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TOKAT GAZİOSMANPAŞA UNIVERSITY

GRADUATE EDUCATION INSTITUTE

DEPARTMENT OF GEOMATICS ENGINEERING

AN ASSESSMENT OF SUSTAINABLE SOCIAL HOUSING PROJECTS IN CAMEROON

MASTER'S THESIS

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TOKAT - 2024

DECLARATION

I hereby attest that I have adhered to the prescribed standard thesis format, academic regulations, and ethical principles. Furthermore, I confirm that all materials utilized in this thesis are duly documented in the reference list in accordance with the stipulated regulations and ethical guidelines. I certify that the findings and outcomes presented in this thesis are original and have not been previously obtained elsewhere. Additionally, I affirm that there is no falsification of data within this thesis, and no portion of this work has been submitted as a thesis at this institution or any other university.

26/08/2024

Arnaud TADIDA FOUTSIWA

JURY ACCEPTANCE AND APPROVAL

The thesis titled "An Assessment of Sustainable Social Housing Projects in Cameroon," prepared by ARNAUD TADIDA FOUTSIWA, was defended on 26/08/2024. It has been accepted unanimously by the jury provided below as a thesis for the degree of Master of Science in the Department of Geomatics Engineering at the Graduate Education Institute of Tokat Gaziosmanpasa University.

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APPROVAL

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Director of Graduate Education Institute

DEDICATION

This thesis is dedicated to the FOUTSIWA family.

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ABSTRACT

AN ASSESSMENT OF SUSTAINABLE SOCIAL HOUSING PROJECTS IN CAMEROON

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Faced with rapid urbanisation and an ever-increasing demand for social housing, Cameroon has witnessed a significant expansion of property development projects in recent years, particularly in Yaoundé, the capital city of Cameroon. This surge in development is driven by the need to meet the growing housing demands of the population. In this context, the concept of sustainability, encompassing environmental, economic and social dimensions, has emerged as a major issue in the construction sector. This study assesses the sustainability of social housing projects in Cameroon, with a focus on the emblematic Olembé and Les Pétales projects as case studies which are currently underway in Yaoundé. These projects, often presented as models of sustainable urban development, offer a unique opportunity to examine the various facets of sustainability within the social housing sector. Through an exploration of the theoretical foundations of social housing and the principles of sustainability, this research aims to identify the key success factors and challenges encountered in the implementation of these projects.

Keywords: Social housing, sustainability, urban planning, Cameroon

ÖZET

KAMERUN'DAKİ SÜRDÜRÜLEBİLİR SOSYAL KONUT PROJELERİ ÜZERİNE BİR DEĞERLENDİRME

Tadida Foutsiwa, Arnaud
Yüksek Lisans, Harita Mühendisliği Ana Bilim Dalı
Tez Danışmanı: Doç. Dr. Aygün Kalınbayrak Ercan
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Hızla artan kentleşme ve sürekli büyüyen sosyal konut talebiyle karşı karşıya kalan Kamerun, son yıllarda, özellikle başkent Yaoundé'de önemli ölçüde gayrimenkul projelerinin geliştirilmesine tanık olmuştur. Bu projelerdeki büyüme, nüfusun giderek artan konut ihtiyaçlarını karşılamak amacıyla gerçekleşmektedir. Bu bağlamda, çevresel, ekonomik ve sosyal boyutları bir arada değerlendirilen sürdürülebilirlik kavramı, inşaat sektöründe temel bir konu olarak ortaya çıkmıştır. Bu çalışma, Kamerun'daki sosyal konut projelerinin sürdürülebilirliğini ele alarak, Yaoundé'de halen inşa edilmekte olan sembolik nitelikteki Olembé ve Les Pétales projelerini vaka çalışması olarak değerlendirmektedir. Genellikle sürdürülebilir kentsel gelişim modelleri olarak sunulan bu projeler, sosyal konut sektöründe sürdürülebilirliğin çeşitli yönlerini analiz etmek için benzersiz bir fırsat sunmaktadır. Bu araştırma, sosyal konut ve sürdürülebilirlik kavramlarının teorik temellerini inceleyerek, bu tür projelerin uygulanmasında karşılaşılan temel başarı faktörlerini ve zorlukları tespit etmeyi amaçlamaktadır.

Anahtar Kelimeler: Sosyal konut, sürdürülebilirlik, kentsel planlama, Kamerun

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LIST OF ABBREVIATIONS

CAHF: Centre for Affordable Housing Finance Africa

CAUE: Conseil d'Architecture, d'Urbanisme et de l'Environnement de Tarn-et-Garonne (Tarn-et-Garonne Council for Architecture, Town Planning and the Environment)

CFC: Crédit Foncier du Cameroun (Cameroon Mortgage Bank)

CIMENCAM: Cimenteries du Cameroun (Cement works of Cameroon)

EPA: United States Environment Protection Agency

HVAC: Heating Ventilation and Air Conditioning

IUCN: International Union for Conservation of Nature

LEED: Leadership in Energy and Environmental Design

MAETUR: Urban and Rural Land Development and Maintenance Mission

MINDCAF: Ministry of Estates, Cadastre and Land Affairs

MINFI: Ministry of Finance

MINHDU: Ministry of Housing and Urban Development

MIPROMALO: La Mission de Promotion des Matériaux Locaux (Mission to Promote Local Materials)

NGOs: Non-Governmental Organizations

PLANUT: Plan d'Urgence Triennal (Three-year Emergency Plan)

SAP: Structural Adjustment Plans

SIC: Société Immobilière du Cameroun (Cameroon Real Estate Company)

SMEs: Small and Medium-Sized Enterprises

UK: United Kingdom

UN: United Nations

UNEP: United Nations Environment Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

1. INTRODUCTION

With global population growth, social housing projects are of considerable importance in tackling housing inequalities, promoting social inclusion, reducing poverty, managing urbanization, stimulating economies, improving health and well-being, enhancing environmental sustainability, stabilizing communities, preserving human dignity, reducing crime and facilitating long-term urban planning. These projects play an essential role in promoting equitable and liveable societies, while meeting the needs of vulnerable and low-income populations. As this is a widely studied field, there are many studies on the subject. For example, Reeves (2005) and Balchin (1996) provide an overview of social housing policies, practices and challenges in various European countries, offering insights into the historical evolution, design, financing and management of social housing programs.

