

University of Regensburg

IRE|BS International Real Estate Business School

IRE|BS Foundation for African Real Estate Research



Sustainable Construction in South Africa

Master Thesis in Partial Fulfilment of the Requirements
for the Degree of Master of Science

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Date of submission: 22/07/2016

Number of words: 17,642

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List of Acronyms

A

A21 SCDC	Agenda 21 for Sustainable Construction in Developing Countries
AMD	Acid Mine Drainage
ANC	African National Congress

B

BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BNG	Breaking New Ground
BREEAM	Building Research Establishment Environmental Assessment Method

C

CBE	Council for the Built Environment
CIB	The International Council for Research and Innovation in Building and Construction
cidb	Construction Industry Development Board
CidB	Conseil International du Bâtiment
CPD	Continuing professional development
CRDP	Comprehensive Rural Development Programme
CRLR	Commission on Restitution of Land Rights
CRSES	Centre for Renewable and Sustainable Energy Studies
CSR	Corporate Social Responsibility

D

DAFF	Department of Agriculture, Forestry and Fishery
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DBE	Department of Basic Education
DEA	Department of Environmental Affairs
DHET	Department of Higher Education and Training
DME	Department of Minerals and Energy
DoE	Department of Energy
DoH	Department of Housing
DPME	Department of Planning, Monitoring and Evaluation
DPW	Department of Public Works
DST	Department of Science and Technology
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
E	
EVI	Environmental Vulnerability Index
G	
GBCSA	Green Building Council of South Africa
GCIS	Government Communication and Information System
GDP	Gross Domestic Product
GHI	Global Horizontal Irradiation
GNI	Gross National Income
H	
HDA	Housing Development Agency
HSRC	Human Sciences Research Council
I	
ICC	International Code Council
IEA	International Energy Agency
IgCC	International Green Construction Code
IPCC	Intergovernmental Panel on Climate Change

J

JLL Jones Lang LaSalle

L

LEED Leadership in Energy and Environmental Design

N

NDP National Development Plan

NGO Non-governmental organisation

NHI National Health Insurance

NMMU Nelson Mandela Metropolitan University

NPC National Planning Commission

O

OECD Organisation for Economic Co-operation and Development

P

PwC PricewaterhouseCoopers

R

RDP Reconstruction and Development Programme

REIPPPP Renewable Energy Independent Power Producer Procurement Programme

S

SACN South African Cities Network

SAIA South African Institute of Architects

SARVA South African Risk and Vulnerability Atlas

SEC Socio-Economic Category

SERI Socio-Economic Rights Institute of South Africa

SOPAC South Pacific Applied Geoscience Commission

U

UN United Nations

UNDP	United Nations Development Programme
UN DESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
UNEP DTIE	United Nations Environment Programme Division of Technology, Industry and Economics
UNEP-IETC	United Nations Environment Programme - International Environmental Technology Centre
UNFCCC	United Nations Framework Convention on Climate Change
UNCHS	United Nations Centre for Human Settlements
UN-Habitat	United Nations Human Settlements Programme
UNISA	University of South Africa
UNO	United Nations Organization
USA	United States of America

W

WCED	World Commission on Environment and Development
WHO	World Health Organization
WWF	World Wildlife Fund

1 Introduction

It has been more than three decades now since sustainability became a topic that moves people all over the world. Sustainable construction as a sub-branch emerged around twenty years ago and has since been developed steadily. While this concept is ruling the market for commercial and institutional buildings in countries like the United States of America (USA), Canada or China, sustainable construction in emerging countries is still in its infancy.¹ South Africa, as both a developed and a developing country, has made much effort in introducing green building practices.

1.1 Statement of the problem

Climate change is a severe problem worldwide and its primary cause is the emission of greenhouse gases into the atmosphere. South Africa already experienced a significant rise in temperature, forecasting an increase of up to 4 °C by 2050. The country's general scarcity of water is alerted to result in a fatal water shortage provided that there is no change in our treatment of the environment. Moreover, rising temperatures, increased rainfall and carbon dioxide in the atmosphere change the ecosystem and endanger South Africa's national parks, e.g. the Kruger National Park. Agriculture, fishery and forestry also face climate change related threats. This implies economic problems due to decreasing exports and tourism, as well as rising unemployment rates. Climate change further directly impacts the South African society. Tropical diseases such as malaria and cholera might become more prevalent, caused by higher temperatures and rainfall. The lack of safe drinking water, especially in rural areas, further exacerbates this problem.²

The main driver of greenhouse gas emissions is the production of energy. According to the International Energy Agency (IEA), 40 % of total energy generated is consumed in buildings and during construction.³ Therefore, the construction industry is in the position to make a major contribution to creating an environmentally and thus economically and socially more sustainable future.

¹ See Kibert (2013), p. 1.

² See Turpie et al (2002), pp. 6-35.

³ See IEA (2016).

1.2 Objectives

The goal of this study is to review South Africa's current situation regarding sustainable construction and, as a result, to provide a strategy for action to further drive the uptake of green building practices in the country. This shall be done on the basis of the "Agenda 21 for Sustainable Construction in Developing Countries" (A21 SCDC), published in 2002 by the International Council for Research and Innovation in Building and Construction (CIB) and the United Nations Environment Programme's International Environmental Technology Centre (UNEP-IETC).⁴

1.3 Scope of the study

Similarly to the A21 SCDC's restrictions, several macro-scale factors like political stability, transparent governance, economic growth, the HIV/AIDS pandemic and natural disasters go beyond the scope of this study and are therefore excluded.

1.4 Course of the study

Chapter 2 provides an insight into sustainable construction as a holistic concept and therefore deals with the emergence of sustainable thinking, the terminology used and the environmental, social and economic linkages between sustainability and the construction sector. Chapter 3 introduces the South African context, pointing out the developmental issues the country is facing, while Chapter 4 shall combine the findings previously made to figure out the challenges and barriers South Africa is facing when aiming to pursue sustainable construction, as well as the opportunities it offers. Chapter 5 reviews the A21 SCDC to identify its relevance and current state of implementation in South Africa, while the strategy for action is set out in Chapter 6.

⁴ See CIB / UNEP-IETC (2002).

2 Sustainable construction – an outline

Sustainability is a subject that moves mankind worldwide, but it is often treated superficially. Seriously considering the topic, the preservation of the environment, social responsibility and equitable distribution of wealth are equally important. As abovementioned, the construction sector has the ability to substantially contribute to creating an environmentally more sustainable future. The built environment further shapes every individual's and the whole population's social and economic situation.

This chapter provides an insight into the history of sustainability, the terminology used and the environmental, social and economic linkages between sustainability and the construction sector.

2.1 Emergence of sustainable thinking

The concept of sustainability initially originates in the field of forestry and was first defined by Hannß Carl von Carlowitz in 1713. In light of an imminent resource crisis, he demanded conservation of natural resources to preserve the nature. At first, this concept described the method of only cutting down as much timber as could grow back by sowing and planting.⁵ Von Carlowitz therewith established a cross-generational view to resource economics and recognised responsibility towards future generations for the first time.



Figure 1: Timeline - Emergence of sustainable thinking

From the mid-1970s, ecological, economical and social problems were piling up (e.g. forest dieback, water pollution and poverty), leading to a growing interest in environmental protection. The United Nations Conference on the Human Environment, having met in Stockholm in 1972, was seeking solutions to these problems. This was

⁵ See Carlowitz (1713), pp. 105f.

the first UNO world conference and thus the start of an international environmental policy.⁶

In 1983, the World Commission on Environment and Development (WCED) was founded, which published the “Our Common Future” report four years later. In this document, also named “Brundtland-Report”, the most widely used and accepted definition of sustainable development is set out: “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”⁷ This statement, clearly focusing on intergenerational justice, served as a basis for subsequent environmental agreements. Special emphasis should be placed on the Rio Declaration on Environment and Development in 1992, which declared the efforts for a sustainable development. As outcomes to the conference, five documents were signed to incorporate the concept of sustainability.⁸ Probably best known is the Agenda 21, announcing detailed mandates of action at national level.⁹ In the follow-up conferences for sustainable development in Johannesburg in 2002 and in Rio de Janeiro in 2012, the concept of sustainability was further strengthened. The most important agreement in the context of climate protection worldwide is based on the Kyoto Conference in 1997. By the ratification of this protocol, almost all of the participating nations - except for the USA - committed themselves to significantly reduce their emissions. Canada withdrew in 2012.¹⁰ In the course of the annual climate conferences, the agreement is updated regularly.¹¹ Another milestone in sustainable development was the Millennium Summit in New York in 2000. The assembly was the largest gathering of the heads of state or government at that time. The participants agreed on a catalogue of measures with clear target and time specifications, primarily aimed at halving poverty in the world until 2015. Environmental sustainability was one of their eight so-called Millennium Development Goals.¹² At the end of September 2015, these goals were extended by seventeen Sustainable Development Goals, which aspire to completely eradicate poverty and hunger until 2030.¹³

⁶ See UNEP (1972).

⁷ WCED (1991), p. 43.

⁸ See UN (1992a).

⁹ See UN (1992b).

¹⁰ See UNFCCC (2014).

¹¹ See UN (1998).

¹² See UN (2000).

¹³ See UN (2015).

To date, the activities are extensive and the principle of sustainability is in constant development.

2.2 Terminology

The term “sustainability” is increasingly gaining importance nowadays and constantly appears in different contexts. Despite the frequent use of this word, it is fairly vague, little concrete and thus subject to uncertainty. In order to clarify the meaning and origin of sustainability, sustainable development and sustainable construction and to avoid any misunderstanding, these terms shall be defined below.

2.2.1 Sustainability

The terms sustainability and sustainable development are often mistakenly interchanged. To clarify the differences and connections, one should take a closer look at the meanings of the words sustain and sustainable.

to sustain: 1 to provide enough of what sb/sth needs in order to live or exist

2 to make something continue for some time without becoming less

sustainable: 1 involving the use of natural products and energy in a way that does not harm the environment

2 that can continue or be continued for a long time¹⁴

Therefore, sustainability is a condition or state, whereas sustainable development is the procedure or course of action to achieve sustainability.

“As human beings are the centre of our concern for sustainable development”¹⁵, they form the basis for any action. Basic human needs have to be met without destroying or degrading the planet earth and with further regard to future generations. Life shall not only be safe, healthy and prosper for everyone, but should as well be in harmony with environmental, social and cultural values.¹⁶ This idea led to the so-called triple bottom

¹⁴ See Oxford University Press (2005), p. 1548.

¹⁵ UNCHS (1996), p. 2.

¹⁶ See UNCHS (1996), p. 1.

line of sustainable development, comprising economy, society and environment. The model consists of three interdependent and mutually reinforcing pillars.¹⁷

Environmental sustainability is basically defined as a state where the needs of present and future generations can be satisfied, without affecting the health of the natural system,¹⁸ while social and cultural sustainability is seen as a condition where social health and well being of everyone is ensured.¹⁹ Regarding economic sustainability, the major concern is to achieve a state, where “wealth (in terms of access to resources and opportunities)” is equitably distributed.²⁰

2.2.2 Sustainable development

As stated in section 2.1.2, sustainable development is the procedure or course of action to achieve sustainability. Due to continuously changing circumstances (environmental, social and economical), the process has to be adapted and updated constantly. The main goal is to find a way of balancing the needs of human beings and their descendants while trying not to deteriorate the ecosystem. Sustainable development therefore “requires the promotion of values that encourage consumption standards that are within the bounds of the ecologically possible and to which all could reasonably aspire.”²¹

The major problem is that many needs are in conflict with one another. For example the need for logged wood to build houses collides with the need to prevent deforestation. Or the need for clean air conflicts with the need for cars as comfortable means of transport. There are numerous other examples of opposing interests, causing the necessity of trade offs. Which needs go first? How can a proper balance be found that satisfies everyone? Who decides what these compromises should look like?

It is obvious that the various needs cannot all be met to the same extent at all times. Referring to the three pillars of sustainable development, it is also obvious that the different approaches are facing trade offs at any time. The crucial task is to find a balance which is not just bearable, but gratifying for everyone.

¹⁷ See UN (2005), p. 12.

¹⁸ See Morelli (2011), p. 5.

¹⁹ See Dillard / Dujon / King (2009), pp. 1-12.

²⁰ CIB / UNEP-IETC (2002), p. 6.

²¹ WCED (1991), p. 44.

2.2.3 Sustainable construction

The Conseil International du Bâtiment (CIbB) defined sustainable construction as “creating and operating a healthy built environment based on resource efficiency and ecological design.”²² However, due to national features, the definition needs to be given context. In South Africa, the impact of the construction sector on economic and especially on social and cultural sustainability is by far more relevant than its impacts on the environment. The reasons for this primarily lie in the country’s history, making social equity a matter of higher concern than any other.²³

Further, a building’s impacts on the environment extend way beyond the construction phase. Therefore, the most important prerequisite for assessing the sustainable quality of a building is to consider its whole life cycle. To ensure sustainable construction, the guidelines and standards of sustainable development need to be applied to each part of a building’s life cycle. As illustrated in Figure 2, this cycle includes the phases of planning, construction, use (including modernisation) and demolition.²⁴ Using environmentally sustainable construction materials alone is not all that is needed to build sustainably. Management and maintenance of a building during the use phase has to be considered, as well as the effects of refurbishment, demolition and recycling.²⁵

²² Kibert (1994).

²³ See CIbB (1998), p. 33.

²⁴ See BMUB (2016), p. 18.

²⁵ See BMU (2011), p. 14.

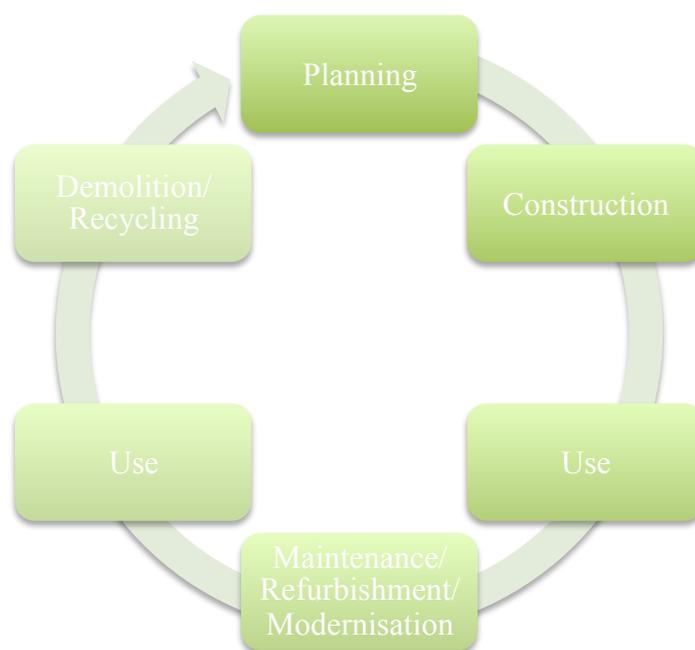


Figure 2: Construction life cycle

With regard to the three pillars of sustainable development, in particular the ecological perspective, an optimisation in the fields of resources, energy, water and sewage is crucial.²⁶ The socio-cultural factors determine the users' appreciation of a building's value. Factors like comfort and health, safety or functionality should be taken into account.²⁷ Regarding the economic dimension on a sustainable basis, it is important to also consider the on-going costs of a building, rather than solely focusing on its investment costs. As abovementioned, a construction has to be assessed on the basis of its whole life cycle.²⁸

2.3 Sustainability and construction linkages

Each phase of a building's life cycle can have both, positive and negative effects on environment, society and economy. As summarised in Table 1, there are several approaches to ensure sustainability in construction. While much attention has been paid to environmental and economic linkages to the building sector, social sustainability was long left behind. As opposed to this, developing countries tend to focus on social development while neglecting the environmental impacts of construction. Whatever category is considered most relevant, the other two need to be pursued as well.

²⁶ See BMUB (2016), p. 15; BMU (2011), p. 17.

²⁷ See BMUB (2016), p. 15; BMU (2011), p. 17.

²⁸ See BMUB (2016), p. 15; BMU (2011), p. 16.

Table 1: Approaches for sustainability in construction

Category	Approaches
Environment	<ul style="list-style-type: none"> • Use of green, locally produced building materials • Reduction of quantity of building materials used • Reuse of materials or whole building structure • Use of renewable energy • Efficiency in the provision of water • Appropriate choice of location
Society and culture	<ul style="list-style-type: none"> • Ensuring decent working conditions • Ensuring access to adequate, affordable housing • Provision of basic services • Provision of public services
Economy	<ul style="list-style-type: none"> • Consideration of on-going costs • Use of local skills

2.3.1 Environmental sustainability in construction

There is no doubt that construction and use of buildings have impacts on the environment. Resources, such as building materials, energy and water are needed during all phases of a construction's life cycle. Further, the operation of buildings impacts the ecosystem, especially concerning air and water pollution. But not only does the construction industry affect the environment, the environment also affects the buildings and users themselves, as they are exposed to potential environmental hazards.

