IRE|BS
Foundation for African Real Estate Research

Green building certification in Sub-Saharan Africa

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An elaboration of sustainable rating criteria

Master thesis

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Abstract

Climate change is a fact rather than a hypothesis, and as a global community we are all affected by its consequences. To counter the aftermath of resource depletion, the solution offered by the real estate industry has been the establishment of green buildings. In developed countries these buildings are common and their number is rising. Despite this, in Africa, a continent with the highest projected growth rates in the next decades, the principle of sustainable green buildings has been non-existent. The lack of awareness and lack of suitable rating tools prevent the establishment of green buildings in Sub-Saharan Africa (SSA). In order to develop adequate criteria, existing tools are compared to externalize drawbacks. To close these gaps an appraisal of the continent is performed to reveal opportunities for the establishment of new criteria, as well to differentiate the weightings of already existing criteria. By conducting qualitative interviews with local theoreticians as well as practical experts, further insights into the conditions in SSA contribute to the elaboration of relevant criteria.

The results of the appraisal and the interviews reveal the need for an adjustment of current tools in all three dimensions of the sustainability definition in order to meet the local conditions. Social and environmental aspects in particular are among the criteria that must be focused on. This thesis is not an ultimate approach but it does reveal potential for the uptake of a suitable tool for the SSA context. Nevertheless, further research with the participation of the individual countries, e.g. green building councils, can help to establish a tool that copes with the internal needs of the countries in the region.

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List of abbreviations

BEE	Build Environment Efficiency
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Model
CSR	Corporate Social Responsibility
DGNB	Deutsches Gütesiegel Nachhaltiges Bauen
FDI	Foreign Direct Investment
JSBC	Japanese Sustainable Building Consortium
LEED	Leadership in Energy and Environmental Design
PIDA	Program for Infrastructure Development in Africa
RICS	Royal Institution of Chartered Surveyors
Sqm	Square meter
SSA	Sub-Saharan Africa
UN	United Nations
USGBC	United States Green Building Council
WGBC	World Green Building Council

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1. Introduction

"We shape our buildings, and afterwards our buildings shape us"
Winston Churchill

Our built environment impacts our surroundings in a multitude of ways. It gives us shelter, forms the appearance of our cities, and we spend most of our lifetime in buildings. Besides the visual aspects, buildings affect our environment in other spheres. The concept of "green building" arose as a reaction to the scarcity of resources and the effects of climate change. As the attribute "green" suggests, green buildings are environmentally friendly constructions and they perform more sustainably than conventional buildings.

The number of buildings constructed using principles of sustainability is steadily rising, and along with this a variety of certifiers have entered the market. In virtue of the climate change and the beneficial effects of green construction, a rising interest in the real estate industry and among stakeholders can be observed.

The multitude of certifiers on the market accompanies a variety of practices associated with green buildings. A one tool fits all solution does not exist, methods of certification are distinguished by a range of criteria and weightings. There are a number of tools and a great diversity in their focus. The need for a rating tool that covers the concept of sustainability in all its dimensions to an appropriate extent seems to be urgent, especially in regions seriously affected by climate change. This thesis focuses on Sub-Saharan Africa as a region with a high potential for growth, and examines the question:

"How can a sustainable rating tool take into account the specific conditions occurring in Sub-Saharan African states and contribute to sustainable development in the built environment?"

In order to answer this question, the thesis first focuses on the definition of sustainable development and clarifies the main characteristics. Subsequently, the transformation to a sustainable approach to the built environment by means of green buildings is described.

For transforming the green building approach in African states, some already existing, well-known green building certification systems such as BREEAM, LEED, Greenstar SA, CASBEE and DGNB are briefly described and compared. These tools contribute to sustainable development in their countries of origin, mainly in already developed states. However, Sub-Saharan Africa (SSA) is different and a simple transformation of the criteria tools is inappropriate in terms of sustainability.

In order to elaborate criteria suitable for the SSA context, specific characteristics of the region are investigated in order to derive a catalogue of relevant aspects. A concluding questionnaire of local SSA theoretical and practical experts provides further insights into the status quo of green building activity and the local conditions, and helps to specify adequate categories for criteria. The final catalogue of categories shows the areas especially important for the SSA context and should contribute to further research.

2. The concept of sustainability

The very first thoughts about sustainability occurred in the early 18th century, when Carl von Carlowitz published his book *"Sylvicult ura Oeconomica"*. Carlowitz, the director of Mines in Saxony, Germany, was concerned about the utilization of the forest. He feared that the wood would soon run out due to industrialisation. He therefore proclaimed continuous, permanent and sustainable utilisation as the rule for forestry.[1]

In the face of the ongoing industrialisation and the mass use of natural resources, the concept of sustainability later regained interest. With the publication of the book *"The limits to Growth"* by the Club of Rome, the UN began to revive the concept of sustainability.[2] The Club of Rome, an informal organization, named five major growth trends that limit the growth of the planet and stated that is these if remained unchanged they would harm human habitats. These trends are world population, industrialization, pollution, food production, and resource depletion. The book strongly suggests altering these scalable issues in order to maintain a transition from unchecked growth to global equilibrium.[3] These warnings of a potential world crisis had a persistent influence on global policies and can be seen as a trigger for the initiation of sustainable development processes.

In the following years, milestones such as the Agenda 21, the Kyoto protocol or the recent 21st UN Climate conference and the first global climate agreement, showed the relevance of sustainability goals on a global scale. Moreover, many companies adopted the objectives of sustainability into their corporate governance policies and the term corporate social responsibility was adopted.[4]

The concept of sustainability seems to be on many people's mind, at least in the majority of developed countries. Nonetheless, the awareness of sustainability in many developing countries is limited, although there is a clear need for sustainability in the light of the more frequent natural hazards that are a result of climate change.

[1] Vehkamki 2005, p. 3
[2] Grober 1999
[3] Meadows et al. 1972, pp. 23–24
[4] Katsoulakos et al. 2004, p. 14

2.1. The definition of sustainability

Sustainable development is an ambiguous process, as heterogeneous as the diversity of human societies and ecosystems. Nevertheless, one basic definition that is often referred to in the literature is the Brundtland report, composed by the UN World Commission on Environment and Development and published in 1987. It defines sustainable development in their statement, *"Our common future"* as follows:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[5]

This definition encompasses two major concepts. On the one hand it addresses human needs, especially those of the poor, and on the other hand, based on the state of technology and social organization it takes into account the idea of limitations on the ability of the environment to meet present and future needs.[6] The Brundtland report can be interpreted as a call to action derived from previous similar studies such as *"The Limits to Growth"*[7] and from natural hazards such as the dust bowl in the 1930s. Our common future emphasises the role of a global agenda for change, in particular a basic consensus of sustainable development, as well as general strategies for achieving the goal of sustainability.[8]

Since sustainability is a complex multidimensional process, it can be modelled in a triad.

"The pursuit of sustainability involves anticipating and considering the economic, ecological and social effect of today's action on fellow men and on the life of future generations."[9]

The quotation alludes to the three pillars of economy, ecology and society as components and necessities of the definition of sustainability. These pillars and their interdependencies are illustrated in Figure 1.

[5] Hinrichsen 1987, Chapter IV
[6] Hinrichsen 1987, Chapter II
[7] Meadows et al. 1972
[8] Hinrichsen 1987, p. 41
[9] Vehkamki 2005, p. 10

Three pillars of sustainable development

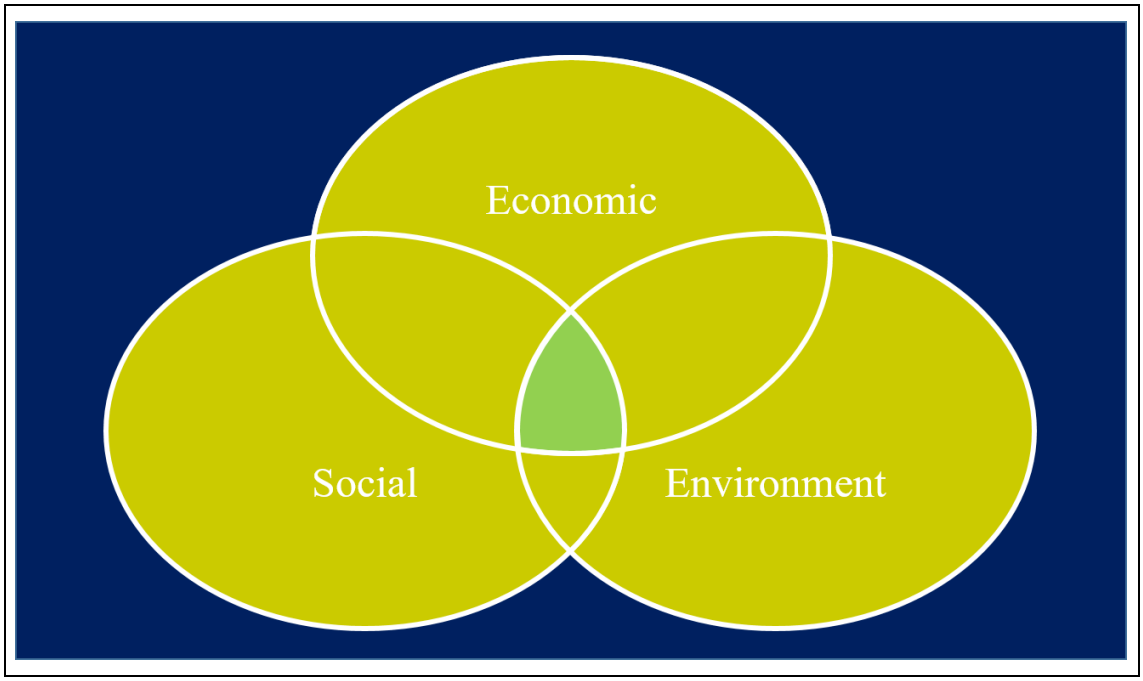

Figure 1: Three pillars of sustainable development[10]

The intersection of the three dimensions is relatively small, displayed as the inner green area of the triad. This intersection describes a state in which all three necessities of sustainability are fulfilled and which therefore can be described as a state of sustainable development. The reason for the low accordance level is the tensions that exist between the pillars. The following three arguments describe the interactions of the three dimensions:

- Economic growth must be balanced with intergenerational equity in order to meet basic social needs.
- Preservation of the environment fosters intergenerational equity, and social values influence how environmental issues are addressed.
- The combination of economic growth and environmental preservation is a well-known and frequent challenge.

[10] Source: Own illustration

- Finally, the pursuit of prosperity is often accompanied by environmental constraints, although in the long-term, the internalization of environmental costs and benefits can improve economic decisions. [11]

As a result, synergies must be identified and maximised in order to lower the tensions and to foster the process of sustainability. This process involves national strategic initiatives as well as international efforts. The role and accountability of the world economy comes especially to the fore, particularly in regard to impacts on the African continent.[12]

2.2. Challenges for a sustainable development

Sustainable development is a process influenced by a variety of factors of different magnitudes. The pace and extent of demographic development is consistently an issue of major relevance. In fact, the world population is increasing at a tremendous rate. From 6 billion in 2000, the population is forecast to reach 9 billion in 2050: an increase of 50%.[13] The intense rise in population stresses the need for sustainable development in multi-layered aspects. Food supply, urbanisation and the provision of basic needs in general as well as environmental constraints are only a few aspects to mention. Moreover, the population growth is unequally distributed, with clear regional differences. Figure 2 shows the population growth rate for various regions in the world.

The forecast predicts that Africa will have by far the largest increase in population. About half of the global population growth rate between now and 2050 is expected to occur in Africa, making it the most rapidly urbanising region in the world.[14]

The majority of developing countries will experience an increase in population, despite some developed countries experiencing a slower increase or even a decrease, as recently observed in many European states.[15]

[11] Simpson 2013, p. 234
[12] Hinrichsen 1987, Chapter II, III
[13] United Nations Department of Economic and Social Affairs
[14] PWC 2015, p. 7
[15] UN Department of Economic and Social Affairs 2015, p. 3

Regional population growth rate forecast

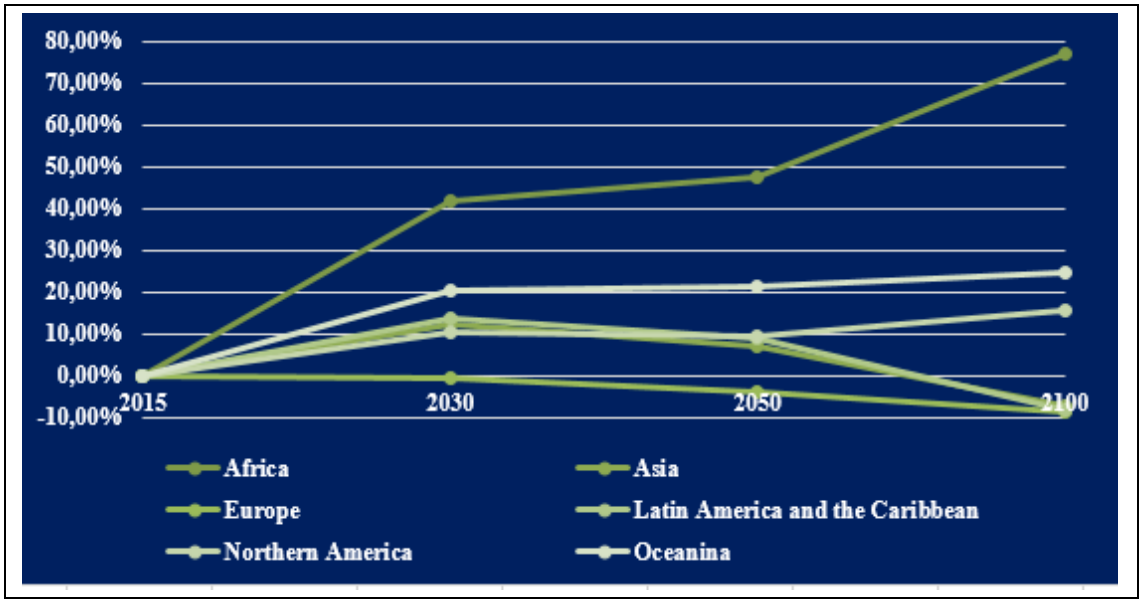

Figure 2: Regional population growth rate forecast[16]

A side-effect of the boom in population is likewise an increase in production and consumption. GDP, which is the key performance index for the growth of global production, shows an average growth rate of 3.5% from 1960 to 2015.[17] The process of growth is accompanied by the increased extraction of limited natural resources as a fuel for powering the engine of growth. As a consequence the volume of climate harming gases, especially the emission of CO^2, has also increased over the years.[18]

Widely observed effects of climate change are the rise of sea levels, higher global surface temperatures, decreases of snow and ice levels and an increase in extreme weather hazards such as droughts and storms.[19] In response to these drastic environmental changes, in 2013 the World Economic and Social Survey named three major challenges for sustainable development.

Firstly, the sustainable urbanisation of cities, especially in those cities heavily impacted by population increases: the so called megacities. Secondly, food and nutrition security, particularly in regard to severe conditions for growing crops and an increasing demand.

