say 2011 when the 2011 act became effective, the department of environmental affairs took rather long to approve the reports, largely because they were not properly written because they were not done by people who were properly trained (Environmental Practitioner, 2016).

The statement also intimates competency issue with those who assess the reports at the DEA. This suggests that the issue of upskilling people who conduct EIAs and who will assess the reports was not done. At the 1992 workshop it was suggested that consultants and DEA assessors should be trained on EIA. It was pointed out that historically in Botswana people who had done EIA were commercial consultants and mainly internationals. For example, knowledge of archaeology, botany, zoology, ecology and sociology was highlighted as important for EIA

assessment. It seems the requisite technical knowledge was not acquired by both consultants and DEA assessors as the process of implementation was subject to back and forth submission of reports between developers and the DEA.

The back and forth submission of reports between DEA and consultants accordingly created an impression that EIA process in Botswana is long. There seems to be contradictions on the cause of the long process with the environmental practitioners suggesting some of the timelines set by the DEA are long and in effect the timelines are not statutory. Based on the assertion of the practitioner, this again points to a lack of a clearly defined scope for the EIA and its process. An Environmental Practitioner commented:

> The process takes about 3 full months, now because they have divided this into stages, they will say the scoping report will take 28 days the EIA report will take 60 days the public review will take a full month and when you start you will have a project brief that is not statutory but they normally say the turnaround time is ten days so if you add all of that time that is actually a lot of time (Environmental Practitioner, 2016).

However the DEA suggest the long process is purely the lack of capacity of the practitioners to conduct the EIA process. In contrast, the practitioners point to the internal DEA systems of lack of standards that can be used to assess reports when they are submitted by practitioners;

> The work that they [practitioners] produce is basically questionable which leads to the back and forth submission of reports and the EIA process will take very long because when something is not done by a professional they will not know even when you are reading the report and say I need this information, they will not be able to address that because they are not professionals in the area and they were talking just a different language from what we would say (Environmental Officer 2, 2015).

> There is a lot of um within the department, they don't seem to have a system where…to measure everything according to their regulations or according to their standards. Why? If I come to a person A, to say assess the report. I give her the report, next report is assessed by person B, the way A is going to be assess it is going to be different from the way B is going to do it. So you find like, let's say people call noise pollution to say it's not called noise pollution, ok others will say no call it elevated sounds or elevated noise which is uncomfortable for people to hear it but not pollution. In some report others they don't care about whether we call it noise or elevated noise. This report passes, the

> other reports no what is elevated sound? Its pollution, so they contradict themselves within the same department (Environmental Consultant, 2016).

There is also a suggestion that consultants lack of knowledge and lack of body to oversee the development of the knowledge on environmental assessment contributed to the long process of EIA;

> In the absence of people that were accredited we were bound to have people whom claimed they were environmental consultant but the quality of our work was wanting, we have instance where somebody will be submitting statements on the study and because they are not competent they will take a lot of time because of the feedback from the department of environmental assessment (Environmental Coordinator, 2016).

Though contradictory, there is indeed agreement that the process was long with each party proffering a different reason why. The long review process has been cited as among the reasons why some developers have lost investment. Investment in Botswana has predominantly come from external sources and they normally base their decision to invest on grading by international agencies.

Based on the challenges that have been discussed above, World Bank came in at this stage to suggest that Botswana was not competitive. The advice from the World Bank was to streamline the investment processes for Botswana. An Environmental Officer had this to say about the role of the World Bank:

> The World Bank has actually helped us to come up with a process to try to streamline our process. We have been working on that project where we look at our systems; we look at our processes to try to see where we can cut and reduce days of us helping developers. The impact that is there on developers is that some developers have actually lost the investors; some construction activities have halted because investors ended up pulling out saying the process is taking long, the investment is not maybe worthwhile (Environmental Officer 2, 2015).

This advice, it seems was intended to shift the focus of effect on EIA at project level (environmental impact assessment for individual projects) to a landscape challenge of improving investor confidence in Botswana. Some of the recommendations however were

intended to change the practice of EIA in Botswana and were specifically made in regard to DEA handling of EIA documents submitted by developers;

> They were saying we are taking long to approve EIA documents and they also noted that there was a lot of backlog of reports; they also noted that therefore because of that it takes a long time to give feedback to the developers and it was stalling the process of ending up doing business within the country They also observed that …, they had a feeling that some of the requirements for EIA are actually …, well it's like certain things they felt we were not supposed to be requiring EIA studies for and they advised that we should review our list of activities for which EIA studies are required and that is also that eeh …, as part of the recommendations from this exercise we are looking into to say how can we review our list to basically the idea is to raise the bar a bit so that a lot of activities will fall off (Environmental Officer 2, 2015).

> This is why we have a problem, you find like somebody is questioning how you came up with err something ok: But herself or himself does not understand exactly, so you might write the report and say ok the reason why I came up with this is because of a, b, c, d. You send the report back, the same comments comes back, but how is a, b, c, d done. Then again comes back, let's say (Environmental Consultant, 2016).

The quotes reinforce the general consensus that the process of certifying individual projects requests takes a long time. Perhaps what is telling is that according to the first quote, there was a list which prescribed the projects for which EIA was required. The point reinforces the suggestion that there was confusion in scope. The requirements of the 2005 Act were that developers had to submit documents for authorisation for every project while the officer suggest DEA had a list which specified projects that require EIA. It seems that information was unknown to developers as the submitted reports for certification for every project they undertook. If it was legally specified, developers would not have been submitting documents for each project they undertake. The second quote while alluding to the confusion in scope, also intimates the lack of knowledge of DEA assessors. The suggestion is they don't know what they are supposed to assess and this coupled with the lack of guidelines on how to carry that assessment, results in delays.

In the workshops that were held prior to the development of the 2005 Act, the IUCN recommended that there should be a list of project that is legislated for which EIA is required. It seems the list that the DEA officer mention was not legislated and that the selection of projects to undergo EIA was done arbitrarily. The World Bank recommended to DEA to improve on that. Accordingly this suggests again that since international tools had clearly defined scope, in the development of the Botswana tool, the DEA chose not to include some of the elements.

The omission of the essential elements of the EIA especially the list of project seemed to have resulted in what can be termed excessive regulation. This was echoed by both the World Bank and environmental practitioners;

> For instance they [World Bank] were saying that a hotel in a built up area; the area is already disturbed; there are already some buildings in there so what part of the environment are you protecting? They were saying if we are concerned about waste management sometimes that area is connected to a central sewer network where you simply discharge the waste water into that central network and basically will dispose into the sewage ponds. And they were saying it is something in place that has already been put for that. We [DEA] agreed with them (Environmental Officer 2, 2015).

> I think there is a fundamental problem at the department of environmental affairs where everything that one was to do get subjected to environmental assessment. I think the fundamental problem as I see it is that we have lost the sense of appreciating that we are talking about sustainable development. Some of the; say if you wanted to build a mall within the CBD, CBD is already a planned area where there is already a lot so you would expect that you have …instead of having a full EIA you may probably have an environmental construction code of conduct so that you are saying to this guys that your dust, your noise, this is how you are going to manage it instead do a full EIA (Environmental Practitioner, 2016).

Both the World Bank and the environmental practitioner intimates that a full EIA is not required in developed areas. The statement of the practitioner is sustainable development is what you do when you actually carry out the project rather than what you predict you will do. The practitioner suggests an environmental code of conduct should be in place and used where there are already existing developments since the environment has already been disturbed;

> this act for me has been useful in that it has helped us to have… to set up a good database in the understanding of the environmental profile of Botswana because in every EIA report each developer first has to describe the project, the geology the hydrology, how people who live there subsist so all that information has to be captured in the EIA system of Botswana (Senior Government Officer, 2016).

While from the practitioners point of view there was perceived excessive regulation, the demands for EIA for every project have actually helped the DEA to understand the environmental profile of the whole country. This was made possible by the submission of documents to the DEA for assessment.

Assessment of actual documents submitted at DEA also elucidated some criticism from the environmental practitioners. The criticism stemmed from what the practitioners perceived as mismatch of competencies between practitioners who develop EIA reports and DEA officials who assess the reports;

> You see, you find like reports are being done by principal practitioners of the industry, the big boys/ girls or so. You go and submit a report to the department, who receives your report. Most of them are interns; they are just people of one year experience, some they are still UB [university] students. You see, so now and this is a person who is going to be writing notes and corrections and that and that. So it's some of the things which already has been highlighted to the department to say look for us to be called principal or senior practitioners or even just practitioner it's because we have accumulated years of experience. So if you give me a junior in my firm, he/she is going to be a junior, if I have to hire that person, this is a person who is going through my reports you see so you find like there are things they don't understand themselves (Environmental Consultant, 2016).

The quote suggests that while the practice of environmental assessment and in particular knowledge and experience was growing on the side of environmental practitioners, the same was not happening on the side of DEA.

This section has highlighted how the Act was developed and implemented between 2005 and 2011. Challenges were noticed during implementation notably because of the lack of a list that specified projects that needed an EIA assessment. Advice to include that list made by IUCN

representative was not incorporated in the Act. The lack of a clear scope of what the Act was to cover and how it was supposed to be implemented led to it being repealed in 2011.

6.4.4 **Revision of the 2005 EIA act**

This section covers the revision of the 2005 Act. The Act was reviewed to address problems/criticisms of the scope of the Act 2005 Act. The review of the 2005 Act was to develop the subsidiary guidelines and regulations to go with the EIA legislation. The review of the 2005 Act changed the scope of the EIA by specifying the list of projects that need EIA as well as promoting the development of environmental assessment professional body.

The process of developing the guidelines and the regulations started in 2005 when the EIA Act was put in place. Based on the account of the Natural Resource Officer, a consultant was engaged to consult with stakeholders and develop the guidelines. The consultation process involved professionals. The Natural Resource Officer representing the Government of Botswana initiated the process by engaging with consultants. The consultants reported to a reference team;

> As natural resource officers we then appointed definitely a consultant, so we have the terms of reference developments for the work, so we instituted a reference committee consisting of various departments and the private sector and part of the private sector was the mines to overlook the process of developing guidelines. It was the same thing done for the regulations having a reference team with even good representation from private sector acting on the terms of reference there will be a series of consultative meetings (Environmental Coordinator, 2016).

The officer further clarifies the process by which stakeholders were made aware of the process of reviewing the Act;

> Workshops were held to agree on what the framework should be like. Then once a draft …… I remember at some stage we had a workshop in Tlotlo Hotel and Conferencing Centre which was advertised through public media for people to come there and review the draft guidelines and regulations before they are finalized. We even published them

> in the Government gazette for people to look at them and make recommendations before they were actually published, when I say we I mean Government (Environmental Coordinator, 2016).
>
> I recall a meeting we had with engineers. The views of the engineers were that environmental assessment should be part of engineering consultancy services and as DEA we said no; that should not be the case. They wanted to be the key contractors and subcontract the environmental services then we said there would not be impartiality in that because there is going to be compromise because if I engage you to do environmental services and then I design the infrastructure there is a likelihood that I would direct you as to what to put in there because and am also trying to make savings from the designs (Environmental Officer 3, 2015).

The quotes reflect some of the tensions that emerged during the process of reviewing the 2005 Act. According to the Natural Resource Officer, the process of developing the guidelines was coordinated by the DEA. The Natural Resource Officer was appointed the project officer for such a process;

> So acting on the behalf of the department of environmental affairs I was the main person who was really coordinating the works of the reference group that was charged to oversee , so I will arrange meeting , chairing for them and actually ensuring that I am the accountable person that the type of reference that we develop are actually realized , so when you are a coordinating person you actually leading other people to ensure that timelines are actually achieved; then making recommendations to the leadership (Environmental Coordinator, 2016).

The account of the officer suggests a similar process with the drafting of the Act where professionals were engaged to draft the guidelines. The general public was only consulted to legitimate the guidelines. The Government Gazette was used to sensitise the public. The Government Gazette is a weekly publication that notifies the public about Government notices, acts, bills, statutory instruments, tenders etc.

As part of learning (from international advisors) by the DEA, a benchmarking trip was conducted in South Africa to learn about their association;

> We looked at South Africa where they have developed an association of practitioners. I remember at one stage we went to South Africa to attend international association of impacts assessment workshop facilitated by practitioners there to look at how they

> regulate their conduct even in one of their workshops that we carried out we prepared it was establishment of the same body in Botswana we invited representatives from south Africa to come in Botswana to give us their insight in terms of how they went about in establishing their body, what that body constituted of and challenges they encountered and how they really set off to address them (Environmental Coordinator, 2016).

The idea to regulate the environmental assessment profession and indeed all the professions in the construction sector was among the reasons that led to the review of the Act. The process of establishing the association started in 2008 and was completed in 2010 with the establishment of the Botswana Environmental Assessment Practitioners Association (BEAPA). The 2005 Act provided for the establishment of a regulatory association. The association was never established until 2011. An Environmental officer commented:

> One of the problems that was inherent in that act [2005 Act] was that although it provided a professional body there were no sections in it that actually established the professional body and provided the basis for its existence (Environmental Practitioner, 2016).

> So one of the major issues that lead to the enactment of the 2011Act was that it needed to address the gaps that were inherent in the 2005 Act but also importantly there was a lot of outcry that projects, construction projects were not completed on time, on budget largely because of participants within the construction industry, environmentalists included, engineers included architects included. So there was a decision by Government that all of those that are in construction must actually have self-regulating bodies to regulate those that will become practitioners within the various areas of expertise that constitute the construction industry (Environmental Practitioner, 2016).

Professionalization of the construction sector was the goal of the Government and the review of the 2005 Act provided conditions for such a requirement to carry on. In the case of EIA, The professional body was to change the practice of environmental assessment. It was meant to change certain practices including regulation, pricing by environmental practitioners and using people who are trained in environmental assessment to conduct EIA. Since the establishment of BEAPA in 2011, some changes in the process of environmental assessment are noticeable. Developers are mandated to engage environmental practitioners to do the assessment replacing consultants. The association has set procedures for accrediting members to the association;

> The primary objective of implementing a professional body is self-regulation, and that self-regulation means, by the way I understand it, you should be able to screen people who should be in the practice and the screening process take at least two levels; one is the appropriate qualification; and two is the experience so that people are certified at different levels (Environmental Practitioner, 2016).

By specifying the qualification and experience of environmental practitioners has shifted the practice of environmental assessment from one that is based on lack of knowledge. The lack of knowledge has been cited as one of the problems that affected the implementation of the EIA.

6.5 Contribution towards change to sustainable construction

EIA tools have been evaluated for various things including the times it takes to finish the process, the quality of environmental statements/assessment/reports, provision for public participation, capacity to follow-up on projects after authorisation.

6.5.1 Evaluation of success

Ecological profiling of the country

The Act can be considered a success in many ways. The first one is that it produced a valuable ecological profiling of the country. The inadvertent lack of regulations and guidelines in the 2005 Act seems to have contributed to its success. The interviews showed there were consternations about submitting environmental statements for each and every project that was done in Botswana. In this way, for every project even when eventually it was found not to need an EIA after, there were already a preliminary environmental assessment which it is argued resulted in knowing the ecology of the whole country.

The ecological profiling is a valuable resource going forward. First it will reduce the length of time needed to do the actual environmental assessment as the different profiles for the country will be readily available. Secondly it will save on the cost of carrying the EIA process.

Establishment of a regulatory association

The establishment of a regulatory association is one of the successes of the introduction of EIA. The establishment of the association came at a time where there were massive shift towards self-regulation for service providers in the construction sector in Botswana. For example, Architects Association of Botswana and Engineers Registration Board were registered around the time the association was established. So the establishment of the board was another step in providing impetus for those service providers who were still not self-regulated. Through registration of members to the association, there has been a creation of a database of people who are competent to carry out environmental assessment. This can even help Government to see when and how they can offer environmental management training in Botswana.

The association has imposed continuous professional development as one of the imperatives to remain registered with the association. This eventually will help improve environmental management in Botswana.

Development of environmental standards

Environmental standards have been developed for built up areas. Though the standards have not been incorporated into the building regulations, they are used as reference for new projects. For example there is a suggestion that there is a standard way of managing waste that is given to developers in built up areas to follow. Developers in built up areas do not need to develop any standards of how they will manage waste. They simply adopt and present the one already developed, provided the project is in a built up area.

> The first thing was raised in the EIA is please minimize noise when executing your works because there are offices around; there is high court on the other side there and these people have to continue doing their work while we doing our construction work,

> so there was that requirement that noise should be kept to a minimum (Contractor, 2016).

The statement suggest in particular projects particular issues that are considered include noise control especially in built up areas.

6.5.2 **Evaluation of failure**

The subtle argument from the respondents is that there has been a failure to integrate EIA with other planning tools. Expansion of cities normally follows development or planning standards. The standards assess what is already available and what is needed going forward to improve cities or towns. There is a suggestion that there seemed to be duplication between the requirements of EIA with other existing standards.

The integration of the EIA requirements into other planning standards could have resulted in the development of environmental standards for developed areas. With the environmental standards, EIA will not be required where the standards are available especially in already developed areas.

6.6 **MLP Analysis of the initiative**

This section uses MLP to explain features of the EIA process and their implication for transition to sustainable construction. Geels (2006) suggests that changing perceptions, goals, knowledge and practices are essential for the transformation of a regime.

Insights into the broader impacts of the EIA can be analysed using the lenses of alignment of visions, changing rules and development of social networks. The analysis suggests that the involvement of international advisors, the lack of knowledge and confusion in scope was critical in shifting the vision, changing the rules and developing social networks. There was a shift of

the EIA vision from project level to a landscape level. In addition there was a change in rules of who need to do an EIA. Lastly the social network which developed around formulation and implementation of the EIA provided conditions for the development of professional associations in the construction sector.

6.6.1 **Changes in visions**

MLP suggest that an alignment of visions amongst different actors is critical for the impact of a regime level initiative (Geels and Schot, 2007). In the case of the EIA the discussion points to a shift in the DEA's view of environmental assessment. In the beginning there was a tension between the focus of EIA at project level and at landscape level, but in the end DEA adopted to use the EIA as a landscape level tool to improve investor confidence in Botswana. The landscape is taken as the impact of the EIA outside the project level.

Evidence from the initiative suggests there was a change in perception about how to manage the risk of diminishing natural resources. The Department of Environmental Affairs (DEA) wanted to ensure that infrastructural developments do not erode the natural resource base. The DEA envisioned an environment that was free from pollution and littering. They further imposed governance mechanisms that they are responsible for overseeing the process. Even during review, there were conflicting views between different actors. For instance, when the 2005 Act was reviewed, construction engineers wanted control of the EIA by proposing environmental assessment to be part of the engineering consultancy services. The DEA still insisted that they should have control over the process. This suggests that the DEA felt the intended purpose of preserving the natural resource base could have been compromised if the process was overseen by people who worked for the developers or they wanted to control the process themselves.

The implementation of the EIA however highlighted that it was unenforceable to have EIA for every construction project. The process was littered with problems. Developers submitted EIA reports to DEA for evaluation. DEA delayed to assess the reports. DEA claimed the submitted reports were poor in quality resulting in the delay to give feedback to developers. In addition to these problems, there were issues with the regulation of the environmental practitioners. The delay and lack of regulation led to international investors losing interest in investing in Botswana. The World Bank made recommendations for the EIA Act to be reviewed.

Some of the World Bank recommendations were intended to change the practice of EIA in Botswana and were specifically made in regard to the time taken to conduct EIA; from assessment studies by environmental practitioners to the approval stage by the DEA. Their main recommendation it seems was however intended to shift the focus of effect of EIA at project level (environmental impact assessment for individual projects) to focusing on a landscape effect of improving investor confidence in Botswana. The World Bank advised DEA to set up a central place where international investors could get all the services pertaining to construction project development. For instance, the World Bank suggested having a single place where services could be provided for acquiring land for development, the EIA and getting work and residence permit within the same building.

The discussion above highlights the alignment and misalignment of visions along the development and implementation of the EIA. The suggestion by the World Bank which was taken into consideration by the DEA seems to introduce a new vision which accords with Van de Poel (2003) on the role of regime outsiders in transformation; which suggests that regimes transform if there is pressure from outsiders. In contrast, the suggestion and subsequent rejection by the DEA to have EIA as part of engineering consultancy services for engineers

perhaps highlights a misalignment of visions. DEA favoured total control of the EIA process as a way to achieving their stated intention of protecting natural resources.

At the time of writing, the proposed changes to the EIA process by the World Bank had not yet been implemented but it seems the DEA has bought into the idea. The changes propose streamlining the EIA process so that it is shorter. In addition they proposed to have a single place where all the requirements for development in Botswana could be handled. For example, the place will have offices that deal with land acquisition, applying for EIA and other processes that are required during developments. If implemented, the proposed changes could have implications for the whole construction sector in future. The changes could ease the process of doing business in Botswana especially for first time international investors who are not accustomed to Botswana. The changes have implications even to the process of EIA. Whereas currently the EIA is used as a risk management tool at the project level, the changes propose EIA to be part of a process to maintain investment in Botswana by internationals.