A major issue regarding environmental sustainability in construction is to select appropriate building materials. These materials can be defined as “those that use the Earth's resources in an environmentally responsible way.”²⁹ They are made from recycled, renewable or abundant sources and should be manufactured, used and recycled sustainably.³⁰ In the first instance, the use of locally produced materials should be preferred. Large transportation distances significantly contribute to the quality of the environment in terms of emissions and associated resources. By minimising these

²⁹ Spiegel / Meadows (2012), p. 27.

³⁰ See Spiegel / Meadows (2012), p. 27.

distances, the materials' negative ecological effects can be reduced.³¹ Further, care should be taken to reduce the quantity of building materials used for construction. Especially developing countries are facing problems of deforestation and land degradation, due to unsustainable harvesting for example.³² It is also desirable to reuse components from old buildings or to even reuse an existing building's structure.³³ Unnecessary use of materials mainly causes waste, which is often dumped improperly and thus leads to increased vermin occurrence.³⁴ A well-elaborated selection of building materials is also important to avoid any potential health hazards for the construction's users. Asbestos, lead paint, arsenic-impregnated timber and formaldehyde binders in insulation foams and pressed wood products are recognised as hazardous materials by the World Health Organisation (WHO) and therefore need to be excluded from any construction process.³⁵

According to the IEA, around 40 % of total energy generated is consumed in buildings and during construction.³⁶ As the production of energy is the main driver of greenhouse gas emissions, the construction industry ranks as one of the central contributors to climate change.³⁷ To reduce the negative ecological impact of the built environment, the use of renewable energy and the improvement of energy efficiency in cooling, heating and electricity in buildings are essential.³⁸ Besides the direct energy consumption during the operation phase, the amount of energy used during construction, refurbishment and demolition needs to be considered as well. Especially the production of concrete and steel and raw materials is energy-intensive and greatly contributes to CO₂ emissions.³⁹

Another part of environmental sustainability in construction is efficiency in the provision of water in terms of fresh water and sewage. Fresh water is a scarce resource, particularly in poor or developing areas. Harvesting rainwater, minimising losses and leaks and the reuse of water are just a few methods of guaranteeing water efficiency.⁴⁰ The building materials manufacturing industry, as well as the construction industry and the buildings' occupiers themselves further pollute existing watercourses and -systems

³¹ See Kibert (2013), p. 364.

³² See CIB / UNEP-IETC (2002), p. 15.

³³ See Kibert (2013), p. 362.

³⁴ See CIB / UNEP-IETC (2002), p. 14.

³⁵ See WHO (2011), pp. 50-52.

³⁶ See IEA (2016).

³⁷ See IPCC (2014), p. 381.

³⁸ See BMU (2011), p. 17.

³⁹ See CIB / UNEP-IETC (2002), pp. 13f.

⁴⁰ See UN-Habitat (2012), p. 20.

by waste and sewage. The contamination of fresh water most importantly leads to diseases and therefore constitutes a serious threat to users' and occupiers' health.⁴¹

Discussing the environmental impact of construction, the choice of location cannot be neglected. Transportation is a major contributor to green house gas emissions, making it obvious that denser populated areas allow a reduced carbon footprint. Further, they promote walking and cycling as an eco-friendly means of locomotion. However, there is a threshold where density becomes congestion and thus living conditions (environmental, social and economic) deteriorate.⁴² Over-occupation also leads to irreversible destruction of land (e.g. soil erosion), mainly occurring in developing countries with poor-quality soils.⁴³

2.3.2 Social and cultural sustainability in construction

The construction industry mainly affects people and societies in two different ways. On the one hand, there are impacts on the users or occupants of buildings; on the other hand, there are impacts on the people involved in the construction process, particularly the workforce.

Construction work - especially in developing countries - is fraught with many dangers. Accidents at the building site and diseases arising from past exposure to hazardous materials (e.g. asbestos, lead paint) are often observed.⁴⁴ Further, the construction industry in low-income countries pays poorly and does not offer any securities in terms of health care or pensions. Women additionally have to deal with gender discrimination and even sexual harassment.⁴⁵ Decent working conditions should be ensured to improve safety, equity and fairness during the construction phase.

Considering a building's whole life cycle, social responsibility does not stop once the construction itself is completed, but needs to cover the use phase as well. Social sustainability should go beyond the fundamental needs (affordability, safety) and address the demands for transport, facilities, education or even neighbourhood quality of the local community to support social development.⁴⁶ As a matter of principle, the

⁴¹ See CIB / UNEP-IETC (2002), p. 14.

⁴² See UN-Habitat (2012), pp. 14f.

⁴³ See CIB / UNEP-IETC (2002), p. 15.

⁴⁴ See UNEP DTIE (2003), p. 72.

⁴⁵ See CIB / UNEP-IETC (2002), pp. 15-16; UNEP DTIE (2003), p. 73.

⁴⁶ See Ancell / Thompson-Fawcett (2008), pp. 432f.

provision of adequate housing should be affordable for all. In this context, adequate does not only mean having a roof over one's head, but also having access to energy and fresh water, proper sanitation and infrastructure. Any potential hazards (physiological, psychological, infection- or accident-related and environmental) need to be prevented.⁴⁷ Besides the provision of basic human needs in place, public services should be easily accessible. Healthcare, schools and shops should preferably be within walking or cycling distance, to make them reachable for everyone and therefore avoid the necessity of relying on cars.⁴⁸ Bearing in mind that the needs of users and occupants are constantly changing in the course of time, buildings should at best be flexible and customisable. The requirements of people with restricted mobility, as well as those of elderly people and children need to be respected.⁴⁹

2.3.3 Economic sustainability in construction

Usually more than half of a nation's public expenditure flows into construction processes (57 % in South Africa in 2014⁵⁰) and therefore the construction industry represents a significant share of a country's GDP (18 % in South Africa⁵¹).

As mentioned before, it is important to also consider the on-going costs of a building, rather than solely focusing on its investment costs. Energy, water, sewage and waste need to be paid for during a construction's whole life cycle. However, buildings do not only cause costs, but also serve as a long-lasting asset. Moreover, construction and operation of buildings add new jobs to a local community and thus represent a large economic employer. In 2015, 471,000 people in South Africa were officially employed in the construction sector, representing more than 5 % of the working population (excluding agriculture).⁵² Hence, economic sustainability in construction also means using local skills and resources to support the communities' economic and social development.

⁴⁷ See UN-Habitat (2012), p. 35.

⁴⁸ See BMU (2011), p. 17.

⁴⁹ See UN-Habitat (2002), p. 43.

⁵⁰ See Statistics South Africa (2015a), pp. 2 / 7f, own calculation.

⁵¹ See GCIS (2015), p. 112.

⁵² See Statistics South Africa (2016a), pp. 2 / 12, own calculation.

3 South African context

Examining sustainability and sustainable construction in a certain country, it is indispensable to look at its geographical, historical, economical and social features. South Africa is exceptionally marked by its past and is still dealing with high levels of inequality in all different kinds of aspects. Moreover, the republic can be characterised as both, a developed and a developing country, which further complicates the approach.

This chapter provides a brief introduction to South Africa's history and present state, pointing out the developmental issues it is facing.

3.1 Geography and climate

The Republic of South Africa is the southernmost country of Africa, bordered by Namibia, Botswana, Zimbabwe, Mozambique and Swaziland and surrounding the kingdom of Lesotho.

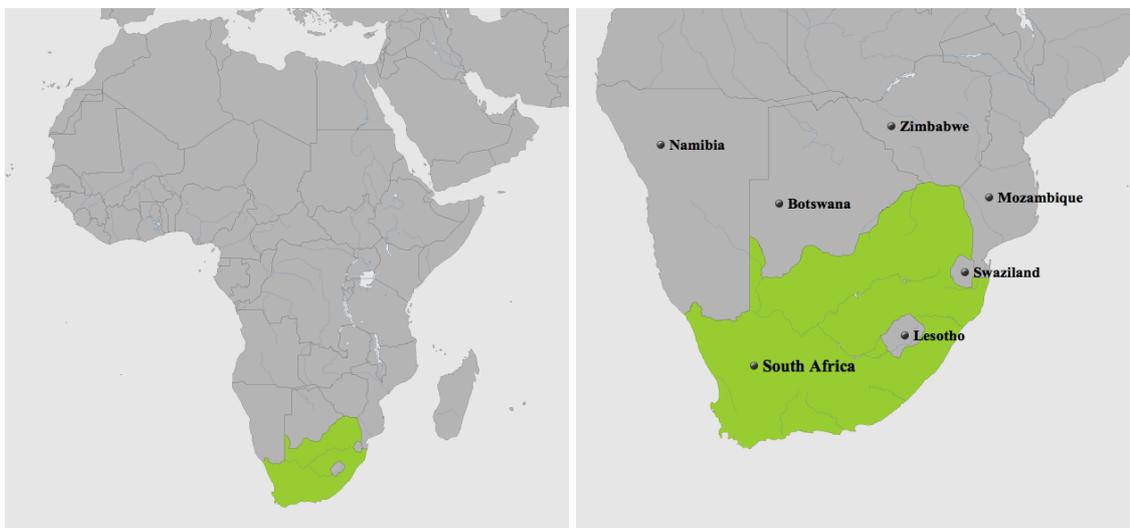


Figure 3: Geographical position of South Africa

The sovereign state has a land area of 1,213,090 sq. km, making it the 24th-largest country in the world.⁵³ Known as “A world in one country”, South Africa has a wide range of different landscapes. Besides a coastline of more than 3,000 km, rocky hills and mountains in the inland and more than 290 conservation parks, the country also shows vibrant, modern cities.⁵⁴ South Africa is divided into nine provinces, varying in

⁵³ See The World Bank online (2014a).

⁵⁴ See GCIS (2015), p. 1-2.

size, topography and climate. Although Johannesburg is the largest city and South Africa's economic heartland, it is none of the country's capitals. Pretoria, the executive is classified as the official capital, whereas Bloemfontein functions as the judicial with the Supreme Court of Appeal and Cape Town serves as the legislative with the country's parliament.⁵⁵

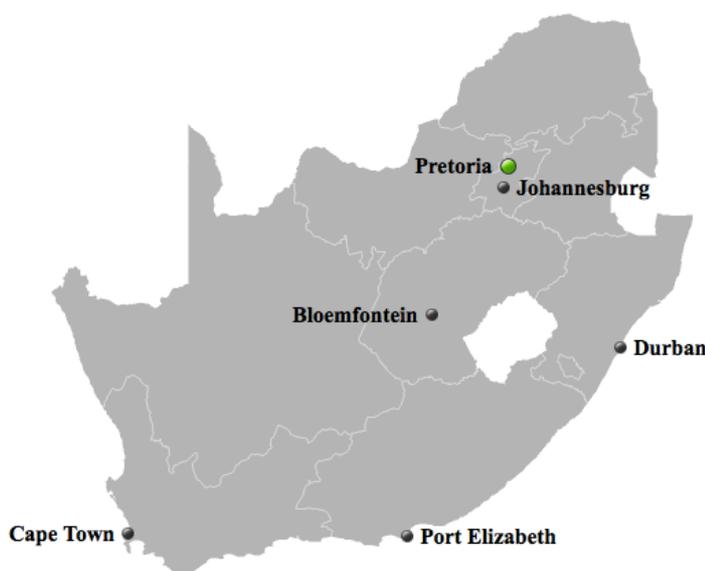


Figure 4: Map of South Africa

South Africa is mainly divided into two different geographical parts, separated by the Great Escarpment, which lies in altitudes between 1,500 m and 3,482 m. The central plateau is located north of the escarpment and stretches to the Kalahari Desert, while the area south of the escarpment hits the coast.⁵⁶

Climate and vegetation zones in South Africa show a great variety, ranging from the desert on the border to Namibia to subtropical forests in the Southeast and on the border to Mozambique. While a dry and arid climate dominates in the interior, the coastal regions are of maritime character. The climate around Cape Town, however, is fairly Mediterranean.⁵⁷

⁵⁵ See GCIS (2015), pp. 4-11.

⁵⁶ See GCIS (2015), p. 2.

⁵⁷ See GCIS (2015), p. 2.

3.2 History and politics

At least 10,000 years before Africa's written history began with the arrival of the Europeans, the Khoisan resided in the southern tip of the continent.⁵⁸ Their presence, however, did not stop Jan van Riebeeck and his crew from setting up a base in Table Bay (Cape Town) under instructions from the Dutch East India Company in 1652. They initially just came to provide basic necessities for passing ships on the Eastern trade route to India, but soon began to spread into the hinterland to settle there permanently.⁵⁹ Dutch colonisers already oppressed the indigenous people at that time. When the British took over in 1806, the European population accounted for 26,600, rising to 252,000 by 1865 and exceeding the one million mark at the end of the nineteenth century.⁶⁰ According to South Africa's last census, around 4,6 million so-called "White people" were living in the country in 2011.⁶¹

The population was fundamentally divided into native black people and new White people from the very start. As the Second World War drew to a close, South Africa's White population started to design the structures of Apartheid, a racist division of the people into two groups: black and white. This form of policy led to exploitation, oppression and deprivation of the non-white population.⁶² While the European people benefitted from the country's economic upswing, starting in 1960, poverty was further rising among the black population.⁶³ During Apartheid, demonstrations, protests and violent assaults were the order of the day. Around 1990, the government made the first step towards capitulation: the ban of certain parties (e.g. the African National Congress - ANC) was lifted and Nelson Mandela - one of the fiercest anti-Apartheid activists - was released from prison.⁶⁴ In 1994, free elections, in which the black population was entitled to vote as well, were held for the first time. An outstanding majority voted for the ANC, which is still the country's incumbent governmental party. In the same course, Nelson Mandela was elected as South Africa's first black president.⁶⁵

⁵⁸ See Feinstein (2005), p. 13.

⁵⁹ See Feinstein (2005), p.1 / GCIS (2015), p. 14.

⁶⁰ See Schumann (1938), pp. 38-39.

⁶¹ See Statistics South Africa (2012a), pp. 14 / 17, own calculation.

⁶² See Feinstein (2005), pp. 149-151; GCIS (2015), pp. 20f.

⁶³ See Feinstein (2005), pp. 165-172.

⁶⁴ See GCIS (2015), pp. 21-23.

⁶⁵ See GCIS (2015), pp. 23-25.

South Africa is still struggling to correct the inequalities created by Apartheid. Although legally equal, the population is still socio-economically divided.

3.3 People and culture

South Africa has a population of almost exactly 55 million, with an annual growth rate of 1.65 % in 2015.⁶⁶ The urban population is fairly high for an African country (64 %) and is well distributed among the numerous big cities.⁶⁷ The metropolitan area of Johannesburg for example is home to 9.2 million people.⁶⁸

The country is made up of various ethnic groups, all having their own language and culture. In the course of South Africa's last census in 2011, Statistics South Africa provided five racial population groups, by which citizens could describe themselves. Figure 5 shows the results of this assessment in 2015.

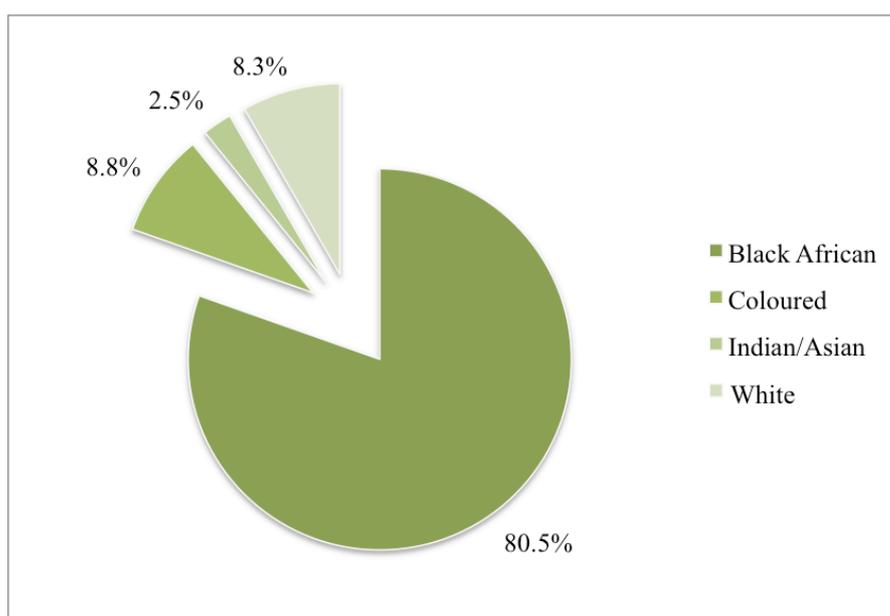


Figure 5: Percentage distribution of the population by population group

The Black African population group has by far the highest proportion, followed by the Coloured with 8.8 % and the White group with 8.3 %. The Indian/Asian group, with 2.5 %, is mainly concentrated in the province KwaZulu-Natal, especially in Durban.⁶⁹

⁶⁶ See Statistics South Africa (2015b), pp. 2 / 8.

⁶⁷ See The World Bank online (2014b).

⁶⁸ See The World Bank online (2014c).

⁶⁹ See Statistics South Africa (2015b), p. 2.