[16] Own illustration, Data: UN Department of Economic and Social Affairs 2015
[17] The World Bank 2016b
[18] ESRL et al. 2016
[19] IPCC 2007

Thirdly, the transformation to renewable energies to enable a secure supply and to limit the output of climate harming gases.[20]

All three challenges are a global affair. However, at present many developing countries, including most African states, are highly affected.

After the introduction of the term sustainability and its challenges, the study will focus on strategies to support the sustainable development process in the real estate industry and will then apply this to the African context.

3. Green buildings as a sustainable approach

As already described, the necessity for sustainable development is a collective undertaking, and the question arises of whether and how the real estate industry can contribute to this process.

Primarily our built environment is omnipresent. Humans spend approximately 90% of their time in buildings; whether working in the office, living at home or using public buildings, we are constantly surrounded by buildings.[21] The majority of buildings are constructed using conventional, long established practices. In the past, awareness of the inclusion of sustainability features in buildings was non-existent. The premise of growth was ubiquitous. Due to resource depletion and climate change, interest has grown in the idea of sustainability. The oil shortages of 1973 and the development of environmental movements were fertile soil to foster research into sustainability in the real estate industry.[22]

In line with the projections of population growth, a concurrent increase in new buildings is anticipated. Referring to the question of the accountability of the real estate industry in terms of sustainability, the impact of buildings on the environment in different scales comes to the fore. As shortages of energy sources are among the most urgent issues, a closer look at the energy demands of buildings reveal the potential upside of sustainable features. Currently about 30% – 40% of global energy consumption is accounted for by

[20] United Nations, vi
[21] McGraw Hill Construction 2013, p. 44
[22] Building Design and Construction 2003, p. 4

buildings; the building sector is responsible for nearly 1/3 of energy related CO2 emissions.[23]

Figure 3 shows energy consumption by sectors in 2010. Approximately 35% of the energy utilization is related to buildings, followed by industry with 31% and transport with 30%. The remaining 4% includes sectors such as agriculture, forestry, fishing and non-specified.

Energy consumption by sector

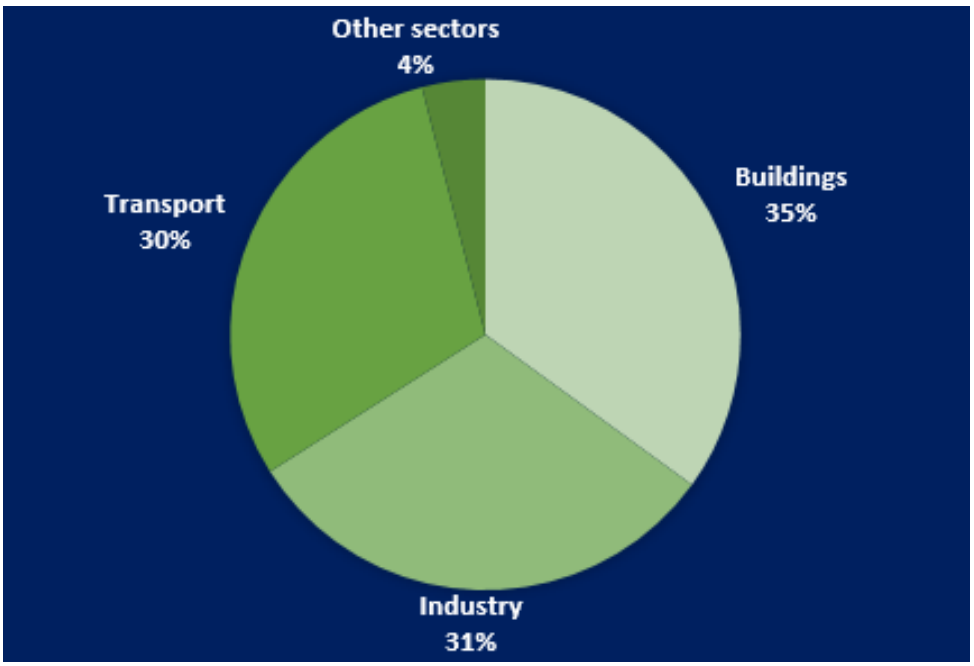

Figure 3: Energy consumption by sector[24]

The level of energy consumption of buildings reveals the relevance and potential for savings on a global scale:

[23] International Energy Agency 2013, p. 25

[24] (Own illustration Data: International Energy Agency 2013

"There is widespread agreement that reliable, environmentally sustainable and affordable energy sources are fundamental to economic stability and development. It is also widely accepted that achieving them will require a truly global and integrated energy technology revolution."[25]

In addition to the utilisation of energy, a building requires further natural resources for construction and maintenance. Water is a resource that is already scarce in many developing countries. According to the UN, buildings use 25% of global water resources.[26]. Keeping in mind that the majority of future population growth will take place in Africa, a region particularly threatened by water scarcity, the procurement and management of water is a major challenge.

The energy and resource consumption of buildings illustrates the relevance and accountability of the real estate industry in the context of sustainable development. Besides the primarily environmental perspective, a sustainable approach also involves economic and social issues. The following chapter defines the term "green building" and takes into account the remaining pillars of sustainability.

3.1.Definition of green building

The first green buildings arose in response to the shortage of energy and the need for resource efficiency. The intentions were clearly based on an environmental perspective, apparent in the label "green building". Gradually, the awareness manifested that besides energy efficiency, a building and its surrounding must be viewed from a holistic perspective.[27]

The principal environmental perspective was complemented by economic and social factors, taking into account the entire concept of sustainability according to the underlying three pillars. This thesis emphasises the definition quoted by Lützkendorf and Lorenz and encompassing the three dimensions as defined by Elkington.

[25] International Energy Agency 2013, p. 27
[26] United Nations Environment Programme (UNEP) - SBCI
[27] Ghaffarian et al. 2013, p. 2

"A sustainable building is meant to be a building that contributes – through its characteristics and attributes – to sustainable development. By safeguarding and maximising functionality and serviceability as well as aesthetic quality a sustainable building should contribute to the minimization of life cycle costs; the protection and / or increase of capital value; the reduction of land use, resources, raw material and resource depletion; the reduction of malicious impacts on the environment; the protection of health, comfort and safety of workers, occupants, users, visitors and neighbours; and (if applicable) to the preservation of cultural values and heritage."[28]

Elkington's definition covers the economic, environmental and social spheres, and is hence an appropriate basis for a holistic green building approach. Aligned with this definition, a study by the Oxford Institute for Sustainable Development[29] surveyed members of the Royal Institution of Chartered Surveyors (RICS) in regard to their engagement with the sustainability agenda. According to the study, the triple bottom line of sustainability affects the built environment in different scopes as displayed in Table 1.

[28] Rottke, Landgraf 2010, p. 36
[29] Dixon et al. 2008

Scope of the built environment in relation to the triple bottom line

Triple bottom line	Built environment scope
Environment	Energy/materials Urban form Land Use/pollution Open space Climate change Biodiversity
Economics	Property market Labour market Household income Investment and equity Production and distribution
Society	Security Identity Accessibility Basic needs (water, food, shelter, clothing)

Table 1: Scope of the built environment in relation to triple bottom line[30]

Table 1 illustrates that besides environmental aspects, buildings have further impacts on the economic and social scales. This broad scope verifies the relevance of the real estate

[30] (Own illustration Source: Dixon et al. 2008

industry in countering impacts on all three dimensions. In addition, the study stresses the importance of the life cycle of buildings, with the phases of location and design, use and operation, and final disposal.[31] A more detailed description of the different life cycle phases is displayed in Figure 5.

Life cycle phases of buildings

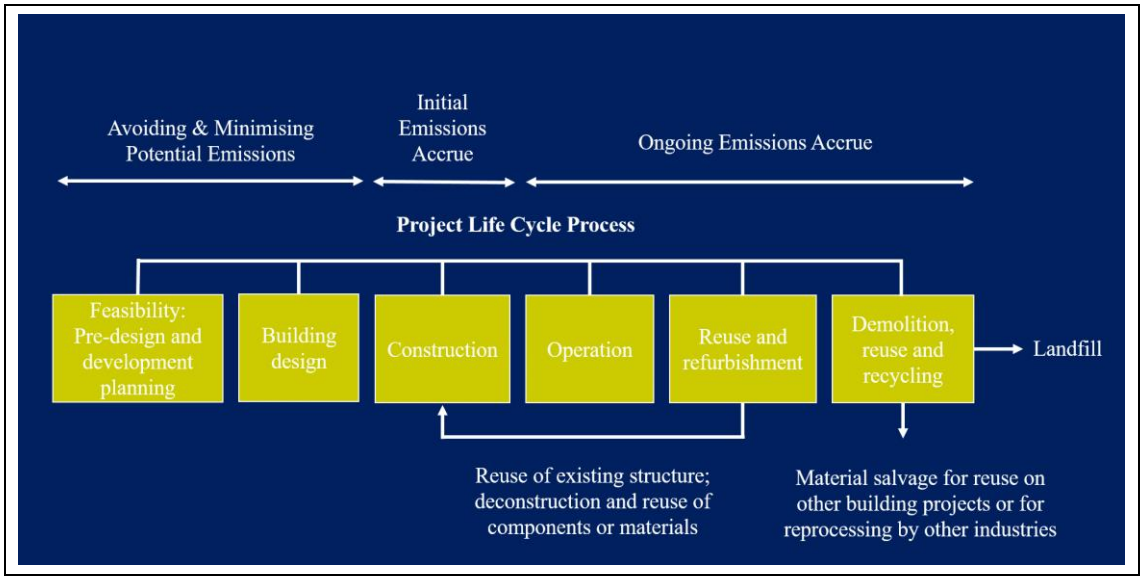

Figure 4: Life cycle phases of buildings[32]

The avoidance and minimizing of potential emissions is mainly controlled by the early stages of pre-design and development planning as well as building design. Due to the relatively long lifespan of buildings, the anticipation of operating costs in the early design process is crucial.

The second phase is the initial appearance of emissions, which takes place during the construction of the building. This includes the transportation and manufacturing of construction materials on and off site. In this phase the sourcing of materials also contributes to the amount of emissions.

The bulk of the accumulated emissions occur in the buildings' operation phase. Studies show that over 80% of greenhouse gases are emitted during this phase.[33] Energy related

[31] Dixon et al. 2008, p. 464
[32] (Own illustration, Source: UNEP SBCI 2009, p. 11)
[33] UNEP SBCI 2009, p. 6

emissions from heating, ventilation and lighting etc. are the main consumers of energy. In addition, a variety of other factors play a significant role. The location of the building is influenced by the climate; the function and use of buildings; the building design as well as choice of construction materials; the source level of demand and supply of energy; the income and behaviour of the occupants. All of these factors have an influence on the amount of consumed energy and related emissions during the operation phase.[34]

The final steps of reuse/refurbishment and demolition/recycling take into account the suitability of already produced and used construction materials for additional usage. The avoidance of virgin construction materials lowers the output of greenhouse gases and preserves natural resources. A precondition for re-use and recycling of materials is an accurate salvage process and a transparent declaration procedure. There is potential for materials to either be re-used in buildings or to serve as a substitute material for other industries. However, the anticipation of all phases in the life cycle of a building is a necessary prerequisite for green building initiatives.

Besides the relevance of the different phases in the life cycle of a building, the status of the certification and the resulting identification as a green building is of major interest. If a building's owner seeks to label a building green, the process of certification comes to the fore. A certification process is necessary to validate the building's sustainability and to officially name it a green building. To get an impression of what is meant by certifying a building as sustainable, the widely used certification system LEED and the underlying certifier USGBC quote the following areas as necessities for a green building certification system.[35]

- Sustainable site planning
- Water efficiency
- Energy efficiency
- Material and Resources
- Indoor environmental quality

[34] UNEP SBCI 2009, p. 10
[35] Yudelson 2007, p. 11

In order to provide a better understanding of how these areas are fulfilled “on site” and also to assist in the finding of new criteria in the later research on SSA countries, a further explanation of the different areas is necessary.

Sustainable site planning:

A site is defined as being sustainable if its location is away from flood land and agricultural prime land and is far away from the habitat of endangered species. Furthermore, urban infrastructure should already be provided, as well as possibilities for people to commute to work. With regard to the selection of building sites, brownfield sites should be building area after adequate de-contamination. Further issues are the appropriate management of storm water run-off and a reasonable urban densification in order to protect open spaces.

Water efficiency:

Saving water resources can be accomplished by control of irrigation for landscaping as well as by using water conserving fixtures inside buildings. A further approach is to reduce sewage flows or even to treat wastewater on site.

Energy efficiency:

This includes the utilisation of on-site energy saving systems as well as the on-site generation of power. The supply of the building’s energy mix by using green offsite power is another aspect. Moreover, a continuous tracking of the energy consumption can provide feedback regarding wastage and can reveal potentials for optimisation.

Material and Resources:

In general, local materials should be used for construction in order to lower the environmental impacts of transportation. In addition, recycled building materials as well as sustainably harvested natural resources should be utilised. During the construction process, waste should be minimized in order to lower costs and to reduce landfill.

Indoor environmental quality:

Providing a better, healthier workplace and housing space can be achieved by the following measures: Usage of low emitting materials to reduce the amount of contamination; installation of an adequate ventilation system and possibilities for natural

ventilation; individual control of thermal comfort, ventilation and lighting as well as sufficient natural light for illumination.

The above mentioned areas are elements in the LEED certification system, the certifying system of the United States Green Building Council (USGBC).[36]

A closer look at other existing certifiers reveals a similar handling of these areas, but with differing extents and weighting for the final labelling status. Some set a lower standard and others are stricter. Moreover, not all dimensions of a sustainable development are covered to a suitable extent. LEED and BREEAM are often criticized for losing sight of the whole life cycle of buildings.[37] A more detailed description of selected rating tools is provided in the comparison in Chapter 4.

For a buildings' assessment it is also crucial to understand the effect that the building has on different scales for the selection and weighting of criteria. Although a building is immobile and hence bound to a local surrounding, it does have impacts on much broader scales. Depending on the performed action, the individual, local, or regional/global scales are affected.

The individual scale focuses on the wellbeing and health of the occupier; it mainly focuses on the building itself. Criteria such as thermal comfort, the usage of fresh water, sanitation and the choice of building materials are impacts on this scale.

A local scale is involved once the neighbouring buildings or the city are impacted, for example through the dependency upon local infrastructure or services. The local economy can be supported by the construction and maintenance of buildings, whereas the construction has impacts on the natural environment surrounding the site. Finally the local water resources are affected by the water usage and sewage treatment methods of buildings.