6.6.2 **Changes in rules**

In MLP, rules guide actors perceptions and activities (Geels, 2004); regime transformation involves changes in rules; it is often influenced by regime outsiders and enacted by regime insiders (Geels, 2006). According to Geels (2004), when one rule changes, there is need to alter other rules as the alignment between rules gives regimes stability and coordinate regime activities. In the case of the EIA, the change in who needs (in terms of projects) to do an EIA was central to the re-evaluation of the Act. It was not given at the beginning and had to be negotiated and in the end it was clarified.

A combination of dissatisfactions about EIA process from Government (poor project delivery where some projects were stopped due to absence of EIA approvals), public perception (EIA

costly), consultants (citing lack of capacity of the DEA) and World Bank (lengthy process of EIA) triggered the review process. The criticisms challenged the environmental assessment regime, creating pressures on regime actors to work towards solutions. A review of the EIA Act was started to clarify who needed to do an EIA which changed some of the existing practices.

At the development of the 2005 Act, it was made clear by international advisors and local experts that there should be a defined list of projects where EIA should be a requirement. The suggestion was not incorporated in the Act. Subsequently, developers have to align their activities with this requirement of carrying out EIA for every development project they undertook. The EIA activity was thereby characterized by submission of many reports by developers to the DEA office for evaluation and this became part of the standard practice for environmental assessment. The failure to properly process reports affected the quality of environmental assessment as well as the time taken to take a decision by the DEA.

The requirement for conducting EIA for every project was subsequently changed when the 2005 Act was reviewed in 2011. A list of projects that require an EIA was defined. This meant there was an elimination of the process of screening. The elimination of the process resulted in change in the practice of environmental assessment from the stated practice that only the Minster through DEA can decide whether the projects has impacts that need to be managed to the one where it is clearly based on the nature of the project that there are environmental impacts associated with the project. It is the role of the developer to show the DEA how they are going to manage those impacts during the course of construction. As a result there was a change in the clause that said the Minster of Environment, Wildlife and Tourism shall decide on which projects should be subjected to EIA. The change in the clause subsequently led to a change in the practice of developers submitting environmental impact reports for every project they intended to undertake. A clear sense of which projects required EIA brought another change of

regulation of the environmental practitioners. The change was influenced mostly by the perception that the quality of reports was poor due to lack of knowledge in environmental assessment.

The other change was in regard to the EIA process. Prior to re-evaluation, consultants were engaged by developers to carry EIA assessment on their behalf. In the process, consultants prepared scoping and screening studies and prepared environmental assessment reports. The consultants were responsible for conducting public consultations. When the Act was reviewed, first there was a clear definition of who can be an environmental practitioner. Most consultants who had been conducting environmental assessment no longer qualified to do so. Further, the responsibility to arrange for public participation was assigned to developers themselves even though they engage environmental practitioners to carry out assessments.

The Botswana Environmental Assessment Practitioners Association (BEAPA) was established to regulate the conduct of environmental practitioners. Implicit in that was the need to have competent practitioners who will produce quality environmental assessment and that it will be reflected in the environmental reports. This was considering that it was no longer a standard practice to submit environmental statements for a vetting from DEA of whether that project needed EIA. It was a necessity that once the intended project was among those listed, good quality environmental assessment was an imperative. In a way the change shifted the practice of environmental assessment from identification of possible impacts to that of drawing mitigation strategies pertaining to the listed projects. Qualified environmental practitioners were needed to cater for that shift.

In terms of the broader effect of these changes in rules on the construction regime, there is appreciation that other professions should be included in the construction process. Previously,

environmental assessment was done at the behest of the designers, meaning it was not considered as a profession that should be part of the design process. The analysis suggests that environmental assessment has been incorporated into the construction process. Environmental assessment practitioners are consulted during design stages; with their separate fees from those of other designers. In fact there is a suggestion that design should include input from environmental practitioners. The shifting of rules within environmental assessment practice and subsequent establishment of BEAPA led to a general shift in practice thereby including environmental assessment as part of the construction process.

6.6.3 **Change in social networks**

Geels and Schot (2007) suggest that social networks enact regime practices. Two elements are important for an effective social network; the composition of the network and the alignment of the actors within it (Schot and Geels, 2008). In terms of composition, a 'good' network requires a diverse group of actors with different interests and roles. van der Laak et al. (2007) suggest that alignment in a network is high if the activities of the network are coordinated through regular meetings of the different actors. In the case of the EIA, a change in the requirements for the scope from a universal to a targeted set of projects requiring EIA was central to the review of the Act. The review implied changes to the social networks initiating a transition in the construction sector. In addition the social network which developed around implementation of the new EIA provided conditions for the development of professional associations in the construction sector.

A network consists of actors who sustain, carry expectations and articulate requirements and demands (van der Laak et al., 2007). For the purposes of this discussion, the concept of a network is defined as all those who were present during the development of the EIA legislation,

independent of whether a specific contribution is evident from the data. The network that was involved at the development stage of the act included NCSCA, Government departments and local and international non-Governmental organisations. Though there was heterogeneity within the network, it did not include construction experts. It is important to note that there were no recognised professional organisations in the construction sector at the time the EIA was developed. Individual professionals only became involved at the review of the act in 2011.

Central Government departments which were involved included civil aviation, town and regional planning, meteorology, surveys and lands, commerce and industry and agriculture. Local Government included Central, North-West, Kgatleng, South-East and Tutume District Councils. Debswana Mining Company, University of Botswana and Water Utilities Corporation were the state owned enterprises that participated. Kalahari Conservation Society (KCS) and the International Union for Conservation and Nature (IUCN) were the non-Governmental organisations that participated. Some actors were not active participants, but their presence legitimised the process of developing the EIA. The active actors were the NCSCA, the IUCN, some central Government representatives and the University of Botswana researchers. The passive actors were Department of Civil Aviation, Local Authorities, Department of Town and Regional Planning, Department of Meteorological Services, Department of Surveys, Ministry of Commerce and Industry and Ministry of Agriculture, Debswana mining company, Water Utilities Corporation and Kalahari Conservation Society.

The National Conservation Strategy Coordinating Agency (NCSCA) led the policy development by organising workshops. Figure 6-1 shows the actors who were involved at the first workshop in 1992. Some actors made presentations which is deemed a direct participation and is represented by a solid line while others attended the workshop but did not make presentations, as represented by a dashed line. During the workshops, the influential actors

were the University of Botswana (UB) and the IUCN. They provided expert presentations on EIA. The UB representatives defined EIA and synthesised the group discussions. The IUCN contribution was to introduce an international perspective on the different ways to introduce EIA. Subsequently, members of the University of Botswana were engaged as consultants to develop the draft legislation. Both the University consultants and IUCN representative advocated for the development of a targeted list of projects. Their suggestions were not taken into consideration at the development stage. The initiative was started by Government and NCSCA was a strong actor because it had support from Government and was powerful to reject some of the suggestions if they deemed fit. In this case, they did not reject outright the suggestion, but the list was never developed.

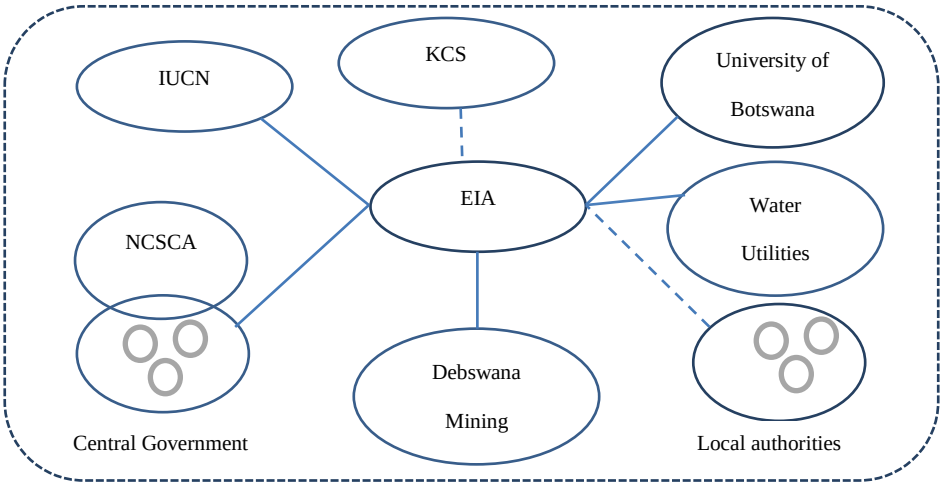

Figure 6-1: Actors and networks at development of EIA

Once the first piece of legislation was passed, a new social network emerged around the implementation of the EIAs (Figure 6-2). The NCSCA was replaced as the administrative authority for the EIA by the DEA. The change was not significant in as far as the development of the EIA was concerned. Construction professionals (consultants), who had not been involved in the legislative (EIA) process, were involved in producing environmental assessment reports

on behalf of private developers. The services of the consultants were criticised by private developers and Government clients. They were criticised for producing poor quality reports and charging high fees for their services. World Bank got involved as an outsider to the EIA process by criticising the EIA process as lengthy in Botswana. The criticism from the World Bank acted as the driving force towards the re-evaluation of the EIA process. The analysis suggests that there were too many reports to be assessed as all projects technically had to have EIA assessment. The second reason was the lack of technical knowledge for consultants to carry out environmental assessment due to limited technical knowledge.

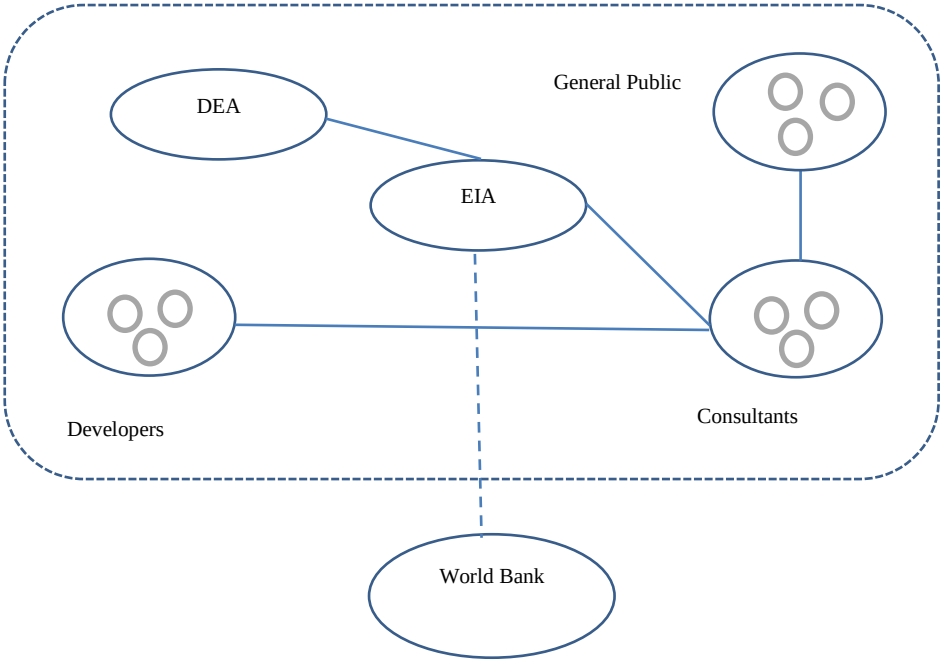

Figure 6-2: Actors and networks prior to review of EIA Act

The re-evaluation resulted in a major change in the governance structures of the EIA. When the 2005 Act was reviewed it narrowed the scope of the EIA and in the process removed arbitrary decision making by political leaders. In addition the review led to the professionalization of the EIA process. The review led to a recommendation that a targeted list of projects for which EIA was required rather than a universal requirement of EIA for all

projects. The targeted list approach was previously suggested by the IUCN representative during the initial development of the 2005 Act, but was not incorporated in the Act. The World Bank views aligned with those of IUCN and UB researchers that the EIA will be unenforceable without a targeted list of projects.

During the review, actors differed on some aspects of the EIA process. For example engineers who were consulted wanted EIA to be part of the engineering services. The DEA refused that suggestion and in a way it resulted in the establishment of the professional body for environmental assessment to be independent of engineers and form part of the construction team (with engineers, architects, quantity surveyors etc.). The re-evaluation of the Act however strengthened the EIA process. The roles of the actors in the EIA process were defined as the network changed.

Botswana Environmental Assessment Practitioners Association (BEAPA) was established by the Department of Environmental Affairs (DEA) in 2011. It was established through consultation by DEA and environmental practitioners who prior to that were described as consultants. The establishment of BEAPA brought about changes in the EIA process. Figure 6-3 show that the key actors after re-evaluation of the Act in 2011 were DEA, BEAPA and developers. BEAPA was responsible for regulating the conduct of environmental practitioners. BEAPA set qualification requirements for practitioners who conduct EIA and a fee structure for the services. Consultants were replaced by environmental practitioners to carry out environmental assessment. Environmental practitioners had to register with BEAPA. DEA still administered the EIA process and started carrying out public awareness and environmental education. Public participation in the EIA process was the responsibility of developers as opposed to previously which was the responsibility of consultants. The establishment of

BEAPA fostered conditions for the emergence of professional associations in the construction sector.

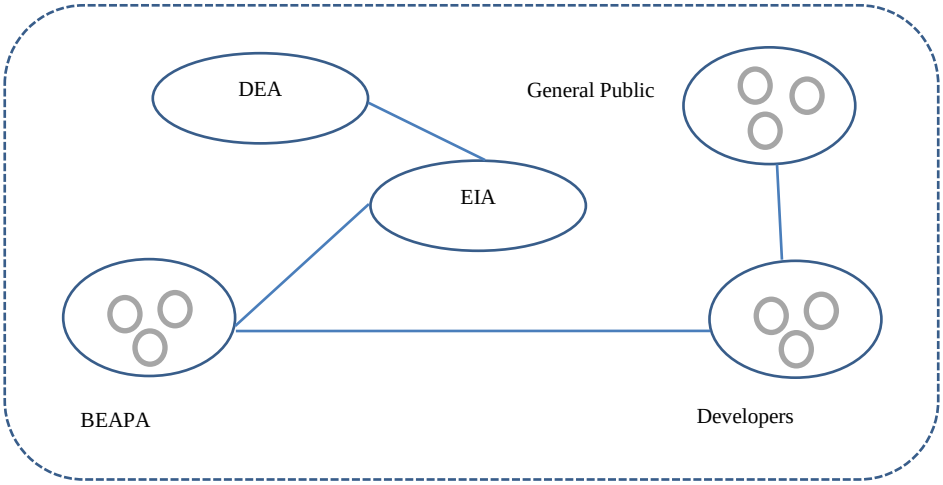

Figure 6-3: Actors and networks after review of the EIA Act

In terms of the broader contribution to transition towards sustainable construction, the change in social networks around the EIA created an actor that is now available for regulation and professionalization in the construction sector. The Botswana Environmental Assessment Practitioners Association (BEAPA) was established in 2011 and as a result and parallel to the establishment of BEAPA (the process started in 2008), all three of the traditional professions of the construction industry namely the engineers, quantity surveyors and architects started to establish their own professional associations. The Engineers Registration Board (ERB) was established in 2010; Quantity Surveyors Registration Council (QSRC) established in 2013 and Architects Registration Council (ARC) was established in 2015. BEAPA added to the impetus towards professionalism in the construction sector.

6.7 **Summary**

This chapter introduced the development of the Botswana EIA Act. The chapter started by giving a background purpose of the Botswana EIA Act. The subsequent discussions focussed on the development of the Botswana EIA Act; first elaborating on the drivers for developing the Act and reflecting on the initial steps in the process. The chapter ends with an MLP analysis of the creation of the initiative.

The discussion noted that locally the main motivations for developing the Act were to address issues of pollution and depletion of resources when construction projects were done. There was also an international move towards establishing EIAs due to climate change concerns. It was also found that during the development of the Act, some advice from local and international experts was not considered resulting in implementation challenges of the Act. The review of the Act in 2011 was necessitated by pressure from both local and international actors.

The MLP analysis of the development of the initiative reveals the effect of the Act on transitions towards sustainable construction. From the analysis of the initiative, the construction sector was effected in three ways. In the first, there was a change of vision from using EIA as a project level tool to using it at the landscape level to manage investor confidence. On the second, there was change of rules about who need to do an EIA. Previously EIA was conducted for every project in Botswana. Lastly, the social networks which developed around the formulation and implementation of the EIA provided conditions for the development of professional associations in the construction sector. The next chapter analyses such an effort to introduce a professional organisation in the Botswana construction sector.

Chapter 7: Botswana Construction Industry Authority

7.1 Introduction

This chapter analyses the development of the Botswana Construction Industry Authority since its establishment was first mooted in 1993. The creation of the Botswana Construction Industry Authority can be analysed in terms of two phases: the attempt to create the Board in 1993 leading to the resistance by two consecutive national presidents to the proposal and the issuance of the Government White Paper in 2010 leading to the creation of the Board in 2016. An account of what happened at each stage is presented, reflecting on the influence of international advisors and construction firms. The case of the Construction Board also provides an opportunity to explore the role of professional organisations in Botswana's transition to sustainable construction.

The establishment of the Construction Board in Botswana is the story of the emergence of a body that could lobby for ethics, standards, training and licensing in the construction sector of Botswana or any new set of criteria at odds with dominant commitment to cost and time. As the discussion which follows shows, obstacles to the creation of the board included: political objections, lack of funding, minimal involvement of relevant stakeholders and lack of evidence about the poor performance of projects. The relevance of this chapter for the overall thesis lies in the importance of professional organizations both as a lobby group and guardian of standards for a successful transition to sustainable development.

There are different kinds of professional associations. The Botswana Construction Industry Authority is a sector level association that could be important for sustainable transitions partially because of the role of sector level associations from the neighbouring countries. For

example, the Construction Industry Development Board (CIDB) in South Africa was established in 2000 to promote among others best practice in safety and health, and environment (CIDB, 2017). The Board in Botswana is modelled on the South African Board and has the potential to be a serious actor in sustainable development. MLP argues for the importance of professional associations in sustainable transitions. It assumes the organisations exist but in Botswana they needed to be created.

The premise of this chapter is that in Botswana sustainable development depends on the greater professionalization of the sector. This chapter explores the process of establishing a construction specific professional body. At the time of writing the thesis, the legislation for the Board is being prepared but the body does not exist yet. It remains to be seen what role is going to play but based on the analysis, it has the potential to be a key player to move the country towards sustainability.

The chapter begins with a discussion of the purpose of the Board followed by an evaluation of the drivers of introducing the Botswana Construction Industry Authority. This will be followed by an analysis of the creation of the Botswana Construction Industry Authority. The chapter concludes with an MLP analysis of the process.

7.2 Purpose of Botswana Construction Industry Authority

The Botswana Construction Industry Authority was initiated by the Deputy Permanent Secretary in the Ministry of Works, Transport and Communication, now renamed Ministry of Infrastructure, Science and Technology. The idea came as recommendation from Southern African Development Community (SADC). SADC is made of fifteen Southern African countries.

According to the BCIA (2016), the Botswana Construction Industry Authority (BCIA) will be a corporate body to lead construction industry stakeholders in construction development in Botswana. A final draft Bill was presented to the Minister of Infrastructure, Science and Technology on 03rd February 2016. Based on the Bill, the name of the proposed association is Botswana Construction Industry Authority but for ease reference, the name 'Board' will be adopted for the remainder of the chapter to mean BCIA.

As stated in the Bill, the proposed objective of the Board is "to implement an integrated strategy for the reconstruction, growth and development of the construction industry" (BCIA, 2016 pg 1). The remit of the Board as proposed in the Draft Bill (BCIA, 2016) presented to the Minister of Infrastructure, Science and Technology would include:

1. Oversee the construction industry and coordinate its development, promote the contribution of the construction industry in meeting national construction demand
2. Provide strategic leadership to construction industry stakeholders to stimulate sustainable growth, reform and improvement of the construction industry
3. Determine and establish best practices for the construction industry (improved industry standards, improved industry performance, efficiency, effectiveness and fair practices, procurement and delivery)
4. Promote best practice through the development and implementation of appropriate programmes and measures aimed at best practice and improved performance of public and private sector clients, contractors and other participants in the construction industry
5. Promote uniform application of policy with regard to the construction industry throughout all spheres of Government
6. Promote, undertake or commission appropriate research on any matter related to the construction industry and its development

7. Provide consultancy and advisory services with respect to the construction industry provided that it is not in competition with local industry participants
8. Initiate and maintain a construction industry information system
9. Provide, promote, review and co-ordinate training programmes organized by public and private accredited training centres' related to the construction industry
10. Accredit and register contractors and regulate their professional undertakings;
11. Accredit and certify skilled construction workers and construction site supervisors (BCIA, 2016).