The country's population is also characterised by a wide range of languages and religious beliefs. There are eleven official and formally equal languages in South Africa. Although "English is generally understood across the country, being the language of business, politics and the media"⁷⁰, Zulu, Xhosa and Afrikaans are spoken more frequently (see Figure 6).

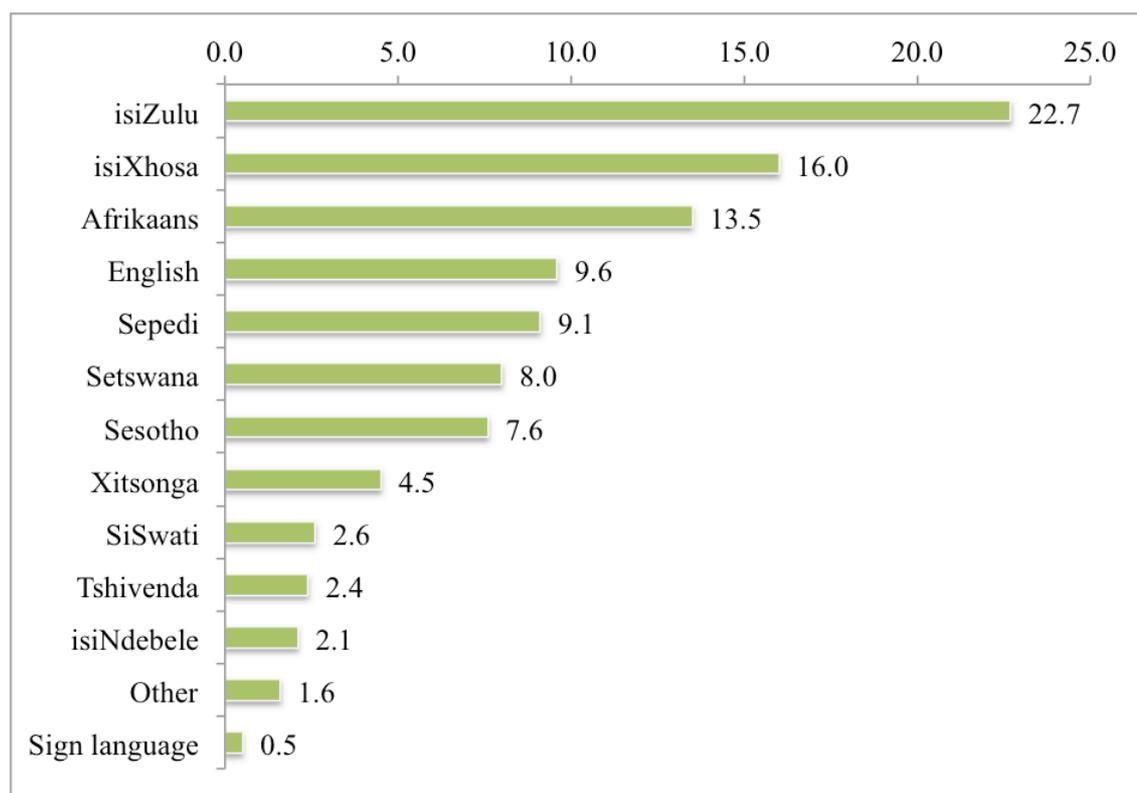


Figure 6: Percentage distribution of the population by first language spoken⁷¹

Most South Africans are Christian (79.8 %), dominated by the African Zion Christian churches, but due to the country's diversity of cultures, there are considerable amounts of other beliefs as well, namely Islam, Hinduism, African traditional beliefs, Judaism and others. While 1.4 % of the population are undetermined, 15 % have no religion at all.⁷²

⁷⁰ GCIS (2015), p. 3.

⁷¹ See Statistics South Africa (2012b), p. 24.

⁷² See GCIS (2015), p. 3.

3.4 Economy

With a GDP at market prices accounting for 350 billion US \$, South Africa is the second largest economy in Africa, only topped by Nigeria.⁷³ It also has one of the highest GNIs per capita on the continent (12,700 US \$ at PPP).⁷⁴ However, due to South Africa's historical circumstances it is not appropriate to use GNI per capita as an economic indicator without considering the high inequality in the distribution of this income across the different population groups.⁷⁵ According to the country's last census, Black African households had an average annual income of R 60,613 in 2011, compared to R 365,134 per year in White households. That means the White population group earns on average more than six times as much as the Black African population group. The Coloured and the Indian/Asian people range in between (see Figure 7).⁷⁶

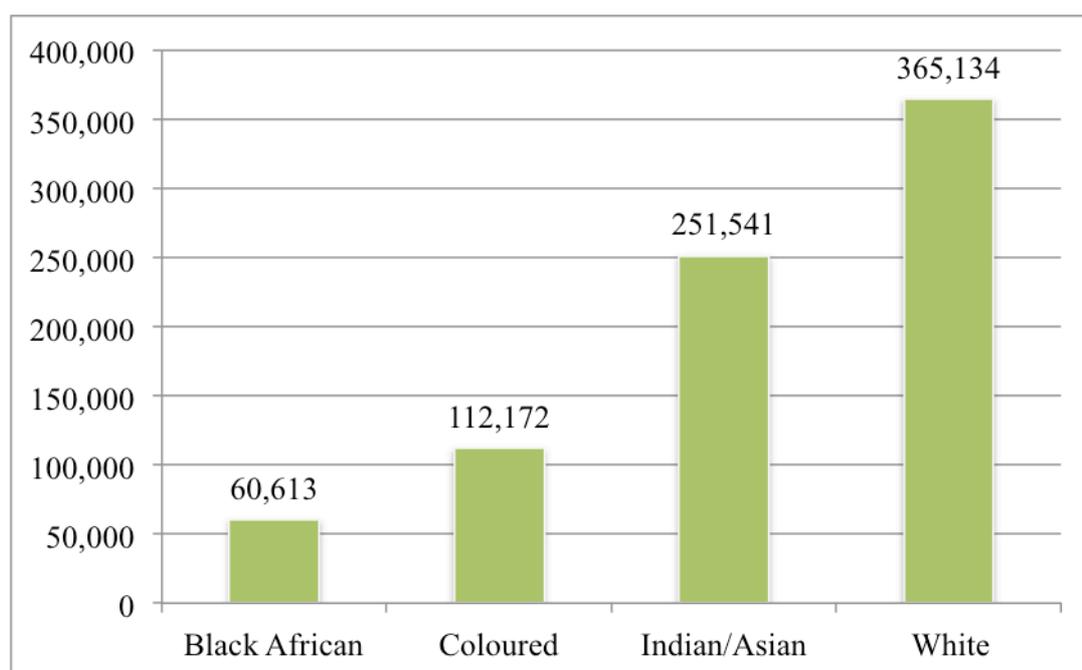


Figure 7: Average annual household income by population group in ZA Rand⁷⁷

With a Gini index of 62.5, South Africa is among the top ten countries for income inequality.⁷⁸ According to its Human Development Index of 0.666, South Africa is characterised as a country with medium human development, but still one of the highest in Sub-Saharan Africa, only topped by Gabon and Botswana. Nonetheless, the country

⁷³ See The World Bank online (2014e).

⁷⁴ See The World Bank online (2014f).

⁷⁵ See Durrheim / Mtose / Brown (2011), pp. 17-19.

⁷⁶ See Statistics South Africa (2012a), p. 42.

⁷⁷ Adapted from Statistics South Africa (2012a), p. 42.

⁷⁸ See CIA online (2013).

ranks 87th in GNI per capita, but only 116th in human development - a difference of 29 points. This shows that South Africa is doing relatively better in terms of per capita income than in terms of human development. That indicates that the benefits of economic growth are not successfully translated into the quality of life for the population.⁷⁹ Bearing in mind, that the average GNI per capita accounts for more than three times as much as the average income of a Black African, this gap becomes even more dreadful.

The service sector comprises most of the country's GDP (68 %) ⁸⁰, followed by the industrial sector (29.5 %) ⁸¹. In contrast to other African nations, agriculture only represents an insignificant share of 2.5 %.⁸² Since the latest significant high in 2006 (5.6 %), South Africa's annual economic growth is steadily slowing down and now stands at 1.3 %.⁸³

3.5 Developmental issues

“South Africa is an anomaly among developing countries. It is both a developed country with good infrastructure and also a country with huge social and economic problems.”⁸⁴

The key developmental issues that cause these problems shall be discussed below.

3.5.1 Racial inequality

South Africans still have to deal with racial inequality. Although Apartheid is dead, its legacy remains. Social and economic disparities are visible in terms of income, employment, education and interaction with one another. Respected intellectuals in South Africa agree that the country's cultural legacy cannot be “swept away in a blink” and that there is “no quick fix”. Overcoming racial inequality is an on-going progress and the government, as well as the private sector and the civilians need to make their own contributions to the development of an equal society.⁸⁵

⁷⁹ See UNDP (2015), p. 209.

⁸⁰ See The World Bank online (2014g).

⁸¹ See The World Bank online (2014h).

⁸² See The World Bank online (2014i).

⁸³ See The World Bank online (2015a).

⁸⁴ Layne (2004), p. 183.

⁸⁵ See Pennington (2011); Stout-Rostron (2011); Ganson (2011).

3.5.2 Unemployment and poverty

The unemployment rate in South Africa has persistently been high, ranging around 25 % for more than ten years, and now stands at 25.1 %.⁸⁶ Unemployment among the Black African people is significantly higher than among any of the other population groups. However, Coloured people and Indians/Asians also have to deal with high rates, whereas unemployment amongst White people is comparatively low (see Figure 8).

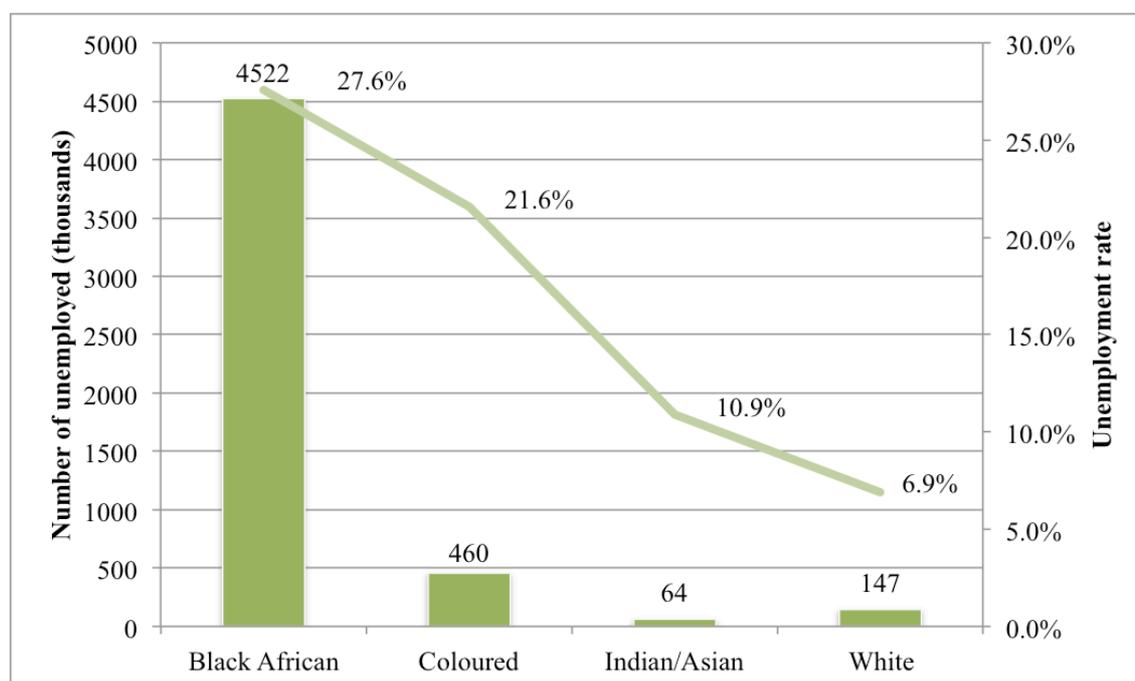


Figure 8: Number of unemployed and unemployment rates by population group⁸⁷

Especially young people are facing extremely high unemployment. By the end of 2015, 50.4 % of the fifteen to twenty-four year olds were out of work.⁸⁸ Unemployment is the greatest socio-economic problem in South Africa and the government is thus aiming to create six million work opportunities (particularly for the youth) over the next five years.⁸⁹

Poverty levels in the country are declining, but remain a severe problem. The latest report on poverty trends in South Africa states that in 2011, 45.5 % of the population were characterised as “poor”, which accounts for 23 million people. A share of 20.2 % (10.2 million) lived in extreme poverty, defined as living below the food poverty line.⁹⁰

⁸⁶ See Statistics South Africa (2016b), p. 4.

⁸⁷ See Statistics South Africa (2016b), pp. 4f.

⁸⁸ See Statistics South Africa (2016b), p. 6.

⁸⁹ See GCIS (2015), p. 95.

⁹⁰ See Statistics South Africa (2014), p. 12.

Several departments, programmes and projects are working on alleviating poverty in the country. According to the National Development Plan (NPD), these efforts shall result in a complete eradication of poverty in South Africa by 2030.⁹¹

3.5.3 Education

After the National Department of Education has been split in 2009, two ministries, namely the Department of Basic Education (DBE) and the Department of Higher Education and Training (DHET), govern education in South Africa.⁹²

In accordance with the South African Schools Act of 1996, attending school is compulsory for every learner between the age of seven and the age of fifteen years (completion of ninth grade respectively).⁹³ However, 26.5 % of South Africans between the ages of five and twenty-four didn't attend an educational institution during the country's latest census.⁹⁴

Further education takes places from grade ten to grade twelve, called matric, the year of matriculation. The latest Education Statistics show that 78.2 % of the pupils passed their matric, all of which got the admission to higher education.⁹⁵ At the time of the census in 2011, 40.7 % of the population aged twenty years and older completed an education of high school or higher, whereas 8.6 % had no schooling at all. A share of 76 % of the White population attained an education level of high school or higher, in contrast to only 35.3 % of the Black Africans and 32.6 % of the Coloureds (see Figure 9). The calculation of the rate only includes those who actually wrote the exam. The children who dropped out of school represent around half of those that started grade one.

⁹¹ See GCIS (2015), pp. 95 / 100f / 110-112.

⁹² See GCIS (2015), p. 118.

⁹³ See Republic of South Africa (1996), pp. 4-6.

⁹⁴ See Statistics South Africa (2012a), p. 32.

⁹⁵ See DBE (2015), p. 24.

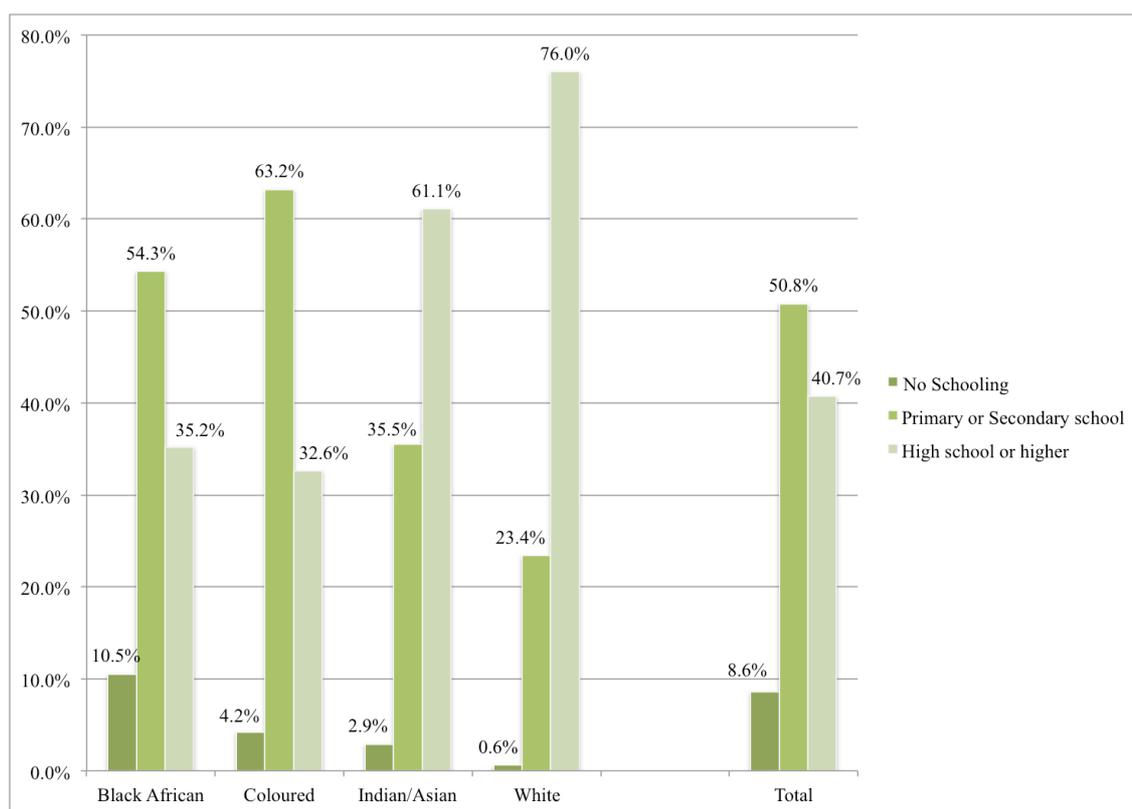


Figure 9: Percentage distribution of population aged twenty years and older regarding their education level by population group⁹⁶

Most men have qualifications in business commerce and engineering, while most women graduated in business commerce, education and health.⁹⁷

One of the major problems of poor education is the teachers' qualification level, as they are not sufficiently educated themselves. Since 2002, a university degree is compulsory to be licensed to teach in South African schools. In poor, rural areas, however, teachers still do not abide by it.⁹⁸ Improving education standards is one of the key issues for the South African government and therefore, it aims to allocate R 297.5 billion to education in 2016/17, representing 20.3 % of total general government expenditure.⁹⁹

South Africa further has made much progress in the area of education for sustainable development. Indigenous knowledge and practices regarding sustainable living, sustainable development and environmental sustainability are now part of every subject in school.¹⁰⁰

⁹⁶ See Statistics South Africa (2012a), p. 34.