The regional/global scales are always involved. During the construction as well as the operation phase the building consumes energy resulting in resource depletion, and the emission of greenhouse gases has an effect on a global scale.[38]

[36] Yudelson 2007, 15ff
[37] Rottke, Landgraf 2010, p. 36
[38] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, p. 15

Scales of the built environment

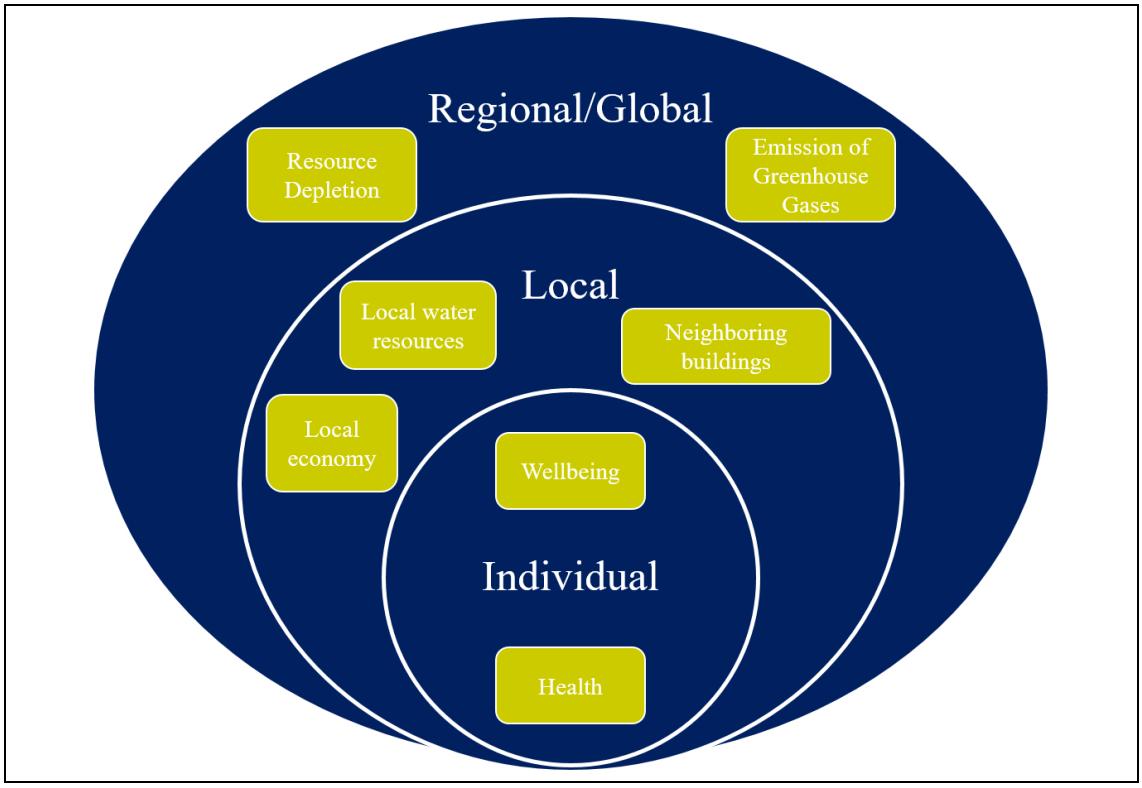

Figure 5: Scales of the built environment[39]

3.2. Benefits of green buildings

The intention of constructing green buildings is reasonable if there are benefits compared to conventional buildings. Besides the first thoughts of better environmental performance and improved energy efficiency, there are other beneficial effects of green construction. In fact, the number of green buildings is on the rise. Statements such as

"Global green building market indicates strong growth expected"

and

"Social and environmental reasons for building green"

are headlines in a smart market report conducted by McGraw Hill construction in 2013.[40] The essence of the study is an increase in green building construction across the globe.

[39] (Own illustration Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)

[40] McGraw Hill Construction 2013

From a primarily idealistic desire, building green has become a business opportunity in an increasingly competitive global market. For an increasing number of companies it has become a business imperative.[41]

Various studies of green building performance have resulted in the identification of benefits ranging from economic, social to environmental aspects. The majority of the study's findings show an overall benefit from green buildings compared to conventional construction. The following attributes were identified as providing supporting arguments.

Green buildings and productivity

Studies concerning the impact of green building initiatives on productivity concluded that overall, the productivity of workers increases. According to Miller et al. (2009), a reduction of sick time was noticed when comparing staff working in a conventional building to an office with certification. Moreover, benefits in the recruitment process and retention are recognized. Sources of these benefits are the utilization of natural light, scalable and adequate ventilation and lighting, the absence of toxic emitting interiors and a comfortable temperature.[42] These aspects are assessed by certification tools under the category of indoor environmental quality.

Benefits related to the building's value

A widespread argument against sustainable building is the assumption of higher construction costs, accompanied by ignorance of the financial benefits.[43] A study conducted by Fuerst and McAllister[44] measured the effects of green building certifications on building values. The results of their investigation showed a price and sales premium for certified buildings in contrast to non-certified ones. The main sources for the premiums are:

[41] McGraw Hill Construction 2013, p. 1
[42] Miller et al. 2009
[43] Kubba 2012, p. 2
[44] Fuerst, McAllister 2011

I. Occupier benefits

II. Lower holding costs for investors

III. Lower risk premium

The occupiers of the building profit from the reduced operating costs, a better working environment and the image factor; the willingness to pay factor therefore increases.

> *"…continuous valuation surveys have revealed that occupiers are prepared to compensate owners for the additional cost of green building through higher rents."*[45]

The owners of the building may benefit from reduced holding costs due to lower vacancy rates and higher tenant retention. Furthermore, reduced depreciation due to the use of newer technologies as well as a decreased regulatory risk are observed.[46]

Taking into account the above mentioned benefits, a lower risk premium for investors can be applied, making certified buildings an attractive investment consideration. Indeed, the amount of investments in green buildings has increased in recent years.[47]

The following graphic briefly illustrates sustainable building features and the resulting benefits in the economic dimension.

[45] Fuerst, McAllister 2011, p. 49
[46] Fuerst, McAllister 2011, p. 49
[47] Deloitte 2014, p. 2

Sustainable design and resulting economic effects

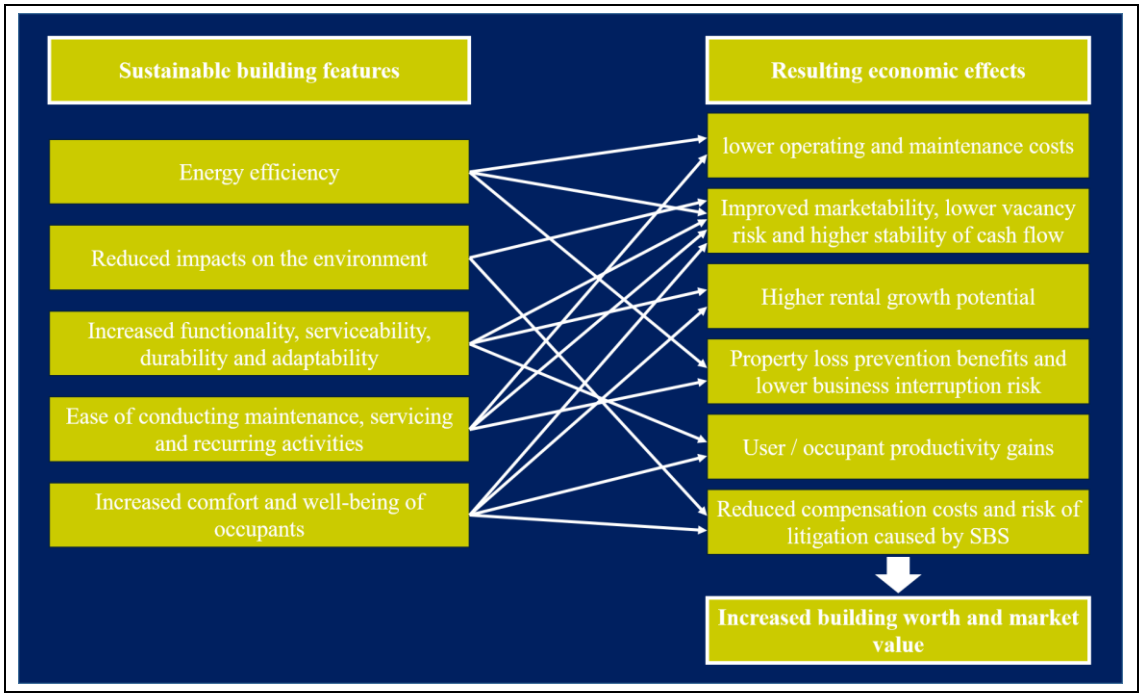

Figure 6: Sustainable design and resulting economic effects[48]

3.3. The vicious cycle of blame

Although the previously mentioned benefits of sustainable building techniques are obvious, the rate of construction of green buildings is still comparatively low compared to that of conventional buildings.

An often stated reason for this development is the vicious cycle of blame referring to a misalignment of incentives between the providers and those who intend to invest or occupy.[49] The four participants in the cycle are: Owners/end users, who would like to purchase green buildings but claim there is no adequate supply; designers and constructers who can plan green buildings but state that there is no demand from the developers; the developers, who would like to ask for sustainable buildings but state that there is no intention of investors; and subsequently the investors, who would invest in sustainable buildings but are convinced that there is no demand. The vicious cycle is displayed in Figure 7.

[48] Lützkendorf, Lorenz 2005, p. 12
[49] RICS 2008, p. 3

The vicious cycle of blame

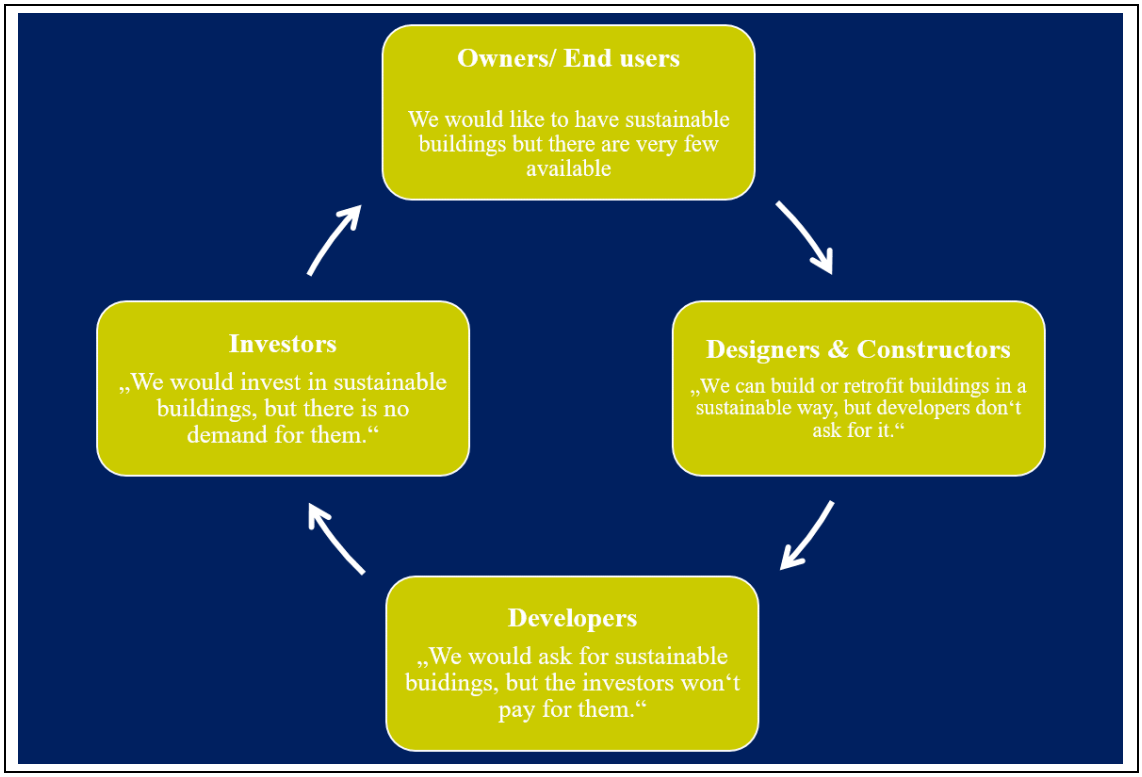

Figure 7: The vicious cycle of blame[50]

Breaking the vicious cycle of blame and turning it into a virtuous cycle is mostly a matter of information.

"The information flow needs to be organised in such a way that the knowledge on the benefits of sustainable buildings pervades all areas."[51]

The correct installation of a feedback mechanism and a realignment of incentives are fundamental preconditions to break the vicious cycle. A confirmation of the environmental and social benefits as well as the financial performance and influence on property value are therefore necessary. The further involvement of additional groups such as property professionals, banks, assessors and research institutes can reinforce the development of green building.[52]

[50] (Own illustration, Data: RICS 2008)
[51] RICS 2008, p. 6
[52] RICS 2008, p. 5

Figure 8 shows the virtuous cycle, which provides benefits for every participating party by enabling the uninhibited flow of information. Every participant in the cycle fulfils their anticipated goals and in the end a better situation for every participant is achieved.

The virtuous cycle

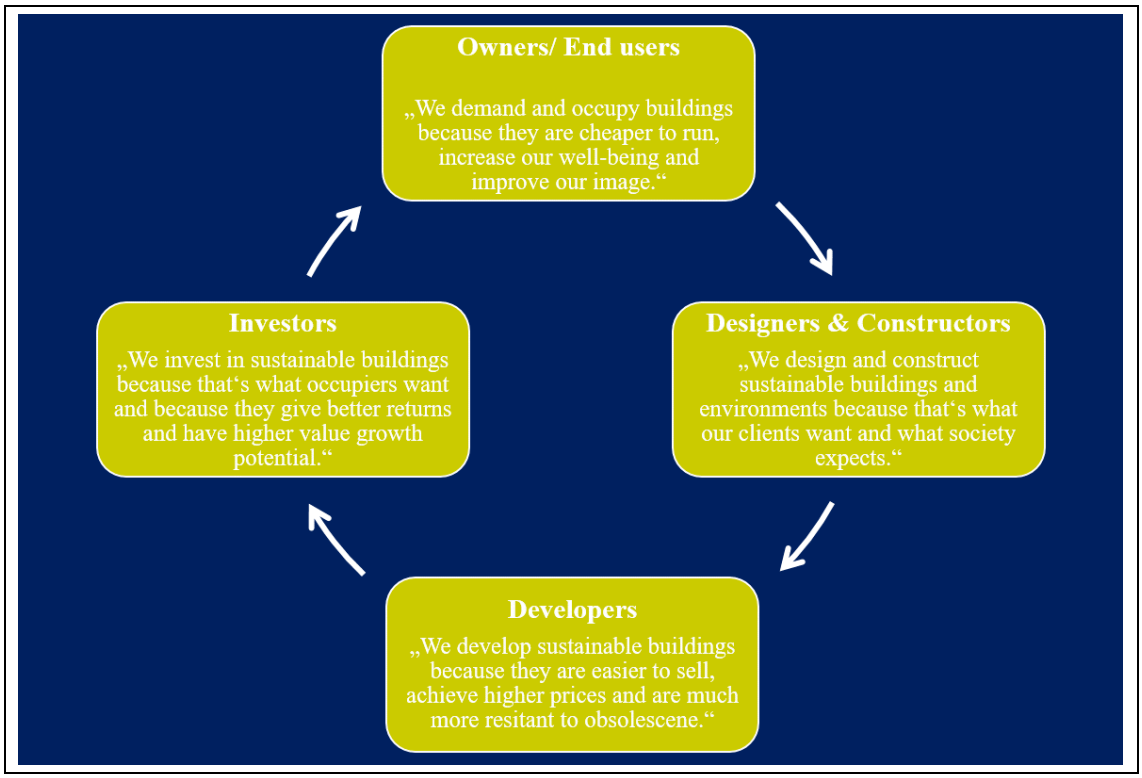

Figure 8: The virtuous cycle[53]

4. Comparison of widespread sustainable rating tools

Since the establishment of the first certification system, several new tools have emerged. The resulting diversity of tools has contributed to an unclear vision of the scope and span of application, especially for those investing in green buildings.[54] In order to derive a sustainable rating tool for SSA, it is unavoidable to compare already existing certification systems. These systems can serve as a starting point for further development, since a pure transformation is difficult and even unsuitable. The compared rating tools, BREEAM, LEED, CASBEE, Greenstar South Africa and DGNB are widely used in an international

[53] (Own illustraion, Data: RICS 2008)
[54] Addae-Dapaah, Chieh 2011, p. 162

context, differing in the extent of their valuation criteria and weightings. Although originating in modernized countries, some criteria and categories (or at least basic frameworks), can be adapted for use in SSA states while others must be new established.