Emerging primarily in response to growing environmental concerns, the concept of sustainability is crucial for social housing projects as it brings environmental responsibility, cost savings, community resilience, improved indoor quality, better liveability and inclusion, and highlights responsible resource management. It aligns with global goals, attracts investment and leaves a positive legacy for future generations. Overall, the sustainability of social housing has many benefits for residents, communities, economies and the environment. Consequently, there is a growing number of studies based on sustainable social housing cases such as those from the UK (Pickvance, 2009), Brazil (Giannetti et.al, 2018), and South Arabia (Al Mulhim et.al, 2022).

1.1. Background to the Study and Description of the Problem

Like everywhere else in the world, sub-Saharan Africa is also facing a housing crisis due to population growth (Tipple, 1994). Academics have already focused on housing problems and social housing projects in countries such as South Africa and Nigeria (Goodlad, 1996; Gunter, 2013, Ihuah et al., 2014; Mohit and Iyanda, 2016). In addition, some studies examine social housing projects in these countries within the concept of sustainability (Goebel, 2007; Ihuah and Fortune, 2013).

Similarly, Cameroon's ever-growing population poses problems of access to housing. As Tabi et al. (2020) have shown, there is a growing demand for good quality housing. This is why the country has been striving to provide social housing projects for at least two decades (Tabi et al. 2020). Moreover, with growing environmental awareness, social housing projects have begun to be designed within the framework of sustainability principles.

It is in this context that the Cameroonian government has launched several social housing projects, notably the Olembé Project and Les Pétales, which are currently underway in the capital city Yaoundé and presented as models of sustainable urban development. These projects are in line with efforts undertaken since the 1960s to solve the problem of substandard housing in urban areas (Akono, 2022). However, the actual sustainability of these projects remains to be assessed, taking into account not only environmental aspects, but also social and economic dimensions, as advocated by the United Nations Sustainable Development Goals (United Nations, 2020). These goals represent a global action plan to build a better world by 2030. They aim to eradicate poverty, ensure quality education, promote gender equality, protect the environment, foster peace and strengthen global partnerships, all with a view to sustainable and inclusive development, where no one is left behind.

1.2. Aim of the Thesis

This study aims to assess the sustainability of social housing projects in Cameroon, specifically focusing on the Olembé Project and Les Pétales in Yaoundé, by analysing their integration into the urban fabric and their ability to meet the needs of the population while respecting the environment. The specific objectives are as follows:

- Analyse the theoretical underpinnings of social housing and sustainability, drawing on the work of researchers such as Reeves (2005), who explores different definitions and models of social housing, Balchin (1996), who highlights the social and economic stakes of housing, and Hajian and Kashani (2021), who propose a framework for assessing building sustainability.
- Identify the key success factors and challenges involved in implementing sustainable social housing projects in Cameroon.

- Assess the sustainability of the Olembé and Les Pétales projects, in terms of their environmental, social and economic performance.

To achieve these objectives, the research questions are defined as the following:

- What are the challenges and obstacles to implementing sustainable social housing projects in Cameroon?
- How can public policies encourage and support the development of sustainable social housing in Cameroon?
- How can the sustainability of social housing projects be assessed holistically, taking into account environmental, social and economic aspects?

1.3. Methodology

This thesis aims to deepen the understanding of sustainable social housing in Cameroon by analysing its integration with sustainability principles in an urban context. It will adopt a holistic approach, considering the environmental, social and economic dimensions of sustainability. Case studies of social housing projects in Cameroon will be conducted to analyse their practices and impact on urban sustainability.

However, the study is limited by the size and representativeness of the sample of projects studied, as well as by the availability and quality of the data. In addition, certain external factors influencing sustainability, such as public policy and climate change, are not fully taken into account, making the assessment of sustainability subjective and dependent on the criteria used.

1.4. Structure of the Study

This thesis is organized into six chapters. After the Introduction, the second chapter presents a review of the literature on social housing, exploring its history, objectives and challenges, drawing on the work of researchers such as Abdel Salam (2023), Mehallaine (2015) and others. The third chapter focuses on the concept of sustainability, examining its three pillars and its application in the field of architecture and urban planning, drawing in particular on the work of Hamiti and Bouzadi-daoud, (2021). The forth chapter provides an overview of the Cameroonian context, presenting key social housing policies

and actors in the country, as well as specific challenges related to rapid urbanization and climate change. The fifth chapter analyses the Olembé and Les Pétales projects in detail, assessing their sustainability using the indicators defined earlier and identifying lessons learned.

Finally, in the concluding chapter, this study synthesizes the findings and reflects on the implications for the field. The results of this research could inform public policy and the practices of actors in the sector, thereby helping to improve access to decent housing for all Cameroonians.