⁹⁷ See Statistics South Africa (2012a), p. 37.

⁹⁸ See Rusznyak (2014).

⁹⁹ See National Treasury (2016), p. 62, own calculation.

¹⁰⁰ See GCIS (2015), p. 117.

3.5.4 Health

Life expectancy at birth increased to 62.5 years, but is still shorter than in most other upper middle-income countries. Although shrinking, infant and under five mortality is still high with 80 deaths per 1,000 live births.¹⁰¹

HIV/AIDS and other poverty-related diseases (tuberculosis, cholera) are a massive problem in South Africa. In 2015, an estimated 6.19 million people were living with HIV. The estimated prevalence rate (of population ages 15 - 49 years) currently stands at 16.59 % and thus, South Africa is still the country with the fourth highest rate, only topped by its neighbours Botswana, Lesotho and Swaziland.^{102,103}

Only 18.1 % of the population are members of a medical aid scheme. More than three quarters (76.9 %) of White people are covered, in contrast to only 10.6 % of Black Africans, 20.3 % of Coloureds and 48.7 % of Indians and Asians.¹⁰⁴

Some of the issues South African government is aiming to approach are the expansion of HIV/AIDS treatment and prevention programmes, revitalisation of public health care facilities and introducing National Health Insurance (NHI).¹⁰⁵ The development of the NHI scheme is a major step in improving the healthcare system and making it accessible for all. NHI is “a financing system that will ensure that all South Africans, including legal long-term residents, are provided with essential healthcare, regardless of their employment status and ability to make a direct monetary contribution to the NHI Fund.”¹⁰⁶ To reach these goals, South African government allocates a great share of total government expenditure to healthcare, namely R 168.4 billion in 2016/17, representing a share of 11.5 %.¹⁰⁷

3.5.5 Corruption and crime

Between March 2014 and April 2015, 2.2 million criminal offences were registered in South Africa. The figure is only slightly tending downwards and the number of unreported cases is substantially higher. The country is particularly confronted with high rates of murder and rape and other forms of sexual violence. The latest statistics

¹⁰¹ See Statistics South Africa (2015b), p. 5.

¹⁰² See Statistics South Africa (2015b), p. 7.

¹⁰³ See The World Bank online (2014d).

¹⁰⁴ See Statistics South Africa (2015a), p. 30.

¹⁰⁵ See National Treasury (2015), pp. 266-268.

¹⁰⁶ GCIS (2015), p. 226.

¹⁰⁷ See National Treasury (2016), p. 62, own calculation.

show 53,617 reported sexual offences within a year. That means that every ten minutes across South Africa, one person (mainly women) becomes a victim of sexual violence or rape. Over time, the numbers indicate a decline, however, it is an open question whether these figures show an actual reduction or just a reduction in the number of reported offences.¹⁰⁸ Women often fear to be accused of lying, feel ashamed, guilty and humiliated and thus shy away from reporting.

A feeling of indifference has spread across the population, while politics are denying or grossly trivialising the problem. Former president Thabo Mbeki for example said, “journalists distorted reality”¹⁰⁹ and “fears of crime are exaggerated”¹¹⁰.

The high rates of murder and rape pose a serious threat to the South African population. Causes are manifold and can often be traced back to the country’s historical past. Apartheid and its long-term effects are the roots of dissatisfaction. Furthermore, poverty and unemployment, especially amongst young, black people, lead to boredom and lack of perspective, which often erupt into violence.

Corruption remains a big problem as well. Corruption Watch South Africa defines corruption as “the abuse of public resources or public power for personal gain”.¹¹¹ South Africa sits in the middle of Transparency International’s worldwide ranking.¹¹² The incidents go way beyond common police bribery and even occur among high political leaders. Even before his inauguration, the country’s current president Jacob Zuma has been accused of corrupt practices. Most recently, he is criticised for excessively upgrading his private premises with the state’s money.¹¹³

3.5.6 Urbanisation

South Africa is one of the most urbanised countries in sub-Saharan Africa, with 34.7 million people residing in urban areas in 2014, representing 64.8 % of the country’s total population. Apart from small states like Réunion or Djibouti, only the Democratic Republic of Congo has a slightly larger share of urban population (65 %).

¹⁰⁸ See SAPS (2015).

¹⁰⁹ See Carroll (2004).

¹¹⁰ McGreal (2007).

¹¹¹ Corruption Watch (2015), p. 16.

¹¹² See Transparency International (2015).

¹¹³ See Alexander / Laing (2015).

Despite rapid growth, especially between 1985 and 1995, South Africa has meanwhile one of the lowest urban growth rates in sub-Saharan Africa with 1.59 % per annum.¹¹⁴

Figure 10 shows that total as well as urban population grew fast during the second half of the 20th century. Within 60 years, the number of people residing in urban areas grew from 6,833,000 to 34,663,000. The share of urban population increased from two out of five people living in urban areas to almost two out of three.

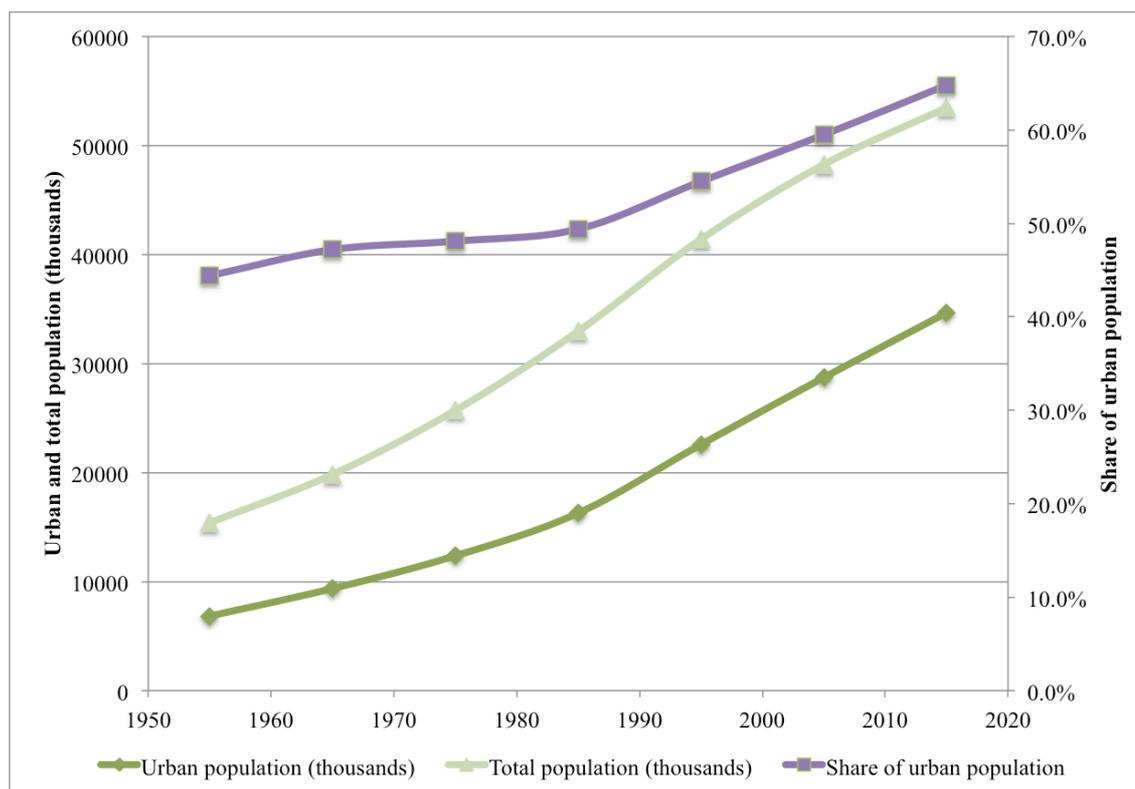


Figure 10: Urban population in South Africa, 1955-2015¹¹⁵

The main reason for people migrating to urban areas is an improvement of their economic opportunities. Agriculture is no longer profitable for the small farmers, as industrial (mainly white) farmers, using machines, chemical fertilisers and special supplements, have replaced them.¹¹⁶ Former agricultural workers are thus looking for new jobs in the cities. The highest concentration of economic activity by far is in the province of Gauteng, with Johannesburg being the hub.¹¹⁷

¹¹⁴ See UN DESA Population Division (2014).

¹¹⁵ See UN DESA Population Division (2014).

¹¹⁶ See Turok (2012), p. 9.

¹¹⁷ See OECD (2011), p. 17.

Cities in emerging countries usually develop rapidly and therefore often fail to place attention on long-term sustainability. Colonialism and Apartheid have left urban areas in a disjointed and fragmented form. Further, population densities within each city are exceptionally uneven. While wealthier people live in low-density areas, many poor people have to reside in densely populated, mostly overcrowded townships and informal settlements.¹¹⁸ These dwellings are relics of racial segregation during Apartheid, when non-white citizens were forced to move into designated areas and are basically similar to the slums in many developing countries. However, this spatial distribution is still common, widens inequality and increases exclusion. There have been no statistically significant changes in the percentage of households living in informal dwellings in the last ten years. The figures constantly ranged between 11 % and 15 %¹¹⁹ and stood at 12.9 % in 2014.¹²⁰

3.5.7 Rural development

Urbanisation and rural development are closely interlinked. One of the key priorities regarding a sustainable development of rural areas is enhancing the productivity of the land reform programme.

Due to more than 250 years of Dutch and British occupation, the native South Africans have lost most of their land. The Native Land Act (1913) for example allocated only 7.3 % of total land area to the so-called ‘Natives’.¹²¹ The Native Trust and Land Act (1936) expanded this share to 13 %, which was, however, never actually reached.¹²² As a result, millions of people were crowded together on less than a fifth of the total land, just to make room for white settlers and their farming activities.

As early as in 1955, the Freedom Charter, a programme opposed to the Apartheid regime, demanding democracy and equality, proclaimed: “The Land Shall be Shared Among Those Who Work It!”¹²³ With the dawn of democracy in 1994, a land reform was introduced. Section 25 (7) of the Constitution serves as a basis for the restitution of land rights, stating that “a person or community dispossessed of property after 19 June 1913 as a result of past racially discriminatory laws or practices is entitled, to the extent

¹¹⁸ See Turok (2011), p. 21.

¹¹⁹ See Statistics South Africa (2011), p. 21.

¹²⁰ See Statistics South Africa (2015d), p. 35.

¹²¹ See Natives’ Land Act (1913).

¹²² See Brief Description of the Native Trust & Land Act (1936).

¹²³ Freedom Charter (1955).

provided by an Act of Parliament, either to restitution of that property or to equitable redress.”¹²⁴ The Restitution of Land Rights Act further established the Commission on Restitution of Land Rights (CRLR), which acts as the custodian of the process.¹²⁵ In 2014, the deadline of land claims was extended to June 2019.¹²⁶ The CRLR’s latest report reveals that there are 8,035 outstanding land claims lodged before the 1998 cut-off date, which need to be settled. Further, 57,300 new claims have been submitted since the amendment and the numbers are rising on a daily basis. Total expenditure on restitutions over the last period accounted for R 2.5 billion.¹²⁷

The Comprehensive Rural Development Programme (CRDP) is the key driver of rural development in South Africa, with the objective of “reducing poverty by creating vibrant, equitable and sustainable rural communities.”¹²⁸ In 2014, 35.2 % of South Africa’s population was living in rural areas.¹²⁹ Besides transformation of the agricultural circumstances, social and economic infrastructure shall be fostered. Therefore, the CRDP distributes land and food, supports smallholder producers and contributes to facilitating access to clean running water, sanitation and electricity.¹³⁰

¹²⁴ The Constitution of the Republic of South Africa (1996).

¹²⁵ The Restitution of Land Rights Act (1994).

¹²⁶ The Restitution of Land Rights Amendment Act (2014).

¹²⁷ See CRLR (2015), pp. 6f / 80.

¹²⁸ GCIS (2015), p. 331.

¹²⁹ See UN DESA Population Division (2014).

¹³⁰ See GCIS (2015), p. 336.

4 Sustainable construction in South Africa – underlying conditions

While the fundamentals of sustainability and sustainable construction were outlined in Chapter 2, Chapter 3 provided an insight into South Africa’s current social and economic situation. These findings shall be combined in the following chapter, pointing out the challenges and barriers the country is facing when aiming to pursue sustainable construction, as well as the opportunities it offers.

4.1 Need for adequate shelter in South Africa

Apartheid has left South Africa in a spatially fragmented form. As abovementioned, land was distributed among white and non-white residents, with the native population only entitled to move within the borders of designated areas, making up 7.3 % of the total land area. One of the new democracy’s key priorities in 1994 was to provide access to housing for all. The policy framework was set out in the White Paper on Housing (1994), while the Housing Act (1997) established the legal framework of South Africa’s ambitious housing development.¹³¹ Section 26 (1) of the Constitution of South Africa also states, that “everyone has the right to have access to adequate housing”.¹³² Despite much progress in the delivery of formal houses, there is still a considerable amount of households in South Africa that live in informal settlements, namely 12.9 % in 2014.¹³³

4.1.1 The contradiction of sustainability in informal settlements

An informal settlement is characterised as “an unplanned settlement on land which has not been surveyed or proclaimed as residential, consisting mainly of informal dwellings (shacks)”.¹³⁴ Those shacks are predominant in most cities of developing countries, just like in South Africa, and incomparably portray unsustainable construction. Besides poor fabric of the buildings, they are often too small for the number of people living in them. During the country’s last census, 22 % of the households residing in informal dwellings

¹³¹ See SERI (2011), p. 14 / 21.

¹³² The Constitution of the Republic of South Africa (1996).

¹³³ See Statistics South Africa (2015), p. 35.

¹³⁴ HDA (2013), p. 6.

had to live in overcrowded conditions (more than two people per room).¹³⁵ Shacks are further marked by insufficient access to basic services such as water, electricity and sanitation, with 24 % of which having no access to any of them.¹³⁶ Moreover, informal dwellings are mostly occupied illegally due to lack of ownership of the land parcel they are being built on. According to the latest General Household Survey, 36 % of the households living in informal dwellings claimed that they owned their dwelling, whereas 25.6 % said they occupied it rent-free.¹³⁷ This data is difficult to interpret though, as there is no reference of the formality of this ownership. The occupants might as well just refer to their feeling of possession or to the ownership of the building itself, rather than to the land it stands on. Other negative characteristics of shacks are poor indoor air quality, lack of waste collection, leading to high rat and vermin occurrence, major contribution to water and air pollution, lack of sanitation, resulting in publicly exposed human waste and thus health risks, increased threat of fires and a high crime rate due to lack of formal jobs. Taking all those features into account, shacks and therefore informal settlements in general are “clear indicators of severe socio-economic deprivation”.¹³⁸

However, shacks do not solely embody unsustainable construction but show a lot of strongly sustainable features as well. First of all, they are almost exclusively built of reused and recycled building materials such as cardboard boxes, plywood and corrugated iron or plastic and therefore promote resource conservation. Furthermore, using local skills in the construction process supports the communities’ economic and social development. Owing to their simple design, shacks are also very flexible and customisable.¹³⁹ These features might just exist, because people have no other choice but to reuse materials and components, due to a lack of financial means, but they nonetheless represent high sustainability qualities, which are seldom recognised and barely appreciated.

Formal low-income housing opportunities hardly display improvements to the informal dwellings. They are not just badly built and deteriorate rapidly, but are also too small, at high risk of fire and floods, lack basic services and are poorly located.¹⁴⁰ These factors

¹³⁵ See HDA (2013), p. 30.

¹³⁶ See HDA (2013), p. 16.

¹³⁷ See Statistics South Africa (2015d), p. 128, own calculation.

¹³⁸ Huchzermeyer (1999), p. 40.

¹³⁹ See Irurah (2000), p. 4.

¹⁴⁰ See Tomlinson (2015), p. 6; Aigbavboa / Thwala (2013), pp. 17f; Zunguzane et al (2012), pp. 20f.

lead to the question, whether formal low-income housing offers any benefits at all and if so, which ones.