4.1.BREEAM

The BREEAM rating tool was the first green building tool to be established, and it has the largest number of issued certificates.[55] The tool was conceived by the Building Research Establishment (BRE), a government funded research program, in 1990. The tool is affiliated to the BRE Global International Code for a Sustainable Built Environment. A set of strategic principles and requirements define an integrated approach to the design, management, evaluation and certification of environmental, social and economic impacts on the built environment.[56]

In order to maintain a flexible system, BREEAM adopts a balanced score card approach. Hence it is possible to transfer credits from compliance to non-compliance in order to achieve a particular level. Nonetheless, to ensure that there is no serious violation of environmental principles, certain minimum standards in key areas are set.[57] The tool contains 10 different categories based on varied weightings, applicable to 4 different fields. These fields are master planning, new construction, in-use and refurbishment and fit out. The proof of sustainable building practices is issued using a certificate percentage system, the results ranging from pass, good, very good, excellent, to outstanding.[58]

For the certification, BREEAM assessors consider the evidence against the credit criteria and report it to BRE, who issue the certificate. Table 1 illustrates the BREEAM new construction tool 2011 at a glance.

[55] BREEAM 2016
[56] BREEAM 2011, xiii
[57] BREEAM 2011, p. 21
[58] BREEAM 2016

BREEAM at a glance

Environmental section	Weighting
Management	12%
Health and Wellbeing	15%
Energy	15%
Transport	9%
Water	7%
Materials	13.5%
Waste	8.5%
Land Use and Ecology	10%
Pollution	10%
Total	100%
Innovation (additional)	10%
Maximum	110%

Pass	Good	Very good	Excellent	Outstanding
30 – 45%	45 – 55%	55 – 70%	70 – 85%	85 – 100%

Table 2: BREEAM at a glance[59]

4.2. LEED

The LEED rating tool was introduced in 1998 by the USGBC, a consensus driven national non-profit membership body. The tool is defined as "*a framework for identifying, implementing, and measuring green building and neighbourhood design, construction, operations, and maintenance.*"[60] The allocation of points between credits is based on the potential environmental impacts and human benefits. The results of the point allocation among credits is called credit weighting.[61]

The first version of the tool came into use in 2000, and since then several new versions have been published, certifying 5 different project types. The project types are: Building

[59] (Own illustration, Data: BREEAM New construction 2011)
[60] USGBC 2015, p. 2
[61] USGBC 2012, xii

Design and Construction; Interior Design and Construction; Building Operations and Maintenance; Neighbourhood Development; and Homes. The current certification criteria "LEED for New Constructions and Major Renovations" span 7 sections resulting in 4 certificates ranked by a point system from certified (the former bronze), to silver, gold and finally platinum. The certification process is performed by the USGBC, who receive relevant information from the projects design teams. An overview of the features of the system is displayed in Table 2.

LEED at a glance

Environmental section	Points
Sustainable sites	26
Water efficiency	10
Energy and Athmosphere	35
Materials and Resources	14
Indoor environmental Quality	15
Total	100
Innovation and design process	6
Regional Priority	4
Maximum	110

Certified	Silver	Gold	Platinum
≤ 49 p.	≤ 59 p.	≤ 79 p.	≥ 80 p.

Table 3: LEED at a glance[62]

4.3. CASBEE

The equivalent Japanese rating tool is the Comprehensive Assessment System for Built Environment Efficiency (CASBEE), which can be defined as a tool for

"…a comprehensive assessment of the quality of a building, evaluating features such as interior comfort and scenic aesthetics, in consideration of environment practices that

[62] (Own illustration, Data: LEED 2009 New construction and major renovations)

include using materials and equipment that save energy or achieve smaller environmental loads."[63]

CASBEE was developed in 2001 by a research committee through the collaboration of academia, industry, and national as well as local governments. The tool covers 3 different scales ranging from construction, urban, to city management. The concept of CASBEE differs from the previously mentioned tools because it draws spatial boundaries to be assessed. A building and its surrounding are determined by a border and evaluated separately. The determinant in the certification process is the Build Environment Efficiency (BEE). The BEE is a key indicator for the performance of the building, using 4 assessment fields. These obstacles are categorized into 2 subjects: "Build Environment Quality" (Q) and "Built Environmental Load" (L). Q and the L represent respectively the inner and the outer border of the assessed building. Furthermore, Q and L possess 6 underlying subcategories, displayed in Table 3. The BEE is calculated using the following formula and is rated within a spectrum from poor, slightly poor, good and very good to superior.[64]

$$BEE = \frac{\sum_1^3 Q}{\sum_1^3 L}$$

Equation 1: Calculation of CASBEE's BEE

[63] CASBEE 2016, p. 1
[64] CASBEE

CASBEE at a glance

Assessment fields	Recategorized	Subcategories	BEE
Energy efficency	Q for Quality and L for Load	Q1 Indoor environment	Numerator
		Q2 Quality of service	
Resource efficiency		Q3 Outdoor environment	
Local environment		L1 Energy	Denominator
		L2 Resources and materials	
Indoor environment		L3 Off-site environment	

Poor (C)	Slightly poor (B-)	Good (B+)	Very good (A)	Superior (S)
≤ 0.5 BEE	≤ 1.0 BEE	≤ 1.5 BEE	≤ 3.0 BEE	≥ 3.0 BEE

Table 4: CASBEE at a glance[65]

4.4. Greenstar South Africa

The Greenstar SA rating tool was derived from the Greenstar tool, which was established by the Green Building Council in Australia. It came into action in 2007 and consists of 9 different categories applicable for the 3 building types: new buildings, existing buildings and interior fit outs. Within the new building sector there is a differentiation between offices, retail centres, multi-unit residential buildings and public and education buildings.

The local conditions in Africa and Australia are to a certain extent similar, for example in their water utilization. As a result, these environmental categories are ranked higher. However, the tool was customized for the South African context. According to the different building types, various weightings of the categories are performed. About 70-80% of the credits for each category are core credits common to all building types. The certification is issued by independent assessors, who evaluate submissions and allocate points. In the end, a certification ranging from 4 to 6 stars can be achieved.[66]

[65] (Own illustration, Data: Source CASBEE 2016)
[66] Green Building Council South Africa 2016

Greenstar South Africa at a glance

Environmental section	Points
Management	12
Indoor Environment Quality	27
Energy	29
Transport	11
Water	12
Materials	25
Land Use and Ecology	8
Emission	19
Total	143
Innovation (additional)	5
Maximum	148

4 star	5 star	6 star
45 - 59 p.	60 - 74 p.	75 - 100 p.

Table 5: Greenstar South Africa at a glance[67]

4.5.DGNB

The "Deutsche Gesellschaft für nachhaltiges Bauen" certificate (DGNB) was established in 2008 by the German Sustainable Building Council in cooperation with the Federal Ministry of Transport, Building and Urban Affairs. The tool assesses the complete life cycle of buildings, separated into 3 different categories: new building, existing building and districts. Out of the compared tools, DGNB is the only one that takes into account an equal evaluation of the 3 dimensions of economic, ecological and social. In addition, the tool investigates the technical and process quality of buildings. Table 5 illustrates the underlying categories. The final certification is performed by an official DGNB auditor and can be issued in 4 different stages ranging from bronze, silver and gold to platinum. The number of points depends on the one hand on a minimum value and on the other hand on the total rating. The minimum value must be achieved in order to consider points in

[67] (Own illustration, Data: Green Building Council South Africa 2016)

all categories. Failure to collect the minimum percentage in one rating leads to the negation of all other points.[68]

DGNB at a glance

Environmental section	Weighting
Ecological quality	22,5%
Economical quality	22,5%
Sociocultural quality	22,5%
Technical quality	22,5%
Process quality	10%
Total	100%
Site quality	0%
Maximum	100%

	Bronze*	Silver	Gold	Platinum
Minimum	-	35%	50%	65%
Total	35 - 50%	50 – 65%	65 – 80%	80 – 100%

Table 6: DGNB at a glance[69]

* The bronze status can just be awarded to existing buildings and has no minimum criteria.

4.6. Comparison of the tools

The purpose of the following comparison of the tools is to identify categories that are covered to an adequate extent, but also most importantly to detect sectors which must be adjusted in order to fit the needs of the SSA context.

Because of the span and the differences between the tools, a direct comparison of each individual criterion is not feasible. However, despite the various choices of criteria, it is possible to identify main categories which are covered by most of the tools to a varying extent. For a better understanding of the content of the tools, Table 7 shows the common categories in green building certification. A cross signifies the categories covered by the

[68] DGNB 2015

[69] (Own illustration, Data: DGNB 2015)

tool, but it does not clarify the weighting. Despite commonalities in the categories, mainly influenced by environmental issues, Table 7 points out categories which are covered by only a few of the tools. The category *Economic* is only assessed by CASBEE and DGNB. *Resources* are analysed by LEED, CASBEE and DGNB, whereas DGNB is the only tool addressing the category *Cultural and Social*. A detailed distinction between the content of the categories is difficult. Existing transitions between the three dimensions blur the lines. However, the listing of a category means that the tool pays particular attention to the related category. The relevance is discussed in the following description of the three dimensions.

Span of categories

Criteria	BREEAM	LEED	Greenstar SA	CASBEE	DGNB
Energy	x	x	x	x	x
Water	x	x	x	x	x
Waste	x	x	x	x	x
Materials	x	x	x	x	x
Indoor Environment Quality	x	x	x	x	x
Emission and Pollution	x	x	x	x	x
Management	x		x	x	x
Land Use, Site and Ecology	x	x	x		x
Economics				x	x
Mobility and Transportation	x	x	x		x
Resources		x		x	x
Cultural and Social					x

Table 7: Own illustration,[70]

The very first conspicuous fact is that the early established tools BREAAM and LEED to a certain extent serve as a basis for subsequent newer rating tools.[71] Categories covered in these early tool are picked up by successive tools. In the categories of environmental,

[70] Reed et al. 2009/Banani 2011)
[71] Reed et al. 2009, p. 8

social and economic features, the following comparison highlights core areas of the tools and illustrates gaps as well as similarities.

4.6.1. The life cycle approach

Buildings undergo a lifecycle encompassing the phases from design, construction to operation to deconstruction. In each phase, environmental, economic as well as social issues occur. All tools consider the first three phases, but CASBEE and DGNB are the only tools that also take into account the demolition phase. The design process has the most significant influence on the building, especially in terms of the later energy use during the operation phase. However, neglecting the demolition phase with its relevance for recycling and reuse of materials conflicts with the full life cycle approach. Recycling and the reuse of materials are most relevant in countries that are lacking in the supply of construction materials and are confronted with high building costs.

4.6.2. The environmental perspective

The initial intention of green buildings was primarily to lower the impact of buildings on the environment.[72] Hence, the majority of categories focus on the environmental impact of buildings and as a result the issuing of certification is mainly driven by environmental qualities. A clear separation of criteria affecting only the environmental dimension is difficult. Moreover, once an environmental criterion is satisfied, other dimensions are also involved. For example, the use of non-toxic materials has on the one hand environmental benefits and on the other hand social benefits, e.g. the well-being of the building's users. Nevertheless, the main intention is to fulfil environmental goals such as the following aspects, which are covered by all tools.

- Energy
- Water
- Waste
- Materials

[72] Todd et al. 2001, p. 326

- Indoor environment quality
- Emission and pollution

4.6.3. The economic perspective

Economic features are covered sparsely by the majority of the tools. Only a few economic criteria such as flexibility and adaptability, which contribute to lower vacancy rates, are relevant for the DGNB and CASBEE tool. BREEAM, LEED and Greenstar SA neglect economic savings. However it must be clarified that the pursuit of environmental aims also affects the economic dimension. By implementing energy efficient systems and fixtures, in the operation phase the extra costs turn out to produce benefits. Indeed DGNB is the only tool that evaluates the economic dimension separately, accounting for the same weighting as the other two dimensions.

4.6.4. Social perspective

Social dimensions are mainly considered by the categories of transport, innovation, and the health and wellbeing of users. Access to public transport and maximising the comfort of tenants is recognized by most tools but to varying degrees. DGNB is again the only tool that summarizes social-cultural and functional quality under a single category, weighting it equally to the other categories. The other tools do not value social constraints in such a scope. For the transformation into the SSA context, social criteria play a significant role in light of the diverse social-culture background and the severe consequences of climate change on the social dimension.

4.6.5. Conclusion

All tools have the common trait that they originated in already developed countries. The origin of each tool has an influence on the key aspects of their certifications and as a result on the final weighting. A pure application of the tools without any adjustments to suit the local context in developing countries violates the sustainable approach. According to various studies (Todd et al. 2001; Reed et al. 2009; Jeremy Gibberd 2002), a simple adaption for different regions in the world is problematic. Developing countries go through processes similar to countries already possessing established assessment systems,

although the barriers and opportunities they face differ according to social, economic, environmental as well as historical contexts.[73] Moreover, building standards are unequal, making the adoption of the tools unfeasible in various regions.[74] Additionally, the methods used in developed countries focus on lowering resource depletion and environmental damage by maintaining living standards. Although the standard of living is much lower in developing countries, the focus should be on satisfying basic human needs as well as avoiding environmental damage.[75] None of the analysed tools are suitable for the Sub-Saharan context. The DGNB tool in particular covers the three dimensions in an equal weighting, which best suits for the African context, but some criteria are still not mentioned as the following description of the conditions in Africa will reveal. The Greenstar SA tool may be suitable for the South African context but Sub-Saharan Africa is different. There have been attempts by Greenstar SA to integrate a social-economic pilot plot into the assessment in order to place more emphasis on these issues.[76]

Up to this point the thesis has outlined the characteristics of existing rating tools, with the result that it is clear that a pure adoption of the criteria of the tools to the Sub-Saharan African context is not suitable in terms of the assessment of sustainability. The next part of the research takes into account the conditions in Africa by conducting an appraisal of individual factors relevant to green building certification. Theoretical and practical experts in the African building industry are interviewed in order to gain further insights and to validate the assessment criteria.

[73] Todd et al. 2001, p. 335
[74] Reed et al. 2009, p. 14
[75] Cole 2005, p. 1936
[76] GBCSA

5. Africa - an appraisal

In order to elaborate relevant aspects for the African context, an appraisal of the continent with its specific characteristics is performed. The appraisal takes into account specific conditions which influence and have an impact on the performance of buildings and their surroundings. The goal is to identify categories and criteria that are especially relevant with regard to sustainability.