2. SOCIAL HOUSING

Social housing is a subject of great importance to many countries and communities. This chapter aims to examine the different aspects of social housing, including its definition, history, objectives and eligibility criteria. It also explores the different types of social housing, the sources of funding and the management of such housing. Finally, this work examines the advantages, limitations, problems, government policies and social impacts of social housing.

2.1. Definition

Housing is not just a roof over one's head, it is above all the solution to the urgent problem of access to affordable housing for households on modest or low incomes, in short, it is the reflection of our society and its values. Social housing, in particular, embodies the quest for social justice and human dignity in housing.

Social housing is a form of rent-regulated housing for people on low incomes or disadvantaged groups. Its aim is to guarantee fair access to suitable housing, regardless of financial circumstances. It helps to reduce inequalities, promotes social inclusion and offers opportunities for personal development. In short, social housing helps to build a fairer, more cohesive society (Bouckaert et al.2020).

Social housing according to Abdel Salam (2023), is housing provided through a public or private initiative for people who have difficulty finding accommodation, usually for financial reasons. The term is also used to designate the economic sector formed by this property market and the social economy policies that govern its administration.

Despite this, there is no exact definition of social housing. According to the Dictionary of the suburbs Mazaleyrat (2018, p. 9), it is: "all housing intended for people on low incomes and benefiting from specific public or private funding". Mazaleyrat (2018, p. 9), adds that "the concept of social housing emerged at the end of the 19th century with the founding of the low-cost housing. These associations were born of the desire of a few philanthropic middle-class people to provide workers with healthy housing. Their work focused on urban areas, where unhealthy housing was developing rapidly. Since the start of the industrial revolution, workers' living conditions had deteriorated. This is due to the

standardisation of production methods with the introduction of Fordism and assembly-line work, and to the deterioration of housing as a result of rent inflation, leading to overcrowding and an increase in the number of slums". Reeves (2005, p. 18, 26), on the other hand, emphasizes that social housing is “a state-enabled commodity” and a specific type of affordable housing, managed by local authorities and housing associations for rent, which shouldn't be confused with general affordable housing.

None of these definitions provides information on the means of financing and satisfaction with housing. What's more, they provide only a vague representation of the beneficiaries. The evolution of social housing can be seen in its architecture, comfort and financing. This evolution is confirmed by the definition of housing proposed by Jolis and Katz (2013, p.14) as "premises forming a whole intended for habitation".

The second point concerns the purpose of social housing. The idea that social housing is not intended for the poor, but for people on modest incomes, has been present from the outset. The Siegfried Law, which gave legal status to low-cost housing, reflects this idea (Kamoun, 2011, p.12) and stipulates that Habitations Bon Marchés are intended for "workers and employees living mainly from their work or wages".

2.1.1. The concept of social housing in Europe

The origins of social housing in Europe date back to the 19th century, when living conditions for the working poor in industrial towns were extremely precarious. Social reformers called for measures to improve housing for the working classes, which led to the creation of the first social housing. These initiatives were often led by philanthropic or government bodies and aimed to provide affordable and sanitary housing for workers. The first models of social housing developed in England, Germany and France, and subsequently influenced other European countries, as Mehallaine (2015) explains in her thesis.

In France, social housing is housing built and managed by public or private bodies, which receives financial assistance from the State. It is intended for low-income households and rents are capped.

In Germany, social housing is housing that benefits from public subsidies for the duration of the repayment of loans granted by the State. Once the loan has been repaid, the property leaves the social sector. This system was fully used after the war, but is no longer attractive today because of property prices.

In Great Britain, the term social housing refers to housing built and managed by local authorities, as well as housing built and managed by housing associations. Housing associations are not-for-profit organisations that build and manage low-cost housing. They were set up in the 19th century to meet the needs of disadvantaged people. Social housing has played an important role in the country's social history. It has enabled millions of people, including those on low incomes, ethnic minorities and the elderly, to have a decent home.

However, social housing was undermined by the privatisation policies of the Thatcher government in the 1980s. The government sold off a large proportion of social housing to private individuals. Housing associations were also encouraged to turn to the private sector (Mehallaine, 2015).

2.1.2. The concept of social housing in Africa

Social housing in Africa plays a crucial role in poverty reduction and has undergone significant change, becoming a major issue for governments and development actors. New approaches have been developed, combining public-private partnerships and community initiatives. Rapid demographic growth, internal migration and widespread poverty are major challenges for social housing in Africa. Community initiatives enable the most vulnerable populations to participate actively in the planning, construction and management of their own housing. Social housing in Africa has evolved to respond effectively to the growing needs of vulnerable populations (Michalopoulos and Papaioannou, 2020).

The participatory alternatives promoted by certain non-governmental organisations have several advantages. They allow the needs and aspirations of local populations to be taken into account, and encourage residents to participate in the design and management of

housing. But will they be enough to invent a new model for social housing in Africa? This is the question posed by Biehler et al. (2015).

In Africa, the concept of social housing was introduced gradually after the decade of independence in 1960; and given that "Strong demographic growth and urban sprawl, planning failures, illegal occupancy and informal housing, and good governance reforms are recurring themes in institutional reports and scientific analyses of African cities" (Biehler et. al., 2015, p. 1). After the hopes of independence, the crisis of the 1980s and the succession of structural adjustment plans in the 1990s led to a withdrawal of the State, followed by calls for public-private partnerships. Intervention in urban areas then became rare. Since 2000, however, there has been a relative return to the urban sphere. Urban development has returned to the forefront of agendas for political decision-makers (including ministries and local authorities) and international donors, driven by goals of economic growth and poverty reduction. Organizations such as the World Bank, the International Monetary Fund, and UN-Habitat are once again promoting technical interventions in urban areas, aligning these efforts with the principles of decentralization and participation. As a result, a number of actors are redeploying or developing development projects, starting with the governments themselves. It is in this context that new programmes for the promotion and construction of 'social' housing are being launched.