According to the Draft Bill (BCIA, 2016), the envisioned Board will have thirteen board members with five Government members representing Ministry of Finance and Development Planning, Ministry of Transport and Communication, Ministry of Minerals, Energy and Water Resources, Ministry of Infrastructure, Science and Technology, and Ministry of Local Government and Rural Development. The other eight private sector representatives will be elected from contractors and subcontractors (2 members), professionals (2 members), and one each from manufacturers, suppliers, transport and plant hire, developers, financial institutions and training and educational institutions. What can be noted from the proposed functions and the structure of the Board is that it will potentially enhance the development of professions. This is emphasised by the quote below about the role of the proposed Board;

> Currently there is a registration board [professional association] for engineers; there is a registration board [professional association] for architects; there is a registration board [professional association] for the quantity surveyors that are all being put into place. What we wanted to do is…, all these registration boards [professional associations] with the registration board for construction contractors; whether civil or building; will all fall under this authority. We have made provision in the act…, the proposed act that there will be a register for each of these industries…, sub-industries if I can put it like that, which will then make sure that the whole industry will be seen in totality because at the moment the consultants do their own thing; the engineers do their own thing; the contractors do their own thing (ABCON representative, 2015).

The statement perhaps sums the change in landscape of the construction sector towards professionalization. Since the professionals associations for architects, engineers and quantity surveyors are not that advanced, establishing the construction Board was seen as reinforcing those efforts. The next section discusses the drivers for introducing the Botswana Construction Authority.

7.3 Drivers for establishing Botswana Construction Industry Authority

The following section explores the landscape and regime level factors which influenced the establishment of the Botswana Construction Industry Authority. The analysis highlight that the landscape issues included demand from SADC member states to establish construction boards and the regime level factors included problems of cost and time overruns and quality issues in the construction sector.

7.3.1 Landscape factors

Prior to the start of the initiative to develop the Board in Botswana, there was a meeting in Swaziland to deliberate about the challenges of construction industries in Southern Africa. The Government of Botswana was represented at the meeting by the Deputy Permanent Secretary (DPS) in the Ministry of Infrastructure, Science and Technology. At that meeting there was a proposal to find ways of controlling the way construction was conducted in the Southern African countries. A senior government officer commented:

> At that meeting in Swaziland in 1993 they realised there was the need for most countries to establish a way of controlling how we run construction industries (senior Government officer, 2016)

> There was a regional effort, at the SADC level to have construction boards. But this could only work if each of the SADC countries had a board. South Africa moved quickly to establish CIDB (University of Botswana researcher, 2017).

Based on the views of the Senior Government Officer and University Researcher interviewed, the participants of the meeting deliberated on the need to control the influx of incompetent people in the construction sector. Government and private customers were cheated badly by people with no experience in the construction industry. This was a regional effort. The Senior Government officer says:

> Construction industry was played by people coming in or not necessarily competent in their field so err we wanted to help so as to protect the public and the customers in construction. They were cheated badly by people without experience in construction. So instead of them getting value for money they were ripped off, very poor construction for high prices and then the contractor disappeared. Even government was cheated very badly so err we felt that there is a need to put control in the industry (Senior Government officer, 2016).

The participants agreed to create bodies that could focus on the construction sector as a whole, not representing a particular section of the construction industry. The realisation by SADC countries of the need to control how construction industries were run put pressure on the Botswana construction industry stakeholders to act. The Botswana Construction Industry Authority developed out of that pressure for more control in the construction industry. These pressures and how they influenced the Botswana Construction Industry Authority are discussed in the following sections.

7.3.2 **Regime factors**

The previous section highlighted the challenges of the influx of incompetent people in the Southern African construction industries. That landscape development created problems at the regime level. The analysis focuses on identification of specific problems which impacted on the development of Botswana Construction Industry Authority. The problem was that there was visible evidence in the construction sector that projects were failing to finish on the allocated time and budget and to the required quality.

Failure of projects to finish on time and budget

There was negative publicity in the construction sector caused by failing projects and the lack of direction the construction was supposed to take. The General Manager of one of the manufacturing firms in Botswana had this to say about the image of the construction sector;

> Because of the value that we have derived from the construction industry over a 120 odd years of existence, we said what can we do for the industry to restore the image that the public had about contractors in Botswana (Manager of a manufacturing firm, 2016).

The quote suggests the general malaise that the construction sector found itself in generally around the period 2010 which impacted on the image of the sector to appeal to manufactures to continue doing business in Botswana.

The period around 2010 is significant in that it marked the holding of the first soccer World Cup on African soil in South Africa. Being close to South Africa, it was expected that some of the visiting teams would train in Botswana. As such, MIST refurbished the soccer stadium and international airport in Gaborone. The projects were supposed to be completed before 2010 but failed and were completed after the finish of the world cup. The failure to complete the projects on time and the subsequent failure to have teams train in Botswana added to an already negative public perception of the construction sector. The general state of the construction sector is perhaps summed by the quotes of two of the interviewees;

> The Government is slow to wake up to things. So even if they are alert but if they don't personally… if the politicians personally don't feel the effect of something negative they leave it. Well by 2010 we had so many crises in the construction sector; so many projects did not run well. We got cost overruns in projects (senior Government officer, 2016).

> In around 2011 there was a huge amount of negative publicity in the construction industry in Botswana. Newspaper articles stated project delays ... projects going over budget, projects not allocated that were on the budget (Manager of a manufacturing firm, 2016).

The problem of cost overruns and time delays was coupled with quality problems that was noticed in some construction projects in Botswana.

Quality issues

Part of the problem as alluded to by interviewees was that people who were not competent were being allowed to do construction in Botswana. As a result poor workmanship by contractors during project implementation was common which could not be identified by consultants because of lack of expertise at times. One of the interviewees has this to say regarding one of the projects he visited;

> Yeah, well I went up there for an inspection and I said here I can't see anything that I will accept as it is. I'm walking up the main stair to the western stand I knocked my head in a concrete beam which was so low and am not very tall but it was low enough for me to knock my head in. I said is nobody checking what's going on? (Senior Government Officer, 2016).

While the state of one project cannot be a representative of most projects, the serious problems at this particular site suggest an industry that was well in serious problems and needed urgent attention. The example suggest an industry that has no standards to adhere to with measures in place to take against those who don't maintain the standards, no ethics as construction firms could produce products of poor quality.

Due to the challenges of having incompetent construction workers in employed leading to quality issues and cost and time overruns in the construction sector exerted pressure for a response. The Botswana Construction Industry Authority was envisaged to respond to these problems.

7.4 Establishment of the Board

This section explores the development of Botswana Construction Industry Authority. The analysis shows that initial attempts to develop the Board were dismissed by Government. The analysis also focus on why later, the government changed and supported the development of the Board. The change of government stance and other factors including the University of Botswana study that provided evidence in support of establishing the Board, involvement of external advisors, and the influence of the private sector- by providing funding for the development of the Board are analysed.

7.4.1 Initial attempts

In this section the initial attempts to establish construction authority are discussed. This section will highlight the initial processes to establish the Board and who drove that effort. The initial efforts to establish the Board were not successful because there was no one who made a political case for it (providing evidence of need with resources implications) and there was a general lack of understanding of how such organisations should exist both in structure and functions.

The process involved a number of different actors at different stages. The actors that were involved at the initial stage were the former Deputy Permanent Secretary at the then Ministry of Works, Transport and Communication now Ministry Infrastructure, Science and Technology, the Chairman of ABCON and the Register of Societies in the Ministry of Labour and Home Affairs.

It was stated that a meeting in Swaziland proposed the establishments of construction boards in Southern Africa. The meeting was attended by the Deputy Permanent Secretary at the then Ministry of Works, Transport and Communication now Ministry Infrastructure, Science and

Technology. On her return from the Swaziland meeting, the DPS asked ABCON whether they wanted to "come on board to get something going" (Senior Government officer, 2016) for Botswana.

It was in 1993 that ABCON embraced the suggestion to establish a construction Board. ABCON assumed the lead role. There was however resistance from the President at that time. Mr Masire was the president of Botswana between 1980 and 1998. The analysis suggests that the resistance was due to lack of understanding of the role and function of professional associations in the construction sector. Two of the interviewees were in agreement about the refusal for the initial efforts to establish a construction Board;

> They decided that we don't need another organisation like BOCCIM which it wasn't (ABCON representative, 2015)
>
> We tried to get the Government to accept this and carry it as well but through the president Masire, they thought no we, we can just have another BOCCIM then we said no (senior Government officer, 2016).

In 1996 ABCON established Botswana National Construction Industry Council (BONCIC).

> Yes and in 1996 we had come as far as establishing an organisation we call BONCIC (Botswana National Construction Industry Council), which was part of the regional initiative and we were also part of establishing the Southern African Construction Industry Council (SACIC) regional construction industry (senior Government officer, 2016).

Government did not recognise the association unless it was registered with the Register of Societies to ascertain their scope. It is procedural that any organisation is registered with the relevant regulatory body. In the case of the construction Board, it was supposed to be registered with the Register of Societies. The Government website list the kind of organisations that are supposed to register to include religious organisations, miscellaneous associations, professional associations, burial societies and recreational and sporting clubs (GOB, 2017). Consequently, when ABCON tried to register BONCIC, the Register of Societies could not approve the use of

words ‘Botswana’ and ‘National’ in the title. The Senior Government officer further commented:

> We submitted of course BONCIC means Botswana National Construction Industry so to use the names Botswana and national and they said no; you are not allowed to do that. You just have to run it like it’s a private sector organisation. We didn’t need another private sector organisation we need a national forum to deal with this (senior Government officer, 2016).

> There was this issue of using the word Botswana. So they blocked it on technical issues that you cannot use the word unless it really represents Botswana. But because this was now registered as an association, it could not use Botswana (University of Botswana researcher, 2017).

Register of Societies rejected the registration arguing that the words ‘Botswana’ and ‘National’ should be reserved for Government controlled entities. On the other hand President Masire led cabinet suggested that there was already BOCCIM which could carry out the same mandate.

The other factor that led to the failure as attributed by the interviewees was a general lack of understanding of how such organisations should exist both in structure and functions. Additionally the failure to set up the board is attributed to the nature of the projects and the general lack of regard for regulation at that time. Regarding those previous efforts, one of the interviewee said the following:

> The industry was small; the projects were not very complicated until we had the North-South Water Carrier Project, the projects were really not very complicated. There were also some vested interests; who didn’t want to see this thing off. Regulation requires a number of so many eyes and ears here and there. Also there people who were telling the Presidents that this was not necessary and also regulation means normalising a situation and reducing the powers... (University of Botswana researcher, 2017).

Even more critical based on this interviewee was the proposed structure for the Board. The interviewee further says:

> Previously I think we went into the wrong direction of an association unlike a statutory instrument which says you must be a member for you to operate. So that was the problem (University of Botswana researcher, 2017).

By implication it was going to be difficult to regulate the construction sector by the proposed association without any legal support. The idea somehow was abandoned until 2010 due to lack of support. It was resuscitated in 2010 partly because of the recognition of problems in the construction sector, support from the sitting President and the availability of funding to carry out necessary activities for the establishment of the Board.

7.4.2 **Later attempts**

It has been highlighted that previous attempts since 1993 to establish a Board for the construction sector was dismissed by Government. This raises two key questions: Firstly, how was the latest attempt (post 2010) successful despite the previous refusals by Government? Secondly, what changed between the initial refusal by President Masire and President Mogae and Government White Paper by President Khama calling for the creation of the Board?

To better understand the Government's change, the analysis focuses on five factors. The first is that, a study by University of Botswana researchers provided evidence in support of establishing the Board. The second is that previously there were no attempts to involve people with already existing boards as advisors. In the successful attempt, the Construction Industry Development Board (CIDB) of South Africa was used for comparison. The third of the factors is a change in Government and support by the new Government which in a way greatly recognised the influence of professional organisations. The fourth of such factors is the influence of the private sector- by providing funding for the development of the Board. In most cases Government cites lack of funding for any potential policy change. The last of the factors is the wider consultation that was instituted by government.

The process involved a number of different actors at different stages. The actors that were involved at this stage were Botswana Confederation of Commerce Industry and Manpower

(BOCCIM), University of Botswana, Construction Industry Development Board (CIDB) South Africa, Botswana Institute for Development Policy Analysis (BIDPA) and PPC Cement Botswana. BIDPA has a mandate to promote policy analysis through research, capacity building, assisting organizations or individuals where appropriate, monitoring the country's economic performance and disseminating policy research results.

University of Botswana study

BOCCIM commissioned a study that was conducted by University of Botswana researchers. The involvement of BOCCIM was conducive to the development of the Board. It is worth highlighting that BOCCIM represents the interests of private firms that are doing business in Botswana. BOCCIM became involved in 2008 when there were allegations that construction firms which incidentally were members of BOCCIM were the source of failing projects. The President then tried to find the cause of poor performance of the construction projects. According to one of the interviewees, he conducted an informal investigation. The university researcher had this to say:

> The President wanted to find out from the civil servants why the projects were failing? The civil servants pointed to the contractors; those are the guys who are making us have a problem. So he went to the High Level Consultative Council. BOCCIM said no, it is the civil servants who are frustrating us. Remember BOCCIM represents contractors and consultants. For example they don't pay on time. Now at that time the electronic funds transfer was not in place; they were paying using cheques. So that was one of the problems (University of Botswana researcher, 2017).

It appeared from the exchange that everyone had a fault. BOCCIM then commissioned a study in 2008 aimed at investigating the causes of poor performance of public construction projects in Botswana (BOCCIM, 2008). The study was conducted by University of Botswana researchers. Though BOCCIM did not state outright, it can be inferred that they wanted to absolve their members from the blame of failing construction projects.

The study identified the causes of poor performance of projects as arising from the client side and service provider side and the environment in which they both operate (BOCCIM, 2008). Of particular interest to this analysis are the factors that were noted in the study to emanate from the environment. These included the lack of a construction board to cater for the interest of stakeholders and coordinate the industry's activities (BOCCIM, 2008). The study recommended that a Construction Board should be established to address the problems emanating from the environment in which construction stakeholders operated in.

> They did a study and in 2008. Out of that report BOCCIM then started a new session of workshops in the industry with all players; Government as well as private sector; contractors as well as consultants; engineers as well as whoever are in.., suppliers who are involved in construction (ABCON representative, 2015).

The successful completion of the first study led to a second study that was conducted in 2010. The aim of the study was to develop a model for transforming the construction industry in Botswana to effectively deliver both public and private projects (BOCCIM, 2010). The study was also sponsored University of Botswana and conducted by the researchers from the university. Generic models of transformation from Singapore, South Africa, Tanzania and Malaysia were studied by the researchers. Of particular interest were the construction Boards in those countries;

> What the committee did is they did an in-depth analysis on a number of construction regulatory boards in different countries. That's where they got their starting point so we can either start from scratch, re-event the wheel or we can look at best practices in other countries and consolidate that and then put a unique Botswana flare on it and say this will work in Botswana and this will not work in Botswana (Manager of manufacturing firm, 2016).

The UB researchers assessed the mandate, governance structure and the functions of the Boards that were studied. The aim was to identify how other countries have structured their Boards and benchmark how the Botswana Board might be structured;

> To give you an example, Singapore's one is focused on assisting construction companies to go outside of Singapore and do construction in other parts of the world. South Africa's one is concentrating on developing non-traditional contractors to become developed. Tanzania one is more focused on control in the procurement process and so on. So we took all of these acts and out of those acts we made up a bill that we think will work for Botswana. The concentration in Botswana is not on Government procurement; is not on development; it is an all-encompassing structure (ABCON representative, 2015).
>
> We looked at acts to see how they are organised in those countries. We looked at how it is organized in South Africa and in Kenya. We have tried to draw out the positives or the good parts from all of these acts, in those countries (BOCCIM Member, 2016).

The researchers found that in all the countries that were studied, there was a statutory umbrella body which was created and charged with industry leadership (BOCCIM, 2010). The umbrella body was given a mandate to lead, develop, coordinate and regulate the activities of the industry. The University of Botswana made the following six recommendations regarding the establishment of the Board (BOCCIM, 2010):

1. A statutory umbrella body is established to provide the necessary leadership and oversight for the construction industry in Botswana.
2. The name of the umbrella body for the construction industry should be called the Botswana Construction Industry Development Authority (BCIDA).
3. BCIDA to have the following objectives.
    a. Provide strategic direction that promotes and stimulates the development, improvement and expansion of the construction industry in Botswana
    b. To advise the Government on matters affecting or connected with the construction industry
    c. Provide a forum for stakeholders to discuss policies and strategies on issues and challenges affecting the performance, growth and viability of the industry
    d. To develop, implement and monitor mechanisms that promote continuous improvement in performance and best practice in the construction delivery process for sustainable growth, delivery and empowerment.
    e. To facilitate the planning and coordination of industry activities in order to achieve the mission of the industry

f. Establish a national register of construction projects with a view to monitor industry performance.
g. Develop a code of conduct for the industry
h. To promote, stimulate, undertake research an and maintain a construction industry information system on any matter relating to the construction industry
i. To provide, promote, review, and coordinate training programmes organised relating to skilled construction workers and construction site supervisors.

4. It is being proposed that the board of BCIDB be headed by a Chairperson who may be chosen by the Minister of Infrastructure, Science and Technology and should be a person conversant with construction industry development
5. The board directors should consist of 10 individuals
6. BCIDA be funded by the Government for five years pending review of the situation (BOCCIM, 2010).

There is a noticeable difference between what the university researchers proposed and what was adopted based on the Draft Bill presented to the Minister of Infrastructure, Science and Technology which was discussed earlier in section 7.2. The changes maybe is the result of the two further consultations that happened after the university researchers submitted their recommendations. There was a national conference in December, 2010 where construction industry stakeholders met.

> In December 2010, the industry with Government in attendance decided that we need an authority. And basically what we did was to give…., at that meeting we agreed on the terms of those …, that organisation (ABCON representative, 2015).

The conference attracted participants from all stakeholder groupings in the construction industry. The UB research team presented the draft report with the recommendations that were highlighted earlier. The CEO of Construction Industry Development Board (CIDB) of South Africa was invited as a keynote speaker. His presentation 'provided first-hand information on the mandate, experiences, challenges and achievements made by CIDB' (BOCCIM, 2010).

The conference ended with the adoption of the UB researcher's recommendations, mainly the need to establish a statutory umbrella body to provide the necessary leadership and oversight for the construction industry in Botswana. The findings of the second study and the national conference occurred on the same year that a Presidential White Paper was issued. We can speculate that they were among the factors that led to the advance to establish the Board which had been hitherto unsuccessful.

Benchmarking to CIDB South Africa

Prior to the conference, a bench-marking trip was conducted by the university researchers in November, 2010 (BOCCIM, 2010). The purpose of the trip was to visit the Construction Industry Board (CIDB) of South Africa and learn about its operations. A researcher says:

> We went to South Africa to see what they (CIDB) do. In South Africa we found CIDB regulates the industry, develops the industry and registers contractors and projects. We found it is important to register projects above a certain threshold because that is when you know how much does the industry use technicians, engineers, quantity surveyors etc. That's when you can know supply and demand (University of Botswana researcher, 2017).

From the quote, the benchmarking trip was to learn about the structure, mandate and the operations of CIDB. The mandate include regulation of the construction industry and some of the operations include registration of contractors and projects.

Government support

The scientific evidence provided by UB researchers about the problems of the construction sector and the need to establish a Board and evidence of evidence of existing boards created a potential for the establishment of the Botswana Construction Industry Authority. In order for this potential to be realised, however, there had to be a change in the way that the governing

elite viewed professional associations. In the years before 2008, both President Masire and President Mogae Governments resisted advances to establish the Board:

> It was something that was started by ABCON about 23 years back. It was developed up to a point and then it was blocked if I can put it that way…or put on hold by President Masire. Then it was re-enacted when President Mogae came into power and between him and then minister of … I can't remember what the ministry's name was; infrastructure [Works, Transport and Communications] I think (ABCON representative, 2015).

What is suggested by the quote is that there was a lack of understanding of the purpose of the proposed Board by the governing elite. The same argument against the establishment of the Board was repeated by President Mogae during his term of office between 1998 and 2008;

> And when President Mogae took over (in 1998) he repeated what President Masire had said that no; we don't need a national organization, so we just kept to a low profile (senior Government officer, 2016)

That changed when President Khama took office in 2008. By then President Khama was still the Vice President between 1998 and 2008. During the period he was the Vice President, President Mogae gave him the mandate to oversee the implementation of infrastructural projects.

> President Mogae told Vice President Khama that your portfolio is to look after the projects to make sure they are delivered. This arose from very poor review of the University of Botswana study which found very poor performance of construction projects (University of Botswana researcher, 2017).