5.1. Geography

With an area of around 30,244,000 km², the African continent is the second largest continent in the world. The land mass covers nearly 20% of the total global land area and contains 54 countries (48 on the mainland and 6 islands). Africa is often geographically separated into two major regions: North-Africa with 5 countries and Sub-Saharan Africa with 49 states.[77]

The continent has 8 distinct physical regions with unique cultural and climate conditions. These are the Sahara, the Sahel, the Ethiopian Highlands, the savanna, the Swahili coast, the rain forest, the African great lakes and southern Africa.[78] The Sub-Saharan region has the highest rate of poverty in the world and is the area most affected by climate change.[79]

[77] nationsonline 2016
[78] National Geographic 2016
[79] Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung 2014

Map of Africa

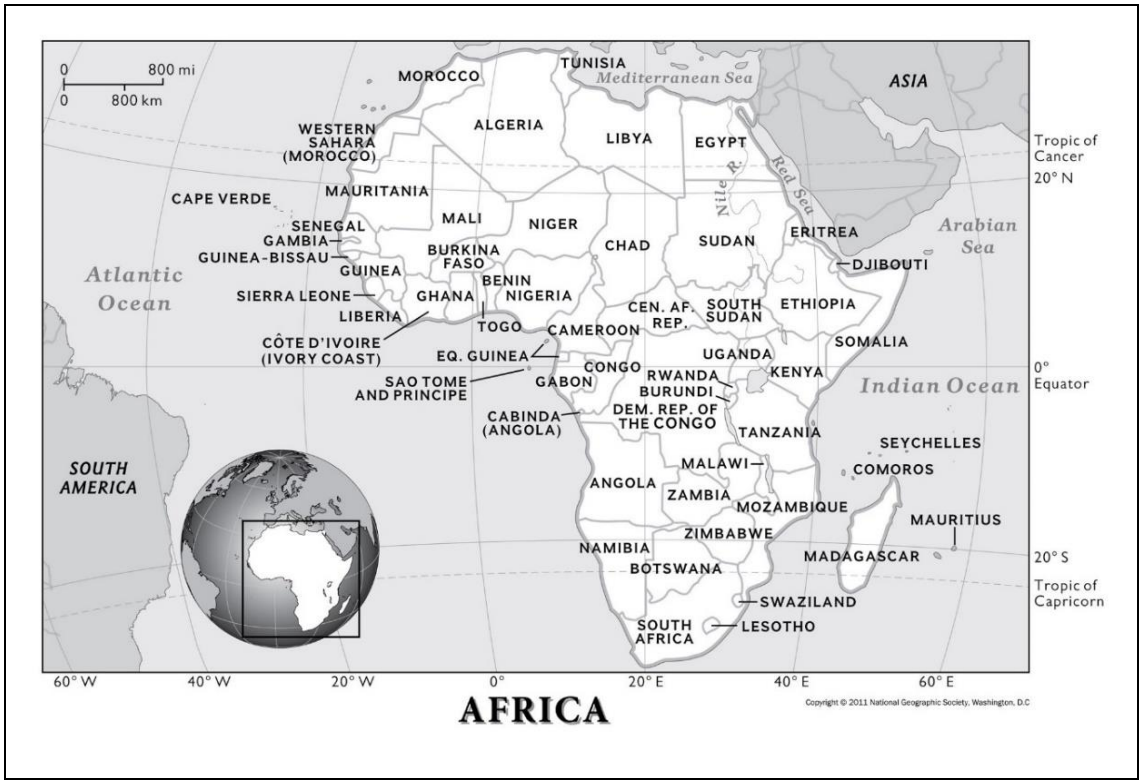

Figure 9:Map of Africa[80]

5.2. Demographics

Chapter 2.2 already mentioned the extent of the human population growth rate and identified Africa as the continent with the highest projected population increase. Moreover, the demographic structure differs from most of the rest of the world. In Africa, a significant proportion of the population are young people, and this is considered to be a major growth factor. The median age in 2012 was 19.7 years and this is expected to increase up to 25.4 years in 2050, making Africa the continent with the youngest population.[81] This shift is often referred to as the demographic divide, a concept describing the interplay between changes in population structure and rapid economic growth.[82]

[80] (Own illustration, Data: National Geographic)
[81] United Nations Statistic division 2016
[82] Canning et al. 2015, p. 4

The depopulation of rural areas and the process of urbanisation has resulted in the creation of so-called megacities. Capital cities such as Nairobi, Kinshasa and Dar es Salaam will have growth rates of around 70% by 2025,[83] with an estimated number of 400 million people migrating from rural areas to cities.[84] In regard to the urbanisation process, sustainable development is a challenge for the cities, especially in lower and mid income countries that have the fastest rate of urbanisation.[85] Taking into account this immense urbanisation, in Nigeria alone a shortfall of nearly 17 million housing units is projected, going in line with an increase of the middle class and the need of adequate housing.[86] In this context, a sustainable rating tool should cater for a sustainable urbanisation process, the fostering of access to public transport, the selection of adequate sites, provision of affordable housing units and the continuity to public infrastructure.

Growth of African cities

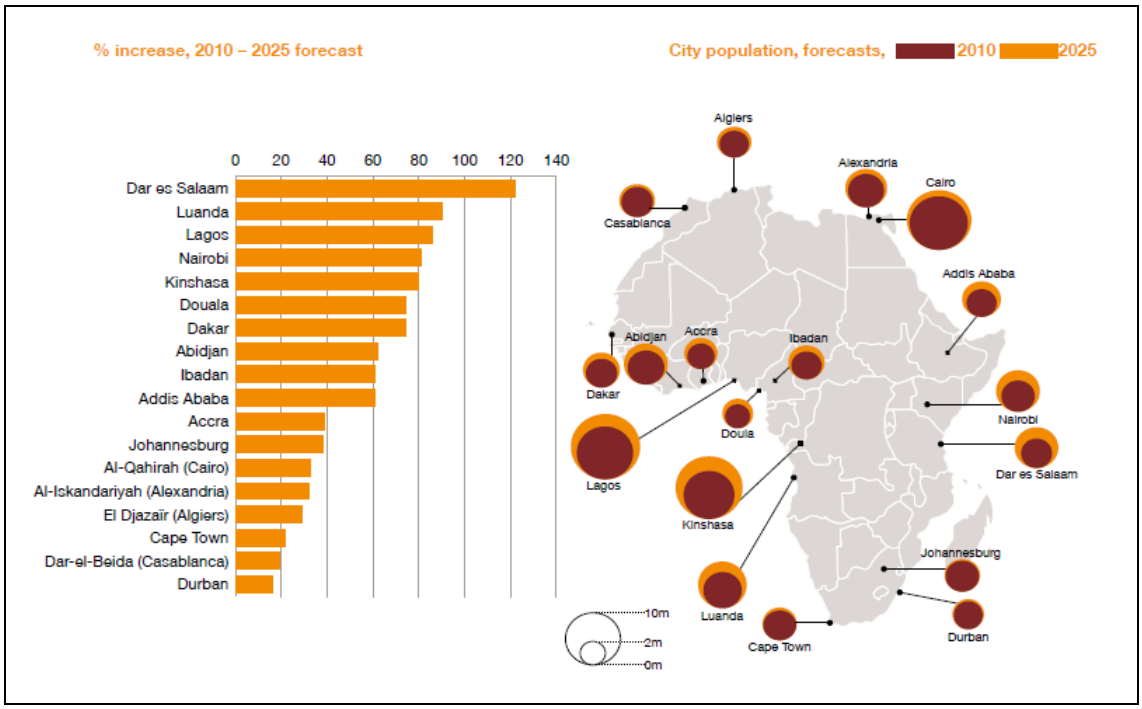

Figure 10: Growth of African cities[87]

[83] PWC 2015, p. 14
[84] PWC 2015, p. 7
[85] United Nations 2014, p. 1
[86] PWC 2015, p. 15
[87] (PWC Real Estate, Building the future of Africa 2015)

5.3. Climate

The climate has an important influence on the energy used by a building as well as on its environmental performance. Sub-Saharan Africa is a region located almost exclusively within tropical latitudes. Different topographies have further influence on the regional climate, for instance the relatively wet and cool Ethiopian highlands and the very dry Sahel region.[88] An additional characteristic of SSA is the variability of rainfall from the inter- and intra-annual perspective. As a result, frequently occurring droughts and dust storms are a common phenomenon in the region. Regular occurring extreme weather events create stress for those living in these regions, and as a result of climate change the events are likely to increase.[89]

Moreover, diseases associated with climate hazards may increase in line with climate change.[90] Figure 6 shows a map of the different climate zones in Africa, revealing the number of states located in tropical latitudes. With regard to the selection of adequate criteria, special emphasis should be placed on energy use for climate control as well as the utilisation of water. The relevance of green building criteria that are related to the climate are more important here than in regions with temperate climate zones.[91]

The potential use of renewable energies such as solar, wind and geothermal are huge, and there are also opportunities for an independent energy supply in regions far away from power grids.[92]

[88] World Bank - Sustainable Development Department, p. 29
[89] Balgis Osman Elasha et al. 2006, p. 21
[90] Balgis Osman Elasha et al. 2006, p. 24
[91] The World Bank 2016a
[92] International Renewable Energy Agency (IRENA) 2014, p. 31

Climate zones in Africa

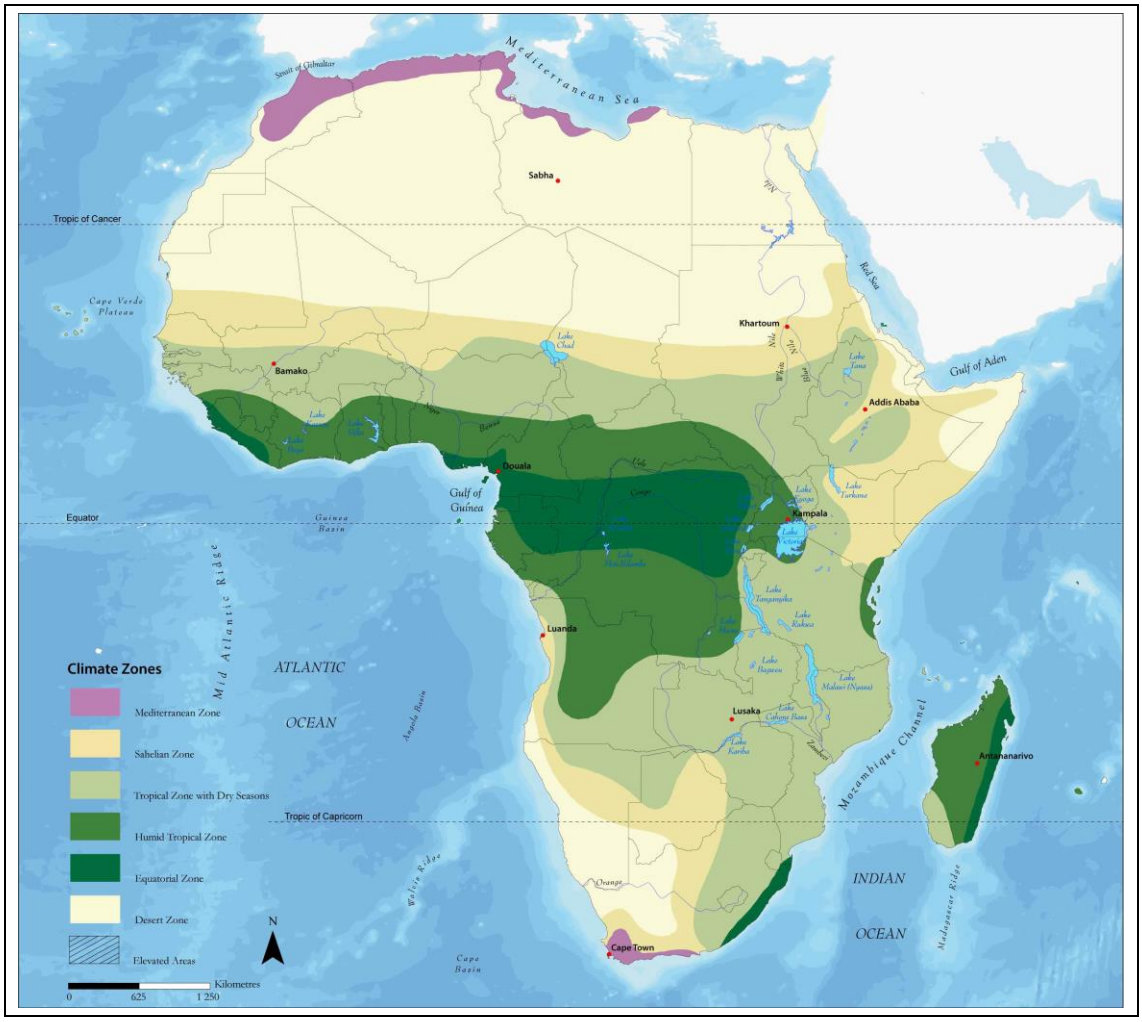

Figure 11: Climate zones in Africa[93]

5.4. Economy

Africa is a continent rich in commodities including oil, gas, minerals and precious stones. From 2001 to 2014 the growth rate of GDP more than doubled to 5%, compared to 2% during the 1980s and 1990s.[94] By virtue of a relatively low internal demand, many African states are reliant on exports and are easily influenced by the world economy, especially the oil exporting countries.[95] Alongside commodities, Africa's transitioning industrialisation is seen as a major factor for growth.

[93] (Source: http://www.zonu.com/fullsize-en/2009-11-07-10911/Africa-climate-zones.html)
[94] AfDB, OECD, UNDP 2016, p. 24
[95] International Monetary Fund 2016, x

"While growth has slowed in many commodity linked markets in Africa, non-commodity driven markets, particularly in East Africa, have continued to perform well."[96]

In particular, investments from China and manufactured exports are pushing the local economy.[97] Along with the increasing industrialisation, a gain in prosperity can be seen. The rise of the African urban consumer creates new domestic growth, resulting from the ongoing process of urbanisation, an expanding labour force and the rise of middle-class consumer.[98] In context of the real estate industry, the demand for buildings in all sectors will continue to increase.[99] In some cities the prime rents are among the highest in the world. Due to the lack of high quality office space and the relevance for the oil industry, in Luanda, Angola the monthly rent for prime office space is 150 US$ per square metre, equivalent to a prime yield of 14%.[100]

In an international comparison of GDP growth rates, the percentage increase in GDP of SSA is lower than that of China but still above countries such as Germany or the USA. The average growth rates between 2010 and2015 were 8.30% (China), 4.28% (SSA), 2.10% (USA) and 1.97% (Germany).[101] Figure 12 shows a selection of growth rates during this period. The economic appraisal of Africa highlights the current and future potential for green buildings as an investment alternative.