2.2. History and Development of Social Housing

Social housing has its origins in the second half of the 19th century, as a response to the housing crisis that prevailed mainly in large industrial cities. This crisis was due to rapid urbanisation and unfit housing. The need for decent housing for the working poor was obvious, which led to the birth of the first social housing initiatives (Tanchoux, 2020).

In the UK, Ebenezeer Howard is best known for developing the garden city concept as part of his vision of planned cities offering a healthy and pleasant environment for the residents. His seminal work, Garden Cities of To-Morrow, influenced the social housing movement and encouraged the creation of garden cities around the world (Howard, 1902) (Figure 2.1).

In France, the Siegfried law of 1894 was the first to introduce the concept of social housing. But it was after the Second World War that social housing experienced a major boom with the creation of the Grands ensembles, vast residential complexes designed to accommodate large numbers of families on modest incomes. The journal "L'architecture d'aujourd'hui", by André Bloc in 1954, provides a good illustration of this period in the development of social housing in France (Bloc, 1954).

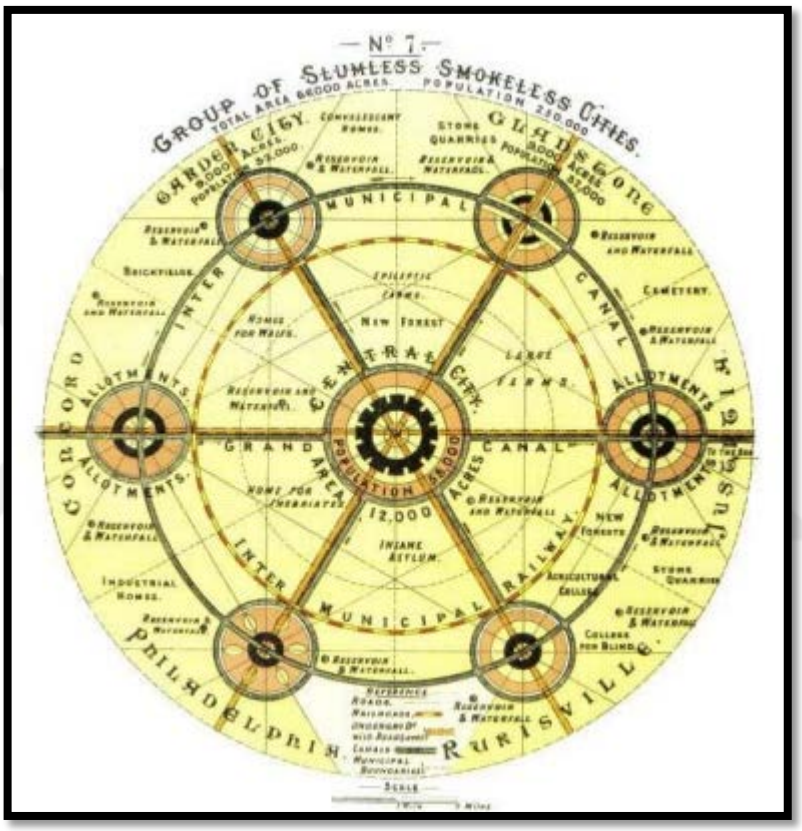

Figure 2.1: Ebenezer Howard’s Garden City
Source: Fahmy (2010, p. 67, Figure 3-1)

The main stages in the history and evolution of social housing can be summarised chronologically, highlighting significant developments and changes over time.

The first social housing initiatives were taken by philanthropists and private companies. In France, for example, the Société française des Habitations à Bon Marché was set up in 1889 to build affordable housing for workers (Fourcaut, 2006, p. 6).

After the First World War, social housing policies were introduced to remedy the shortage of affordable housing. In France, the Loucheur law of 1928 was passed to encourage the

construction of social housing through tax breaks for investors. This policy led to the construction of a large number of affordable homes for working people and stimulated the construction sector. Other European countries have also adopted similar policies to meet the growing demand for social housing (Kholodilin et al., 2022).

During the inter-war period, social housing was closely monitored due to the housing crisis. Numerous social housing initiatives were launched to meet the needs of low-income workers and families. These initiatives included the construction of garden cities, collective housing and housing cooperatives. Modernist architects introduced innovations to the design of social housing, emphasising natural light, green spaces and communal facilities. These efforts helped to improve the living conditions of disadvantaged populations and encourage the emergence of neighbourhoods offering greater social equity (Kholodilin et al., 2022).

After the Second World War, great progress was made in the field of social housing. The priority was to rebuild devastated cities and create large-scale social housing projects to meet the pressing demand for affordable housing. These projects consisted of low-cost, medium-sized flats, with community infrastructure such as schools, parks and community centres. These developments went some way to solving the housing crisis and improving living conditions for many families. However, over time, some of these large housing estates have encountered problems of management, isolation and social stigmatisation, calling this model of social housing into question (Kholodilin et al., 2022). And so it is that households in all European countries, the majority of whom are tenants of social or private landlords, are finding that over the decades, "ownership is taking precedence over renting" (Louvot-Runavot, 2001, p. 29).

2.3. Development of Social Housing as a Means of Combating Substandard Housing

Insalubrity is a major problem in the field of social housing. It concerns housing conditions that do not comply with health and hygiene standards. Substandard housing can pose health and safety risks for the occupants. It may be infested with pests, or have problems with damp, mould or poor ventilation. Insalubrity is often linked to the socio-economic precariousness of residents and a lack of maintenance. Combating substandard

housing is therefore a key issue in the development of social housing in order to guarantee decent living conditions for all (Alberghini et al., 2020).