4.1.2 From housing to human settlements

The government's national housing goal, outlined in the ANC's Reconstruction and Development Programme (RDP) in 1994, was to increase the country's budget allocation to housing in order to reach the target of one million houses in five years.¹⁴¹ Since then, the government has delivered 3.7 million formal homes, accommodating approximately 12.5 million people.¹⁴² Further, a great deal of money has been invested by the private sector, together facilitating the delivery of a total of 5.6 million housing opportunities.¹⁴³ Thus, the number of people living in formal housing increased from 64 % in 1996 to 79.4 % in 2014.¹⁴⁴ Nevertheless, the country's housing backlog is now bigger than it was in 1994, namely 2.7 million units as opposed to 1.5 million units. One of the reasons for this drastic increase is that many South African citizens (affected by Apartheid or not) take the allocation of housing subsidies for granted and thus "continually break themselves up into smaller units".¹⁴⁵ However, 15.3 % of South African households effectively received a government housing subsidy in 2014. As mentioned before, the quality of those housing opportunities is questionable. 14.2 % of those households for example reported their walls and/or roofs to be weak or very weak.¹⁴⁶ Furthermore, the housing provided so far has mainly been located in the periphery of cities and moreover, the government fails to establish a sufficient public transport system. Consequently, many communities remain excluded from the cities' benefits and the spatial distribution, Apartheid has left behind, has not been transformed adequately.¹⁴⁷

The first major refinement to the White Paper on Housing since 1994 came with the Breaking New Ground amendment (BNG) in 2004, a comprehensive plan for the development of sustainable human settlements.¹⁴⁸ The focus of the Department of Housing (DH) has broadened to regard "housing" as the delivery of human settlements,

¹⁴¹ See DoH (1994), Section 4.3.

¹⁴² See oS (2014), p. 3.

¹⁴³ See GCIS (2015), p. 239.

¹⁴⁴ See DPME (2014), p. 34.

¹⁴⁵ Tomlinson (2015), p. 2.

¹⁴⁶ See Statistics South Africa (2015a), pp. 37f, own calculation.

¹⁴⁷ See Joseph / Karuri-Sebina (2014), pp. 2-3

¹⁴⁸ See SERI (2011), p. 21.

rather than solely focusing on the provision of shelter. Therefore, it changed its name to “Department of Human Settlements” (DHS) in 2009.¹⁴⁹ BNG defines sustainable human settlements as “well-managed entities in which economic growth and social development are in balance with the carrying capacity of the natural systems on which they depend for their existence and result in sustainable development, wealth creation, poverty alleviation and equity.”¹⁵⁰ The core message of this is that the department should concentrate on building integrated neighbourhoods and communities as opposed to just houses. That implies the provision of basic services such as water, electricity and sewerage, as well as public services such as healthcare and education facilities, transport and shops.

According to the National Planning Commission (NPC), the targets formulated in the RDP, namely “breaking down apartheid geography through land reform, more compact cities, decent public transport and the development of industries and services that use local resources and/or meet local needs” are still a long way from being accomplished.¹⁵¹ In 2012, the NPC has therefore identified spatial transformation as the main means for achieving social equality and economic efficiency.¹⁵² New spatial norms and standards are one of the ten critical actions set out in South Africa’s National Development Plan (NDP), which is primarily aimed at reducing inequality and eliminating poverty in the country.¹⁵³ The government is aware of the complexity and time required to reshape a country’s geography, but nonetheless feels confident that “South Africa should observe meaningful and measurable progress” by 2030. A guideline for spatial development needs to be formulated and vigorously be pursued with well-suited and powerful tools.¹⁵⁴

4.2 Challenges of sustainable construction in South Africa

The need for adequate shelter and sustainable housing for all clearly is the major objective of sustainable construction in South Africa and needs to be implemented stringently. Having discussed many of the linkages between the construction sector and environment, society and economy under 2.3, it is obvious, that South Africa is facing

¹⁴⁹ See SERI (2011), p. 15.

¹⁵⁰ DoH (2004), Section 3.1.

¹⁵¹ NPC (2012), p. 260.

¹⁵² See NPC (2012), p. 260.

¹⁵³ See NPC (2012), p. 24.

¹⁵⁴ NPC (2012), p. 260.

several challenges when aiming to address sustainable construction. This subchapter shall examine some of them more precisely. Reducing resource use goes hand in hand with the prevention of deforestation and the transformation of the country's mining industry. Moreover, the necessity of providing basic services, public services and transport cannot be neglected when targeting a sustainable built environment.

4.2.1 Prevention of Deforestation

Forests cover around 30 % of the world's land area, and provide homes for over 70 % of the planet's organisms. Further, they produce oxygen, which is inevitable for every living thing on earth, and mitigate greenhouse gases that cause global warming. Loss of trees results in an increase of those gases in the atmosphere. Moreover, deforestation itself contributes to almost 20 % of all CO₂ emissions. Trees and plants store carbon dioxide and when cut down, release it into the atmosphere. Due to the lack of sufficient forest area, those gases cannot be soaked up and therefore, speed and seriousness of climate change increases. Deforestation further degrades natural resources in terms of soil erosion and disruption of water cycles, reduces biodiversity and increases food insecurity. Nevertheless, 120,000 – 150,000 sq. km of forest area are lost every year. Causes are manifold and range from natural disasters like fire to human activities like illegal logging, the need for agricultural land and of course the need for timber for construction purposes.¹⁵⁵

Sub-Saharan Africa lost 830,000 sq. km of forest area since 1990, translating to an average annual deforestation rate of 0.5 % and is thus leading the world's ranking. South Africa, however, has an average annual deforestation rate of 0 %, which means that it hasn't lost any forest area within the last fifteen years and still stands at 92,000 sq. km.¹⁵⁶

The legal framework for sustainable forest management is outlined in the National Forests Act (1998) and the Forestry Laws Amendment Act (2005). Furthermore, the Department of Agriculture, Forestry and Fishery (DAFF) has set itself the goal of planting 100 sq. km of wooded area every year to promote afforestation. Despite not

¹⁵⁵ See WWF (2016); National Geographic (2016); Makki (n.d.).

¹⁵⁶ See The World Bank online (2015).

reaching this goal lately, the DAFF successfully combats deforestation in South Africa by supporting related cooperatives and by offering incentives to new entrants.¹⁵⁷

4.2.2 Transformation of mining industry

Mining is not only expensive, but can harmfully invade the environment as well as negatively interfere with the society. South Africa is particularly rich in mineral resources and is therefore one of the world's leading raw material exporters.¹⁵⁸ Twenty years ago, South Africa produced almost 500 million tons of mine waste per year, and even now, mineral waste is the largest contributor to CO₂ emissions in the country.¹⁵⁹ Mining activities further pollute the already scarce water resources. The so-called acid mine drainage (AMD) does not only contaminate the water, but also causes soil degradation and destroys marine habitats.¹⁶⁰ South Africa has undoubtedly made much progress in steering developments in the mining industry on a sustainable path. The environmental consequences of AMD are being addressed by regulatory measures and by effectively installing AMD pumps to protect the country's watercourses.¹⁶¹ The Mine Health and Safety Inspectorate has committed itself to the social aspects of mining activities and therefore implemented legislation to ensure safe and healthy working conditions. Since 1994, there has been an 83 % reduction in the number of fatalities for example.¹⁶² Moreover, the government is aiming to foster equal opportunities in terms of employment, guaranteed by the Mineral and Petroleum Resources Development Act (2002). The Mining Qualifications Authority further ensures the development of a skilled workforce.¹⁶³

However, transformation of the mining industry is not yet completed and custodians demand a “stable, predictable and equitable policy environment”¹⁶⁴ to assure a sustainable use of the country's abundant, but limited mineral resources.

¹⁵⁷ See GCIS (2015), p. 50.

¹⁵⁸ See GCIS (2015), p. 301.

¹⁵⁹ See Hobbs et al (2010), p. 51.

¹⁶⁰ See Adler / Rascher (2007).

¹⁶¹ See GCIS (2015), p. 309.

¹⁶² See Chamber of Mines (2014), p. 30, own calculation.

¹⁶³ See GCIS (2015), p. 303.

¹⁶⁴ Chamber of Mines (2014), p. 6.

4.2.3 Provision of basic services

Whenever talking about sustainable human settlements and sustainable construction, it is crucial to acknowledge the necessity of providing basic services, i.e. water supply, sanitation, electricity supply and refuse removal. In 2000, the implementation of a Free Basic Services (FBS) policy was announced, in order to support poor households, who cannot afford to pay for them. FBS includes the following:

- Free Basic Water:* 25 litres per person per day or 6 kilolitres per household per month within 200 metres of a household¹⁶⁵
- Free Basic Sanitation:* Provision of the least cost sanitation facility that is appropriate to the settlement conditions, e.g. waterborne sanitations or ventilated improved pit latrine¹⁶⁶
- Free Basic Electricity:* 50 kWh per month for grid electrified households or a subsidy of up to 80 % of the monthly service fee to provide access to non-grid systems¹⁶⁷
- Free Basic Refuse Removal:* The most appropriate level of waste removal service provided based on site-specific circumstance¹⁶⁸

Despite this policy undoubtedly being honourable, its implementation is cumbersome. Municipalities struggle to identify those households, who are eligible to receive FBS. This is exacerbated by the lack of awareness among indigent households. Further, many municipalities have problems with the administration of FBS and therefore simply fail to deal with it sufficiently.¹⁶⁹ Nonetheless, around 12.55 million consumer units received at least one of the free basic services. Accumulated, 29.5 % of those households who used basic services benefitted from the FBS policy in 2014.¹⁷⁰

¹⁶⁵ See DWAF (2001), p. 4.

¹⁶⁶ See DWAF (2008), p. 8.

¹⁶⁷ See DME (2003), pp. 11 / 14.

¹⁶⁸ See DEA (2011), p. 11.

¹⁶⁹ See SERI (2013), pp. 43-47.

¹⁷⁰ See Statistics South Africa (2015e), pp. 3-7, own calculations.

a) Water

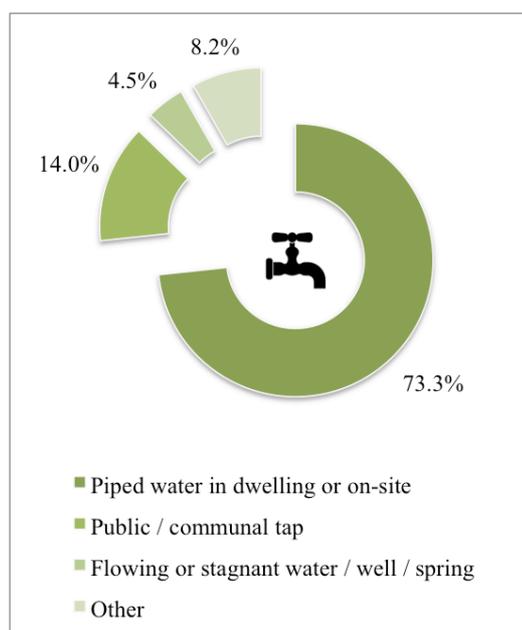


Figure 11: Main water source for drinking

According to South Africa’s General Household Survey (2014), 90 % of the country’s households had access to piped water either in their dwellings, on-site or off-site, of which 38.2 % benefitted from the FBS policy.^{171,172}

Figure 11 shows a distribution of the main water sources for drinking used by South African households. An estimated 73.3 % of them had access to piped water either in their dwellings or on-site (i.e. in their yard), while 14 % had to rely on public or communal taps.

Despite annual fluctuations, water access generally improved. Nonetheless, 4.5 % of households still had to get their water from flowing or stagnant waters (i.e. rivers, lakes, dams), wells or springs.¹⁷³ However, only 61.4 % rated the water services as “good”, which constitutes a drastic decrease since 2005, when the approval rate stood at 76.4 %.¹⁷⁴ This reflects the perceptions of households regarding the quality of water they drink, as 31.1 % reported their water to be “not safe to drink”, “not clear”, “not good in taste” or “not free from bad smells”.¹⁷⁵ South Africa’s water resources are very limited and average rainfall is well below the world’s average. The Department of Water and Sanitation (DWS) is aiming to improve the management of these limited resources in order to provide equitable and sustainable access to water.¹⁷⁶

¹⁷¹ See Statistics South Africa (2015d), p. 41f.

¹⁷² See Statistics South Africa (2015e), p. 4.

¹⁷³ See Statistics South Africa (2015d), p. 43, own calculations.

¹⁷⁴ See Statistics South Africa (2015d), p. 44.

¹⁷⁵ See Statistics South Africa (2015d), p. 47, own calculation.

¹⁷⁶ See GCIS (2015), p. 431.

b) Sanitation

In 2014, 79.5 % of households had access to RDP standard toilet facilities, defined as “flush toilets connected to a public sewerage system or a septic tank, and a pit toilet with a ventilation pipe”. 30.5 % of these received the services for free.¹⁷⁷ The distribution within the country, however, is fairly uneven. While the percentage of households who could access proper sanitation accounted for 94.6 % in the Western Cape, it only amounted for 54 % in the province of Limpopo.¹⁷⁸

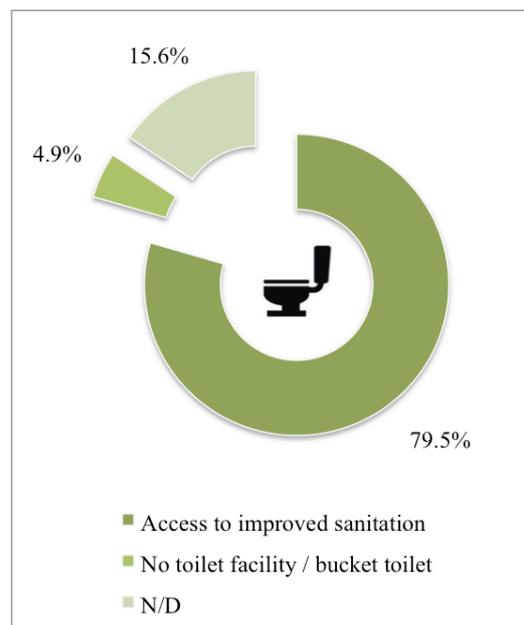


Figure 12: Access to sanitation

In addition, there is no indication about the location of those facilities. According to the available data, many households have to share sanitation. Those facilities were reported to lack sufficient lightning (25.9 %) and hygiene (23.7 %). Other problems experienced were long waiting times, full toilet pits, lack of water to wash hands and even threat of physical safety while using the facilities.¹⁷⁹ An estimated 4.9 % had no access to toilet facilities at all, or have been using bucket toilets (see Figure 12).¹⁸⁰

The access to RDP standard toilet facilities has been increasing steadily. Sanitation provision is determined by the Strategic Framework on Water Services (2003) and the Water Services Act (1997) and is managed by the DWS.¹⁸¹

¹⁷⁷ Statistics South Africa (2015e), p. 6.

¹⁷⁸ See Statistics South Africa (2015d), p. 48.

¹⁷⁹ See Statistics South Africa (2015d), p. 50.

¹⁸⁰ See Statistics South Africa (2015d), p. 49.

¹⁸¹ See GCIS (2015), p. 433.

c) Electricity

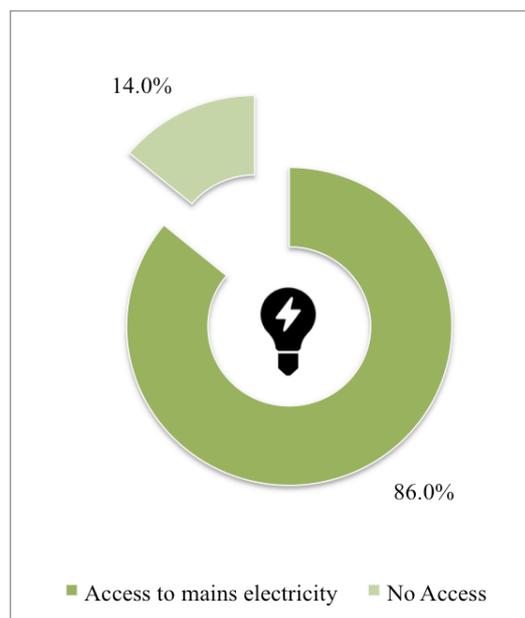


Figure 13: Access to mains electricity

In 2014, 86 % of South African households were connected to the mains electricity supply. This percentage has continually been rising with the largest increases being recorded in the provinces Eastern Cape and Limpopo (28 percentage points, 19.6 respectively).¹⁸² Around 22.6 % of all consumer units had free basic electricity, i.e. 50 kWh per month.¹⁸³

According to a study conducted by the Department of Energy (DoE), electrified households almost exclusively use electricity for cooking and lighting, while non-electrified households have to rely on candles, firewood and paraffin. Surprisingly, only 39 % of electrified households use electricity for heating. Some 27 % use other energy sources, while 35 % do not heat at all, but rather wear warm clothes or use blankets.