[96] Africa Property News 2016
[97] PWC 2015, p. 18
[98] McKinsey Global Institute 2010, p. 18
[99] PWC 2015, p. 11
[100] Knight Frank 2015, p. 17
[101] The World Bank 2016c

Annual GDP growth rates

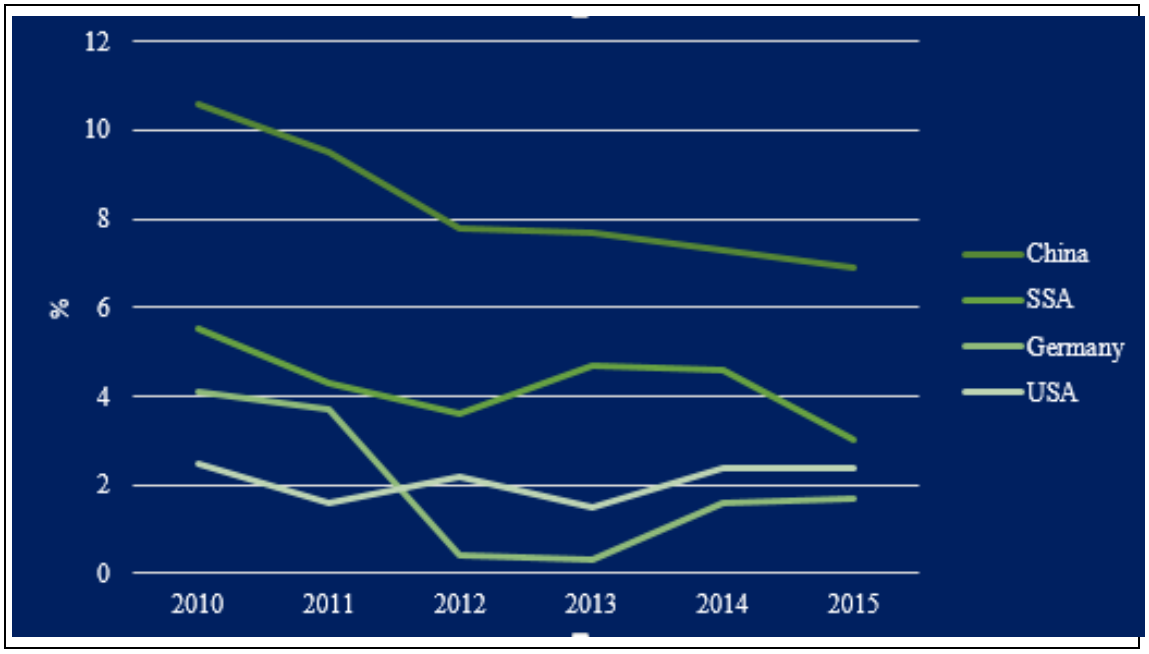

Figure 12: Annual GDP growth rates[102]

5.5. Infrastructure

Infrastructure has played a significant role in the turnover of Africa's economy and will continue to play a major role in the future.[103] The supply of power, telecommunications, roads, sanitation, and water is crucial for the development of growth and prosperity. Raising Africa's infrastructure to some regional or international benchmarks reveals a considerable consistency of 1 or 2 percentage points per capita growth.[104]

Significant infrastructure projects are the construction of dams in Ethiopia and Congo for the supply of energy as well as several railroad projects in Ethiopia, Kenya, Nairobi, and Nigeria.[105] The Programme for Infrastructure Development in Africa (PIDA) initiative, launched in 2010, has the goal of promoting socio-economic development and the reduction of poverty through improved access to integrated regional and continental infrastructure networks and services. PIDA's President Mr. Zuma said at the opening speech of the program:

[102] (Own illustration, Data: World Bank)
[103] Africa - Fact Sheet: Infrastructure in Sub-Saharan Africa 2008
[104] Vivien Foster et al. 2010, p. 43
[105] Knight Frank 2015, p. 10

"Africa's time has come and without infrastructure, our dreams will never be realized. We cannot trade on the continent because of the lack of communication. The infrastructure that we want to create will provide new opportunities for our continent."[106]

Adequate access is essential for a sustainable development process. For the built environment, proper site selection including accessibility to human basic needs and transportation is a criterion of special interest.

5.6. Socio-cultural environment

Africa is a diverse continent with close to 160 ethnic groups contributing to a complex socio-cultural setting.[107] The current weak economic structure and different languages, religions, governmental structures, laws and conflicts create a mixed environment incomparable to developed countries. A rating tool must consider these aspects and take into account the socio-cultural diversity. The following aspects are not new approaches; their underlying data originate from already existing tools but their weighting might be adjusted in terms of equity and wellbeing.

- **Occupant comfort and health**

Primarily influenced by the climate, an adequate heating and especially cooling system is fundamental for the wellbeing of the users of a building. The utilisation of traditional building designs and natural ventilation techniques can contribute to a reduction of energy use, as western technologies might be inapplicable and cost-intensive.

- **Public participation**

The users of a building are the best experts regarding their needs. The early participation of those living or working in a building can contribute to satisfaction and motivation when moving in. Foremost, the participation process should be accompanied by education and training to raise the awareness of sustainability and the techniques of green buildings.

[106] Moyo 2015
[107] Hitchcock 1993

- **Access to services**

Private and public services such as shopping malls, schools, health facilities, as well as public transport foster equity and social interaction. The avoidance of individual transport using cars and the promotion of public transport reduces environmental damage, especially in Africa where transportation aspects are an issue.[108]

5.7. Corruption

Corruption is a term often used in relation to Africa in regard to government structures and the investment environment. Institutional weakness leads to a misuse of natural resources, accompanied by a decline in the living standards of public servants and the blind eye turned to corruption by western countries.[109] In fact,

> *"Governance and corruption are controversial issues of great significance for sustainable development."*[110]

Figure 6 reveals the corruption index measured by the organization Transparency International. The Sub-Saharan region has a tremendous need to improve; 40 out of 46 countries exhibit a serious corruption problem. The average score is 33/100, compared to the global score of 43/100. In particular the rule of law and justice scores badly, and although some governments are reducing risks for business, little is changing for citizens. Transparency and accountability are approaches to tackle corruption, though it is not the norm in Sub-Saharan Africa.[111]

Well formulated and effectively implemented structural transformation agendas can lead to benefits for African countries. The implementation of a transparency criterion could be an approach for green building construction. Factors such as the participation of affected groups in the planning process as well as the disclosure of project documents and a transparent call for proposals can contribute to a sustainable development process.

[108] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, p. 17
[109] United Nations Economic Commission for Africa 2016, xiii
[110] United Nations Economic Commission for Africa 2016, viii
[111] Transparency International 2015, p. 17

Corruption Perception Index 2015

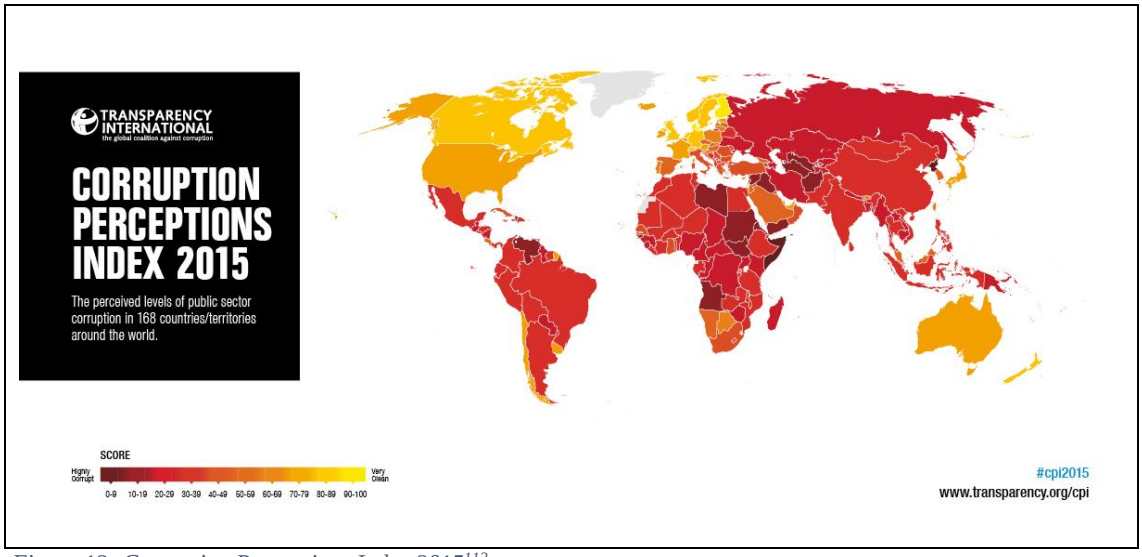

Figure 13: Corruption Perceptions Index 2015[112]

5.8. Building Costs

The costs during the construction process are a critical aspect of building construction. In fact, building costs in Africa are at a high level compared to other developing countries and even compared to developed ones. Figure 14 displays the average building costs per square meter categorized into residential, commercial and retail and industry. The capital of Angola, for instance, has nearly the same level of construction costs compared to Sydney or Singapore. A survey that consulted professionals in the Nigerian real estate industry named the overdependence on imported building materials as the major contributor to rising building costs. In addition, the lack of efficient infrastructure and knowledge of construction techniques are drivers of accelerating costs.[113]

The high cost of building materials slows down the amount of construction and as a result decelerates economic growth opportunities. Hence, the production and usage of local sustainable building materials can contribute to decreased construction costs and can foster the local economy.

[112] (Transparency international)
[113] Ihuah 2015, p. 225

Moreover, a material is sustainable if it is recyclable, natural, plentiful and renewable and has a resource efficient manufacturing process. By using sustainable building materials, the life-cycle costs of a building can be reduced and the health as well as the productivity of occupants improved.[114] The criteria of a tool should advocate the use of locally available building materials for green building constructions. This also means the evaluation of whether modern construction techniques or traditional building techniques are more feasible, or if or a combination of both can meet the standards of wellbeing.

Average building costs

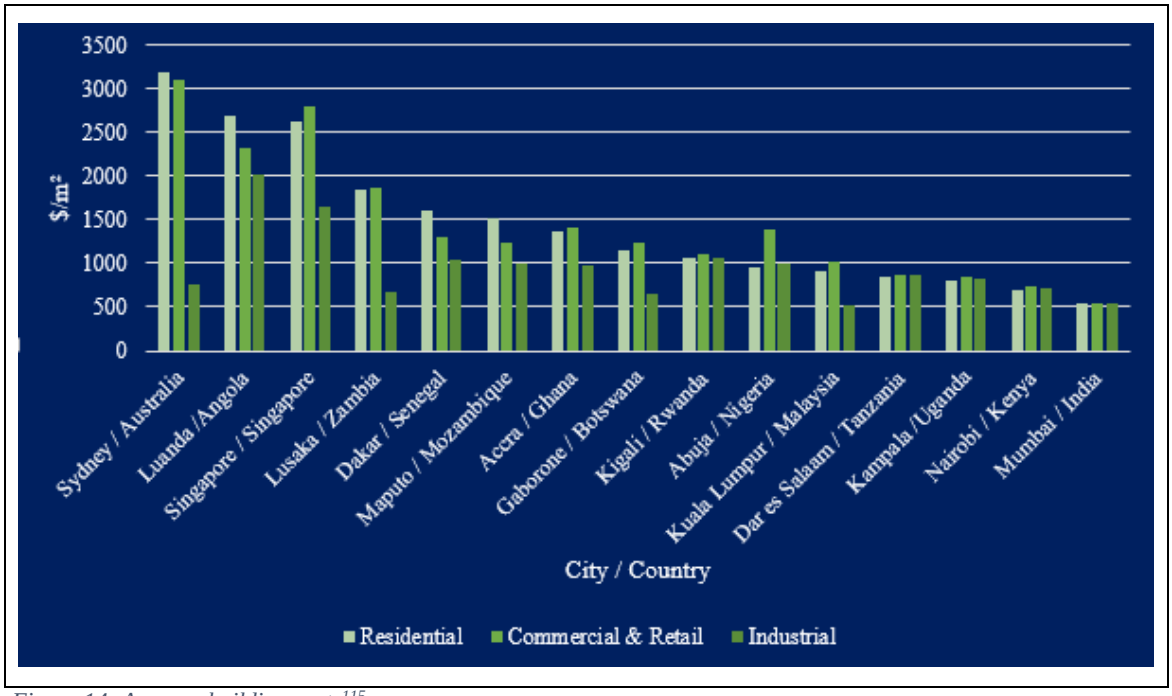

Figure 14: Average building costs[115]

5.9. Energy supply

The supply of energy is one of the biggest challenges for Sub-Saharan African states. Low access and insufficient supply, poor reliability and high costs result in a barrier for competitive economic growth.[116] The International Energy Agency published a report

[114] Ihuah 2015, p. 222
[115] (Own illustration, Data: KPMG (2014) Construction in Africa)
[116] The World Bank 2008

specifically about the energy outlook in Africa[117]. The continent, rich in resources but poor in energy supply, struggles to unleash economic and social development; 13% of the world's population are demanding 4% of the global energy and only 290 million people out of 950 million (30%) have access to electricity.

The main source of energy in SSA is still bioenergy. Wood to fuel cooking devices, for heating purposes or for lighting is still the dominant source of energy supply, at least in rural areas.[118] The use of biomass accelerates deforestation and brings with it serious health issues through the emission of smoke. However, SSA has great potential for the use of renewable energies, and in fact some promising projects are under construction.[119]

In Kenya and Ethiopia geothermal projects are underway. In Congo a hydropower project contributes to the supply of energy and a solar project is lighting up Rwanda.[120] Nonetheless, the amount of renewable energy sources is still comparatively low. Figure 11 quantifies the African energy mix, clearly dominated by the usage of bioenergy. The category *Others* includes nuclear (2%), hydro (10%) and renewables (2%).[121]

[117] International Energy Agency 2014, p. 1
[118] International Energy Agency 2014, p. 2
[119] International Renewable Energy Agency (IRENA) 2015, p. 35
[120] Smith 2015
[121] Quitzwo et al. 2016, p. 18

The African energy mix

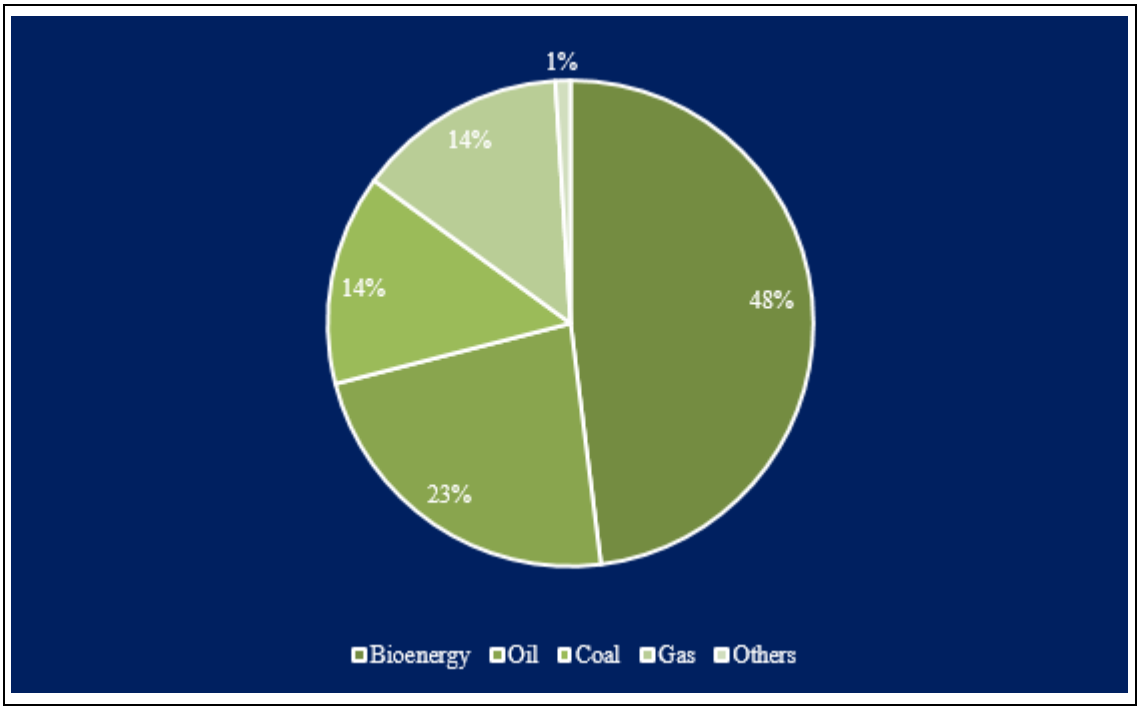

Figure 15: The African energy mix[122]

In terms of green building criteria, the energy landscape is of special interest. Through the lack of energy supply, the design of buildings must anticipate features that on the one hand lower the demand for energy and on the other hand supply enough energy for maintaining the building; or even more ambitiously to supply the neighbouring areas. Abundant energy resources such as wind and solar can offer the possibility for renewable energy systems to remain efficiently utilised and incorporated into the built environment.[123]

5.10. Financial environment

The domestic capital markets in Africa have blossomed in only a few selected countries and remain dormant in most of the SSA states. Thus, the continent is highly reliant on

[122] Own illustration, Data: IASS Study 2016
[123] Umar, Khamidi 2012, p. 3

foreign direct investors, especially in terms of financing capital intensive infrastructure projects.[124]

For foreign investors there are perceived barriers to investment in Africa. A survey conducted by Ernst and Young revealed the following constraints for investments.