In the work of Mazaleyrat (2018, p. 39), "the industrial revolution was accompanied by a deterioration in living conditions in working-class homes and led to numerous urban hygiene problems". This issue became increasingly important. It led to the development of a new science, medical topography, the results of which raised awareness of the problem and its consequences for society, forcing the French government to take action.

In the same vein, the profound transformation of society brought about by industrialisation was also reflected in the field of medicine, where many doctors became aware of the impact of living conditions on people's health and decided to take action to improve the situation. According to Kamoun (2011, p. 38), these doctors "travelled around towns and working-class neighbourhoods. They observe and document the unhealthy environments in which workers and their families live. Their often voluminous reports accurately described the appalling housing conditions of the working class".

Guerrand (1966, p. 32), in his article, makes us understand that "the inventors of the new science [medical topography] not only revealed the critical state of housing for the working classes, but above all laid the foundations for public hygiene in housing".

Eradicating substandard housing is a complex challenge that cannot be solved by evicting the occupants alone. In fact, it is vital to offer appropriate rehousing solutions so as not to make already precarious populations even more vulnerable. That's why building healthy, affordable housing for people on low incomes is a key element in the fight against substandard housing. This development responds to an urgent need and makes it possible to offer these populations a decent environment conducive to their well-being through construction. But these buildings were mainly built by entrepreneurs, many of whom wanted to "link the worker more closely to the factory", as Butler and Noisette put it (1983, p. 111).

2.4. Types of Social Housing

There are different types of social housing available to meet the varied needs of those eligible. These types include collective housing, individual housing, housing adapted for disabled people and temporary housing.

2.4.1. Collective housing

Collective housing is one of the types of social housing available. They are designed to accommodate several households in the same building or residential complex. They offer communal areas such as shared kitchens, meeting rooms and children's play areas. They are ideal for people who prefer to live in a community and share certain resources (Filali, 2023).

2.4.2. Individual housing

Individual dwellings are also an option among the available social housing. They are intended to accommodate a single family or household in an independent residential unit. These homes can be flats, houses or detached houses, offering residents greater privacy and autonomy. They are suitable for those who prefer to live more independently (Marechal, 2023).

2.4.3. Adapted housing for disabled people

Social housing adapted for people with disabilities is specially designed to meet the specific needs of individuals with physical or intellectual limitations. These homes are equipped with access ramps, wider doors, adapted bathrooms and other features that make daily life easier for disabled people. They offer an accessible and inclusive environment, promoting independence and integration (Tannoia, 2023).

2.4.4. Temporary accommodation

Temporary accommodation is one of the types of social housing available to meet the urgent needs of people in vulnerable situations, such as homeless people or people affected by natural disasters. This type of accommodation provides temporary and secure

accommodation, usually for a fixed period. They allow individuals to stabilise, access support services and work towards a more permanent housing solution (Stébé, 2022).

2.5. Advantages and Disadvantages of Social Housing

Social housing has both advantages and limitations. The advantages of social housing are numerous. First, it provides affordable housing to low-income individuals who may not be able to afford renting or buying housing in the private market. It thus helps reduce social inequalities by offering shelter to the most disadvantaged. Additionally, social housing often provides decent and secure living conditions, with guaranteed quality standards. It may also offer additional services such as playgrounds, community gardens, or meeting spaces. However, social housing also has limitations. One of the main limitations is the limited availability of social housing compared to demand. Additionally, some social housing may be poorly maintained or suffer from neighbourhood issues, which can affect residents' quality of life. Despite these limitations, social housing remains an essential tool in combating homelessness and ensuring the right to housing for all (Dietrich-Ragon, 2020).

2.5.1. Advantages

Financial accessibility, residential stability and mobility

Social housing is extremely beneficial for low-income individuals, providing essential affordable housing and residential stability. In addition to financial assistance, it also fosters close social connections and reduces socio-economic inequalities. Furthermore, social housing plays a crucial role in stimulating the local economy by creating job opportunities in the construction sector and encouraging local spending. Moreover, it is essential for environmental preservation, as it promotes sustainable construction and reduces greenhouse gas emissions. It is therefore paramount to actively support social housing, to ensure a decent standard of living for all citizens and contribute to the overall well-being of society. Hence, supporting social housing is essential for a more equitable, prosperous, and environmentally respectful society (Dietrich-Ragon, 2020).

Social housing tenants typically benefit from stable lease agreements. This means they are less likely to face eviction or move frequently, creating greater residential stability.

Bigot et al.'s publication (2014), housing stability is crucial for the security and well-being of families.

However, in essence, social housing is designed to promote mobility. By offering low rents, it lowers the reservation wage for workers, making it easier for job seekers to relocate for new opportunities if their housing costs are more affordable (Bigot, et. al, 2014, p 23).

According to Bigot et al.'s calculations (2014), countries where social housing is most prevalent are also those with the highest residential mobility: this correlation is observed in 16 countries of the Organisation for Economic Co-operation and Development during the recent period (2008-2012) (Figure 2.2).