The same behaviour could be observed within non-electrified households, where 64 % use firewood, paraffin or other sources for heating, while 36 % do not heat at all.¹⁸⁴

South Africa's primary electricity supplier Eskom provides more than 95 % of the country's energy usage. By the end of 2014, one of the major power plants collapsed and thus, Eskom could no longer meet the people's electricity demand. The supplier therefore reintroduced a schedule of rolling blackouts, known as load shedding, which had been implemented once before in 2008. Timed blackouts were announced throughout the country, which occurred for a period of two hours at a time.^{185,186} The main reasons for the undersupply are underinvestment and a massive delay in building new power plants. Currently, Eskom is not load shedding, but further blackouts are anticipated in the future.¹⁸⁷

¹⁸² See Statistics South Africa (2015d), p. 38f.

¹⁸³ See Statistics South Africa (2015e), p. 5.

¹⁸⁴ See DoE (2012), pp. 24-28.

¹⁸⁵ See The Economist (2015).

¹⁸⁶ See Eskom (n.d.).

¹⁸⁷ See Eskom (n.d.).

Since the electricity crisis in 2008 and therewith the first period of load shedding, electricity tariffs in South Africa increased by 335 %.¹⁸⁸ According to a study, conducted by the statistics and research company Statista, South Africa ranks tenth in terms of electricity prices, compared to seventeen other leading economies worldwide. By international standards, electricity appears to be cheap (8.46 USD ct / kWh), but in comparison with the countries' GDPs per capita, this appearance is deceiving.¹⁸⁹ This is reflected in the households' perceptions about the pricing of electricity: more than a third (34 %) regarded the prices to be "far too high" with another 38 % feeling they were "too high". Only 22 % thought the prices were "about right".¹⁹⁰

The DoE is aiming to ensure secure and sustainable provision of energy for all. A greater involvement of renewable energy resources is one of its major goals, as well as a marked decrease of CO₂ emissions.¹⁹¹

d) Refuse removal

Figure 14 shows the distribution of household refuse removal in 2014. For two thirds of South Africa's households, refuse was removed mainly once per week, while almost one third had to rely on its own or a communal dumpsite to get rid of the rubbish. 2.4 % of households had no facilities and therefore dumped or left their waste anywhere.¹⁹² Out of those consumer units, who received basic refuse removal, 26.8 % got the service for free, as laid down in the FBS policy.¹⁹³

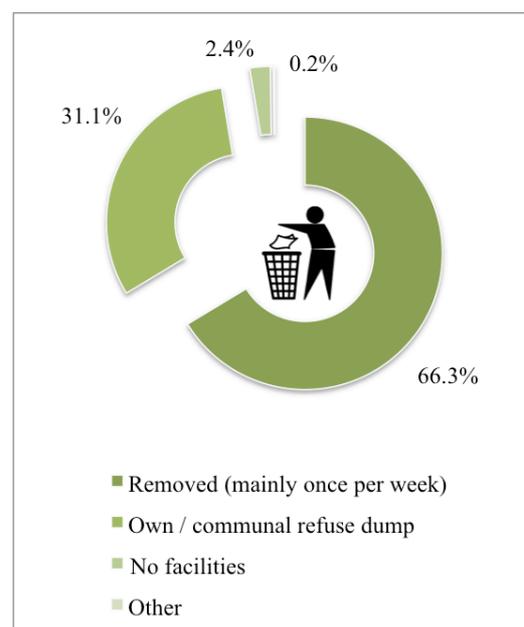


Figure 14: Household refuse removal

The provided data, however, is not entirely representative, as there is a striking imbalance between rural and urban households to be

¹⁸⁸ See Eskom (2015), own calculation.

¹⁸⁹ See Statista (2015).

¹⁹⁰ See DoE (2013), p. 86.

¹⁹¹ See GCIS (2015), p. 135.

¹⁹² See Statistics South Africa (2015d), p. 50, own calculations.

¹⁹³ See Statistics South Africa (2015e), p. 7.

observed. While 89.5 % of households had their refuse removed in urban areas, only 7.6 % in rural areas received this service. The share of households benefitting from a solid waste management is only slowly increasing with a gain of 7.3 percentage points since 2002.¹⁹⁴ Refuse removal plays a vital role in environmental hygiene and therefore in preventing diseases. As mentioned before, lack of waste collection leads to high rat and vermin occurrence, both serving as a breeding ground for health hazards. In line with that, almost 14 % of the country's households reported to experience environmental problems due to irregular or no waste removal, 93.2 % of which were Black Africans.¹⁹⁵

4.2.4 Access to public services and transport structures

Besides the provision of basic human needs in place, public services should be easily accessible. A proper transport system is of great importance for the development of sustainable human settlements.

A questionnaire carried out by Statistics South Africa, revealed that the majority (68.4 %) of those attending school walked to get there, while 17.7 % used either a private vehicle or a vehicle hired by a group of parents. Another 6.8 % used taxis as their usual mode of transport.¹⁹⁶ The Department of Transport (DoT) established a National Scholar Transport Programme, aiming to provide safe transport for pupils, who have to travel long distances to attend an educational establishment. Besides improving road safety, the DoT is distributing bicycles to learners, to facilitate their way to school.¹⁹⁷

The most commonly used modes of transport when travelling to work are private vehicles (32.9 %) and taxis (23.6 %). 19.2 % walk to work, while another 11.8 % work at home.¹⁹⁸ Public transport systems such as buses and trains are hardly used, mainly because there are little. However, the government states that “South Africa is on its way to becoming the first country in Africa to have rapid public transport networks”¹⁹⁹, as they are currently implementing a Public Transport Strategy, comprising rail, taxi and bus services. To expand the system, a Rural Transport Strategy was developed with the

¹⁹⁴ See Statistics South Africa (2015d), p. 51, own calculations.

¹⁹⁵ See Statistics South Africa (2015d), p. 163, own calculations.

¹⁹⁶ See Statistics South Africa (2015d), p. 55.

¹⁹⁷ See GCIS (2015), pp. 421f.

¹⁹⁸ See Statistics South Africa (2015d), p. 55.

¹⁹⁹ GCIS (2015), pp. 420f.

objective of enhancing mobility and access in rural areas and therefore social and economic opportunities.²⁰⁰

4.3 Barriers to sustainable construction in South Africa

For the South African construction industry, sustainability is still a relatively new phenomenon. The government mainly focuses on alleviating poverty, reducing unemployment and improving education and health care. Consequently, sustainable construction practices remain neglected.

As presented in Table 2, there are numerous barriers to sustainable construction, which shall be discussed within this subchapter. All these obstacles can mainly be attributed to a lack of knowledge on sustainability issues, which results in a general resistance to change. Most importantly, there is a need to raise awareness on the construction industry's impacts on environment, society and economy – positive or negative.

Table 2: Barriers to sustainable construction in South Africa

Category	Barriers
Professional Barriers	<ul style="list-style-type: none"> • Lack of knowledge on sustainability concepts • Lack of skilled labour force • Lack of accurate data
Financial Barriers	<ul style="list-style-type: none"> • Additional costs • Inadequate information regarding the benefits of sustainable construction • Lack of financial resources
Social Barriers	<ul style="list-style-type: none"> • Lack of interest / awareness • Resistance to change • Lack of governmental incentives
Technological Barriers	<ul style="list-style-type: none"> • Limited range of environmentally responsible materials • Resistance to technological optimisation

²⁰⁰ See GCIS (2015), p. 421.

4.3.1 Professional barriers

Since the introduction of sustainable development in 1987, the awareness on environment and sustainability agendas is increasing continually. The responsibility of the construction industry to pursue sustainability is also generally admitted. However, lack of capacity of the construction sector has been identified as the most vital barrier to sustainable construction in developing countries.²⁰¹

Several research has been done to measure the knowledge of construction practitioners on the concept of sustainable construction in developing countries. While the majority of respondents in Malaysia for example considered themselves to have moderate or good knowledge of sustainability concepts,²⁰² most of those surveyed in Nigeria and Tanzania indicated low knowledge.^{203,204} In South Africa, 50 % of the construction practitioners surveyed agreed (or strongly agreed) that the country's lack of capacity hinders the development of sustainable construction.²⁰⁵ Since sustainability is a relatively new philosophy, many respondents never came across related subjects during their time at university. They further lack professional experience, as there are not enough projects to learn from.²⁰⁶ The problem is not only a common lack of knowledge on sustainability concepts, but also a lack of data and information on the impacts of non-sustainable practices on environment, society and economy.²⁰⁷

Education and training on sustainable construction practices needs to be enforced to increase knowledge and to establish a skilled labour force.

4.3.2 Financial barriers

Sustainable construction practices are estimated to increase conventional construction costs by 2 %.²⁰⁸ Further, the risk of unforeseen costs is higher, due to the lack of knowledge, lack of previous experience and thus unfamiliar techniques. According to a survey conducted by the Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth, 74.7 % of the respondents agreed (or strongly agreed) that inadequate cost

²⁰¹ See CIB / UNEP-IETC (2002), p. 35; Hankinson / Breytenbach (2012), p. 5; Simphe / Smallwood (2015).

²⁰² See Abidin (2009), p. 810.

²⁰³ See Abolore (2012), p. 957.

²⁰⁴ See Kusiluka / Kongela (2009), p. 12.

²⁰⁵ See Simphe / Smallwood (2015), pp. 5f.

²⁰⁶ See Emuze / Ntoi / Isa (2015), p. 5; Hankinson / Breytenbach (2012), p. 5.

²⁰⁷ See Jacobs (2011), p. 221.

²⁰⁸ See Kats (2003), p. 15; Kibert (2013), p. 462.

data for green buildings hampers the development of those. Moreover, 59.2 % agreed (or strongly agreed) that there is inadequate information about the financial benefits of sustainable buildings.²⁰⁹

The government is a major client of the construction industry in the formal sector. In developing countries, as in South Africa, there are often more pressing issues to focus spending money on, such as improving education and health care or combating poverty and unemployment. With respect to these matters, the government is unlikely to allocate a high amount of funds to measures supporting sustainable construction. The government's budget allocation for human settlements and municipal infrastructures accounts for R 182.6 billion (12.5 %) in 2016/17, 74.8 % of which mainly goes to the provision of basic services and transport structures.²¹⁰ As mentioned before, the housing and services provided are often unsatisfactory and far from being sustainable. Emphasis seems to be put on the quantity rather than the quality, which is understandable to a certain extent. It should be reconsidered to give priority to providing basic shelter and services for all, as opposed to allow sustainable, good quality housing for only a few. However, a balance needs to be found where sustainable construction is not sheer luxury, but a matter of course.

4.3.3 Social barriers

Awareness and interest in sustainability issues is a crucial component for the implementation of sustainable construction practices. Not only the players of the construction sector, but also the politicians, local authorities and the public, i.e. the clients lack interest. They tend to admire modernity and buildings inspired by those in the developed countries. Construction companies in turn follow the consumption preferences of clients, creating a vicious circle of neglecting sustainability issues.²¹¹ As mentioned before, the willingness to take risks, especially financially, is very low. All this results in a resistance to change conventional construction practices into more sustainable ones.

The government could stimulate sustainable construction by offering incentives and by establishing an adequate legislative framework. Therefore, the South African

²⁰⁹ See Simphe / Smallwood (2015), p. 4.

²¹⁰ See National Treasury (2016), p. 70, own calculations.

²¹¹ See CIB / UNEP-IETC (2002), P. 37; Simphe / Smallwood (2015), p. 2.

government has provided incentives to encourage investment in renewable energy. Co-investments with independent power producers for example paved the way for several infrastructure projects. An amount of R 325 billion has been spent on photovoltaic, wind and concentrated solar power projects, which together will add 14,550 MW in the current 3,725 MW renewable energy independent power producers.²¹² Despite this progress, 78.9 % of the NMMU’s study’s respondents agreed (or strongly agreed) that there is a general lack of incentives for promoting green building.²¹³

4.3.4 Technological barriers

The use of green building materials is an important aspect for the success of sustainable construction practices. However, the selection of such materials in South Africa is limited and imported products carry a carbon footprint. Another obstacle is the uncertainty in the performance of these materials and thus their cost effectiveness.²¹⁴

As indicated before, developing countries tend to adopt building codes and planning concepts from developed countries, which are often inappropriate for the local climatic, economic and social circumstances. These patterns are traditionally hard to change and result in what the UNEP calls “technological inertia”. Instead of developing new technologies or re-evaluating traditional ones, which are better adapted to its own natural resources, South Africa is mainly dependent on the technology from Western countries. Moreover, traditional technologies and construction practices are considered to symbolise primitivism and poverty, what makes them even more unpopular for the masses. These long-established patterns of thinking lead to a deadlocked resistance to technological optimisation.²¹⁵

4.4 Opportunities for sustainable construction in South Africa

Developing countries in general and South Africa in particular are not only facing challenges and barriers to sustainable construction, but also offer exceptional opportunities.

²¹² See National Treasury (2016), p. 137, own calculations.

²¹³ See Simphe / Smallwood, p. 4.

²¹⁴ See Emuze / Ntoi / Isa (2015), p. 5; Hankinson / Breytenbach (2012), p. 6.

²¹⁵ See CIB / UNEP-IETC (2002), p. 38.

4.4.1 Traditional construction

The above possibility of re-evaluating the traditional components of construction poses a great opportunity for sustainable building practices in South Africa. The indigenous people have used the natural resources in their surrounding area for construction purposes for thousands of years. Besides being cheap and easily accessible, these materials, have been well embedded into the natural environment. Moreover, the reuse of components from old buildings, respectively, the reuse of an existing building's structure, was common practice. This approach naturally eliminated inordinate amounts of construction waste.²¹⁶

The problem with traditional construction methods is mainly their reputation. Colonialism and the industrial revolution brought new building materials and designs into the country, creating an extreme aversion to native construction practices. As mentioned before, they are symbols of poverty and primitivism and regarded as being outmoded. Western construction techniques represent wealth and a higher social status and are therefore preferred, especially by the urban population.²¹⁷

Needless to say that traditional buildings cannot simply be copied into an urban environment, but have to comply with modern technological knowledge and contemporary cultural and social circumstances. Instead of serving as a concrete blueprint, they shall rather provide the impetus for more sustainable construction ideas and possibilities.²¹⁸

4.4.2 Renewable energy resources

Africa is the continent with the highest Global Horizontal Irradiation (GHI) on Earth, with South Africa ranking in the Top 3. Apart from the coastal region, South Africa receives at least 2,000 kWh/sq m of solar resources per annum. The Northern Cape even obtains up to 2,350 kWh/sq m, which is fairly close to the global maximum and nearly twice as much as in most parts of Europe.²¹⁹ South Africa further has a large coastline of more than 3,000 km, showing a great potential for wind and wave power resources. These resources are not only abundant but also highly scalable. This means it is possible to electrify single homes (or even small devices), as well as whole provinces. In contrast

²¹⁶ See CIB / UNEP-IETC (2002), pp. 40f.

²¹⁷ See CIB / UNEP-IETC (2002), p. 42.

²¹⁸ See CIB / UNEP-IETC (2002), p. 42.

²¹⁹ See SolarGIS (2014).

to conventional grid systems, wind and solar resources can easily provide energy in remote, rural areas, as power is produced where it is consumed.²²⁰

Since the release of the National Climate Change Response White Paper in 2011, South Africa has made much progress in implementing the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and is therefore placed in the Top 10 countries in terms of renewable energy investments. Within a period of three years, a total number of 92 independent power producers have set up projects throughout the country with a total capacity of 6,327 MW. The majority of these projects is located in the Northern Cape and while 40 of them concentrate on photovoltaic, 34 are using wind resources. South Africa is well on track to reach its goal of 30 % clean energy by 2025.²²¹

4.5 Best practice examples of sustainable construction in South Africa

Despite the challenges and barriers mentioned earlier, a significant number of green buildings already exists in South Africa. To get a better understanding of the features, looks and benefits of such constructions, a couple of best practice examples shall be introduced in the following.

4.5.1 Vele Secondary School, Vhembe District (Limpopo)



Figure 15: Vele Secondary School

Source: eastcoastarchitects.co.za

Opened in 2011, Vele Secondary School won the AfriSam-SAIA Award for Sustainable Architecture one year later.²²² Besides featuring a passive low energy design, solar energy, dry composting toilets and rainwater harvesting, Vele also has green roofs and food gardens.²²³

Moreover, the community and the students were integrated in the design

²²⁰ See DoE (2015), pp. 46-58.

²²¹ See DoE (2015), pp. 1-8.

²²² See East Coast Architects (2015a).

²²³ See East Coast Architects (2015b).

and construction process by being offered to attend vocational training and skills-development courses. One of the most impressive characteristics of the school is the electricity meter displaying the current energy demands of the site and thus raising awareness of the need for energy efficiency.²²⁴ Vele Secondary School ranked second in last year's Greenest School on Earth Reward²²⁵ and therefore serves as “a role model rural high school”.²²⁶



Figure 16: Vele Secondary School - Site plan

Source: eastcoastarchitects.co.za

²²⁴ See AfriSam (n.d.).

²²⁵ See East Coast Architects (2015b).

²²⁶ AfriSam (n.d.).