A Presidential White Paper was issued in 2010 by President Khama. The paper directed that the Ministry of Infrastructure, Science and Technology (MIST) should establish a construction Board. For the first time that Government was amenable to the establishment of the construction Board and there was an opportunity for consultations to start. The white paper in effect directed the Minster of MIST to consult with the relevant stakeholders on the modalities to establish such a Board;

> So that's what I came in to do and in the process I learnt that they had now seen the need for registration for contractors...and so also there was a presidential paper stating that yes we have to develop this board (senior Government officer, 2016)

With this kind of directive, finally there was recognition by Government that professional associations were essential. What it meant was that the governing elites had agreed that the Board should be established. Without the support of political leadership, investors hardly get involved. In addition, without the support of the political leadership doesn't license an attitude for people to take initiatives seriously.

Private sector funding

The last of the factors which helped overcome the resistance was the provision of funding from the private sector for the establishment of the Board. It was highlighted that from an investor's perspective, it was difficult to invest in the construction sector due to the negative publicity the industry was engrossed in. There were media articles about many unfinished construction projects around 2010. In 2012 a private manufacturing firm, PPC Cement started to sponsor a contractor competition called Number One Builder. The objective of the competition was to improve the image of the construction sector by showcasing successful projects according to a set of criteria. The criteria included safety considerations, delivery of the project within budget and time limit, and quality of the building and appeal to the eye.

> When Government started putting restrictions on Government projects because of the global recession, there weren't any new projects coming on stream so we then said running the Number One Builder Competition for a fourth year without a lot of projects, we now have restored credibility within the industry, between the contractors in the industry (Manager of manufacturing firm, 2016).

While it is accepted that the recession affected many countries, the lack of new projects from Government suggest poor planning of construction projects. Regardless of the recession, there should have been some projects in the pipeline if the planning was done well. In 2014 instead

to continue sponsoring the Number One Builder competition again, PPC suggested that the funds should be used on the ongoing effort to establish the Construction Board. One of the interviewee who was directly involved in the process to establish the Board said;

> We had PPC cement supported the initiative a bit with providing some refreshments as well for the team who was working and also supporting us with the secretariat to keep the records of what we were doing and providing a place for us to meet other than that totally voluntary (senior Government officer, 2016).

When PPC got involved, there was already an existing committee that was working on drafting of the legislation. The view of the Manger of PPC who inquired about the status of the construction Board suggest that part of the impediment of establishing the Board was the lack of funding for the activities;

> So we said no… what is the problem? There were various things cited then PPC said ok so the money that you would have spent running the Number One Builder, here is something that is more critical. So what we said is we are going to take that money and we are going to use that money to sponsor the drafting of this … construction regulatory board (Manager of manufacturing firm, 2016).

The UB researchers had proposed that the construction Board should be statutory. In the normal procedure of enacting legislation in Botswana, the Government's Attorney General (AG) Chambers has the sole prerogative of drafting Government bills before they are passed as law by parliament. In the case of the Construction Board, before it was sent to the AG chambers, a private law firm was engaged to draft the bill presumably the way the private sector wanted.

> So we then engaged Armstrong and John... who has written a number of acts and this will never be accepted because all of a sudden you relinquish power completely from the main client which is Government on the majority of projects so they've been guiding us in writing their thing so when we handed it over to the attorney general it wasn't a law layman's document already it was a layman's document already converted into legal language to try and fast track the ……of this thing or the err what you call it enactment of the layman's bill into law so we were hopeful that the process will then be a lot quicker so it doesn't go to parliament, parliament sends it back to the attorney general and the attorney general sends it back to the committee (Manager of manufacturing firm, 2016).

Engaging a private law firm was made possible by the funding from PPC Cement. The use of the law firm also hastened the overall process as quite often the delay is caused by the legal people at the AG Chambers not understanding the technical requirements of the proponents of Bills, in this case the technical committee that was selected to oversee the process of establishing the Board. Though there were recommendations from the studies conducted by University of Botswana researchers on the modalities of establishing the Board, the Ministry of Infrastructure, Science and Technology started its own consultation processes.

Government consultations

Government policy initiatives in Botswana are however rooted on consultations between Government and the society. It was mentioned in the previous chapter that the Kgotla was a forum in which such issues of importance could be discussed and debated. Consequently, the Government has an obligation to consult ordinary citizens, and that at least occasionally the consultation would influence policy decisions. Given the potential implications of introducing a new organisation among existing construction stakeholders, Government instituted consultations with stakeholders that were likely to be affected. The Government consultation process with stakeholders used the two studies conducted by the University of Botswana researchers completed in 2008 and 2010 and the Presidential White Paper issued in 2010. The Botswana Institute for Development Policy Analysis (BIDPA) led the consultation process. Their engagement as alluded by the BIDPA researcher was to broaden the consultation that was undertaken in previous studies;

> We had an invitation from the MIST (Ministry of Infrastructure, Science and Technology) and they said to us that they had a previous interaction with UB, for a study with which UB collaborated with BOCCIM to undertake the reformation of the construction sector; and they said to us we are not happy with the level of consultation that was undertaken (BIDPA researcher, 2016).

The Botswana Institute for Development Policy Analysis (BIDPA) was engaged by the Ministry of Infrastructure Science and Technology (MIST) in September 2011 to look into what BOCCIM had proposed in regard to the establishment of the authority;

> The Ministry of Infrastructure, Science and Technology instituted a new study conducted by BIDPA which in my mind or from my point of view brought in the element of how the procurement regulations are interconnected or are deficient. So its strength was to do more with the current regulatory environment such that if you put in something, how does it sit in the current regulatory environment (University of Botswana researcher, 2017).
>
> They were analysing the UB report, they were analysing what BONCIC had done in the past and the entire industry stakeholders were saying (Senior Government officer, 2016).
>
> I think the other thing is we were also told to do a critic of UB study and BOCCIM. We found that particular study took more on a project implementation approach but MIST wanted us to look into institutions, the laws, the policies that affect the construction sector (BIDPA researcher, 2016).

BIDPA carried out a study to determine the policy implications of establishing the construction Board. Government through the Ministry of Infrastructure, Science and Technology adopted a broad based approach to the process. While the UB study was narrow and looked at the models of existing construction Boards, among the deliverables of the study BIDPA study was to establish the mandates of different stakeholders in the Botswana construction sector and how they would be affected by the proposed Board. The full scope of BIDPA (BIDPA, 2012) study was to:

1. Undertake a comprehensive study to establish all current bodies in Botswana that regulate, set standards, control, guide, monitor and register the various activities in the construction industry and assess their configurations and capacities.
2. Research and assess similar construction industry bodies in other countries.
3. Assess all previous research about formation of national construction industry bodies such as the BOCCIM/UB research.
4. Establish the need for one central authority versus splitting the responsibilities among several new or existing bodies.

MIST provided funding for the activities preceding presentation of the Bill to register the authority. They submitted their report around July 2012. Their recommendations on the report to MIST (BIDPA, 2012) mirrored those of the UB study team and include the following;

1. Establish an organisation founded on statute to regulate, coordinate, provide a vision and other services for the needs of construction industry
2. The functions of the regulator should include contractor registration
3. The functions of the Board will include, among others, planning of construction projects, marketing and global alignment of the construction industry, performance monitoring and evaluation, coordination of skills development and contractor development.

As the story suggest, the Construction Board came about when the political leadership recognised the importance of a better organised and regulated construction sector. A better organised and regulated construction sector reduces chances of corruption. The support of the political leadership is not only that their word matters, also they instigate a lot of funding opportunities which were absent previously. In addition to the political support, there was public pressure and criticism about the state of the construction sector. There was an effort to involve as many stakeholders as possible and the stakeholders recognition that we needed professional associations to move forward towards sustainable construction. An analysis of the BIDPA's recommendations is made in the following section on the potential impact of the construction Board in the construction sector.

7.5 Potential contribution towards change to sustainable construction

The establishment of the Construction Board in Botswana is the story of the emergence of a body that could lobby for ethics, standards, training and licensing in the construction sector of Botswana. The analysis which follows will use MLP to reflect on how the Board might help to drive sustainable construction.

In the West professional organisations established to promote good practice have all incorporated sustainability as a key goal, language which is used to frame many more specific goals. In Southern African countries, professional organisations also highlight sustainability as a goal. Both developments suggest that similar development is likely in Botswana.

The reflection on the implications of this episode for sustainable construction in Botswana is based on the documents and the interviews conducted with people who were involved in the establishment of the Board. The document analysis explored the Board's possible interests and looked for evidence of activity related to ethics, standards, training and licensing. The documents analysed covered Construction Industry Authority Final Draft Bill and the BIDPA Report. The BIDPA report is in the public domain in contrast to the Construction Industry Authority Final Draft Bill which is not. To put it into context why the BIDPA Report is analysed, the University of Botswana report recommended the establishment of a board. The BIDPA Report went further and suggested specific functions and governance structure; hence it can be used as a point of reference from which to consider whether the actual Board has been designed in a way which is likely to contribute to the maintenance of ethics, standards, training and licensing.

7.5.1 **Ethics**

The intended purpose of the Board with regard to ethics in the construction sector is specified in the Construction Industry Authority Final Draft Bill that was presented to the Minister of Infrastructure, Science and Technology in 2016. In terms of content, the Board proposes to "promote, establish or endorse ethical standards" (BCIA, 2016). The focus in this section is on governance of the Board rather than on the responsibility of members to uphold the ethical

standards. As this is a Draft document, there is a possibility it will be broadened moving forward, but this remains to be seen.

It should be noted that mentioning ethics in a document such as this does not always signify real intentions, but it does set down a standard against which appeals can be made. Moreover, a more direct recommendation is made in the BIDPA Report (BIDPA, 2012) of its planned intention to promote ethical conduct in the construction sector. An example of the recommendation from the BIDPA reports reads;

> The regulator should lead construction industry in the promotion and inculcation of ethical and professional conduct in the construction industry and be the first port of call for promoting ethics, liaising and supporting the PPADB and the CAB and registration boards/councils to ensure that they too perform their part under this function; and that
>
> To close an important loophole, the founding statute should ensure that the regulator has jurisdiction over all professionals, including those on Government payroll (BIDPA, 2012).

However, the document does not further elaborate how this will be achieved when the Board has been established.

Part of the BIDPA study was to specify the mandate of existing entities in the construction process. An example of an ethical issue that is currently not addressed in construction is highlighted in the report on the mandate of the Public Procurement and Asset Disposal Board (PPADB). The BIDPA study notes;

> A significant bottleneck for the functioning of the PPADB is that no distinction is made on ownership of entities that it registers to conduct business with Government. Where, for instance, a professional body like an architectural firm is owned by a non-architect, the PPADB has no means to enforce the ethical standards that ought to be applied to architects. The professional obligations of architects may thus be compromised by those of the employer (BIDPA, 2012).

What the statement suggests is the vacuum of enforcement of ethical consideration and the possible need for realigning roles when the construction Board is fully operational.

7.5.2 **Standards**

It is expected that the Board will maintain standards in the construction sector. The BCIA (2016) document proposes the Board will "promote, establish or endorse uniform standards" in the construction industry. The BIDPA recommendation on the other hand recommends the Board should be;

> Legally be entrusted with the management of quality standards in the construction sector; and
>
> Continually scan the legal and policy environment and advise Government and other relevant bodies on the need to design new standards or update existing ones (BIDPA, 2012).

However, the documents doesn't contain any examples of actual standards to be maintained, rather it contains the intended best practice. One of the interviewees highlighted one of the potential issues for the Board and what he felt needed to be done to maintain technical standards in building construction;

> If you go and look around town is any of the current buildings being set up built for our harsh environment, very few. They are mostly built to European standards because they use European plans; that's glass buildings. Now for me a glass building radiates heat. There is no insulation or very little and it traps heat so your cooling cost is becoming enormous and we don't have electricity. So we should be building buildings that is an example to the rest of Africa on how we should build in our harsh environment; we don't (ABCON representative, 2015).

The quote highlights the aspirations of the construction sector practitioners for the construction Board to increase awareness of, and inform, technical issues such as the choice of the right materials for the Botswana environment. The example signifies the direction that the Board can take in terms of standardising building construction in relation to certain building materials that are not suitable for the Botswana environment. Consequently the Board can encourage improvement of construction materials and techniques through standardisation.

7.5.3 **Training**

It is expected that the construction Board will facilitate training of construction personnel especially for contractors. This is captured in the Construction Industry Authority Final Draft Bill. In terms of training the Board intends to;

> Provide, promote, review and co-ordinate training programmes organized by public and private accredited training centres' related to the construction industry (BCIA, 2016).

The training will be aimed at growing the capacity of local contractors and citizen manpower development. Training for the construction industry has been the preserve of institutions such as the University of Botswana Faculty of Engineering and Technology. The Botswana International University of Science and Technology started its operations recently.

7.5.4 **Licensing**

It is expected that licensing of contractors will be one of the roles of the Board. Currently contractors who intend to bid for Government projects are only expected to register with the PPADB. Those contractors who do private jobs are not required to do so. The Board is expected to address this disparity by licensing all contractors irrespective of whether they bid for Government or private jobs;

> So this authority the way we see it from the private sector will be set up in such a way that somebody can go in there and complain there and the authority will then take away the license of that contractor to do construction work in Botswana, and once that is done, he cannot work as a contractor. He either fixes his problems; he will get time to fix his problems or if he doesn't want to fix his problems then we will advise the client that we are going to take that contractor's license as a contractor and he can't work on site any longer (ABCON representative, 2015).

> Accredit and register contractors and regulate their professional undertakings (BCIA, 2016).

The first statements suggest the industry has a problem with contractors who do not perform to expectations. Without formal registration, the sector cannot monitor or regulate their conduct, creating problems. Consequently, the board intends to accredit contractors and regulate their professional conduct.

7.6 MLP Analysis of the initiative

The multi-level perspective (MLP) can be used to study transition from one socio-technical system to another. It can also be used as a road map to reflect on the potential of discrete innovations to contribute to a transition. In the previous empirical chapters 5 and 6, MLP was used to study a transition from one socio-technical system to another.

In Chapter 5, MLP was used to study the contribution of BOTEC demonstration project on change of the residential house sector and brick making regimes in Botswana to sustainable construction. From the analysis of the project, the contribution varied based on the articulation of visions and expectations, learning processes and formation of networks.

In Chapter 6 MLP was used to study a transition towards environmental management in the construction sector. The discussion of this episode highlighted three aspects; first, there was a change of vision from using EIA as a project level tool to using it at the landscape level to manage investor confidence. Secondly, there was change of rules about who need to do an EIA. Previously EIAs were conducted on every project in Botswana. Lastly, the social networks which developed around the formulation and implementation of the EIA provided conditions for the development of professional associations in the construction sector.

In this chapter, MLP is used to explore features of the construction Board and reflect on their potential to contribute to a transition to sustainable construction. Geels (2006) suggests that

changing perceptions, goals, knowledge and practices are essential for the transformation of a regime.

The focus is on assessing whether the Botswana Construction Industry Authority will serve as a driver for sustainable transition as theorised in the MLP literature. Geels and Schot (2007) note that professionals may have specialist knowledge that allows them to criticise technical details of regimes and propose alternative courses of action. These potential broader impacts of the Construction Board are analysed using the lenses of visions, changes in rules and development of social networks.

7.6.1 **Change in visions**

MLP suggest that an alignment of visions amongst different actors is critical for the impact of a regime level initiative (Geels and Schot, 2007). In the case of the Construction Board the discussion points to a slow development of a vision of the Board. In the beginning the vision was to control the construction sector but in the end the Ministry of Infrastructure, Science and Technology (MIST) adopted to use the Board as a value adding body for the sector.

Evidence suggests that the SADC regional leaders envisioned using national sector level boards to gain some control over construction industries in Southern African region. At a regional conference in Swaziland each member country of the region present was encouraged to set up a body that would act as a gate keeper to control the entrance of unqualified construction personnel in the sector. However it appears there were no mechanisms put in place for the proposed bodies to be effective. In Botswana in particular, organisations were set up that could have played that role. For example, BONCIC was set up but encountered some constraints. The Register of Societies denied BONCIC registration due to the use of words ‘Botswana’ and

'National'. It appears there was no clear vision of how the proposed Board was going to be structured and its functions.

The involvement of the private sector served to impress on the Government the value that the construction sector brings to the economy. To enhance and render visible that value, private organizations linked the Board to professionalization of the sector, including ethics, standards, training and licensing. Rather than acting as a gatekeeper to control the movement of contractors which was the original purpose of the Board, the private sector impressed that the Board could do more.

In terms of broader transition to sustainable construction, the Construction Board can act both as a lobby group and guardian of standards for a successful transition to sustainable development. Based on the analysis, there is potential for the proposed Board to drive sustainable development in that regard. Being an umbrella body for the construction sector, it can bring together people or organisations with a shared commitment to sustainability.

7.6.2 **Change in rules**

In MLP, rules guide actors perceptions and activities (Geels, 2004), and that regime transforms when there are adjustments in rules, influenced by regime outsiders and enacted by regime insiders (Geels, 2006). According to Geels (2004), when one rule changes, there is need to alter other rules as the alignment between rules gives regimes stability and coordinate regime activities. In the case of the construction Board, the change of landscape in the construction sector towards professionalization was central in the establishment of the Board. Conversely, the establishment of the Board reinforced the efforts towards professionalization. This means the construction sector will be better organised.

There were dissatisfactions from both private sector and Government about the general state of the construction sector and the performance of construction projects in particular. For example, regarding the construction sector in general, the analysis suggests that the private construction firms were critical of the Government planning process. ABCON representative highlighted that there were periods where there were many projects from Government while in some other years there were no new projects. The lack or poor planning by Government was cited as one of the causes.

The general malaise in the construction sector heightened by many stories of project failures in the period around 2010 invigorated efforts to establish professional associations. In terms of the broader transition to sustainable construction, the Construction Board acted in two ways to effect the transition. First, it happened at the same time where there was a big movement towards professionalization in the country as a whole. Professional associations were now accepted as bodies that could stimulate good ethical conduct, standards, training of workers and licensing contractors. Secondly, the Board itself was a move towards professionalization of the construction sector. When it is established, it intends to uphold such characteristics as ethical standards, licensing and training in the construction sector.

With regard to sustainable development, the analysis suggests that the Board will provide a platform for organisations in the construction sector to interact. Through that interaction, organisational and professional competences can be broadened. In addition the interaction of Government representatives and professional associations will provide a platform for stimulating and sharing of experiences. In addition, the Board will potentially help in commercialisation of the sector. It proposes to facilitate the development of local contractors and help them to establish in foreign markets.

7.6.3 **Change in social networks**

Geels and Schot (2007), suggest that social networks enact regime practices. Two elements are important for an effective social network; the composition and alignment of the actors within the network (Schot and Geels, 2008). In terms of composition, a good network requires a diverse group of actors with different interests and roles. van der Laak et al. (2007), suggests alignment in a network is high if the activities of the network are coordinated through regular meetings of the different actors. In the case of the Construction Board, the analysis suggest that a social network that developed in the process of establishing the Board provided conditions for realignment of roles for existing entities in the construction sector.

The network that was involved at the initial stages included ABCON, then Ministry of Works, Transport and Communication which was later renamed Ministry of Infrastructure, Science and Technology. Later the network was increased to include BOCCIM, University of Botswana and PPC Cement Botswana.

The lack of evidence about problems associated with failing projects in the Botswana construction industry frustrated the early efforts to establish the Board. The initial idea to establish the Board was proposed by the Deputy Permanent Secretary in the Ministry of Works, Transport and Communication to ABCON. It appears the Ministry's bought into the idea based on the discussions about the general poor performance of projects and the lack of control in the construction industries of the South African region. In contrast it appears ABCON agreed to the idea and believed the Board will act as a gate-keeper to control the influx of contractors who lacked technical ability to implement construction projects. For both actors, there was however lack of evidence about the causes of the poor performance of projects in Botswana. For the ministry, they ascribed the problem to lack of control in the sector while ABCON

believed it was due to unskilled contractors. Both however agreed there was need to set a Construction Board.

BOCCIM got involved to establish the causes for the poor performance of construction projects. They commissioned studies which University of Botswana conducted. The studies provided evidence about the extent of the problem of poor performance of construction projects. The first study provided evidence that indeed construction projects were failing due to various reasons ranging from client to the service providers. The second study emphasised that some of the challenges emanate from the environment in which the stakeholder operate in. One of the identified factors included the absence of a Construction Board to cater for the interest of stakeholders and coordinate the industry's activities. Hence the study recommended that a Construction Board be established.

The establishment of the Board gave a lot of people chance to reflect on their goals. PPC Cement Botswana diverted funds meant for a construction competition to be used to fund the activities of the Board. The funds were used to pay legal advisors who drafted the Draft Bill before it was sent to the Attorney General Chambers. The change in focus by PPC Cement by funding the activities leading up to the drafting of the bill, provided space for the establishment of the Board. Additionally for PPC, it was a way to make a contribution towards an organised construction sector that can contribute to the economy.