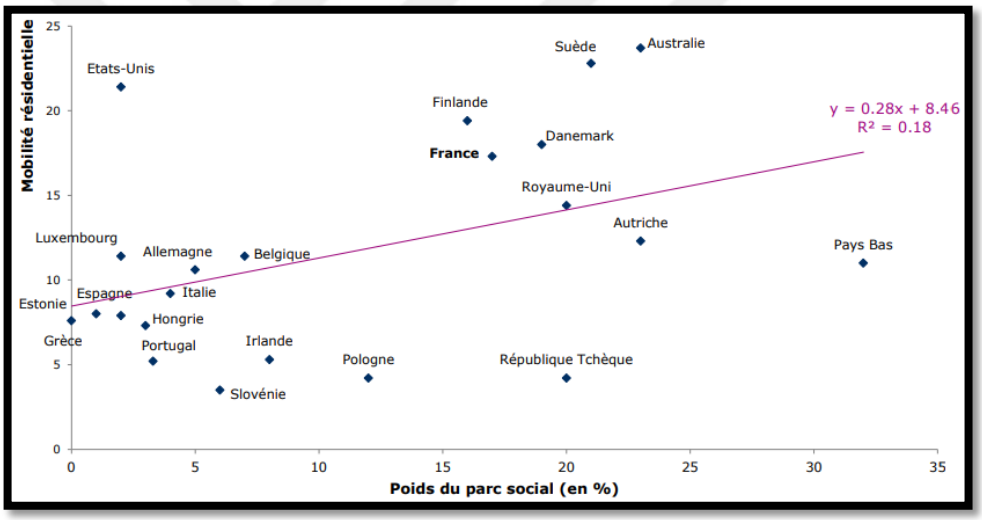

Figure 2.2: Link between the importance of social housing and mobility
Source: Bigot et al. (2014, p. 23)

Reduction of social inequalities

Social housing also has a significant impact on individuals' health. By providing adequate housing conditions, it helps prevent overcrowding-related diseases, such as respiratory infections and contagious diseases. Additionally, by offering a safe and healthy environment, social housing promotes residents' mental and emotional well-being, thereby reducing the risks of stress and depression (Dietrich-Ragon, 2020).

Furthermore, social housing contributes to strengthening the social fabric of communities. By bringing together people from diverse socio-economic backgrounds, it promotes social mix and encourages mutual support among residents. Neighbours can support each other, share resources, and create a sense of solidarity and belonging (Dietrich-Ragon, 2020).

Moreover, social housing provides individuals with the opportunity to focus on other aspects of their lives, such as education and training. By significantly reducing the financial burden associated with housing, it allows individuals to invest more in their own personal and professional development. This results in a more skilled workforce and a more competitive economy in the long term (Dietrich-Ragon, 2020).

Social housing contributes to family stability. By providing affordable and sustainable housing, it allows families to feel secure and plan for the future. This promotes stability in family relationships, enhances children's well-being, and encourages educational success.

Services and community

Many social housing developments offer common spaces, facilities, and additional services. This fosters a sense of community among residents. Facilities such as playgrounds, community gardens, and educational programs contribute to residents' well-being.

Economic development

The construction of social housing creates jobs in the construction sector and stimulates economic activity. This can have a positive impact on local economic growth. Social housing also seems to act as a buffer against economic shocks. Not only are countries where social housing is important those with the lowest unemployment rates, but they are also the ones where unemployment has progressed the least during the economic crisis between 2008 and 2012 (Bigot et al., 2014) (Figure 2.3).

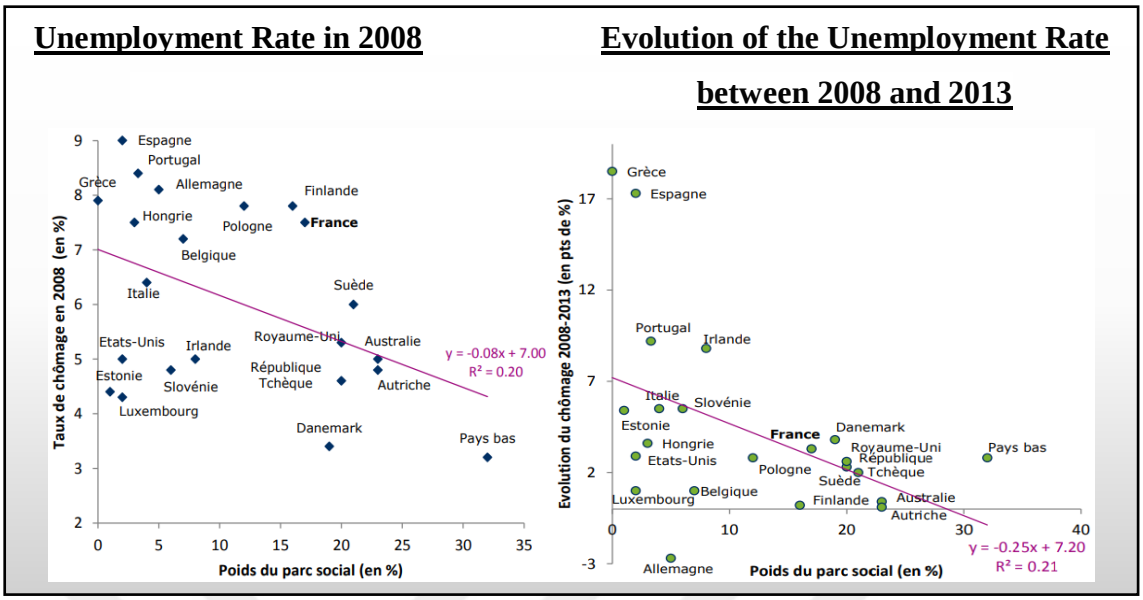

Figure 2.3: The importance of social housing and unemployment rate
Source: Bigot et. al. (2014, p. 24)

Housing quality

Social housing is generally subject to rigorous construction and maintenance standards, ensuring quality housing for residents. This contributes to improving residents' quality of life. In fact, according to Bigot et al. (2014, p. 21), "the corollary of the price effect is that social housing offers more comfortable housing for low-income households: among households currently receiving housing assistance or social housing, just under a quarter would move to less comfortable housing if public aid were removed. This proportion rises to a third for disadvantaged households assisted in the private sector."