Barriers to investment in Africa

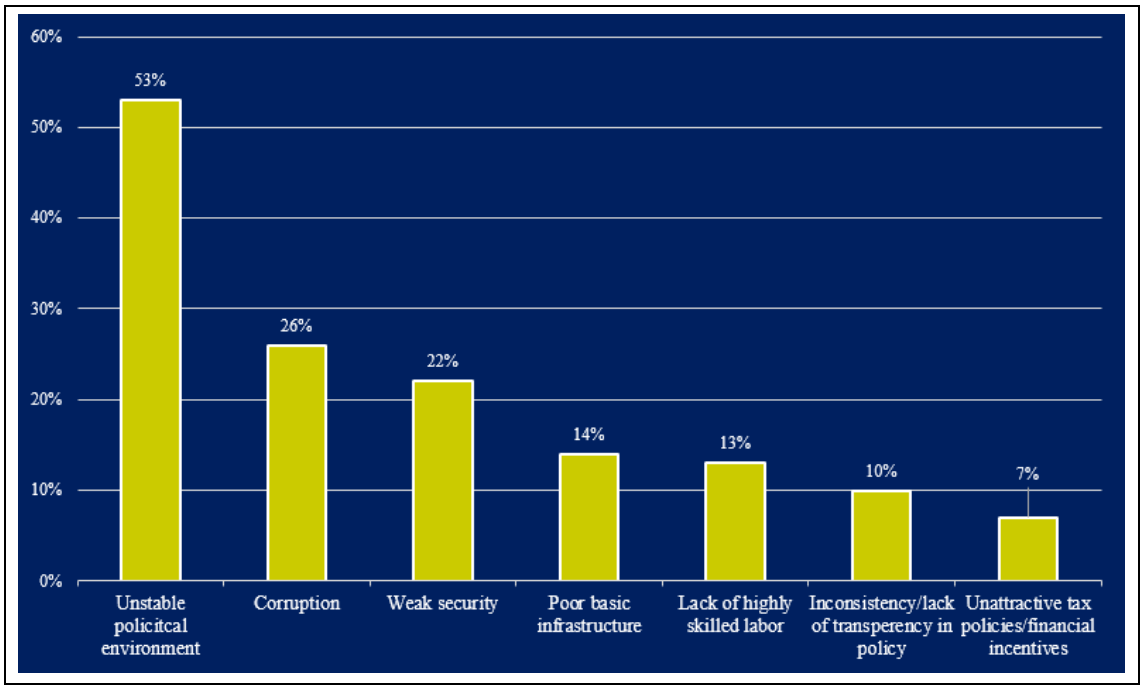

Figure 16: Barriers to investment in Africa[125]

Despite the existing barriers, Africa's real estate industry is gaining interest for foreign investors, who accounted for 43.8% of capital investment inflows in 2014. [126] In line with the population increase, the surge in spending power and the urbanisation process, the demand for real estate continues to grow.[127]

According to the transparency index published by Jones Lang LaSalle[128], the trend for SSA is *"Progress, but patchy"*. The overall progress is recognizable, but with limited advancement in regulatory and legal reforms as well as enforcement In particular, new

[124] KPMG 2014, p. 4
[125] Own illustration, Data: EY's 2015 Africa attractiveness survey
[126] Ernst&Young 2015, p. 22
[127] PWC 2015, p. 12
[128] JLL 2016

entrants such as Tanzania or Ivory Coast reflect the early stage of real estate markets.[129] Figure 17 shows a map of transparency in African countries, dominated by countries without reliable data and with opaque countries with low transparency being the next most prevalent. Only South Africa has the status of a transparent country, revealing the need for whole SSA to catch up.

Sub-Saharan Africa Real Estate Transparency Index 2016

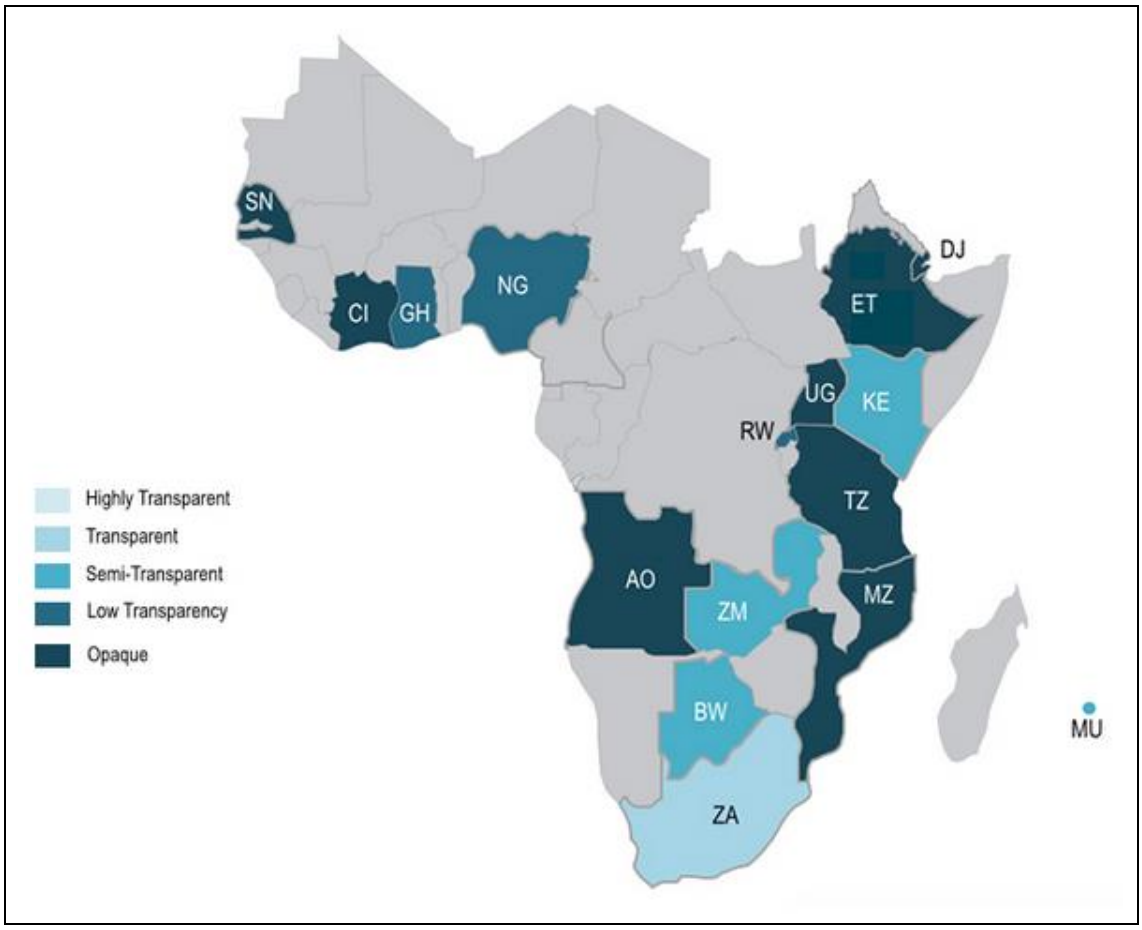

Figure 17: Sub-Saharan Africa Real Estate Transparency Index 2016[130]

For the selection of criteria, the aspect of transparency can contribute to further investments in green buildings by foreign investors as well as by domestic stakeholders.

[130]Data: LaSalle Investment Management

5.11. Building stock

An investigation of the existing building stock is relevant to the assessment of green building criteria. Because of the lack of transparency in the real estate markets, a reliable statement is difficult. Moreover, traditional building techniques often used in rural areas cannot be compared to building standards in developed countries. A rating tool must consider indigenous building techniques and anticipate local practices in order to adequately address sustainability issues. The local sourcing of building material as well as methods of construction have shaped the built environment for decades. When constructing new buildings, traditional techniques and architecture can contribute to the maintenance of heritage in a modern context. Projects making use of traditional African architecture combined with the use of local materials are already established in a few African cities.[131]

5.12. Training and education

The low level of awareness and lack of enthusiasm for sustainability results in a small number of green buildings. This limited consciousness constrains the spread of sustainability features and lifestyles.[132] Training and education regarding the benefits and techniques of green building can help to promote a mind-set of sustainability and accelerate the construction of green buildings. The institutional framework for providing a platform can be accomplished by local governments and NGO's. Some African countries have already established green building councils in order to raise awareness and to demonstrate the benefits. A collaboration of green building councils and local governments across the border of countries can bundle resources and strengthen research and acceptance.

5.13. Water

Africa is the second driest continent on earth. In Sub-Saharan Africa the water coverage spans 61% and as a result only 40% of the population have access to drinkable water. In this context, buildings are major consumers of the scare resource water. Water is used not

[131] Goodwin 2015
[132] Olaleye et al. 2015, p. 42

only during the operation phase, but also in the extraction of building resources, in the production and delivery of materials and in the on-site construction. Besides the supply of potable water, sanitation is equally relevant. Lack of sanitation and contaminated water are catalysts for disease.[133] Effective water management is a criterion of utmost relevance. The recycling of water and water saving fixtures can contribute to the reduction of water wastage. In terms of the climate change and the growing population with its need for water, this criteria is even more crucial.

[133] United Nations Department of Economic and Social Affairs 2014

6. Elaboration of sustainable rating criteria

After the initial clarification of meaningful aspects and criteria, a further in-depth analysis will be performed using qualitative questionnaires. A collection of local theoretical as well as practical experts in the real estate industry contribute with their experience and knowledge to validate criteria and to establish new ones.

Mr. Ayodele from the Obafemi Awolowo University in Ile-Ife, Nigeria is a theoretical expert in African real estate research and also in the field of green buildings. He has published various papers, including several about the relevance of green building practices in emerging markets.

Mr. Olawore, a chartered surveyor and valuer from Nigeria, gives insights into his long established knowledge about the real estate market from the practical perspective. In addition, Ms. Njer, a sustainable engineer, and Ms. Thuo, a sustainability consultant, both from Kenya, share their experience with green building activities. Both are in the process of becoming green star accredited professionals.

6.1. Research methodology

The collection of data is performed using a qualitative, semi-structured questionnaire. This type of survey is useful for identifying new ways of seeing and understanding the topic, and allows the informants to express their views by using open ended questions.[134] The interview questionnaire is structured in three main parts. First, the status quo of green building activity, pointing at the awareness and amount of investment. Second, the drivers and barriers for a sustainable development process and third, the elaboration of sustainable criteria divided into the three dimensions of the sustainability definition.

[134] D. Cohen, B. Crabtree 2006

6.2. Evaluation of the questionnaire

6.2.1. The status quo of green building activity

In this part, the participants were asked to state the current status of green building activity. For this purpose, questions regarding the level of awareness, the main construction type of green buildings and the amount of investments and their origin were asked.

Awareness of sustainable construction

The level of awareness of sustainable construction practices is at a low level. Even though various national governments have increased their efforts to promote sustainable building constructions, even in these countries the uptake and response is moderate. An alarming amount of environmental hazards and degradation are pushing national authorities to act. Nevertheless, the knowledge and construction of green building is still limited. Not only society but also building professionals such as architects and engineers are inadequately informed about proper techniques and the benefits of green building construction.

Types of construction and investments

The few buildings that utilise green construction are retail malls, offices and large residential developments, mostly owned and developed by foreign investors. The majority of foreign investors already insist on green building features when investing in development sites. However, the amount of investment by private domestic property developers is abysmally small. The few green constructions financed by local developers are buildings for local governments; Kenya in particular leads in this. As a result, the rate of foreign direct investment appears to higher than that of local investors. However the recent recession coupled with socioeconomic and political instability might serve as inhibitors to these investors. The amount of foreign investment in the few green buildings is more than 67% of the total investments.

6.2.2. Drivers and barriers for a sustainable development process

In this part of the questionnaire, the participants are asked to name frequent drivers and barriers promoting and hindering the process of sustainable development.

Drivers

From the investment perspective the drivers are essentially the investor's individual perceptions with regards to the market, the local customs and the enabling of government policies. Aside from the financial perspective, respondents identified the role of non-profit organizations as accelerators for green building and sustainability. Institutions such as Green Building Societies promote the concept of sustainability among society and professionals and also encourage the government to implement sustainable frameworks. In addition, these institutions serve as a platform and bring together engineers, architects, developers and property managers. Besides, the primary drivers for green construction are mainly the same as those in other countries, i.e. the environmental, social and economic benefits.

Barriers

The barriers for green construction are complex. Next to the above mentioned low level of awareness, the initial costs of construction are a huge problem. Green building standards require modern materials which must be imported because of the lack of locally available building materials. As a result, these increased costs have lead to the preference for conventional construction instead of the more efficient green buildings. Moreover, the reluctance of governments and regulatory agencies hinders the increase of green building construction. The lack of effective support and existing obstacles in bureaucracy, especially in land titling and documentation, are barriers for the promotion of green construction. The high cost of certification as well as delays in obtaining certification status are additional constraints. Another issue is a conservative attitude towards change to existing construction practices, which can be linked to the low level of green building awareness. Moreover, insufficient knowledge regarding the financial benefits contributes to a lack of interest among stakeholders. Even if a decision is made to build green, there are difficulties in getting contractors with green building design experience. One participant named the deficit of infrastructure as a reason for using environmentally

harmful services for maintaining the building, for example the supply of energy by generators.

6.2.3. Sustainable criteria

For the elaboration of sustainable criteria, the participants were asked about the particular relevance of a variety of criteria derived from the appraisal of SSA, and were also asked to contribute their own suggestions for further meaningful aspects. Besides the relevance, the participants suggested solutions for handling the problems. The results are categorized in the three dimensions of the sustainable development definition.