Before the Board could be established, the Government determined that further consultation was needed. The Botswana Institute for Development Policy Analysis (BIDPA) were engaged to do the consultation. The BIDPA consultations were to find how the procurement system for construction projects is interrelated. This was necessary to establish the mandates of each of the stakeholders in that system for possible realignment when a new organisation was established.

As this suggests, activity around the Board contributed and supported the creation of a social network including: Association of Botswana Building and Civil Engineering Contractors (ABCON), Botswana Confederation of Commerce Industry and Manpower (BOCCIM), PPC Cement Botswana and Botswana Institute for Development Policy Analysis (BIDPA).

In terms of the broader transition to sustainable construction the change in social networks around the Construction Board, means realignment of roles of existing entities in the construction process when the Board operational. For example, by establishing a register of contractors at the Botswana Construction Industry Board will mean taking that role from the Public Procurement and Asset Disposal Board (PPADB). PPADB currently registers contractors. In addition the role of training contractors will also be taken over by the Board from PPADB.

7.7 Summary

This chapter analysed the development of the Botswana Construction Board. The chapter started with a brief background about the purpose of the board. The subsequent discussions focussed on the development of the Botswana Construction Industry Authority; first discussing the drivers for establishing the board and reflecting on the initial and subsequent steps in the process. The chapter ends with an MLP analysis of the creation of the initiative.

It has been found that professionalization happened at the same time as the move towards sustainable construction in the Botswana construction sector. It was therefore a condition for and a product of sustainable transition. It was highlighted that in the West professional organisations established to promote good practice have all incorporated sustainability as a key goal or language which is used to frame many more specific goals. In southern African countries, professional organisations also highlight sustainability as a goal. Both developments

suggest that similar development is likely in Botswana; through promotion of ethics and standards in the construction sector.

The MLP analysis of the development of the initiative reveals a potential for a transition in the construction sector highlighted by three scenarios. In the first, the vision was to control the construction sector but it was changed to potentially use the Board as a value adding body in the construction sector. On the second, the change in rules proposed by the introduction of the Board promises to introduce professionalism in the construction sector. Lastly, the social network that developed around the establishment of the Board provided conditions for realignment of roles for existing entities in the construction sector.

Chapter 8: Discussion

8.1 Introduction

The previous three chapters (Chapter 5, 6 and 7) analysed the process of introducing three government-supported initiatives in Botswana using concepts from MLP. The central aim was to explore the role that government policy initiatives play in a transition towards sustainable construction. Six themes emerged from the analysis, three from the original MLP categories, including: visions, learning processes and development of social networks and three from the empirical analysis of literature on construction industry change, including: organisational capabilities, professional competences and role of international actors. A review of each theme provides a basis to discuss the Botswana construction sector's transition to sustainable construction and conditions for changing rules.

Sustainable transitions are long-term, multi-dimensional transformation processes through which socio-technical systems undergo fundamental changes to more sustainable modes of production and consumption (Geels and Schot, 2010). As such, a change towards sustainable construction is not just about adding another criterion to the list of what counts when designing buildings, it is also about developing and supporting organisational capabilities and professional competences that can support the change process towards sustainable construction. In countries such as Botswana, it is also about creating a balance between international and local actor involvement in the change process.

8.2 Research analysis overview

The three government initiatives analysed include the BOTEC demonstration project, Botswana Environmental Impact Assessment Act (EIA) and Botswana Construction Industry Authority.

The discussion above explored the process of development using the multi-level perspective (MLP) concepts to analyse the visions, learning processes, development of social networks and changes in rules.

The MLP model was designed primarily on Western cases so it is interesting to explore its relevance for the study of an African case. The core MLP model implies a Western case so some of the assumptions work better than the others for an African case study. For example, MLP presume existence of institutional structures for the professions or existence of standards or policies that could hamper or promote niche development. In some African countries, professional bodies or standards do not exist.

The main research question of the thesis was: what is the role of government policy initiatives in transition towards sustainable construction? The intention was to use the empirical data from the cases to assess whether or not the government efforts are facilitating dynamics towards sustainable construction and to develop recommendations based on the analysis.

The research traced the process of developing the initiatives. The analysis highlighted the problems or drivers to which the initiatives were responding. It also followed the steps that were taken in the process of development, documenting the influence of different actors involved in the process. The analysis also documented the contribution of the initiatives to efforts towards sustainable construction. The use of MLP concepts to analyse the initiatives documented the importance of visions, learning and social networks as conditions for transition to sustainable construction.

8.3 Contribution of the three government initiatives to change towards sustainable construction

This section discusses the contribution (short term successes during the change process) of the three initiatives to a change towards sustainable construction in Botswana.

8.3.1 Botswana Technology Centre

The findings from the case study reinforce the argument that demonstration projects are exemplars of best practice and a means to transfer knowledge across projects and across the construction industry (Smyth, 2010) for improvement of the construction industry. The BOTEC demonstration project was found useful to trial applicability of new technology, transfer knowledge and diffuse policies.

There was knowledge transfer both within and outside BOTEC. The knowledge learned from the demonstration project was used for other projects. Some of the sustainable principles that were learned by the different participants included sustainable design principles and assessment of thermal comfort. The sustainable design principles learned in the project were used to design a cafeteria. A software was used to assess thermal comfort of the buildings. The knowledge gained was used by the Principal Architect from Australia. The architect uses a similar software designed with Australian conditions to assess buildings in Australia.

The other contribution of the case was in regard to demonstrating the applicability of new technologies. Literature suggest demonstration projects serve as testing grounds to evaluate application of technology (Zhou et al., 2015). Thermal monitoring was conducted after completion of the project suggests to assess the applicability of the experimental materials in the project. The program ran for a period of three years. Interior thermal comfort levels for

Botswana environment were demonstrated and assessed during the thermal monitoring period. Evidence from people who stayed in the houses indicates that thermal comforts of the buildings with the experimental materials were greatly improved over those with conventional building materials.

The other contribution of the BOTEC demonstration project was in regard to policies. Literature suggest demonstration projects are used by Governments as a strategy to diffuse policies (Rasmussen et al., 2017). It was found that the BOTEC demonstration project introduced new governance techniques from abroad into the BOTEC which passed on to Government. International researchers shared their experience of how quality and standards were safeguarded in other countries. The concept of standards body was borne from the expectation to develop good quality technologies. A systematic approach to assessing quality standards of materials and technologies started the process to develop Botswana Bureau of Standards (BOBS) which to date has been able to develop standards for Botswana.

8.3.2 **Environmental Impact Assessment Act**

The introduction of the EIA Act can be considered a success in many ways. The first one is that it produced a valuable ecological profiling of the country. The inadvertent lack of regulations and guidelines in the 2005 Act seems to have contributed to its success. Submitting environmental statements for each and every project that was done in Botswana led to a preliminary environmental assessment which resulted in knowing the ecology of the whole country. The ecological profiling of the country is a valuable resource going forward. First it will reduce the length of time needed to do the actual environmental assessment as the different profiles for the country will be readily available. Secondly it will save on the cost of carrying the EIA process.

The establishment of a regulatory association is another of the successes of the introduction of EIA. During the review of the EIA Act, a new organisation was established; the Botswana Environmental Practitioners Association (BEAPA). The introduction of this organisations conforms to a suggestion in literature that institutional frameworks change in a change processes (Adamson and Pollington, 2006). The establishment of the association came at a time where there were massive shift towards self-regulation for service providers in the construction sector in Botswana. So the establishment of the board was another step in providing impetus for those service providers who were still not self-regulated. BEAPA has imposed continuous professional development as one of the imperatives to remain registered with the association. This is in line with an assertion in literature that the roles and functions of new organisations need to be specified to influence change (Rasmussen et al., 2017).

8.3.3 Botswana Construction Authority

The Construction Board is not yet operational so it is not yet clear how it will contribute to change towards sustainable construction.

8.4 Institutional structures in a change process

This section discusses the role institutional structures play in a change process. The discussion is centred on the influence of people and organisations in a change process.

8.4.1 Organisational capabilities

One of the findings of the research concerns the capacity of organisations to influence transitions. Two scenarios in the analysis of the cases document this finding. In the demonstration project case study, it was found that the BOTEC organisation did not have mechanisms to communicate the results of the two experiments they conducted. The project

goal was to experiment with different materials and in particular to promote the use of local materials as well as timber. The other goal was to test the thermal performance of the different houses built with different materials. The aim was to compare the performance between the materials. Two types of insulated materials and two for solid blocks were trialled in the project.

The results for both the experiments were compiled but never distributed to a wider construction audience. The failure to communicate the results suggests that there was an inherent weakness within BOTEC about capturing and disseminating the results. Perhaps there was confusion about the purpose of the project-whether it was for demonstration or it was just a project to construct staff houses using principles that BOTEC were mandated to promote-that is technology development. This finding seems to confirm Smyth (2010) assertion that the tangible goals for which demonstration projects were instigated provide the evidence of improvement in the construction industry. From the analysis of the two cases, the goals were clear and were useful to ascertain the influence of the projects on the construction sector.

In the case of the EIA case, in the beginning when the original Act was enacted in 2005, the scope of the process was not prescribed. There was a failure to prescribe a list of projects for which EIA was needed. The failure to develop the list caused implementation challenges for the Act, as EIA was essentially required for all projects. The Department of Environmental Affairs (DEA) could not enforce the legislation as they were overburdened by the many EIA reports. In 2011 when the Act was reviewed, the scope was changed from a universal to a targeted set of projects. This in turn contributed to the professionalization of the process where arbitrary decisions by political leaders was taken away and replaced by a more organisational guideline that was known to every actor in the EIA regime.

The scenario seems to contradict what MLP predicts as the seed of change in socio-technical systems. MLP predict that change comes from niches (Geels and Schot, 2007), but in case examined of the EIA, this was not the case. Potential for a transition was triggered by the re-evaluation of the Act in 2011 to clarify the scope of the EIA process. The critical developments associated with professionalization of the EIA process suggest something about how conditions for sustainable transition may not be specific to sustainability initiatives. In this case, the unintended consequence of reviewing the Act after it has been implemented between 2005 and 2011 started a transition.

8.4.2 **Professional competences**

In the transitions literature, professional associations are depicted as outsider groups. The status of being an outsider matters, as an outsider does not conform to regime rules. They can act as a societal pressure group and try to mobilise public opinion (Geels, 2006) to put pressure on the regime. In addition, Geels and Schot (2007) suggest that professionals may have specialist knowledge that allows them to criticise technical details of regimes and propose alternative courses of action.

In MLP discussions, criticizing the regime involves highlighting regime problems, which in turn promotes niche developments to address the noted problems. In this research, it was found that the absence of professional associations when the demonstration project was constructed may have contributed to the lack of influence to change the construction sector. It was shown that the network that developed around the demonstration project was weak; it did not involve construction professionals. Construction professionals with their knowledge could have advised on the efficacy of some of the technologies that were trialled as part of the buildings.

Professional associations are well established in developed countries. In a lot of developing countries there are no professional associations in existence, which mean that niche development can't contribute to sustainable transitions in the same way. This was the case in Botswana, where there were no professional associations at the time the demonstration project was developed.

In the case of the Construction Board, professionalization happened at the same time as the move towards sustainable construction. The creation of the construction board was therefore a condition and a product of sustainable construction. It was a condition of sustainable construction in the sense that it intends to stimulate good ethical conduct, standards, training of workers and licensing contractors once it is fully established. It was a product of sustainable transitions as it was created after the creation of the Botswana Environmental Assessment Practitioners Association (BEAPA). It was found in chapter 6 that BEAPA created conditions for professionalization of the construction. The networks which developed around EIA, directly contributed to the creation of the BEAPA, which in turn helped to shape the EIA.

The point about the case in Botswana where professionalization happened at the same time as the move towards sustainable construction is interesting. In the West professional organisations were established first to promote good practice. Later they incorporated sustainability as a key goal or language and that was used to frame many more specific goals. In the case of Botswana, the two processes developed in tandem. This suggest in many other developing countries the process of transition to sustainable construction can be merged with the development of professional associations.

The point that the Construction Board was created at the same time as the move towards sustainable construction could possibly suggest that the construction board will start from a

stronger position. Currently most professional associations are incorporating sustainability in the language they use to communicate to customers. The case of the Botswana Construction Board makes for an interesting case going forward. It remains to be seen whether it will keep to the stated goals once it is fully functional. In terms of the wider implications, it shows that transitions to sustainable construction in developing countries can possibly be promoted with the creation of professional association provided they intend to promote sustainability through their standards.

8.4.3 Role of international advisors

MLP talks of the importance of expert knowledge introduced into the host country by people who are not part of the regime. Geels and Schot (2007), suggests they bring specialist knowledge that allows them to criticise technical details of regimes and propose alternative courses of action for sustainable transitions. In two of the three cases, the role of international advisors was crucial but in a different way. The key points that are highlighted in the analysis are about provision of experts in Africa and how being an outsider their input was valued more than others. Internationals were relied on because they were outsiders with expertise, sometimes to the benefit of the initiative, but sometimes at the expense of valuable local knowledge.

In the demonstration project, it was found that certain actors were privileged at the expense of others. In particular international workers were privileged at the expense of locals. It is important to highlight however those international workers provided expertise which was essential for the project. The international experts were allowed to take the lead role during design preparations and subsequent construction of the project. Further they were allowed to take the lead role in the thermal monitoring program conducted on the houses after completion of the project.

As lead design engineers and architect, they specified the materials that were used in the houses. Secondly, they took the lead role in the monitoring and evaluation program that followed the commissioning of the houses. It was not stated clearly how the rest of the international workers ended up in Botswana. However an account of one of them gives an indication of how they might have been involved. The expert was placed in Botswana by a volunteer organisation and hired by BOTEC as Principal Architect. Both his foreign credential and formal role contributed to his voice being privileged. Further he was an expert in sustainability; hence he was given the leading role in the thermal monitoring program at the expense of locals. The involvement of the experts brought things that were advantages and some were less advantageous.

Their involvement was positive in as far as design of the houses were concerned and setting up of the monitoring program. For example, they introduced the concept of thermal simulation using a computer software package CalPas3 which enabled the researchers to compare the performance of different materials in as far as interior temperature of all the buildings was concerned. The other positive outcome of the involvement of international actors was the introduction of new governance techniques from abroad into the government. From the accounts of the local actors, issues of quality were previously handled within BOTEC. The international researchers advised the use of an independent standard board to assess the quality of BOTEC products. The Botswana Bureau of Standards (BOBS) was set up due to their recommendation.

The significant negative aspect of the involvement of international actors which perhaps shaped the influence of the demonstration on the regime was on the prescription of construction materials to be trialled. It was envisaged that the project will influence future house construction regime in Botswana. For example, the projects wanted to improve the use of timber as a construction material in Botswana. In the end the international researchers lost sense of that

vision during the design and construction of the project. A lot of materials that were used in the project were sourced from outside Botswana and as far as Sweden. This was at odds with a very specific principle of promoting locally sourced construction materials. This point is discussed further under visions.

By comparing the involvement of the international actors in the two cases, a few observations can be made. In the case of BOTEC an account of how one of the project team members was recruited for the project perhaps highlights why they were privileged to lead the team at the expense of the locals. The architect applied for a job as a volunteer worker through an Australian volunteer organisation. He did not specify any particular country. The Australian organisation linked him with BOTEC and he started to work in 1993. The architect worked specifically on the thermal monitoring program. The architect had been working for more than ten years in Australia prior to joining BOTEC. As part of his training for a degree in architecture, he took courses in environmental design and environmental science. That training helped him to develop interest in sustainability. In the case of the EIA, the role of international advisors (IUCN representative) was not as pronounced as in the demonstration project. The advisors suggested a model for EIA legislation to the stakeholders during consultations. It is not clear how the IUCN representatives got involved in the initiative, but came in at the stage of consultation. Their role was therefore limited to stakeholders who were consulted but for them they had expertise in EIA. The demonstration project case suggest there was some prior agreement that the experts will lead the process while the latter suggest they participated as like other stakeholders, but having more expert knowledge on EIA than the other participants.

A few things can be inferred from this account besides the suggestion that there was lack of experts on sustainability in Botswana at the time the demonstration project was developed. It appears the experts came to Botswana as part of assistance programmes from the developed

countries. As such the assumption was that they will take lead roles in issues of sustainability which knowledge in the developing countries was very low. There was indeed proof that there was limited expertise in Botswana at that time and especially for sustainability and as well there was the attachment that experts have been dispatched from abroad and therefore they should be given lead roles lest they go back to their countries. There is an implicit assumption that even where local input could have been used, there was an expectation that since they were brought in as experts, then they must know.

What this means for transitions is the need to monitor and maintain a balance between local and international expertise An argument can be made about the types of issues that international experts should be allowed to lead and not to lead. They should be allowed to lead where the initiative involves generic models which are applicable worldwide. For example, the international experts were given an advisory role in the EIA case to develop EIA legislation which appears to be generic worldwide. Some of the most important steps which are incorporated in other EIA systems were missed in the Botswana tool, even though they were suggested by the international experts. In the demonstration project case, the international experts on the contrary were given a leading role even though they were not accustomed with the Botswana conditions. They ended up specifying materials that were not available locally to achieve the objective of promoting locally produced materials.

8.5 Influence of prior developments on direction of change

This section discusses the influence of prior developments on the direction/nature of change. The discussion is centred on the importance of visions, learning and social networks in change process.

8.5.1 **Visions**

This section reflects on the importance of a vision for sustainable transitions based on the analysis of the three initiatives. MLP suggest there are two ways in which visions matter in transitions. MLP suggest that at the niche level, visions give direction to niche development, influence design choices and attract resources (Geels and Schot, 2007). This implies that actors and activities during niche development should strive to support the vision. At the regime level, MLP suggest that an alignment of visions amongst different actors is critical for the impact of a regime level initiative (Geels and Schot, 2007). This links sustainable transitions to a convergence in visions. The three cases show elements where activities were decoupled from the vision while in some instances visions were aligned to imply a transition.

Visions and expectations about the future provide the legitimacy for actors to invest time and effort into a new technology that does not yet have any market value. Actors may have different visions of the future and different expectations about the viability of niche innovations. In the demonstration project case, the vision was to have a housing sector characterized by locally sourced materials. The Managing Director (MD) of BOTEC envisioned at the concept design stage to construct house buildings that use less active heating and cooling with locally sourced materials. Construction materials were selected to show the benefit of insulation. Insulated panel based materials (Sagex and Prolith) and mass based materials (Ceratec and Hydraform) were selected and used in the construction of the houses.

The selection of the materials was based on pre-determined criteria by the researchers. The choice was based on the quality of construction, fire protection, rainwater penetration, thermal performance, durability, buildability and cost implications. The vision of the Managing Director was decoupled from what the researcher's expectations were about the future

performance of the materials. What was missing from the researcher's expectations was the local sourcing of the material. The researchers specified materials from outside Botswana. This created a problem with the researchers losing sense of what they were supposed to do to achieve the vision. It seems the researchers were driven by the nature of the work; being to find materials that were durable, easy to construct with and cost effective. These demands however were not in line with what the Managing Director was thinking. This reinforces the interconnectedness of developing a clear vision and making explicit the expectations (van der Laak et al., 2007) for others to follow through.

Other studies have made attempts to explain the importance of having a vision for initiatives such as the demonstration project. Berry et al's study of the transition to a sustainable housing sector in Australia (Berry et al., 2013) exemplifies a process of envisioning. The vision was to have a clean and modern green Adelaide and to achieve that the study suggests a 'thinker in residence' was engaged to lead the process. The thinker engaged policy makers and the public to set targets were set to reduce energy used, greenhouse gas emissions and potable water use from the 2004 averages. Two points are of interest from that process. First the public was engaged to suggest what needed to be done and secondly there were targets that were set. It appears from this account that the visions and expectations for the project were shared by many actors, and they were specific enough to give guidance in setting the targets for the project (Schot and Geels, 2008).

In the EIA case study, the vision was to use the EIA as a risk management tool at the project level to be part of a process to maintain investment in Botswana by internationals. Evidence suggests that the different actors aligned to the vision after some contestations. The Department of Environmental Affairs (DEA) envisioned developing an EIA tool to be used at the project

level to manage the disposal of waste and degradation of natural resources. This led to the DEA to lead a panel of stakeholders to define the content and legislation for the EIA law.

The process of engaging stakeholders was firstly to develop the content of the EIA legislation but secondly and more importantly to align the different visions of the stakeholders. Other studies suggest alignment of visions can be achieved by regular contact of actors. In the case of the EIA in Botswana, the two three day workshops served the purpose to consolidate the vision for the EIA. Besides consolidating on the vision, the deliberations with targeted stakeholders were intended to develop the content of the legislation. During the stage of developing the content of the EIA, the International Union for Conservation of Nature (IUCN) representative proposed that a list be developed to specify the projects that required an EIA. The suggestion was not incorporated in the subsequent EIA act. The implementation of the 2005 Act though successful was characterised by delays caused by the lack of a specified list which rendered all projects to undergo EIA process. The vision of the DEA was clear but due to the lack of defined parameters (list of projects) it was difficult to achieve that vision prompting a re-evaluation of the Act.