Reduction of homelessness

Social housing helps reduce the number of homeless people by providing affordable housing solutions to those in need. As illustrated by Bigot et al. (2014, p. 21), "numerous studies show that effort rates in the population have increased significantly over the past thirty years, particularly among tenants and even more so among the most modest tenants, but the impact has been mitigated by social housing: social housing has thus contributed to reducing inequalities in effort".

Social housing is much more than just a means of affordable housing. It has significant impacts on health, social fabric, education, economy, and family stability.

2.5.2. Disadvantages

High demand, limited supply

According to Burdet and Lanz (2018), one of the most obvious disadvantages of social housing is that demand is often much higher than supply. Long waiting lists can make access to social housing difficult, leaving many families in unstable situations, especially for the most precarious households.

Uneven quality

The quality of social housing can vary significantly. Some housing units are poorly maintained, outdated, or even unsanitary. This can have a negative impact on residents' lives. Bigot et al. (2014, p. 21) states that, "social housing introduces risks of geographical segregation because social housing units are unevenly distributed across the territory, with some municipalities being reluctant to build social housing and residents choosing their neighbourhood based on the type of population living there. Among the disadvantages regularly debated in public opinion, social housing is sometimes criticized for the opacity of its housing allocation rules."

Stigmatization

As Wacquant (2008) indicates, people living in social housing may face social stigma. This social stigma can affect their self-esteem and psychological well-being, creating a vicious circle of prejudice.

Complex management

According to Merlo and Puig-Denzer (2018), managing social housing can be complicated, and public or private entities responsible for administration may face issues related to management, bureaucracy, and meeting the needs of residents.

Concentration of disadvantaged populations

Musterd and Ostria (2016) argues that the concentration of disadvantaged populations in social housing neighbourhoods can have negative effects on social cohesion and economic opportunities, and can also create ghettos and foster urban segregation.

Delays in repairs

Repairs and maintenance of social housing units can take time due to limited resources. This can impact residents' quality of life, as they may face unresolved housing issues for extended periods.

In a study commissioned by the Union Sociale pour l'Habitat on the question: Is social housing an asset or a hindrance to growth? Bigot et al. (2014, p. 21) illustrate: "A recurring debate revolves around the comparative cost of social housing and individual housing benefits." Individual benefits are often seen as preferable because they aim to reduce the amount of rent (or fees if residing in a shelter) and their amount depends on the household's resources, because they have the advantage of being able to be used everywhere:

- They are usable everywhere and would help avoid the effects of ghettos.
- They are better suited to the household's financial situation, its evolution, and its mobility.
- They are not suspected of being allocated in an opaque manner (which is sometimes criticized in social housing allocation committees).
- They would be less stigmatizing than the allocation of housing in the social sector.

Cost-effectiveness analyses conducted in the United States using a synthesized methodology seem to indicate that, overall, the total cost paid by society and the beneficiary of social housing is higher than the total cost that the same household would pay in private housing while benefiting from personal assistance. However, personal assistance would have an inflationary effect, as landlords would incorporate the additional purchasing power that these aids grant to tenants. On the other hand, social housing is an asset that offers sustainable services.

3. SUSTAINABILITY

Global climate change has brought environmental protection to the forefront of current concerns, and this is what constitutes a sustainable development perspective, hence the notion of sustainability, which "has always been discussed by experts" and can be defined as the ability to maintain a balance between human needs and the preservation of the environment and natural resources (Hajian and Kashani, 2021). This is how Keller (2013, p. 7) puts it in his work: "At the Earth Summit organised under the aegis of the UN in 1992 [United Nations Conference on Environment and Development], the action plan for sustainable development known as "Agenda 21" was defined and then ratified by 181 governments. Agenda 21 is a global call to national, regional and local leaders to define their priorities and actions in terms of sustainability to move towards sustainable development in the 21st century." Hence "ecological architecture", "bioclimatic architecture", "solar architecture", "high environmental quality", "sustainable architecture", etc. all these terms reflect the same concern: to design architecture that is more respectful of the environment and minimises energy consumption. But each of these terms reflects a particular period, and sometimes a particular country, and often responds to different rationales.

This chapter examines the concepts of sustainability and sustainable development, as well as their application in sustainable architecture. It also considers sustainable social housing projects, focusing on how these efforts meet the demand for affordable housing while promoting environmental responsibility.

3.1. Concept of Sustainability, Origin and Issues

3.1.1. Origin and historical context of the concept of sustainability

In Caradonna's book "Sustainability: A history" published in 2022 (p. 22), the concept of sustainability has its origins in the historical context of the industrial revolution. With the advent of industrialisation, environmental concerns gradually emerged. These concerns focused on the impact of industrial growth on the environment, particularly in terms of pollution and the destruction of natural resources. It was against this backdrop that

ecological movements began to develop, with the aim of promoting more sustainable and environmentally-friendly practices.

Again in his book "Sustainability: A history", Caradonna (2022, p. 55) points out that the historical context for the emergence of the concept of sustainability dates back to the industrial revolution of the nineteenth century. This period was marked by rapid and massive industrialisation, accompanied by numerous environmental problems. The uncontrolled exploitation of natural resources, the use of fossil fuels and pollution led to a gradual awareness of the harmful consequences of these activities on the environment. This historical context laid the foundations for thinking about sustainability and gave rise to the first discussions on the need to reconcile economic development with respect for the environment.