4.5.2 Sandbag houses, Cape Town (Western Cape)

The Sandbag houses, dating back to 2008, were the first proficient solutions for the Design Indaba 10x10 Low-Cost Housing Project. The task was “to design 10 low cost houses in partnership with international architects for 10 families”.²²⁷ MMA Architects replaced the commonly used brick



Figure 17: Sandbag houses - construction process

Source: hinhabitat.com/sandbag-house-mma-architects/

and mortar and chose a timber structural frame, filled with sandbags. These materials are not only cheap, but also locally sourced and provide thermal stability. As construction is simple, unskilled labour gets support and moreover, the need for electricity while building the houses is minimal, if not zero.

The design of the Sandbag houses further favours a lot of private outdoor space, i.e. external terrace on the upper floor and a garden, providing a safe play area for the children. Moreover, these houses were built for a mere R 65,000 and can individually be extended in the future.²²⁸

Although the Sandbag homes lack the typical features of green buildings, such as solar panels or insulation, they are nonetheless an exceptional example for sustainable construction. The use of local building materials minimises transportation costs and corresponding effects, preserves resources and the simplicity of the construction process boosts employment within the communities.

²²⁷ Mpahlwa (2008).

²²⁸ See Mpahlwa (2008).

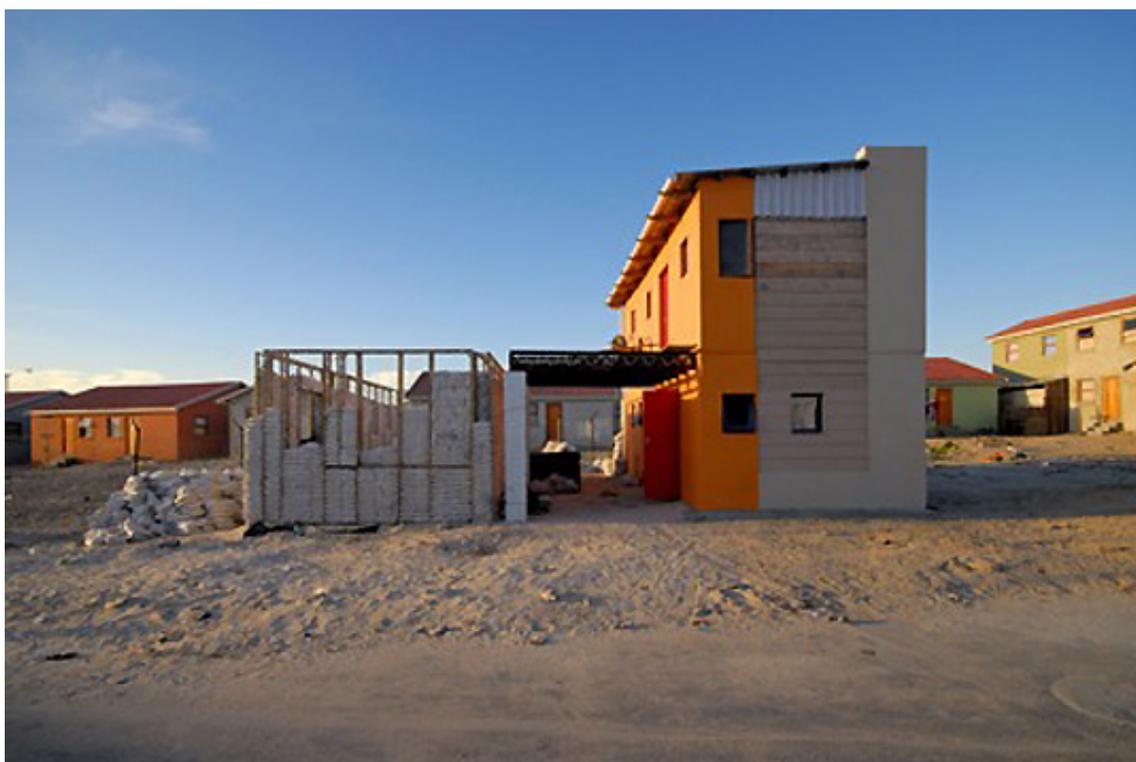


Figure 18: Sandbag houses

Source: hinhabitat.com/sandbag-house-mma-architects/

4.5.3 Alice Lane Health Club, Sandton (Gauteng)

The Alice Lane Health Club is the latest project to be certified as a Green Star SA building by the Green Building Council South Africa (GBCSA). Besides including a 100 % heat recovery chiller, 95 % of the building's flooring and paints are low volatile organic compounds, diminishing the risk of environmental and health hazards, such as allergic or respiratory effects. Moreover, the backwash from the swimming pools is reused in toilets and CO₂ sensors control the air conditioners' speed. The Health Club further features a meter showing energy and water consumption, similar to the one provided at Vele Secondary School.²²⁹

²²⁹ See GBCSA (2016a).



Figure 19: Alice Lane Health Club

Source: <http://propertywheel.co.za/wp-content/uploads/2014/>

For a gym, this kind of sustainability certificate is unprecedented and the Alice Lane Health Club was therefore granted environmental leadership within its branch.²³⁰

²³⁰ See GBCSA (2016b).

5 Review of research and development agenda

As can be seen from the preceding chapters, the developmental challenges South Africa is facing are enormous. To limit the scope of this study, the subsequent chapters follow the model the CIB has set out in cooperation with the UNEP-IETC in 2002, namely the “Agenda 21 for Sustainable Construction in Developing Countries” (A21 SCDC). Therefore, the focus is not placed on “the development that is needed, but on what would be necessary to make sure that when development happens, it would be sustainable.”²³¹

As outlined in Chapter 2, sustainable construction implies creating and operating a healthy built environment with respect to ecology, society and economy. The A21 SCDC identified three types of enablers required to meet these demands: technological, institutional and those related to value systems.²³²

In the following, the key areas of these enablers shall be revised to identify their relevance and current state of implementation in South Africa.

5.1 Technology enablers

There is no way of establishing sustainable construction practices without the use of technology. The challenge lies in developing and selecting technology that is according to sustainability principles. Technology enablers do not only include hardware such as equipment and materials, but also software (systems and models) and know-how. They therefore provide the base of knowledge and the technological capacity that is necessary for the development of institutional enablers.

Despite much research being done in the developed world, emerging countries need to set up their own technologies, as those from developed countries often do not present the environmentally and socio-economically preferable option. A number of key research and development areas for technology enablers identified in the A21 SBDC shall be discussed below.

²³¹ CIB / UNEP-IETC (2002), p. 45.

²³² See CIB / UNEP-IETC (2002), pp. 46ff.

5.1.1 Know-how

In order to select appropriate construction technologies and to develop new ones, a sound database is indispensable. The A21 SBDC considered, inter alia, knowledge on the impact of the construction sector and the built environment, on the capacity of the industry and on existing technologies as being crucial to a sustainable development. Since 2002, a lot of research has been done on these aspects. The environmental impacts of construction practices are widely known and everyone is aware of sustainability issues. Internationally dominating auditing companies, such as KPMG and PwC regularly publish reports on the South African construction industry, regarding its impacts on employment and economy.²³³ There is, among many others, also research on labour and work conditions,²³⁴ on the capacity of and the competition in the sector²³⁵ and on financial statistics.²³⁶ The South African Housing Development Agency further considers the impacts of different types of built environments, such as informal and rural traditional settlements.²³⁷ Even Life Cycle Analyses for construction materials and technologies have been conducted.²³⁸ Certainly, no matter how much knowledge and information is gathered, it is never enough. Nonetheless, South Africa's construction sector is relatively well analysed and moreover ranks as the most transparent market on the African continent and even higher than European countries like Italy or Austria.²³⁹

The A21 SBDC further suggested developing a vulnerability index to identify potential areas of environmental risk. Since 2005, the Environmental Vulnerability Index (EVI), created by the South Pacific Applied Geoscience Commission (SOPAC), is said to be globally applicable. South Africa scored an EVI of 324 and is therefore considered to be “highly vulnerable”. The issues of greatest environmental vulnerability are degradation, spills and conflict. That means there is a high percentage of severely or very severely degraded land area and a great number of spills of oil and hazardous substances in the country. The high score for conflict can be attributed to South Africa's past, i.e. Apartheid, as the indicator is calculated over the past 50 years. The country is generally most vulnerable in the category “Resources & Services”, showing an obvious

²³³ See KPMG Africa (2015); PwC South Africa (2015).

²³⁴ See cidb (2015).

²³⁵ See Cramer Media Product (2015).

²³⁶ See Statistics South Africa (2013).

²³⁷ See HDA (2013).

²³⁸ See Ampofo-Anti (2009);

²³⁹ See JLL (2014).

need to pay greater attention to sustainability principles.²⁴⁰ Although providing an insight into the country's problems, the general applicability of this index is questionable. Such a large country-scale index immensely aggregates the indicated risks and the term "vulnerability" becomes a universal condition with little relevance. To construct a meaningful index, smaller scales and site-specific assessments are more appropriate. Therefore, the Department of Science and Technology (DST) designed the South African Risk and Vulnerability Atlas (SARVA) with the intent of providing information to support development in the areas of risk and vulnerability.²⁴¹ It is clear, that information alone cannot ensure resilience, but gathering and sharing knowledge provides the basis for future action and thus for a sustainable growth path.

According to the A21 SCDC, it was a major problem to disseminate the knowledge that has been developed. Researchers might even have worked on the same topic without ever noticing. The Internet surely revolutionised worldwide communication and enormously facilitated knowledge sharing. There are numerous databanks and publications online, revolving around issues regarding sustainability and construction. Nonetheless, there is still need for a databank of relevant studies on sustainable construction (in South Africa). Assembling and storing data and documents in a central place, e.g. a website, where they can easily be retrieved would immensely facilitate further research.

5.1.2 Software and hardware

A large number of green building technologies has been developed over the course of the last decade. What the A21 SCDC regarded as "technologies of the future" is commonplace now. Recycling, solar power, insulation or green building materials are not a new phenomenon anymore. However, the majority of sustainable technologies still focuses on mitigating the impact of construction on the environment. As mentioned many times before, sustainability is not just about the nature, but about the society and the economy as well. Sustainable construction technologies need to alleviate the social impacts of construction and should at best even support the creation of areas and communities, which are well integrated into the social environment. Economic sustainability inter alia implies job creation and entrepreneurial opportunities.

²⁴⁰ See SOPAC (2005).

²⁴¹ See SARVA online (2016).

Table 3: Technology enablers - Summary of achievements

Technology enablers	Achievements
Know-how	<ul style="list-style-type: none"> • Construction sector relatively well analysed • Most transparent market on the continent • South African Risk and Vulnerability Atlas • Knowledge-sharing facilitated through Internet
Software and hardware	<ul style="list-style-type: none"> • Large number of green building technologies • Technologies to mitigate impact on the environment

5.2 Institutional enablers

Although developed, green building technologies are often hardly implemented into common building practices. It is important for them to be regarded as “normal”, rather than something luxurious or special. This also means that they need to be affordable for every income level. In 2002, the A21 SCDC mainly attributed the problem of implementation to an imperfect understanding of roles and duties. Each institution regarded sustainable construction to be someone else’s job. This has definitely changed over time and financial institutions, as well as the government and construction practitioners make their contribution to creating a sustainable construction industry in South Africa.

5.2.1 Education

It is clear that a skilled labour force and professionals are necessary to ensure the development of a sustainable built environment. South Africa has made much progress in the area of education for sustainable development. Indigenous knowledge and practices regarding sustainable living, sustainable development and environmental sustainability are now part of every subject in school.²⁴² Higher education also offers subjects and degrees related to sustainability. Stellenbosch University for example facilitates degree programmes in renewable and sustainable energy studies²⁴³ and the University of South Africa just recently opened a Sustainable Process Engineering

²⁴² See GCIS (2015), p. 117.

²⁴³ See CRSES (2016).

Laboratory.²⁴⁴ Moreover, there are several post-educational training programmes, such as the Continuing Professional Development (CPD) for architects, which deepen knowledge on sustainability issues.²⁴⁵

5.2.2 Regulatory mechanisms

The A21 SCDC demanded the development of regulatory mechanisms to include new technologies and introduce sustainability criteria. In 2011, new energy efficiency building regulations came into effect and supported the growing trend of modern green architecture in South Africa. The new provisions are defined in the so-called SANS 10400 XA standard. Since commencement of this act, all new buildings have to use solar water heaters, heat pumps or similar technologies, while ceilings, walls and windows have to meet minimum requirements in insulation, to minimise heating in winter and cooling in summer.²⁴⁶ For the future, however, it is important to encompass all the environmental impacts of construction, not only energy efficiency. The government has further generally addressed sustainable development in various frameworks, but has not deepened exploration on sustainable construction, yet. Especially socio-economic impacts need to be addressed in greater depth.

The Construction Industry Development Board (cidb) also promotes a regulatory and developmental framework and therefore provides leadership to stakeholders and stimulates sustainable growth, capacity development and empowerment.²⁴⁷

Another measure to support the introduction of sustainable technologies and practices are incentives, disincentives respectively. Besides incentives to encourage investment in renewable energies, the government does not offer any support to encourage green building.

5.2.3 Cooperative partnerships

In order to drive sustainable construction, the A21 SCDC suggested enabling cooperative partnerships between researchers themselves and between researchers and implementers. The major initiative, facilitating stakeholder communication and involvement in South Africa is the Council for the Built Environment (CBE).

²⁴⁴ See UNISA (2015).

²⁴⁵ See SAIA (2014).

²⁴⁶ See SANS 10400 XA (2011), pp. 6-12.

²⁴⁷ See cidb (2016).

coordinates six professional councils (e.g. architecture, engineering, property valuation) and therefore serves as a forum, where built environment professionals can discuss relevant issues. It thus improves stakeholder relations and establishes partnerships to enhance service delivery.²⁴⁸

5.2.4 Advocacy and awareness

Advocacy and awareness about the need for sustainable construction is necessary to promote the implementation of green technologies. Construction practitioners, the government and the public need to receive sufficient information about the benefits of implementing such technologies.

According to the A21 SCDC, monitoring and evaluation is a strong tool to illustrate the benefits that can be achieved through sustainable construction. The GBCSA, established in 2007, has developed a rating system to objectively measure green buildings, namely the Green Star SA. According to its own statement, the GBCSA therewith wants to “recognise and reward environmental leadership in the property industry”.²⁴⁹ Projects are rated in various categories, such as materials, energy and water. To provide a more holistic approach, an additional category called Socio-Economic Category (SEC) is available as well.²⁵⁰ To date, 153 properties have been Green Star SA certified, achieving a 4, 5 or 6 star rating.²⁵¹ In June 2015, a pilot project in Bellville, Cape Town received a SEC rating as the first one in Africa.²⁵² The GBCSA does not only evaluate projects regarding their sustainable performance, but also provides a best-practice guideline and points out the advantages of green construction. When the council had reached the milestone of certifying one hundred buildings for example, it announced the combined annual savings thus made: 131 million kWh of electricity, 176 million kg of carbon emissions and 171 million litres of drinking water.²⁵³ By illustrating actual numbers regarding the benefits of sustainable construction, the GBCSA further encourages construction practitioners to follow the good example set by others before.

²⁴⁸ See CBE (2016).

²⁴⁹ GBCSA (n.d. a).

²⁵⁰ See GBCSA (n.d. b).

²⁵¹ See GBCSA (2016c).

²⁵² See GBCSA (2015a).

²⁵³ See GBCSA (2015b).

Table 4: Institutional enablers - Summary of achievements

Institutional enablers	Achievements
Education	<ul style="list-style-type: none"> • Sustainability as part of every subject in school • Degrees related to sustainability at university • Post-educational training programmes
Regulatory mechanisms	<ul style="list-style-type: none"> • New building regulations • Regulatory and developmental frameworks • Incentives to encourage investment in renewable energies
Cooperative partnerships	<ul style="list-style-type: none"> • Council for the Built Environment
Advocacy and awareness	<ul style="list-style-type: none"> • Green building rating system • Best-practice guideline • Information on the advantages of sustainable construction

5.3 Value system enablers

For many people, sustainability seems to be some kind of short-term trend or a stubborn attitude and therefore just a recommendation for action, rather than a necessary conduct. All knowledge, technologies and favourable institutional environments are as good as useless until people deliberately decide to make use of the opportunities created. The fact that South Africa is still struggling with developmental problems like racial inequality, unemployment and poverty makes it difficult to additionally adopt the values of sustainability. However, sustainable construction cannot become a deeply ingrained conviction without personal commitment. To assist with this, the A21 SCDC proposed, inter alia, re-evaluating the traditional, developing codes of conduct, as well as implementing a corporate social responsibility (CSR) reporting for the construction sector.

5.3.1 Landmarks of change

People are generally reluctant to change longstanding behavioural patterns without seeing specific reasons to do so. First of all, they need to be informed about the current

state of our environment and the changes caused by unsustainable practices. Although everyone who has a radio, television and/or reads a newspaper knows about climate change and its effects on our planet, only few admit their responsibilities. Global warming is without doubt a severe problem, but the individual human being usually does not feel affected and therefore does not see the need to change. It is necessary to point out the damage mankind is causing and, as a second stage, demonstrate the success that has been achieved so far with all its benefits. A good example is the GBCSA's statement to the actual savings, mentioned before.