The re-evaluation of the Act in 2011 highlighted that the focus of the EIA should be broadened to the landscape level based on other actor's views. EIA was otherwise used at the project level to study potential impacts of projects in advance and propose alternatives. The World Bank suggested a new vision for the EIA; to improve investor confidence in Botswana. It was somehow easy for the DEA to align with this new vision as Botswana is a developing country and relies on investment from outside. The World Bank can provide such investment opportunities. The adoption of the vision demands a shift in the process of EIA. Some of the suggestions of the World Bank include reducing the length of time taken to conduct EIA.

In the case of the Construction Board, the vision is to have a value adding construction sector to the national economy. In the beginning the Ministry of Infrastructure, Science and Technology (MIST) vison was to have a regulated construction sector. There were concerns among Southern African countries of the uncontrollable entry of people into the construction sector who were deemed unqualified to do so. The concern was mainly directed at construction firms whom it was claimed did not have the requisite skills and capacity to carry construction work. The proposal to establish construction boards in those countries was to control the entry of the contractors.

The initial efforts to establish the board in Botswana failed due to lack of political support, lack of funding and failure to consult the other stakeholders in previous efforts. In respect to funding, a manufacturing firm provided the funds to develop the Board when political leadership acceded to its establishment. The firm introduced a new vision for the construction sector; to have a valuable construction sector with ethics and standards. In this respect the Ministry of Infrastructure, Science and Technology (MIST) vision to have a well-regulated construction sector was subsumed by the vision of the private sector firm to have a valuable construction sector with ethics and standards.

8.5.2 **Learning process**

In MLP, learning builds momentum for the niche innovation to impact on the regime. Learning can be related to how regulations and government policy and societal and environmental effects (Schot and Geels, 2008) are suited to the future development of the innovation. In niche development, experiments produce the results and actors learn from the results and make adjustments to improve the niche innovation. According to van der Laak et al. (2007) a good learning process is reflexive and focuses on many aspects. In the transition process, learning

can be related to the technical performance of innovations and how complementary infrastructures have to be set up (Smith, 2007).

Learning as a concept was analysed in the demonstration project case study. The researchers in the demonstration project anticipated learning about the performance of the different construction materials in the thermal monitoring program. The program started immediately after commissioning of the houses. The intent of the thermal monitoring program on site was to compare and assess the seasonal and long-term effect of each building design and the different building materials that were used on the project.

When the residential houses were designed, simulation with Calpas3 computer software of existing houses in Botswana constructed by Botswana Housing Corporation (BHC) was done and the results were used as benchmark for the new houses. Thermal monitoring of the new houses was then done. Some of the new houses were insulated while others used thermal mass to improve indoor thermal comfort. It can be said the learning from the benchmark process with BHC houses was reflexive. It was noted the houses performed poorly because of poor insulation. Based on that feedback, ideal thermal conditions were simulated using the software and houses built to those simulated standards.

The effort to provide complementary infrastructure for the project failed when the intention to set up BEGUS Botswana collapsed. BEGUS Botswana was supposed to be a local provider of BEGUS timber systems from Sweden. The demonstration project therefore did not influence any change in the commercialisation or availability of more sustainable materials.

The analysis suggests that there was reliance on individual transmission of the results of the project. It seems there was no attempt by BOTEC to communicate the results of the demonstration to a wider audience including the construction sector. Individual engineers had

the results of the thermal performance of the houses but they did not communicate them to others. The wider construction sector did not learn about the technical performance of the materials that were trialled and this hindered a transition towards sustainable construction as the materials from the project were not used eventually in the sector. In this case the failure to effect a transition can be attributed to failure by BOTEC as an organisation to take ownership of the project results and disseminate them widely. Learning was restricted to individual engineers who as international workers upon leaving BOTEC, they left with those results.

The point highlights issues of the original intention of the project. The project had two objectives that were at odds with each other. The first it was intended to provide residential houses for staff. Second it was intended to demonstrate the efficacy of certain materials-local materials and timber in particular. The demonstration project aspect was not communicated to the industry.

8.5.3 **Change in social networks**

Dynamics in the composition of social networks is the third MLP concept which informs this analysis. MLP suggest that the formation of social networks is important for niche development since they sustain development, and new actors and enable learning to take place to achieve the expectations (van der Laak et al., 2007). Two elements are important for an effective network: the composition and alignment of the actors within the network (Schot and Geels, 2008). van der Laak et al. (2007) asserts that regular interaction and cooperation between different actors can achieve alignment of actors.

Literature suggests that actors commit to the network where there have vested interests (Kemp et al., 1998). This was evident in the three cases but with different dynamics and results. In the case of the demonstration BEGUS Sweden was engaged to supply timber prefabricated house

units. They came to be involved in the project as part of aid package from Sweden to construct the timber framed houses. They eventually became interested to set up a timber manufacturing plant in Botswana due to their vested interests in the commercialisation of their products. They anticipated tapping into the envisaged timber market as one of the objectives of the demonstration project was to promote the use of timber in the construction sector. In the Construction Board case, the involvement of PPC Cement was due to vested interests in the construction sector. As suppliers of cement, the lack of projects due to perceived poor planning by government affected their business. They got involved to speed up the process of establishing the board. From their standpoint, the Board could help in planning of construction projects. Lack of good planning by the Government was cited as a problem which led to periodic booms and busts in the construction sector. The booms and busts affected cement sales. In the EIA case, the analysis suggest World Bank as an investment bank could not provide financial support for investors to invest in a country which was perceived to have an unwieldy long, which from the World Bank was seen as an unjustified process. In addition to the already existing problems of trying to get an EIA, this only exacerbated the misgivings from international investors.

The three cases showed the role of social networks on transitions in different ways. Two elements are suggested as important for an effective social network; the composition and alignment of the actors within the network (Schot and Geels, 2008). It is suggested a good network requires a diverse group of actors with different interests and roles. In the case of the demonstration project, the network did not include a diverse group of actors. The network was made entirely of project team members. Alignment of the network was however high as they held regular meetings. In the case of the EIA, the network developed over time. It was diverse as it involved government, private and non-governmental organisations. It however did not

include professional associations as they were not yet established at that time. Alignment was achieved by two well attended workshops. In the case of the Construction Board, the network is still developing as the Board is being set up.

The analysis highlighted the effects of the different compositions of the social networks in the cases. The social network that developed in the process of establishing the Board has to date provided conditions for realignment of mandates for existing entities in the construction sector. For example, the University of Botswana researchers conducted studies that provided evidence that projects in the construction sector were failing. PPC Cement provided funding while the Botswana Institute for Development Policy Analysis (BIDPA) conducted the study on the mandates of existing entities in the constructions sector to see how they will be affected by the new board. The clarity of responsibilities was crucial to get the board going. In the case of the demonstration project, the social network did not make any change in the construction regime. In the case of the EIA Act, the social network which developed around implementation of the new EIA provided conditions for the development of professional associations in the construction sector.

The findings of the analysis support the existing literature on the importance of social networks in transitions (Geels, 2006). A change in social networks meant that is was clear who was available for what going forward. For example, the university researchers conducted research that provided evidence of problems in the construction sector. Going forward they are available to provide such services-to provide scientific evidence through research. PPC Cement and other private sector firms can provide funding.

8.6 Change in rules/transition to sustainable development

The concept of sustainable transition can be thought of as a change in rules. MLP uses the term 'rules' to suggest some sort of shared structure (e.g. routines, norms, protocols etc.) that guide the activities of regime members (Geels, 2004). Geels (2004) distinguishes the three dimensions of rules: regulative, normative and cognitive rules. The regulative dimension refers to explicit formal rules which constrain behaviour and regulate interactions. The normative rules confer values, norms, role expectations, duties, rights, responsibilities. Cognitive rules constitute the nature of reality; they give meaning to or make sense of the world. Geels (2005) suggest rules are reinforced and changed through action and enactment.

Three government initiatives were examined and they are evaluated on whether and how they contributed to sustainable development. The introduction of the cases was an effort to change the construction sector towards sustainable development.

EIA was introduced in 2005 to provide for environmental impact assessment to be used to assess the potential effects of planned developmental activities. At the stage of first introduction, it was intended to introduce a 'rule' of environmental management. Implementation challenges of the Act between 2005 and 2011 necessitated a review of the Act. Government was concerned about the poor project delivery where some projects were stopped due to absence of EIA approvals. There was public perception that EIA was costly. Construction professionals decried the poor quality of feedback they receive from DEA when they evaluate their submissions and the World Bank decried that the EIA process in Botswana was unnecessarily long. A combination of these problems triggered the re-evaluation of the 2005 EIA Act.

The re-evaluation of the 2005 Act and implementation of the 2011 Act, initiated a process of change of EIA practices resulting in many changes of rules. There was a change in the regulative dimension of the EIA process. A targeted list of projects was drawn up which replaced the practice of carrying out EIA for all projects. In addition, the change in regulation meant the role of the Minister of Environment who in the 2005 decided which projects needed EIA, was changed. The move in a way professionalised the EIA process by removing arbitrary decision making by political leaders.

The other regulative dimension which leads to professionalization of the EIA process was affected by the requirement that all environmental practitioners should be certified before they can carry out environmental assessment. Previously the process was not regulated hence the many complaints about the process being costly. Botswana Environmental Assessment Practitioners Association (BEAPA) was established to certify and regulate the conduct of environmental practitioners. They put some requirement for one to be allowed to practice which includes education and experience to qualify to conduct EIA.

The normative dimension is noticeable through the specification of roles and responsibilities of the actors involved in the EIA process. Prior to re-evaluation, consultants were engaged by developers to carry EIA assessment on their behalf. In the process, consultants prepared scoping and screening studies and prepared environmental assessment reports. The consultants were responsible for conducting public consultations. The review of the Act resulted in clarity of the roles for developers and consultants. Consultants were phased out from the process and replaced by environmental practitioners who were qualified to carry out the assessment. The role of arranging for public participation which was previously carried out by consultants was assigned to developers.

The review has elevated the importance of EIA which otherwise was not considered important by developers previously. There were some reports that some developers especially government departments always tried to bypass the process altogether mainly because they felt the process delayed their projects. From the environmental practitioner's side, the change which resulted in the requirement for certification has assured them that their reports are assessed by competent people. DEA officers are required to register with BEAPA and thereby conform to the educational and experience requirement set by the body.

In the case of the Construction Board, it was found that the Board promises to uphold ethics and standards as well as licensing and training construction workers. These formal commitments are otherwise missing in the construction sector of Botswana currently. There were many documented problems in the construction sector including poor planning by government, projects not finishing on time and budget and some hidden suggestion of corruption. The introduction of the Construction Board was aimed at changing the rules towards upholding standards.

In terms of the process to sustainable construction, there are couple of points that can summarise the story of the Botswana Construction Board. First, it was learned from the story that political support matters for regime transformation. Secondly, involvement of many stakeholders in processes of change is important as they bring in different resources. The Board was established when there was funding that was provided by both government and the private sector organisations.

One of the big problems in the earlier version of the EIA was the lack of clarity about who is supposed to do EIA. One of the lessons was that it is important to worry about the implementation process. In order to make that happen, new roles in the EIA process were

created. A new oversight body called Botswana Environmental Assessment Practitioners Association (BEAPA) was created. That is how the move helped to contribute to sustainable development in the construction sector. BEAPA added to the impetus towards professionalism in the construction sector. Three other professional associations were created after BEAPA was established.

The demonstration project case was not examined with the concept of changes in rules but it has contributed to sustainable construction. When the project was under construction, quality issues were checked internally by BOTEC staff workers. The practice was changed with advice from international workers to establish a national standards board. The Botswana Bureau of Standards (BOBS) was established based on the recommendations from the experts working on the project.

8.7 Summary

The chapter discussed the findings of this research and its contributions to the existing body of knowledge. The role of institutional structures in a change process; the contribution of the initiatives to a transition; the influence of specific conditions on change were explored. The conclusions and implications for further studies are presented in the next chapter. The study recognises that in developing countries it is critically important to improve organisational capabilities and professional competences to complement the change initiatives.

Chapter 9: Conclusion

9.1 Introduction

The aim of this research is to explore the role of Government policy initiatives in transition to sustainable construction. The research considers the development of three Government initiatives. The term transition is used as an evaluation of the overall influence of the policy initiatives in the construction sector. The specific objectives were:

1. To analyse the on-going contribution of the three government initiatives to sustainable construction
2. To use the analysis of the specific initiatives to identify the relevant institutional structures and explore their role in shaping the development of the sector.
3. To explore the influence of prior developments on the direction/nature of change
4. To consider the implications of that analysis on the move towards sustainable construction in Botswana in particular and developing countries in general

In the empirical chapters, each of the three initiatives was analysed. The analysis traced the process of creating the initiatives and the context specific problems or drivers the initiatives were responding to. It also followed the steps that were taken in the process of development, documenting the influence of institutions and actors involved in the process. The analysis also documented the contribution of the initiatives to an ongoing transition towards sustainable construction in Botswana. The use of MLP concepts to analyse the conditions necessary in a change process documented the importance of visions, learning and social networks. The broader contribution of the initiatives to transition towards sustainable construction was highlighted.

This final chapter summarises the practical and theoretical contributions of this research; followed by conclusions for each of the research objectives. It goes on to identify the theoretical and methodological contributions and then summarises practical implications for policy makers and practitioners. Finally, the limitation of the research are highlighted and future areas of research are suggested.

9.2 Theoretical contributions

This section looks at the theoretical contributions of this research to both construction industry change literature and to the MLP approach.

9.2.1 International actors in construction industry change

This thesis contributes to literature on the role of actors in change process by demonstrating that international actors influence the content of the change initiatives. In developing countries international actors are relied on for their expertise and funding. Sometimes the experts came to developing countries as part of assistance programmes from the developed countries. It was documented in the analysis that internationals actors were relied on because they were outsiders with expertise, sometimes to the benefit of the initiative, but sometimes to the detriment of the initiative. This finding suggest there is potential for a misfit between bringing foreign expertise and valuable local knowledge in developing countries change initiatives.

9.2.2 Institutional structures in construction industry change

The other organisational effect is professional competences that are needed for a transition. It has been found in the study that the development of professional associations happened at the same time as the move towards sustainable construction. In the West professional organisations were established first to promote good practice. Later they were engaged in change initiatives

to provide expertise. In the case of Botswana, the two processes developed in tandem. This suggest in many other developing countries the process of change can be merged with the development of new institutional structures such as professional associations.

9.2.3 **Multi- level perspective**

Early studies that used MLP focused on emergent transitions and their analysis was purely historical commenting on the changes as they occurred. Current studies on transitions have tried to analyse transitions as they happen, which this thesis adopted. Rotmans et al. (2001) suggest the Multi-Level Perspective (MLP) framework can be used to track changes in a system over time, but also to allow comparison across cases. As a result, MLP has been used predominantly as a macro level framework to analyse historical dynamics of transitions. For example, Verbong and Geels (2007) analysed the historical dynamics within the Dutch electricity system from 1960 to 2004. Other analyses have examined transitions from sailing ships to steam ships (Geels, 2002a); from horse-drawn to automobile transport systems from 1860 to 1930 (Geels, 2005); from cesspools to sewer systems from 1840 to 1930 (Geels, 2006). The use of MLP on historical studies reflects a methodological limitation as the analysis relies on secondary data (Genus and Coles, 2008). In this research, MLP was used to analyse dynamics of ongoing transitions (short term) to offset that limitation. Further, primary data from sources who were directly involved in the cases was used.

9.3 **Summary of research findings to the aim and objectives**

With respect to the first objective- **to analyse the on-going contribution of the three government initiatives to change towards sustainable construction**, a number of findings about the on-going contribution (short term success) of the initiatives in the construction sector have been made. It was found that the BOTEC demonstration houses have been successful in

transferring knowledge and technology both within and outside of BOTEC. In addition, it was found that thermal monitoring of residential buildings was successfully done. Lastly, the demonstration project introduced new governance techniques from abroad into the BOTEC which passed on to Government. International researchers shared their experience of how quality and standards were safeguarded in other countries. A systematic approach to assessing quality standards of materials and technologies started the process to develop Botswana Bureau of Standards (BOBS) which to date has been able to develop standards for Botswana.

In regard to the EIA, the Act can be considered a success in many ways. The first one is that it produced a valuable ecological profiling of the country. The ecological profiling is a valuable resource going forward in the construction sector. First it will reduce the length of time needed to do the actual environmental assessment as the different profiles for the country will be readily available. Secondly it will save on the cost of carrying the EIA process. Thirdly, the EIA Act resulted in the establishment of a regulatory association for environmental practitioners. The establishment of the association came at a time where there were massive shift towards self-regulation for service providers in the construction sector in Botswana. For example, Architects Association of Botswana and Engineers Registration Board were registered around the time the association was established. So, the establishment of the association was another step in providing impetus for those service providers who were still not self-regulated. Through registration of members to the association, there has been a creation of a database of people who are competent to carry out environmental assessment. This can even help Government to see when and how they can offer environmental management training in Botswana. The association has imposed continuous professional development as one of the imperatives to remain registered with the association. This eventually will help improve environmental management in Botswana. Lastly, implementation of the Act has resulted in development of

environmental standards for built up areas. Though the standards have not been incorporated into the building regulations, they are used as reference for new construction projects.

The Construction Board has not yet been established but it has the potential to lobby for ethics, standards, training and licensing in the construction sector of Botswana.

With respect to the second objective- t**o identify the relevant institutional structures and explore their role in shaping the development of the sector**, a number of findings about the influence of institutional structures has been made. It was found that organisations influence change process. In the demonstration project case study, it was found that the BOTEC organisation did not have mechanisms to communicate the results of the two experiments they conducted. The project goal was to experiment with different materials and in particular to promote the use of local materials as well as timber. The other goal was to test the thermal performance of the different houses built with different materials. The aim was to compare the performance between the materials. Two types of insulated materials and two for solid blocks were trialled in the project. The results for both the experiments were compiled but never distributed to a wider construction audience. The failure to communicate the results suggests that there was an inherent weakness within BOTEC about capturing and disseminating the results. In the case of the EIA case, in the beginning when the original Act was enacted in 2005, the scope of the process was not prescribed. There was a failure to prescribe a list of projects for which EIA was needed. The failure to develop the list caused implementation challenges for the Act, as EIA was essentially required for all projects. The Department of Environmental Affairs (DEA) could not enforce the legislation as they were overburdened by the many EIA reports.

With regard to professional competences, it was found that in the case of the Construction Board, professionalization happened at the same time as the move towards sustainable construction. The creation of the construction board was therefore a condition and a product of sustainable construction. It was a condition of sustainable construction in the sense that it intends to stimulate good ethical conduct, standards, training of workers and licensing contractors once it is fully established. It was a product of sustainable transitions as it was created after the creation of the Botswana Environmental Assessment Practitioners Association (BEAPA).

In regard to the role of actors, in two of the three cases, the role of international advisors was crucial but in a different way. In the demonstration project, it was found that international actors were privileged at the expense of locals. It is important to highlight however those international workers provided expertise which was essential for the project. The international experts were allowed to take the lead role during design preparations and subsequent construction of the project. Further they were allowed to take the lead role in the thermal monitoring program conducted on the houses after completion of the project. In the case of the EIA, the role of international advisors (IUCN representative) was not as pronounced as in the demonstration project. The advisors suggested a model for EIA legislation to the stakeholders during consultations. It is not clear how the IUCN representatives got involved in the initiative, but came in at the stage of consultation. Their role was therefore limited to stakeholders who were consulted but for them they had expertise in EIA. The demonstration project case suggest there was some prior agreement that the experts will lead the process while the latter suggest they participated as like other stakeholders, but having more expert knowledge on EIA than the other participants.

With regard to the third objective- **to explore the influence of prior developments on the direction/nature of change**, it was found that visions, learning processes and development of social networks matter for transition to sustainable construction. In the demonstration project, the MD's vision was decoupled from that of the researchers. This resulted in the materials that were trialled in the project not to influence house construction and brick making practices. The analysis suggests that privileging international workers resulted in their word carrying more weight and hence they prescribed materials which did not have a local presence. This suggests that a clear vision with all actors aligned to it is a necessity for a transition to sustainable construction to happen.