6.2.3.1. Environmental perspective

Energy

The supply of energy is a very critical aspect. Most of the countries in SSA still do not have access to sufficient energy to satisfy their basic needs. Energy conservation should therefore be given utmost priority. Moreover, the use of frugal energy loads in addition to supply by renewable energy sources decreases the amount of emissions and has beneficial economic aspects. In terms of energy utilisation, as much natural lighting as possible should be used, at the same time taking into thermal issues consideration. Appropriate orientation of the building is vital for energy savings in the early stages of development.

Water

The utilisation of water and techniques of saving this scarce resource are of similar importance. The majority of SSA states are land locked and the access to water is crucial, especially in the dry seasons. A special emphasis should be placed on the treatment of effluent. Recycling of water is currently not an issue but it offers huge potential for water saving. Recycling of water in the building system lowers the total amount of wastage. An adequate sewage system can prevent the spread of diseases that are often caused by inadequate waste water management. Moreover, the implementation of rainwater storage systems and the recycling of water used by air conditioners can help to lower the use of water.

Waste

The management of waste seems to be equally relevant. Due to the increasing environmental degradation from the poor waste disposal practices of most industrial property users in Africa, there should be particular focus on a sustainable recycling process. Furthermore, it is common to use waste as landfill material, since there are no restrictions by governments. Poor urban planning and the rapid growth of urban areas challenge local waste management systems. The inclusion of recycling units and adequate waste management systems in buildings can help to reduce pressure on local dumping areas and avoid the spread of tropical diseases.

Procurement

The sustainable procurement of building materials is not considered by most developers. The factor of economic affordability often determines the procurement method and the building materials. The utilization of timber sourced from native forests as a building material is a common problem. Responsible procurement management and the implementation of a certain percentage of recyclable or reused materials can contribute to waste reduction and can grant transparency about the supply chain.

Land use and ecology

Another relevant environmental criterion is the aspect of land use and ecology. The selection of building sites constantly harms the ecology when wetlands are encroached or prime agricultural areas are occupied. A thorough selection of suitable building sites is a meaningful contributor to sustainable development and should be a focus area in the rating tool. However, for efficient implementation the participation of local governments is necessary in order to establish policies for the selection of sites. An additional suggestion is the use of landscaping as a neutraliser of greenhouse gases and other emissions originating from the building.

6.2.3.2. Social perspective

Participation of the public

An aspect of the social dimension is the participation of the local community in the construction process. As communities are affected by nearby construction in terms of noise and pollution but foremost as future tenants or users of the new construction, it makes sense to include their statements and needs in the early planning process. However, this participation practice requires at least knowledge with the construction process and sustainability features. Given that the knowledge of green building is very limited, the intelligence of the construction and green building features helps to spread the awareness of sustainability and can influence the behaviour of tenants in terms of sustainable lifestyles.

Local material sourcing

The use of local materials is environmental friendly, fosters the local economy and creates jobs. Moreover, the preservation of heritage and culture can be supported by the input of local materials and architecture. Pride in cultural heritage should not be underestimated in a continent defined by its cultural variety. However, some materials may have to be adjusted in order to meet modern standards. An already common building material in east Africa is sisal, a locally harvested fibre which can be used in the construction process. An innovation criterion of local material research, or a combination of local, traditional and modern materials seems to be favourable.

Training and education

A very important social criterion emphasized by each participant is training and education as a method of spreading awareness and technical comprehension. Understanding the concepts of sustainability and the role of green building in this context helps to manifest the sustainable mind-set and can contribute to a higher demand for and supply of green buildings. As learning is a continuous process and green building techniques evolve over time, a permanent supply of information seems desirable. Adequate training and education for workers and staff involved in the construction process should be a criterion of green building. Seminars and lectures for stakeholders as well as for the public contribute to raising awareness and acceptance of green buildings.

Corruption

Corruption riddles the construction industry in Africa, leading to increased costs and opacity. The inclusion of indicators for transparency in a rating tool can help to reduce bureaucracy, corruption and high-handedness in the construction process. Furthermore, a transparent process aids developers as well as purchasers of the building in terms of materials that have been used and standards that have been implemented in order to avoid low standards and the use of non-certified materials. Foremost, eradication of corruption leads to decreased costs and contributes to the higher affordability of green buildings.

Infrastructure

Access to public infrastructure saves time and money. Since buildings should be accessible to the majority of the public, an adequate connection of the construction should be guaranteed although this criterion is not as striking as those previously mentioned. A stronger focus should lie on the positioning of the building in terms of access to public infrastructure.

Nursing and day care

A further recommended feature for green buildings is the inclusion of nursing and day care facilities in green buildings. The high fertility rate in Africa creates stress for local day care facilities and the inclusion of in-house facilities can support staff and raise their satisfaction levels, as well as reduce the pressure on public facilities.

Air quality

Another criterion mentioned by respondents is the air quality and circulation in buildings. The usage of bioenergy in open fires and low regulation of emissions from vehicles as well as coal plants has a negative impact on air quality in large African cities, and should be anticipated in building designs.

6.2.3.3. Economic perspective

Life cycle assessment

A full life cycle assessment is important for the performance of the building and can be a basis for investment decisions by developers, users and investors. Besides the performance of the building, the local economy plays a significant role for local and foreign investors. A strong local market encourages investors to become involved, so a transparent market is therefore a priority. The availability of market data and access to the market are important for further development in the construction industry.

Minimum standards

A set of minimum standards for developers can help green building practices in the construction industry to flourish. This can also help the local economy in terms of the sourcing of locally available materials and construction practices. A further benchmarking of existing buildings as well as refurbishments can help to draw attention to green building. An additional aspect are green leases, which can help to manifest sustainability patterns and raise awareness of green buildings.

Governmental incentives

Another relevant aspect is promotion by local governments. On the one hand government buildings can serve as a vanguard and lead by example, on the other hand government formalities such as minimum standards, an efficient legal and regulatory framework as well as transparency during the whole construction process can foster green building activity. A further economic approach is to favour green buildings in terms of tax benefits or subsidies by governments, if feasible. Additionally, training in sustainability by government led institutions such as universities or schools has major relevance to the advancement of the green building movement and the creation of new sustainable jobs.

6.3. Criteria catalogue

The closing part of the evaluation displays categories of special interest for the Sub-Saharan African context. Some categories are not new, they appear in other rating tools but special emphasis should lie on the specific weighting of these categories. Energy, water, waste and sustainable procurement/local materials are especially meaningful for

SSA, and the selection of criteria in these categories must be adjusted to have more relevance to the resulting certification. New criteria such as training and education or the minimisation of corruption are approaches that can increase awareness and can help to set up basic frameworks. Land use and ecology is a meaningful category in light of the rapid urbanization and the conservation of the biosphere and agricultural land. The final life cycle assessment, with the purpose of attracting investments by displaying the costs and benefits of green buildings, is equally important for the inclusion of sustainability features in the built environment and to attract investment.

Selection of criteria

Category
Energy supply and savings
Water management
Waste management
Training and education
Corruption
Land use and ecology
Sustainable procurement / Local materials
Life cycle assessment

Table 8: Selection of criteria[135]

[135] Own illustration

7. Conclusion

The construction sector is fundamental to the way we shape our future and the future of our descendants. In view of climate change, a responsible, sustainable development is the fertiliser for long term growth and prosperity. The biggest potential for SSA is simultaneously the biggest challenge. The growth of population and the very young working force has huge potential to accelerate Africa's transition. Nevertheless, potential can only be revealed if the surrounding conditions are favourable. The rapid urbanization process stresses the real estate industry to intervene. The construction of sustainable, green buildings is a prerequisite for long term growth and the eradication of poverty.

As the thesis has revealed, the establishment of a rating tool that takes into account the unique conditions in SSA is a necessity to guarantee a sustainable adaption of green building in Africa. The proper consideration of social aspects, environmental adjustments and economic barriers are issues that must be covered in a tool for SSA states. None of the existing green building rating tools can fully take into account these aspects. The origin of the tools influences their focus, and therefore the application of existing tools to the diverse Sub-Saharan Africa region is unfeasible.

With the adjustment and creation of criteria, a green building tool can pave the way for a more sustainable environment and the wellbeing of inhabitants. Opportunities are present, but implementation is important. As far as energy, water and waste are concerned, the technologies to implement efficient features already exist. In combination with traditional heritage building models, green buildings could be redefined for the African context.

For the achievement of widespread sustainable buildings in SSA, further research and the raising of awareness are key aspects. The thesis statement and investigation of categories as well as the criteria are an impetus for further research initiatives. In this context there is a vital role for non-government organizations such as green building councils and societies as well as governmental initiatives. Their close collaboration can raise the awareness of green buildings and their accompanying benefits, making green buildings the rule, not the exception. This may include deeper research within every country in SSA, or at least a regional association to bundle resources and efforts in research and promotion of green buildings.

Appendix

Questionnaire – Guide

Green building certification in Sub-Saharan Africa

-

An elaboration of sustainable rating criteria

Dear Mr./Ms._____

First of all I want to thank you for taking your time to contribute to this thesis and to real estate research in Africa. Before explaining the purpose of this study I would like to briefly introduce myself.

My name is Marius Sachs, I am from Cologne, Germany and a master student at the International Real Estate Business School (IREBS) in Regensburg, Germany. Currently I am writing my master thesis under supervision of Prof. Schulte about real estate research in African states. My research in particular investigates green building certification under the premise of the concept of sustainability. The following abstract gives you an outline about my topic.

Abstract

"We shape our buildings, and afterwards our buildings shape us."
Winston Churchill

The climate change is a fact not a hypothesis and in light of the enduring globalization with its increase of population the consequences are becoming more menacing. In fact, the real estate

industry is a major consumer of energy and contributor to the emission of greenhouse gases. In light of the discussion about sustainability the real estate industry responded with the development of green building standards. The very first purpose was to decrease the amount of climate harming pollution, but gradually besides environmental constraints, economic and social dimensions came to the fore.

However, the amount of green building labels is diverse and mainly engraved by the country of origin. Developed countries were the first to issue green building certification, whereas developing countries had other constraints. Meanwhile the developing countries are on the rise. According to recent projections, Africa's population will register the highest growth in the next decades, accompanied by economic growth and prosperity. Moreover Africa is the continent stroke the most by the consequences of the climate change. The need for sustainable constructions seems unavoidable but a burden to handle. Africa's diversity is omnipresent, making a pure adoption of already existing green building criteria critical as often not suitable for local conditions. Hence an elaboration of country specific criteria matching the concept of sustainability is the stimulus of the underlying thesis.

The main research question is:

"How does a sustainable rating tool can take into account the specific criteria occurring in Sub-Saharan African states and contribute to a sustainable development in the built environment?"

For answering this question the thesis first reconsiders the definition of sustainable development and clarifies the main characteristics. Subsequently the transformation of a sustainable approach into the built environment by means of green buildings is described. For evaluating sustainable criteria, some already existing, well-known green building certification systems like BREEAM, LEED, CASBEE, Green star South Africa and DGNB are described and compared. These systems contribute to a sustainable development in most develop countries. Africa however is different and a simple adoption of the tools criteria is not fitting in terms of a sustainable definition. In order to investigate local conditions in Sub Saharan Africa and to gather information about sustainable rating criteria, experts in the real estate industry are consulted.

In the end, the thesis emphasises relevant criteria for a sustainable green building certification system. This is certainly no final approach, though the results should help to encourage further research in the field of green building certification for Sub-Saharan African states.

Note:

Please refer to commercial buildings such as retail, industry and office when answering the questions of the attached questionnaire.

Research method

The following questionnaire is based on a semi-structured qualitative design to obtain reliable and comparable qualitative responses with in depth information. This kind of survey is congenial for identifying new ways of seeing and understanding of the underlying topic and allows the informant to express their views. The collaborating participants are theoretical as well as practical professionals in the real estate industry. The questionnaire is divided in three sections namely the status quo of green building certification in Sub-Saharan Africa, drivers and barriers for a sustainable development process and an elaboration of sustainable criteria.

Questionnaire green building certification in Sub-Saharan African states

I. The status quo of sustainable construction

For this topic I would like to get an overview of the green building activity in Sub-Saharan Africa (SSA). Since South-Africa is different compared to the rest of SSA please neglect this country when answering the questions.

1. How do you estimate the awareness of sustainable constructions in Sub-Saharan-Africa?

2. Which kind of buildings are mainly constructed “green” and who are the purchaser?

3. How do you value the amount of domestic investments in green buildings currently?

4. How do you value the foreign direct investments in green buildings at the time?

II. Drivers and barriers for a sustainable development process

For this part I would like to get an impression of existing and potential drivers to a sustainable development as well as obstacles hindering the transformation in the built environment.

5. Which drivers to green building constructions are present and who are the initiators?

6. Can you enumerate factors which hinder the construction of green buildings?

III. Sustainable criteria

This topic should contribute to evaluate criteria/categories which are especially important for Sub-Saharan Africa and are not covered in an adequate extent by existing rating systems. The questions are divided in the three subcategories economic, socio-cultural and environmental in dependence on the definition of sustainability. The proposed criteria were investigated during the research. Some are already observed in a few tools and others are mentioned in research papers.

A. The environmental perspective

Environmental criteria are broadly covered by most of the existing rating tools but in a different extent. Please answer the following questions in regard to environmental criteria particularly relevant for the African context.

7. What do you think about the utilisation of water as an especially important criteria?

8. How do you value the energy supply in terms of green buildings?

9. Do you think waste management is especially important for SSA sates and if so why?

10. What do you think about responsible procurement in terms of building materials?

11. Can you think of other relevant environmental criteria?

B. The socio-cultural dimension

The socio-cultural dimension is regularly not considered in an adequate extent and refers in general to the country of origin. Due to the cultural diversity and the social deficits in SSA, socio-cultural criteria are more relevant than in other states.

12. Do you think the participation of the community during the construction process might be useful and feasible?

13. Why could be the usage of local materials and architecture contribute to social improvement and do you think this approach is convertible?

14. What do you think about training and education as a criteria when construction green buildings?

15. Do you think transparency in the construction process could hinder corruption and should be implemented in a rating tool and if so why?

16. How do you value the access to public infrastructure as a rating criteria?

17. Can you identify criteria fostering the health and wellbeing of the buildings user different from those in already existing tools or with a special weighting approach? (E.g. thermal comfort, lighting, acoustic, safety & security etc.)

18. Can you name other significant socio-cultural criteria?

C. The economic context

The last section of the questionnaire deals with the elaboration of economic criteria.

19. Why could be the anticipation of the life cycle cost approach be beneficial for SSA?

20. What role can the local economy/real estate industry play in the construction process?

21. How can the government act a part?

22. Can you think of other economic criteria?

Thanks a lot for your time and commitment.

Sincerely

Marius Sachs

If you have any further suggestion please feel free to contribute.

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Declaration of Academic Integrity

Hereby, I declare that I have composed the presented paper independently on my own and without any other resources than the ones indicated. All thoughts taken directly or indirectly from external sources are properly denoted as such.

This paper has neither been previously submitted to another authority nor has it been published yet.

Cologne, 4th of November 2016 _____