5.3.2 Re-evaluating the traditional

As discussed under 4.4.1, re-evaluating the traditional components of construction poses a great opportunity for sustainable building practices in South Africa. However, the people have to overcome the aversion they developed against traditional building techniques and recognise their value. Agrément South Africa enables the introduction of innovative construction products and systems in the country. The issue of an Agrément certificate for Compressed Earth Blocks Building Systems in 2011 for example showed that there is a market for improved traditional building methods in the formal construction sector.²⁵⁴

5.3.3 Measuring value

The A21 SCDC criticised that the value of something was usually measured in monetary terms, just like the means through which people were reward. Unfortunately, not much has changed in this regard since the agenda's publication in 2002. However, if the motivation to build sustainably is of monetary nature, change is unlikely to be persistent once the incentive is removed. Consequently, motivation needs to be intrinsic to permanently change behavioural patterns. As the A21 SCDC already proposed 14 years ago, companies need to develop a common set of values to assist with this. If someone starts, others are likely to follow. Not only will other companies follow, according to "anything you can do, I can do better", but also will the staff share the values it subscribed to with its social environment.

²⁵⁴ See DPW (2013).

5.3.4 Codes of conduct

A code of conduct specifically for the construction sector would immensely simplify the establishment of sustainable building practices. Once the industry has directions on how to best act to ensure environmental, social and economic sustainability, it becomes a lot easier to realise these approaches. The International Green Construction Code (IgCC), published in 2010, is “the first model code to include sustainability measures for the entire construction project and its site”.²⁵⁵ The code is adoptable around the globe as it is flexible in terms of legal systems. The IgCC could further serve as a basis for developing an own code of conduct in South Africa.

5.3.5 Corporate social responsibility reporting

Since commencement of the Companies Act No. 71 of 2008, CSR reporting is a legal obligation for companies in every sector in South Africa.²⁵⁶ The country therefore is one of the four countries with the highest CSR reporting in the world, the other three being India, Indonesia and Malaysia. While the average CSR reporting rate around the globe stands at 73 %, South Africa possesses a percentage of 99 %. Moreover, the rate of integrated reporting in the country is by far the highest in the world, standing at 91 %.²⁵⁷

Table 5: Value system enablers - Summary of achievements

Value system enablers	Achievements in South Africa
Re-evaluating the traditional	<ul style="list-style-type: none"> • Agrément certificates for traditional building materials
Codes of conduct	<ul style="list-style-type: none"> • The International Green Construction Code
Corporate social responsibility reporting	<ul style="list-style-type: none"> • CSR reporting as a legal obligation • South Africa as one of the four countries with highest CSR reporting in the world

²⁵⁵ ICC (2016).

²⁵⁶ See The Companies Act (2008).

²⁵⁷ See KPMG (2015), pp. 32-38.

6 Strategy for action

In order to effectively implement sustainable construction in South Africa, the development of the enablers discussed in Chapter 5 needs to be supported by the various construction practitioners and stakeholders. The research and education sector has to create an enabling environment that facilitates the implementation of green building practices for the private and public sector. Therefore, the A21 SCDC identified six key areas of action:

- Capacity building
- Access to funding
- Partnerships and cooperation
- Internal housekeeping
- Encouraging and supporting implementation
- Monitoring and evaluation

The A21 SCDC took the sectors and stakeholders as a basis and built its strategy around the six key areas.²⁵⁸ To get a more holistic approach, this study individually focuses on each of the elements and hence identifies the necessary actions for the various role-players.

6.1 Capacity building

Lack of capacity is one of the major barriers to sustainable construction in South Africa. Reshaping the research and education sector is the first essential step that leads towards capacity building. The country is on the right track with its commitment to teach sustainability issues at school and university. However, it is necessary to not only treat the matter superficially but to focus on sustainable construction in particular. As a second step, the private sector has to admit and assume its responsibility to continually educate the present workforce. Therefore, the following actions are required from both, the research and education sector and the private sector:

²⁵⁸ See CIB / UNEP-IETC (2002), pp. 59ff.

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- **Make sustainable construction part of the curriculum:** Green building practices need to be a compulsory part of every degree, related to construction (e.g. civil engineering, architecture, real estate). Besides raising awareness and interest in sustainable construction issues, this obligation will establish a skilled and knowledgeable academic workforce.
 - **Establish continued professional education:** The concept of sustainability is emerging continually and professionals need to be kept up-to-date at anytime. Further, those, who haven't been educated in sustainable construction while at university, have to get a chance to rectify omissions.
 - **Conduct training programmes:** Seminars and training programmes for the non-academic workforce, i.e. blue-collar workers, employed in the construction sector need to be conducted to guarantee a high level of knowledge and skills throughout the entire industry.

However, creating and maintaining a trained and competent workforce within the industry needs to be accompanied by capacity building within the public sector and the society. This can be facilitated through the actions below:

- **Raise awareness:** Assuming that the above arrangements are put into practice, there is still a need to raise awareness among clients and the public sector, i.e. politicians and regulatory stakeholders. This could be achieved through campaigns, presentations, advertisement and training programmes.
- **Announce landmarks of change:** Information about the consequences of unsustainable construction, as well as the positive effects of green building practices need to be reported to the public to ensure that everyone gets a better idea of what sustainable construction really means. Simple measures could be taken to advertise benefits and challenges on TV, radio, newspapers or journals.
- **Establish mandatory training and education programmes for government officials:** Employees at all stages of government need to obtain sufficient knowledge on sustainable building practices through compulsory seminars or programmes.

6.2 Access to funding

Funding is a strong measure to promote sustainable construction. Development can only happen if there are sufficient monetary resources to conduct research and to implement the practices designed. According to the Human Sciences Research Council (HSRC), the government expenditure on research and development in South Africa is inadequate.²⁵⁹ As stated before, there is also a lack of incentives to promote green construction. In order to improve access to funding in the South African construction sector, the following actions are suggested:

- **Provide funding for capacity building:** All the actions proposed under 6.1 require funding from either the government or the private sector. It is very unlikely that academic, as well as non-academic workers, are willing to pay for (compulsory) training programmes themselves. Free courses, subsidies and scholarships are necessary to promote capacity building.
- **Increase government expenditure on research and development:** The overall expenditure on research and development in South Africa is inadequate and thus, funding for research on sustainable construction is virtually non-existent. Considering the (monetary) benefits, however, the budget allocations need to be revised.
- **Raise funds:** Researchers, developers or firm owners all must at last stir themselves into action. Actively asking for funds often leads to success. People constantly receive funding from private and corporate individuals for self-serving purposes, such as travelling the world or entering a sports competition. The environmental, social and economic benefits of sustainable construction for all surely justify soliciting funding.
- **Opt for green buildings:** Clients are the final instance; their decisions determine the success or failure of the sustainable construction industry. Green buildings usually involve higher investment costs. However, significantly reduced operation expenses outweigh these additional expenses. The clients thus have the opportunity to avail themselves of the savings made.

²⁵⁹ See HSRC (2016).

6.3 Partnerships and cooperation

Forming partnerships and cooperations is a main driver of success and change. Together, you are more influential and powerful than alone. Partnerships can be established within the sector or cross-sectoral, locally, nationally or internationally and between private and corporate clients. Some of the actions to form the kind of cooperations considered most effectively are listed below:

- **Develop a database:** A databank of relevant studies on sustainable construction could immensely facilitate knowledge- and information-sharing.
- **Introduce mandatory internships:** Partnerships between academic institutions and industry sectors are necessary to ensure a practice-based nature of the education provided at university. Students get the chance of learning-by-doing right on the spot and, as a result, keep sight of on-going research and innovations.
- **Establish partnerships between research and private sector:** It is indispensable for the research sector to receive information about the actual impacts of construction from the industries involved. Such partnerships will guarantee that researchers adjust their efforts accordingly and will further lead to greater efficiency in implementing new findings and technologies.
- **Form partnerships with related and supporting industries:** Interaction between the various industry role-players can be mutually advantageous. Forming partnerships with suppliers, water and sewerage corporations or electricity distributors ensures faster and cheaper supply and integrated development.

The public sector cannot be powerful when working on its own. The government needs to form partnerships to be assertive and influential.

- **Include the informal sector:** In 2014, 12.9 % of South African households were living in informal settlements.²⁶⁰ The informal sector is thus still a

²⁶⁰ See Statistics South Africa (2015), p. 35.

considerably big part of the construction industry and needs to be included when aiming to implement sustainable construction practices.

- **Involve traditional leadership:** The South African Constitution recognises the institution, status and roles of traditional leadership.²⁶¹ However, it is important to strengthen this institution in order to ensure that they can contribute to the development of the country. Traditional leaders have an incomparably great influence on the people living in their specific region and involving them can vastly push the uptake of sustainable construction in rural areas.
- **Cooperate on all governmental levels:** "The national, provincial and local levels of government all have legislative and executive authority in their own spheres, and are defined in the Constitution as distinctive, interdependent and interrelated."²⁶² Cooperating on all these levels is very important to drive green building practices.

6.4 Internal housekeeping

As elaborated in section 5.3, it is inevitable for the various construction practitioners to set a good example for others to follow. The technological and institutional enablers described can only be brought into practice if researchers, companies, clients and the government deliberately decide to make use of the opportunities created. This needs to be supported by the following actions:

- **Revise university curricula and training measures:** The research and education sector's duty to revise existing curricula and develop new training programmes has been mentioned under 6.1.
- **Estimate parameters:** Every role-player in the construction industry needs to independently get an overview of challenges, risks and benefits of green building practices. Only then can he decide which measures to take towards a more sustainable construction sector.
- **Develop individual codes of conduct:** As mentioned in sections 5.3.3 and 5.3.4, each company should develop a common set of values and, at best, an

²⁶¹ See GCIS (2015), p. 214.

²⁶² GCIS (2015), p. 201.

individual code of conduct. Having a best practice framework makes it easier for the staff to adhere to a sustainable behaviour.

- **Reduce the industry's environmental impact:** This includes the approaches listed under section 2.3.1 Environmental sustainability in construction, namely the use of green, locally produced building materials, reduction of quantity of building materials used, reuse of materials or whole building structure, use of renewable energy, efficiency in the provision of water and appropriate choice of location.
- **Create a sustainable work environment:** Companies, as well as the government need to change their work environment, i.e. their offices, to adjust to sustainability principles. Using recycled paper, avoiding waste or making use of renewable energies are just a few arrangements that can be made.
- **Lead by example:** The government, as well as the private sector need to function as prime models and abide to the standards and regulations they establish.
- **Reconsider value:** Every role-player, but especially the clients, have to reconsider their perspective on value. As soon as the clients change their procurement system to promote sustainable construction, there is no choice for the sector but to follow their demands.

6.5 Encouraging and supporting implementation

Many of the actions regarding internal housekeeping overlap with those associated with encouraging and supporting implementation. While the former can be seen as measures concerning the various role-players themselves and their personal choice of acting, the second should be viewed as means to carry these actions to the outside world and thus encourage others to act accordingly. The following approaches are proposed:

- **Facilitate implementation of research results:** The main task of the research and education sector is, as the name suggests, doing research and education. However, the academic professionals have to make their research results understandable and available to the masses. They need to demonstrate their findings, explain benefits and assist with the adoption of new technologies.

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- **Initiate demand:** Supply can also somehow determine demand. The private sector has to trigger demand by providing attractive alternatives to customary buildings and materials. The more companies partake, the greater the demand for sustainable construction and materials, as people usually join the crowd.
 - **Show commitment:** To encourage and support implementation, it is not enough for the private and public sector to comply with the values and codes they developed, but to actively show sustainable commitment. That means inter alia that the companies themselves have to work in a green building, use renewable energies and use responsible building materials. They are only taken seriously if they demonstrate dedication themselves.
 - **Withdraw support from unsustainable businesses:** As mentioned before, clients can change their procurement system to abandon companies that act in an environmentally, socially or economically unsustainable way which will in turn support sustainable construction practices.

While research and the private sector can only subliminally encourage the implementation of sustainable construction practices, the government can actually – to a certain extent – force change. Adopting green building standards and regulations immensely promotes the uptake of sustainable construction:

- **Update building standards and regulations:** The construction sector is constantly changing and new technologies and research results are permanently developed. Existing standards and regulations have to be reviewed and updated on a regular basis to provide for all upcoming contingencies.
- **Refine energy efficiency standards:** The current SANS 10400 XA standard, mentioned under 5.2.2, needs to be maintained and refined over time to guarantee energy efficiency in the construction sector.
- **Establish water efficiency standards:** Water is a scarce resource, especially in South Africa, and has to be conserved. Standards like the SANS 10400 XA, particularly for water efficiency need to be established to ensure future water supply.
- **Provide governmental incentives and disincentives:** Offering incentives can immensely stimulate the uptake of sustainable construction practices.

Supporting new entrants in implementing innovative technologies or encouraging investments in green building surely leads to increased activity in this field. Likewise, disincentives keep companies from building unsustainably and thus from polluting the environment.

- **Enforce regulations and standards:** Developing countries are often too meek when handling violations of their rules. It is indispensable to ensure that the regulations and standards are stringently enforced. Further, the government has to develop an appropriate penalty system for the case of infringements.

6.6 Monitoring and evaluation

South Africa has made much progress in the area of monitoring and evaluation. The fact that CSR reporting is a legal obligation represents an outstanding example of commitment to sustainability principles. Moreover, the country has established its own green building rating system, governed by the GBCSA, which is based on the Australian Green Star rating system.²⁶³ The following actions can help to further drive monitoring and evaluation in South Africa:

- **Participate in international rating systems:** Green Star SA certified projects should subsequently apply for a certificate issued by one of the internationally recognised schemes, such as BREEAM or LEED, to gain recognition worldwide.
- **Enact laws to penalise shortcomings:** Legally obligating companies to report on CSR is only the first step. In second instance, it is necessary to enact laws to prosecute businesses that do not act according to sustainability principles.
- **Monitor impacts of sustainable construction:** When building or purchasing sustainable projects, it is necessary to draw up a detailed list of the individual items. This includes additional capital costs on the one hand and savings made during the product life cycle on the other hand. Further, positive effects on environment and society need to be taken into account. Monitoring impacts of existing projects enables future role-players to recognise the advantages of sustainable construction.

²⁶³ See GBCSA (n.d. a).

7 Conclusion

Sustainable construction practices in South Africa are evolving rapidly. Many of the proposals outlined in the A21 SCDC have already been successfully realised. The country's construction sector is relatively well analysed and considered to be the most transparent market on the African continent. Academic institutions meanwhile attach great importance to sustainability issues and therefore offer degrees related to sustainability and sustainable construction and provide post-educational training programmes. New building regulations and regulatory and developmental frameworks facilitate the implementation of sustainable construction practices. South Africa's own green building rating system further stimulates the pursuit of a more sustainable future in the industry and additionally sets out best-practice guidelines. Agrément certificates for traditional building materials support the sector in gaining national confidence and the legal obligation to report on CSR encourages private and corporate individuals to reconsider their general values.

Despite this progress, considerable barriers remain. The developmental issues, South Africa is facing, are still regarded as being of greater urgency than the implementation of green technologies. There is still a lack of knowledge on sustainability issues, resulting in a general resistance to change. As stated in Chapter 6, the key areas of action when aiming to implement sustainable construction practices in South Africa are capacity building, access to funding, partnerships and cooperation, internal housekeeping, encouraging and supporting implementation and monitoring and evaluation. Most importantly, there is a need to raise awareness on the construction industry's impacts on environment, society and economy – positive or negative. Educating and training the sectors' practitioners is inevitable to establish a skilled and knowledgeable workforce. People need to understand what sustainable construction means and even more vitally, they need to be aware of the harm unsustainable behaviour is causing. We have to comprehend that we are destroying our planet and take action against its deterioration. Reconsidering value is the core idea. How much is money, a big house and an impressive car worth if we live in a world that is wrecked due to climate change; a world where South Africa is inter alia facing severe water shortage, an endangered ecosystem, decreasing exports, omitted tourism, rising unemployment rates and further prevalence of tropical diseases. As soon as people are aware of all that, the remaining obstacles can be challenged much easier.

Charles J. Kibert, one of the greatest researchers and writers on sustainable construction, said: “Like other processes, sustainable construction may one day become so common, that its unique distinguishing terminology may be unnecessary. At that point, the green building movement will have accomplished its purpose: to transform fundamental human assumptions that create waste and inefficiency into a new paradigm of responsible behavior that supports both present and future generations.”²⁶⁴

South Africa is well on track, especially in relation to other developing countries and is likely to further enhance and implement sustainable construction practices. It is important that all the role-players, i.e. government, education sector, private sector and clients, participate and work together to drive change in the industry.

²⁶⁴ Kibert (2013), p. 25.

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Ehrenwörtliche Erklärung

Ich erkläre hiermit, dass ich die vorliegende wissenschaftliche Arbeit

“Sustainable Construction in South Africa”

selbst angefertigt habe. Die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht.

Die Arbeit wurde bisher keiner anderen Prüfungsbehörde vorgelegt und auch nicht veröffentlicht.

Regensburg, den 22.07.2016