In the case of the EIA, the vision was to use the EIA as a risk management tool at the project level to be part of a process to maintain investment in Botswana by internationals. Evidence suggests that the different actors aligned to the vision after some contestations. The Department of Environmental Affairs (DEA) envisioned developing an EIA tool to be used at the project level to manage the disposal of waste and degradation of natural resources. This led to the DEA to lead a panel of stakeholders to define the content and legislation for the EIA law. At the time of writing, the proposed changes to the EIA process by the World Bank had not yet been implemented but it seems the DEA has bought into the idea. The changes propose streamlining the EIA process so that it is shorter. Alignment to a vision was critical to the proposed change in the EIA process.

In the case of the Construction Board, the analysis points to a slow development of a vision of the Board. In the beginning the vision was to control the construction sector but in the end the Ministry of Infrastructure, Science and Technology (MIST) adopted to use the Board as a value adding body for the sector. The private sector got involved to enhance and render visible that value, private organizations linked the Board to professionalization of the sector, including

ethics, standards, training and licensing could form part of the vision for the Construction Board. From there onwards, the development of the Construction Board was accelerated.

With regard to the second concept of learning processes, it was found that there was a conscious effort to learn about the technical performance of the materials by researchers. The performance of the building materials used in the project was evaluated prior to use which suggest technical learning took place. The second aspect of learning was noticeable through the thermal monitoring program. The learning from the program emerged as a competence and an opportunity to shift practices in the house construction sector in Botswana. In the end project reports detailing the design and construction of the project as well as the thermal monitoring process were produced for future reference. But due to poor capacity of Government and BOTEC to capture and disseminate the learnings, it was relied on individuals to transmit that learning. The individual learning could only be transmitted in limited projects. The importance of learning is emphasised as there was no diffusion of the technical knowledge learned in the project to the mainstream construction industry.

With regard to the social networks, it was found in the BOTEC project that the composition of the networks was made up of only project team members-the funder and researchers from BOTEC. The analysis suggests that the network was poorly constituted and therefore could not promote the development of the innovations into a niche market. In the EIA case, the diverse social network which developed around implementation of the new EIA provided conditions for the development of professional associations in the construction sector. In the case of the Construction Board, a social network that developed in the process of establishing the Board provided conditions for realignment of roles for existing entities in the construction sector. As the findings suggest, a diverse social network is a necessary condition for a transition.

With regard to the last objective - **to consider the implications of the analysis on the move towards sustainable construction in Botswana in particular and developing countries in general**; it was found that the niche based, bottom-up innovation did not document success as expected and documented in transition studies from western countries. It was instead found that the unintended consequence of reviewing EIA Act, contributed to a transition in the construction sector.

In the BOTEC case, the project has not changed the house and material markets thus far towards a greater use of local materials and to commercialise the materials and in particular timber products. There were hopes to promote use of locally produced materials as well as commercialising the production of timber in Botswana. This is at odds with the literature on niche which has been taken as the basis for emerging novelties (Markard and Truffer, 2008) and are expected serve as a test bed for learning with the aim of wider societal embedding of the innovations (Kemp et al., 1998). As pointed out, the learning in the project was not satisfactory which led to failure of the niche materials to shift the house and material markets. Niches also have been found to develop to address specific problems in the market (Geels, 2006). However in the case of BOTEC, even though there were problems with lack of use of timber use in the construction sector, timber use did not develop into a niche market.

In the case of the EIA, it was found that there has not been any integration of EIA with other planning tools thus far. The integration of the EIA requirements into other planning standards could have resulted in the development of environmental standards for developed areas.

It was found that the combination of the three initiatives contributed significantly to the on-going professionalization in the construction sector. Implementation changes in the EIA process created an actor that is now available for regulation and professionalization in the construction

sector. The Botswana Environmental Assessment Practitioners Association (BEAPA) was established in 2011 and as a result and parallel to the establishment of BEAPA (the process started in 2008), all three of the traditional professions of the construction industry namely the engineers, quantity surveyors and architects started to establish their own professional associations. The Engineers Registration Board (ERB) was established in 2010; Quantity Surveyors Registration Council (QSRC) established in 2013 and Architects Registration Council (ARC) was established in 2015. BEAPA added to the impetus towards professionalism in the construction sector.

The scenario that created BEAPA seems to contradict what MLP predicts as the seed of change in socio-technical systems. MLP predicts that change comes from niches (Geels and Schot, 2007), but in case examined of the EIA, this was not the case. Potential for a transition was triggered by the re-evaluation of the Act in 2011 to clarify the scope of the EIA process. The critical developments associated with professionalization of the EIA process suggest something about how conditions for sustainable transition may not be specific to sustainability initiatives. In this case, the unintended consequence of reviewing the Act after it has been implemented between 2005 and 2011 contributed to a transition in the construction sector.

9.4 **Implication for policy makers**

This research has provided an analysis of three government supported initiatives. It provided an understanding of the role of visions, learning and development of social networks in transitions to sustainable construction. The findings of the research can offer policy makers some insights into how they can approach future policy initiatives. The relevant policy makers are the Government of Botswana and those of other developing countries. Sustainability transitions are characterised by setting of visions (Geels and Schot, 2007), learning about the

desirability of the new innovation (Kemp et al., 1998) and development of social networks that enact regime practices (Geels and Schot, 2007).

It is suggested to policy makers that there should be a robust analysis of the initiative where visions are clearly set. The visions have to be shared by all the concerned stakeholders. It is therefore critical to involve as many stakeholders. It was found that in the BOTEC case, the vision of the Managing Director was decoupled from that of the researchers. This suggests there was no regular contact at the beginning of the project where alignment of the two visions could have been reached. This accords with van der Laak et al. (2007) who suggest alignment can be achieved through regular interaction and co-operation between the different actors. In the case of the Construction Board the discussion points to a slow development of a vision of the Board. There was no vision when the initial idea to develop the Board was muted until the private sector got involved.

The other message for policy makers is in regard to build capacity for organisations developing and implementing policy initiatives to appropriately disseminate the results of policy initiatives to improve their influence. It was shown in the thesis that in the BOTEC case the dissemination of results to the wider construction sector was not done by either BOTEC or Botswana Government. It is worth highlighting that it is not only the technical performance of the innovations that needed to be disseminated, even the infrastructure needed to support the innovations needed to be transmitted to the construction sector. This is line with Smith (2007) who argues that in the transition process learning can be related to the technical performance of innovations and how complementary infrastructures have to be set up. In the case of BOTEC, researchers made a conscious effort to learn about the technical performance of the materials. That knowledge however remained with the individual researchers who transmitted it to narrow projects they were involved in as individuals subsequent to the end of the project. It is critical

therefore that organisations and Government to in future find ways of disseminating results of policy initiatives.

9.5 Limitations of the study and suggestions for future research

9.5.1 Limitations

This research analysed the development of three government initiatives using the MLP framework. The contributions made are subject to some limitations. These are elaborated in detail below.

The research operationalised the MLP framework to study short term transitions contrary to its normal use to historically analyse sectoral change over long periods of time. The use of the MLP in this manner was found to be useful. It highlighted the short term contributions of the initiatives to a transition of the construction industry in Botswana to sustainable construction. However the use of MLP to analyse sector level change within a short period of time could have led to the premature conclusion that some of the initiatives were not successful. Transitions are long-term transformation processes in which society changes in a fundamental way over decades or generations (Rotmans et al., 2001). The three initiatives analysed in this study span periods of less than 30 years. The short term nature of the case study initiatives precludes the collection of empirical data on the success of the change initiatives over time which could have been possible in historical studies.

The second limitation was in regard to the analysis of the effectiveness of the initiatives. The study sought to explore the contribution of the initiatives and conceptualise such a success as a transition. The Construction Board case study was studied while still under development. As such its contribution to change the construction sector could not be ascertained at the time of the study. As such the study cannot claim about its impact in the construction industry.

9.5.2 **Future research**

This research explored the process of development of three government supported initiatives using MLP to analyse sector level change within a short period of time. The initiatives could be studied in future to explore their impact in the construction sector over a long period of time. The study showed also that international experts shaped the contents of the policy initiatives.

The findings of this study provides insights into how sustainability policy initiatives could be developed and implemented in the construction industry. Other policy initiatives could be analysed as well.

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Appendices

A: Study Information

Information Sheet

Student: **Keneilwe Ntshwene**

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Date:

Sustainability initiatives in Botswana construction sector

My name is Keneilwe Ntshwene and I am a PhD candidate in the School of Construction Management and Engineering at the University of Reading, Reading, UK.

I am carrying out a study to analyse sustainability initiatives in Botswana construction sector. I am particularly interested in investigating the development of sustainable construction in Botswana prompted by initiatives such as BOTEC projects, green building regulations and the professional boards. For this reason, I would like to interview construction professionals.

If you are willing to be interviewed, you will be asked to participate in an interview of about 45 minutes. During the interview, I will ask you questions on your views on either BOTEC demonstration projects, green building regulations, professional boards, and sustainability initiatives and factors that led to those initiatives in the construction sector. You can choose not to answer any questions. You are free to withdraw from the study at any time.

At every stage, your identity will remain confidential. Your name and all identifying information will be removed from any written transcript. I (Keneilwe Ntshwene) and my supervisors (Dr Libby Schweber email l.schweber@reading.ac.uk and Dr Emmanuel A. Essah email e.a.essah@reading.ac.uk) will be the only people who will have access to this data.

With your permission, I would like to tape the interview and transcribe sections later. Copies of the transcript will be made available on request and any changes which you request will be made. The data will be kept securely and destroyed when the study has ended, which will be a maximum of 12 months from completion of the research. The data will be used for academic purposes only.

Copies of the research findings will be available on request. If you have any further questions about the study, please feel free to contact me and/or my supervisors at the above addresses.

This project has been subject to ethical review, according to the procedures specified by the University Research Ethics Committee, and has been given a favourable ethical opinion for conduct.

Consent Form

Sustainability initiatives in Botswana construction sector

1. I have read and had explained to me by Keneilwe Ntshwene the Information Sheet relating to this project and any questions have been answered to my satisfaction.

2. I understand that my participation is entirely voluntary and that I have the right to withdraw from the project any time, and that this will be without detriment.

3. I understand that my personal information will remain confidential to the researcher and their supervisor at the University of Reading, unless my explicit consent is given.

4. I understand that I will not be identified either directly or indirectly without my consent.

5. I agree to the arrangements described in the Information Sheet in so far as they relate to my participation.

6. I would like to review the transcript of my interview before use

☐ Yes ☐ No

Signed

Print Name

Date

B: Research Permit, MIST

C: Sample Interview Questions

Interview Schedule: BOTEC projects

Date:

Background questions

1. Tell me about your background and how you came to be in this position
2. Can you give an account of past interest or experience with sustainability/sustainable construction?

BOTEC Projects

1. How/why did you come to be involved in the BOTEC projects?
    a. What were the main motivations and interests for you?
    b. What did you think the project was going to lead to?
    c. What were your expectations of the projects?
    d. Did you think other people shared your views on the expectations?

2. Can you give me an account of how it happened?
    a. The lead up to the projects?
    b. Who was involved?
    c. Sources of funding?
    d. What were the main challenges?
    e. What learning came out of that?
    f. Sharing of experiences?

3. What about the market potential of the technologies?
    a. Did anyone think or discuss about it?
    b. How were the technologies identified?
    c. Were the technologies already in use?

D: Sample Interview Transcript

Interview with the Researcher at Botswana Technology Centre (BOTEC). The interview was at the BITRI offices in Gaborone, Botswana on 31st August 2015 at 0830 hrs.

The interview lasted for 1hr and 9 minutes.

E. (BC1.1)

K. (Keneilwe Ntshwene)

To start, we had introductions about me; background and qualification experience and interest and those of the interviewee.

K: My name is Keneilwe Ntshwene. I am currently a PhD student at the University of Reading. I have an interest on sustainable construction and currently I'm working on this study looking at sustainability transition in Botswana construction sector. Maybe you can just give me a brief background about yourself; education and professional qualifications, professional experience and the type of projects that you are involved in.

E: Ok. My name is BC1.1. My first degree was in civil and industrial construction. My first degree was a master's degree which is the system…, the Russian system when I started. My PhD was in structural design specializing in cables suspended systems. After that I worked in applied research institutions. My first full time job was at the scientific and industrial research and development centre in Zimbabwe. I worked there for 5 years as a research scientist the first two years, and as a senior research scientist the last 3 years in the building technology institute whose mandate was development of new building materials from natural resources and industrial wastes (clears throat), and optimisation of structural designs solutions and the

optimisation of the use of conventional building materials with respect to raw material consumption and a response to load…, to stresses under loads. After the 5 years there I moved to work at Botswana Technology Centre, eeh… otherwise known as BOTEC where I worked for the next nine years. There I was working in the unit that was named civil engineering unit and I was a senior research civil engineer. The mandate of that unit was very much similar to the mandate of the building technology institute where I worked in Zimbabwe; that is development of new materials, construction materials also from natural resources and industrial bio-products. In this case, there was an additional infrastructure development, eeeh…, this was introduced after a regional research alliance was formed. It comprised of BOTEC itself SIRDC that is the Zimbabwean Scientific Industrial Research Development Centre and CSIR of South Africa. These three research and development institutions were the first ones to form this new entity called Regional Research Alliance (RRA). So its mandate was to address issues to do with the built environment, infrastructure included. So I led the infrastructure division of that research alliance that was under BOTEC. CSIR took another one Zimbabwe took another so infrastructure development was spearheaded by BOTEC and I was the leader on that group. The group will be formed by representatives from all these organisations. So, besides the materials development, optimisation and so forth and structural design, there was this added domain called infrastructure development. After the nine years of work at BOTEC, I moved to the University of Botswana where I was a lecturer for four and half years from January 2010 to June 2014. For four and half years as a lecturer I was taking engineering materials, a faculty course and construction materials a departmental course. Those were my major courses besides other courses being pursued by master's students. After the four and half years I joined the Botswana Institute for Technology Research and Innovation (BITRI) which is where I am now. In this new institution, I am a Lead Researcher in the Building Materials Science Division. The

mandate of that division again not surprisingly is very similar to SIRDC and my unit at SIRDC BOTEC.

K: Just for clarification maybe you can touch on the transition from BOTEC to BITRI. What changed? Has the mandate changed from the previous one of BOTEC to the new one of BITRI or is still the same as one of BOTEC just a name change?

E: There has been more than a name change. BOTEC had what was called units. Those will be equivalence of divisions in BITRI. Of the divisions that are in BITRI today, what has been sought of continued from what BOTEC used to be would be in part our building materials division because at BOTEC the civil engineering unit was not specialising only in building materials. It was also specialising in structural design and infrastructure development. But at BITRI this division concentrates only on building materials development, optimisation, assessment and testing. So with respect to other divisions for instance, in BITRI we have only two departments, that is, natural resources and materials and technology. What was in BOTEC and continues to be in BITRI is electronics, ICT was not there in BOTEC, but under technology we have ICT, electronics and energy. So its electronics and energy were also there in BOTEC. In materials, besides our building materials division, there is a division, a large one called nano-materials. That division was completely not there at BOTEC. So this is completely new in BITRI.

K. Coming back to the BOTEC projects, I understand you were involved in those, maybe you can tell me more about them, how did the projects come about and when did you get involved?

E. Right now at BITRI one of the major projects, one could safely call it the flagship project is the roll-out of the Kalahari Sand Building Block (KSBB) technology. So as you can see its roll-out. The technology itself was developed in BOTEC. It was developed during the time of

BOTEC and patented by BOTEC. It was patented in February 2010 just after I joined UB. Right, so that happened during the time when there was rationalisation of Government supporting institutions. In respect to BOTEC, rationalisation meant it being merged with another organisation called Rural Industries Innovation Centre (RIIC) into one organisation. So this patenting is happening when the focus is the merger. So the actual technical research work and later on its roll-out was pushed to the side-lines. As if that is not enough, the people who could have championed the roll-out, the people who had the technical knowhow were no longer at BOTEC me included. So there was nothing happening to this newly developed technology until BITRI was established. BITRI was initially mooted as the new entity to replace this although later it was now seen as a completely new having nothing to do with BOTEC. So all it did was to inherit …, to take over the assets of these two organisations in terms of fixed and non-fixed assets and run with those as its assets. So that is what happened.

K. Ok

E. So you ask what actually motivated for the technology as KSBB. When I joined BOTEC in 2001, there was a general, ehh I can't call it feeling but awareness in the countries that fall within what we call the Kalahari Sand Basin. There are about nine countries stretching from South Africa right up to Gabon that fall within what is called the Kalahari Sand Basin. Kalahari sand unlike popular belief is not limited to the Kalahari Desert. It is everywhere. In Zimbabwe we don't have any hint of a desert but it is there.

K. Ok

E. So what is peculiar about this soil type is it is a wind-blown soil, very fine grained. When I say fine I mean ranging from 0.06 mm diameter through to about 0.6, very fine, rounded and

completely devoid of any clay and silt fractions. So it has never been known to be used for building purposes because of that.

K. Ok

E. Now it started for instance in Zimbabwe it started with the challenges people faced building pit latrines because when you dig it is very unstable, it just falls in. So there was a challenge on how do you stabilise it so that the pit is there. Then there was an idea of actually producing masonry units from it. This was the initiative borne at BOTEC. So when I joined BOTEC I found this challenge having being articulated but nothing has been done so I took up that and developed this.

K. Who articulated those challenges and what were the specific challenges in Botswana. You mentioned the challenges in Zimbabwe what about those in Botswana, what were the issues?

E. The issues were, of the nine countries that were within the Kalahari Sand Basin, Botswana happens to have the biggest chunk of its territory under that type of soil, actually 75% of Botswana territory is Kalahari sand territory. So the challenge with Botswana was the most acute of all the nine countries in the sense that for the purposes of needing anything from your dwelling to institutional buildings in most of Botswana you had to import materials. As you know in construction import does not necessarily mean from abroad. It means from another distant place to where you are building. So you take for instance the Lobatse Clay Brick, its produced only in Lobatse because that is where you have the Lobatse clay fields. They are highly localised resource. The Makoro bricks are also in Makoro not because of any other reason besides that's where you find those clays. Now if you are building in Ghanzi or Shakawe you would have to carry those bricks to Shakawe to build a school, a house, a council building and so forth. Now the cost of hauling these building materials which are typically heavy because

these are earth products is very high. In some places it is actually higher than the cost of the materials themselves. Besides the cost of the materials being prohibitive the stress on the road infrastructure because remember building materials are typically very bulky and heavy. So the stress goes because almost all are transported by road and you talking of 30 tonne trucks typically that's what you use. Now the stress on the road was so much that the cost of maintaining roads as a result of that was not negligible.

K. Ok

E. So those considerations posed a greater challenge to Botswana to say okay is there no way of localising this, localising means using this material which we have here. It first even for road construction, Botswana does not have wide spread sources of granite. So most of the road material used for sub-bases would have to use calcrates and calcrates are known to have unreliable hardness strength. So that challenge also alongside the Kalahari sand exploitation.

K. Ok

E. So in BOTEC we decided to .., so this challenge was coming from industry from the people. Those are the people who kept on saying but what do we do with this. So ours was just to crystallise it, so the challenge is this, how do you use this type of soil for purposes of building. Popularly in this part of the world we use masonry units because we can afford to build at our pace any time of the year unlike in Europe where they use mostly pre-fabricated panels because of the weather where you need high speed construction. Here we do either in-situ concrete we can afford that with the time and the climate permits it or more popularly we use masonry units. So we targeted that because that what we can use it for as a source of material and that's what people use here as blocks or bricks.

K. Ok

E. So that is what motivated the research and development of finding out how can Kalahari sand be used to produce masonry units.

K. Very interesting. I will come back to the KSBB. But my interest was on the demonstration projects, the headquarters and the residential buildings in Gaborone West.

E. Yes

K. How did those come about, what were the factors that led to those and what innovations are in those buildings?

E. Ok, alright. The …, let's start with the senior ones meaning the ones that came first. The Gaborone West Phase One compound on plot 14949 is a place where there is no building that is made from the same material as the next one. They are all made from different materials. So it was a case of saying we will use different building materials and or building technologies to put up residential units to house our own staff and we will monitor the performance of those buildings in terms of the micro climate inside the houses, how much there is need for artificial heating or cooling or no need for the same and how durable are these materials against the elements. That project came …, was…, actually took place before I joined BOTEC but I know the history because I went through the archives. So these structures were put up in the late 80's early 90's and indeed there was monitoring in a very direct manner of temperatures variations within the building right, and heat gradient, how, what is the heat gradient inside the building with respect to the heat outside. But the materials that were used to build those houses were not necessarily from Botswana. They were materials from as far as Norway, where they use plywood on walls with insulation and materials from the region right, in the form of hydraform.

Hydraform is a technology that uses typically what we call G5 soil. But it needs to have some clay to be cohesive because we use only about 12% by mass, safety net. So it was a mixture of materials from all over right, to see what would best suit Botswana.

But it was not only limited to materials and technology of buildings. There was also the architectural aspect. If you were to go to that compound, you will find that the shapes of the houses some of them are pretty unconventional because what the architects did was to follow the zenith of the sun, to trace the trajectory of the sun and shape and orient the buildings in such a way that at a …, when it's cold; when its winter, then the sun's rays are allowed to penetrate the house to warm it. When its summer, then the sun rays are not allowed to penetrate so that the house remains cold. The residents were actually given something like an operational manual. From that when you are leaving the house to work, depending on which season you are, you have to open certain louvres which were on the roof or close them depending on the season. If you follow those operational rules, then you will eventually, in certain houses, for instance in the house that I lived in would not need any air-conditioning at all to warm the house. But if you violate them then it will not work. That is what happened first. I repeat materials were not necessarily from Africa, some were some were not.

So, findings of that exercise were published. One of the papers was published actually by me for the Domestic Use of Energy (DUE) Conference in Cape Town, South Africa. There is a paper on that right! So the houses that belonged to BOTEC that were under that category of research were only in that compound. Any other property somewhere else was just conventional materials. Then the headquarters of BOTEC itself was also built, actually when I joined BOTEC that's when we moved into this headquarters. It was meant to be a green building and it used what we call the solar chimney effect where hot air would be sucked out of the building by the chimneys that make this building distinctive even from a distance. And under the building, in

the territory of this there are quite a number of water reservoirs which are fed by the storm run-off. That water is supposed to be used within the building there is a water course which cascades. So the water would be circulating and cooling the building during summer. So this building was built as a green building. That is why you find that on the south wing of this building there is no air-conditioning, because it was supposed to manage itself.

K. Ok

E. How did it fare? When we moved in winters you would find that staff would find ways of bringing heaters. So that means the warming effect was not as good as was meant to be as per design. But during summer no one had any problem with the need of trying to bring air-cons to cool themselves down. So it would appear that the cooling effect during hot season was okay. So that is what happened with respect to manipulation of the micro-climate of the living space both at the compound and in the headquarters.

K. Ok, in both, I would talk about the specifics of the projects. But what I want to understand in both projects what were the broader issues that led to the projects. Were there in response to any particular issue, environmental issue or anything? I understand those were the innovations that were put in. What was the purpose of the demonstration projects? Were they demonstration projects or it just happened that this was the headquarters and those were the houses for staff.

E. They were demonstration projects. What motivated them, firstly it was energy saving. There was recognition that there is need to maximally save energy. As a matter of fact this followed a Southern African Development Community (SADC) conference in 1998 in Harare, Zimbabwe where energy experts of the region predicted that there would be a serious energy crisis within 10 years in SADC because the pace at which energy infrastructure was being built was far lower than the pace of energy consumption aggravated by aggressive migration, rural-

urban migration. So energy saving was a clear motivation for that. Then there was also the need to have durability in structures. That's where the material aspect comes in. I would say those were the major motivations for these. They were demonstration projects no doubt about that motivated by what I have just said.

K. Ok. Do you have any idea of the costs and who financed the projects?

E. As far as BOTEC is concerned, BOTEC was fully funded by the Government of Botswana. The headquarters I may not give you the exact figure but what comes to my mind now I remember it cost something like 30 million.

K. 30 million pula?

E. Yes, to put up the headquarters. The BOTEC houses I cannot put a figure to that. I don't have that information right now. If I had known the question earlier I would have made my research because I think I know where I can get that kind of information. So I can't put a figure to that.

K. You mentioned the two technologies; I would say the innovations within the headquarters, the solar chimney effect and the water reservoirs. Are they the only technologies within the headquarters or there are other innovations.

E. Well there is what we call a sunshield effect. If you look at this building you would find that, depending on which side you are looking at, there are areas where you have sunshields. In other words these are structures that protect the wall from direct beaming by the sun rays.

K. Ok

E. They usually take a decorative form. People who are not familiar with them usually think they are just decorations. Actually they are not decorative they are, their main purpose is to shield the building from the sun. Because what happens is, what makes a building not to be comfortable is in respect to heat for instance is the fact that the sun rays will have heat direct on the wall and then the wall material will transmit the heat. That is why we talk of a heat gradient. If your material has a low heat gradient, then that means the difference between the temperatures of the wall on the outside and inside is not much. For instance if outside you have 40 degrees Celsius, and the gradient is only about 5 degrees, so that means inside will be 35. That's what it absorbs. So if you can reduce the incidence rays heat then, there are many ways of doing that. So the other innovation in the headquarters building for instance is the sunshields.

In the residential buildings the innovation was orientation. The walls of the buildings are not typical. If you were to look at them you would wonder why someone would have such a shape because the orientation was such that you don't want at any point to have a very high incidence of the sun rays. Pretty much like the, you know this military plane called the self-bomber. The self-bomber is shaped in such a way that at no point would the radar actually hit surface and report back. It would hit and go astray. That is why the radar can't pick it. Because the radar works on this principle that it must hit and come back to report that there is an object there. So it won't come back because it goes somewhere else. So that is the principle that was used there. So those are the other innovations.

K. Ok. Do you have any idea who was involved when the projects were conceived?

E. You mean the Gaborone West and this one (Headquarters)?

K. Yes

E. Well to a greatest extent it was the researchers in BOTEC. Because that time BOTEC had a lot of researchers who were expatriates actually, from the UK and so forth. So it was them but in conjunction with Government officials. The Government officials were sought of putting forward that we have this challenge of excessive consumption of energy with these conventional offices that there need to be put air conditioners. That is why you will see that they are like bees there, air conditioners on the walls. So it's consuming because air conditioners are consuming a lot of energy. So can you come up with something? So this was a mutual effort with the Government expounding the problem and the researchers responding by proposing solutions. Whether the solutions succeeded or not is another issue now. For instance the houses in Gaborone West, those that used plywood have turned out not to be durable at all. They fell apart because plywood cannot withstand our high heat. They did not withstand much, but those made of earth like hydraform and so forth, those are intact.

K. During the .., when the projects were conceived was the policy favourable to the technologies because I understand there are building standards that have to be followed. Were there waivered or anything like that?

E. The mere fact that the structures were put up at all means there were waivers. There were waivers because it was understood that this is for research purposes. But after a technology has say been found to be acceptable generally then it had to go through the rigorous requirements of conformity with the regulations. You take KSBB; KSBB was developed as an S and T product. It went through all the peer reviews, rational assessment and so forth. That is a domain for researchers and industry. After the peer review and rational assessment and so forth had been put in place, then you needed to go to Botswana Bureau of Standards (BOBS) so that this product has a standard and a code of practice. So that was done. So it's a two stage thing.

Usually the environment here is quite amenable to entertaining your development stage. The Government gives in to that and its arms but after that then you need now to conform.

K. What impact has the projects or the technologies had on the industry so far?

E. The Gaborone West demonstration project unfortunately has had no real impact on industry. In other words the findings of that research endeavour have not been up-taken by industry. Nowhere would you find buildings that have been put up with orientation in mind and architectural form in mind. Everything is just standard. Nowhere have you seen a project, development project use for instance hydraform. You have seen individuals use hydraform. I know one house in Tlokweng which the client built using hydraform because he was impressed by it. But we don't have a development project use hydraform. So that one did not have the impact one would have wanted it to have. This building here is the only one that looks like that. If for instance it had had an impact, we should be seeing more of such buildings. But since it was opened in 2001, there is no other building that seeks to explore it, this technology.

K. So in other words these technologies are only seen in BOTEC?

E. Yah they are, they have remained there. They haven't really been up-taken by industry unfortunately. The only one is the KSBB. The KSBB has got standards now, two standards and as I said right from the beginning it is actually a flagship project for BITRI, the roll-out. So that one is being up-taken by industry.

K. What could be the reasons? I know you touched on especially the hydraform type of technology that people maybe were not impressed.

E. No, no they were impressed.

K. Yah, but what could be the reasons for this lack of impact or lack of adoption in the industry?

E. Well, there is no one-size fits all answer to that. Eeh, hydraform for instance, people actually liked it. It's actually you know mortar you just put mortar after certain courses just to tie the building together. It is interlocking blocks. The challenge with hydraform is the soils that you need are very rare in Botswana. The gentleman who had his double storey house built using hydraform technology had to source the soils somewhere beyond Mochudi. We have these pockets of laterites, they are called lateritic soils. That's what you need; you can't use it with Kalahari sand type of soil. So that is a limitation. I even know certain small and medium scale industries that were set up to exploit this technology. They ended up using crusher dust because there is no soil. It's difficult to find that soil. Hydraform would spread very easily in Zimbabwe for instance because laterites are plenty there. They tend to be reddish with high content of clay. So that takes care of that. With the others, the materials that were used in the …, I mentioned for all the way from Norway, right and the other from UK and so forth. They themselves turned out to be expensive because you would literally have to import this plywood from there. So it was not viable. So no one took that kind of technology.

K. But what was the original reason of importing materials as far as Europe?

E. As I said the researchers at that time were predominantly expatriates. As a person who has been in research for quite some time myself, the first consideration a researcher has in mind is not so much the cost but whether or not it can be done. So the cost comes later and usually when things are already done. Yes it is true that of recently researchers are called upon to input the cost effect, the cost factor into their work. But to tell you the truth that is very rare. That is usually seen more as an institutional issue than a researcher's issue. Researchers say can we do it or not, that's it. And then afterwards if it is affordable, well enough if it is not then something

can be done now to say okay maybe we should change this to make it affordable, and then the results. But otherwise it's done even the KSBB. KSBB there is no way we could have said, we could predict that you know what if we can find a way of using this material it must be cheaper because that means you have cut out the need for transport. There is no way it can be expensive. But that is intuitive. That is you have not really sat down. It turned out that intuition was correct because it is quite logical that if you are using material on the spot it must be cheaper than material that was carried from somewhere. Two, this material does not need any firing. Just open air curing. So that means you cut down on the firing which is done at Lobatse and Makoro. So it's obvious that you could say there is no way it can't be cheaper than the others. So these guys, as you can see the plywood is there, is soft wood. We don't have plywood here. Plywood means soft woods. Here in this part of the world we don't have soft woods. So they brought the materials they are familiar with that's where it came from, you see. So that played a role.

K. Are those houses still operational? Are people still living there?

E. Eeh…, in some of them yes.

K. What support do you get from Government to make them a success or to make …, I would like you to take it generally. These were demonstration projects what support did you get from Government to make them successful?

E. I think to be fair to Government, the mere fact that they were prepared to fund an organisation that undertakes that kind of projects, is already support enough but your question is here they are there are there now so why? I think the challenge is less before the Government than before researchers because one, I don't think it was a good idea in the first place to try out technologies whose raw material base was known to be not here. Personally I think that was not a good move to say okay let us try out hydraform. I mean hydraform, yah it worked but where is the soil, you

see, that's two. In all these, plywood was examined to say we would look at these. So I don't think that was a good move in the first place but whose fault is that, Government is not aware of that. They make higher level decisions. This is the choice of researchers on the ground. Yah!

With respect to this building, this building, I think, even here you can't say but why is Government not supporting replication of this building. Who is pushing for that, I mean. I think industry; it's more to do with researchers championing this technology and industry working together with them to say, if for instance this was a success, let's say it's considered to be a success, 60%; 70% success in terms of energy saving, then you can't market by just putting it up and letting people look at it, right. You have to push the idea; you have to push like we are doing now with the KSBB. Like, we had an open day on the 15th of July where all people were invited, stakeholders, industry and so forth. You see what I mean, you can't just say people who are driving past, they are seeing it and they will like it. They just look and don't understand why you are having all those things turning up there.

K. So basically what has the industry done to try to understand or try to replicate what you have or, you, what have you done to try to sensitise the industry of what is available here or how they can benefit from some of these technologies?

E. Very little, with respect to the Gaborone West demonstration project and this. Very little really. I am not aware of a deliberate effort to sensitise people to those technologies.

K. So I your opinion, the open day that you just mentioned was it the first or it has been happening for some time.

E. Well as far as we are talking about our products, the open day…, the KSBB technology open day was the first one meant for promoting our own product. By the way this was not the first

effort. When the KSBB was developed it, there was …, took it out of its way to follow certain channels that are required in order to promote and facilitate the uptake of a new technology. There is what we call rational assessment; that is the professional consultancy is engaged to use that material, to design a structure. They will design say double storey building and calculate the loadings based on the density of that material and so forth and give a professional evaluation that this material is fit for purpose to build three storey buildings and not more, for instance. That is called rational assessment. There is also the…, this one is based in South Africa, is called…, is not.., actually is universal just that its headquarters in this part of the world is in South Africa is called eeh…., how can I forget this eeh…, eeh.. You subject this new technology to that. I will try to remember its name. But the sense behind it is; it's a certificate of acceptability of a material. So for that to happen, the material will have to undergo a number of tests. It could be stress related tests like strength; it could be durability or soundness depending on the material you dealing with and where it's to be used; is it a tile on the roof; is it a wall and so forth. There are a number of tests stipulated in standards. So this material was subjected to that; to test the product in South Africa.

And then you have what you call peer reviews where you invite people; stakeholders. Stakeholders in the case of building material like KSBB would be your design engineers, your architects, your contractors people who actually use these and your quantity surveyors and so forth; to come and say yes. All this was done at different stages right; to say just come together. The peer review was done at Fairgrounds for instance for three days where delegates from all over came in. Before they even came in they were given write-ups about this technology so that when they come there they already have a very good idea about it. So these people would be told about this technology, they are shown demonstrations tests were conducted in front of them and then they go back and give feedback in terms of questions, we not happy about this, about

that; all that was done. So you see you need to push it and then the momentum was lost as I said earlier on when the merger now became centre stage. So this BITRI effort now is to revive that thing, right! So what has happened, we have had Government delegations here to come and see; we demonstrated to them the tests and so forth, the test walls and so forth; we have even a demonstration house at that same compound. Someone is living in it as we speak. We built it with this material. So we are targeting the decision makers then the open day was targeting the market, the doers and the designers, right! We even targeted the funding agents like Citizen Entrepreneurship Development Agency (CEDA), Local Enterprise Authority (LEA) and so forth to say listen, if tomorrow someone comes and say what I need a loan because I want to open the KSBB depot, they know what that person is talking about.

K. So have they been made aware of the technology?

E. Yes, they have been. We have had meetings with them and they were also represented at the open day. So what I am saying is I have not seen similar things happen with these other technologies.

K. Ok

E. Yah

K. Talking about the KSBB what is the cost compared to the normal brick. Is there any cost comparison or what is innovative about the brick as compared to the other bricks?

E. What is innovative about the brick; first is the fact that, the mere fact that it was actually patentable. It means it has what we call the inventive step in patent language. And what was that inventive step? It was for the first time a soil type that has never been known to be used

and has never been used for moulding masonry units; a technology for doing that was actually put in place.

K. Was that in Botswana or…?

E. No, the worldwide; because this type of soil here is called Kalahari, in China is called what; they are there these soils somewhere. Otherwise we would have not been able to patent it because there is what we call patent searches; they will say no, what you are saying has been done somewhere else. So they are wind-blown sands. You can find Kalahari sands in the UK because the wind can carry it up, especially on the roofs you find it there right! But of course is not so much as to affect their soils, but you find it there this type of soil. But what was the most interesting part about the case here was that a number of mix designs; eight of them were developed with predictable strength. In other words the invention went as far as say if you want to end up with a block which will have strength of 7mpa after 35 days then you mix in these proportions. Even hydraform doesn't have that. So only concrete has that; only in concrete can you do that. Can you choose a mix design with an intended …, say for instance say I want 30mpa; then the concrete technologist would say is that what you want?, yes; then he knows how to mix for you to achieve that. You don't have that with earth based units; or the so called compressed earth blocks, you don't have that. So Kalahari sand.., the technology has that capacity. So that is what.., actually the title of the invention was Target Strength Kalahari Sand Building Block Mixes; that was the …, so target strength is the strength you want before you can even mix. So that is the innovative part of the thing that made it patentable.

Then you said okay how about the costs. We have done some costs comparisons of the Kalahari sand masonry units. I keep on using the word masonry units because it can be a block it can be a brick; right. With five very widely used types of bricks in Botswana; just to give you an idea,

Kalahari sand came at 82% the cost of the cheapest of the five and 33% the cost of the most expensive. Did I make any sense to you?

K. Not really

E. I said if for instance; typically we cost masonry units by a square metre for walling; right! So if we were to say; I am using Makoro brick; Lobatse, I am using Kwena concrete products; a brick and so forth and I am building a load bearing wall right; one square metre of it. How much does that wall cost? So if the cheapest wall cost; of the five cost 100 Pula, then the Kalahari sand was 82 Pula; of the cheapest. If the most expensive cost say; 200 Pula, then the Kalahari sand block cost 33% of that which is 66 Pula. We have compared with the tables, we have everything.

K. Ok

E. Another way of illustrating the cost effectiveness of this technology is by looking at the most costly component of it. What is it? What goes into Kalahari sand block? Is the Kalahari sand itself, then the blend; the blend in this case we are using Morupule fly ash mixed with Ordinary Portland Cement (OPC); that's pure cement OPC; right; and then water. So what is the cost? Say you are building in Ghanzi or Shakawe or Maun or Kasane. What's the cost component of the sand? It is just haulage. You go to mining, you get allocated a burrow pit site, and you mine it; the mines allocate it to you on the condition that you rehabilitate it afterwards if you have exhausted it. So the real cost is hauling it from the burrow pit to the project site. Isn't it? Which is not much? Then how about the water? We have tested that Kalahari sand block is not sensitive to salinity of water. The worst you can get out of using saline water is efflorescence which has no performance related detriment. It is an aesthetic issue; efflorescence. So water is not also an issue because you don't need to have the trouble of looking for portable water; a thing you

might need to do when you are using concrete for instance. So the most important …, the most significant cost is the blend; because that one needs to be manufactured and we are going to be manufacturing it in Palapye. Why in Palapye; because the bulk of it is fly ash. So we want to manufacture it close to where the most bulky material is to avoid the need to carry it. So we will just import OPC either from Zimbabwe or South Africa depending on which is closer and cheaper. So we produce the blend. Now when we compared the cost of the blends; because even the cement we buy is also blends; right! So we compared and found that the cheapest of them all after being transported to Tsabong; Tsabong as a case study is 79 Pula. When we manufacture our sample and take it also to Tsabong it would cost 55 Pula; after making a mark-up just like the others did.

K. So it will be cheaper to ……

E. So there is no way the final product can be more expensive because the most important component in all of them is the cement. And our cement…, the cement for our sand won't be this one. It will be our own. That is why we have to build our own blending plant. It has a higher content of fly ash, up to 65% by mass.

K. So that plant is already under construction or you are still to design…..

E. No we are going to float…, actually today; we going to float the tender today.

K. Ok, lastly, just the last questions. What does sustainable construction mean to you?

E. For me as someone who has been in research in the built environment domain, sustainable construction for me means; you have to name with respect to what. Now first are the materials because as a matter of fact in any construction project the highest cost is the cost of materials. And that cost is increasing with time, why; because we are depleting the conventional sources

of raw materials and we are increasingly having to use non-conventional materials. We are having to use natural resources but processed differently. And that arm is decreasing because these natural resources are not renewable. So were increasingly having to use man-made materials or materials produced using industrial wastes. And those need even more processing because of issues of toxicity in certain cases. So if we want to have sustainable housing, we must find ways of developing affordable, cost effective but durable aesthetically appealing materials. So the first thing to concentrate on is developing of construction materials. Second…., so that is…, if we can do that.., if we can continue working on that, we would have sustainable. Sustainable in the sense that it is something that we can live with in terms of our capacity to replicate; to expand our living space. Then sustainable to me also means having put up this structure, what is the cost of running it? Have you put up a structure and there is a beehive of air conditioners there because you can't simply live in there if the air condition is not working? If we can now make sure that we shape; orient our buildings in such a way that we minimally use or if possible avoid use of artificial micro-climate developments; heating, cooling; especially cooling because here in this part of the world cooling is of more concern to us than the heating because we have longer hot times than cold ones and science has shown that creation of cold is several times more than creation of heat. So if we can now attend to that, then we are going to have sustainability. Then in this case sustainability is the running cost is not something that is a preserve of those who have money. You don't want to spend the whole day sitting under the tree because you can't stay in your house; because it's too hot. You see what I am talking about. So that is what it means. So the cost of running this built environment is also an aspect of sustainability.

K. Ok

E. Yah

K. No thanks a lot for your time BC1.1. Maybe one will ask, is it possible to get any notes about the demonstration projects, any notes or minutes of what transpired when they were conceived from the archives?

E. I can't promise that one, I can see if I have anything in my personal library because the archives that were put in place by BOTEC are not very easy to use now because they have been moved to those houses and it is difficult to follow now the way they were, its difficult. For instance, you see that pile there, that's KSBB material there. For me to get that it took about…, the lady managing them had to go and literally sift through material to find those, big as they are. So.., but I will check in my own personal library and see if a can find something for you.

K. Thanks a lot for your time.

E. Okay

End of Interview