The first stirrings of ecological awareness were heard in the late 60s, just before the oil crisis. The alarm was sounded about the impossibility of consuming limited resources (particularly energy) ad infinitum. The concept of sustainable development was first defined in 1987 in the report "Our Common Future" published by the UN under the leadership of Gro Harlem Brundtland, President of the World Commission on Environment and Development (Brundtland, 1987).

3.1.2. The challenges of the sustainability concept

Taken from the 1987 UN report "Our Common Future" (Brundtland, 1987), the challenges of sustainability are of crucial importance for the future of our planet. They relate to preserving ecosystems, ensuring the availability of natural resources for future generations and reducing negative impacts on the environment. Sustainability also helps to promote social equity by ensuring fair access to basic needs and protecting people's health and well-being. In economic terms, sustainability issues are essential for stimulating sustainable economic growth, promoting sustainable job creation and encouraging corporate responsibility. In short, sustainability issues are inseparable from the development of a balanced, equitable and prosperous society.

Environmental issues

Environmental issues concern the challenges facing our natural environment. They include managing natural resources, preserving biodiversity, and combating climate change. These issues are crucial because they directly affect the health of our planet and all the living beings that inhabit it. By tackling these issues in a sustainable way, we can ensure that our environment is preserved for future generations.

Social issues

The social challenges of sustainability are essential to ensuring the balanced and harmonious development of society. They encompass aspects such as equity and social justice, access to basic needs, and people's health and well-being. By guaranteeing equity and social justice, the aim is to reduce wealth disparities and promote equal opportunities for all. Access to basic needs is also a crucial issue, as it means ensuring that every individual has access to food, drinking water, housing, education and health. Finally, people's health and well-being are major issues, as a healthy environment and favourable living conditions are essential to guaranteeing people's quality of life.

Economic issues

The economic challenges associated with sustainability are many and varied. They include sustainable development and economic growth, corporate responsibility and the creation of sustainable jobs. These issues are essential to ensuring a stable and prosperous economy while preserving the environment and the well-being of people. Economic sustainability involves striking a balance between the needs of the present and those of future generations. It is based on policies and practices that encourage the efficient use of resources, the reduction of waste and the promotion of sustainable technologies. The economic challenges of sustainability require a global approach and close collaboration between governments, business and civil society.

In the early 1980s, the International Union for Conservation of Nature (IUCN) came up with a strategy for combining development and the environment: this process is defined by the term "sustainable development". It was taken up and popularised by the Brundtland Report, Our Common Future, which served as a reference for the World Summit in Rio

de Janeiro in 1992. Many institutions use this concept as a basis for developing new measurement and analysis tools, or for recommending measures to promote a more inclusive economy (Hamiti and Bouzadi-daoud, 2021).

Now that the consequences of imbalances between these three pillars have been identified, sustainable development aims to establish a virtuous circle between them. It is an attitude that aims to be more global and qualitative, tending to emancipate itself from consumerism and the quantitative aspect.

3.2. The Concept of Sustainable Development

3.2.1. Definition and history of sustainable development

Sustainable development is a concept with multiple definitions. In the article "Étude du concept du développement durable", Hamiti and Bouzadi-daoud (2021, p. 135) highlight this diversity, explaining that the term "development" can refer to a state, a process or an objective, and is often associated with notions such as well-being, progress, social equity, economic development, personal fulfilment and ecological harmony. In their view, sustainable development is the result of mental and social changes within a population, enabling cumulative and sustainable growth in its overall real performance. This growth is not limited to the quantitative aspect, but also integrates a qualitative dimension, including elements such as well-being.

Thus, Hamiti and Bouzadi-daoud (2021, p.135) define development as "the evolution of a society that uses its productivity gains not to increase indefinitely a production that generates environmental degradation, dissatisfactions, repressed desires, inequalities and injustices, but to reduce work for all by sharing the income from activity more equitably".

In the report "Our Common Future" (Brundtland, 1987), published by the UN in 1987 under the direction of Gro Harlem Brundtland, President of the World Commission on Environment and Development, "sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs". It is therefore a development model that seeks to reconcile economic, social and environmental aspects, in order to guarantee a better quality of life

for all, while preserving natural resources and avoiding irreversible damage to the environment.

The Sustainable Development Goals are defined by the United Nations' Agenda 2030, adopted in 2015 (United Nations, 2020). They comprise 17 sustainable development goals aimed at ensuring a sustainable future for all. These goals include access to safe and affordable housing, accessible and safe transport systems, sustainable urbanisation, protection of cultural and natural heritage, reduction of natural disasters, reduction of the environmental impact of cities, access to green and public spaces, and promotion of positive links between urban, peri-urban and rural areas. It also involves promoting integrated sustainable development policies and supporting sustainable construction in the least developed countries. These goals are intended to guide the efforts of countries and stakeholders to achieve more sustainable and equitable development by 2030 (United Nations, 2020).

In this way, a thoughtful approach to the present that takes account of long-term effects reveals three major pillars of sustainable development that are essential and interdependent (Figure 3.1): the ecological aspect, the social aspect and the economic aspect (Hafizyar and Dheyaaldin, 2019). Like a stool, neglecting even one of its legs can only lead to wobbly solutions in the long term, perpetuating an unsustainable system. All forms of development and evolution have social, ecological and economic effects on the world as a whole, which can be considered as a common spatial and temporal system. It is important to understand that actions taken in certain geographical areas at certain times can have an impact on other geographical areas at other times, from an ecological, social and economic point of view.

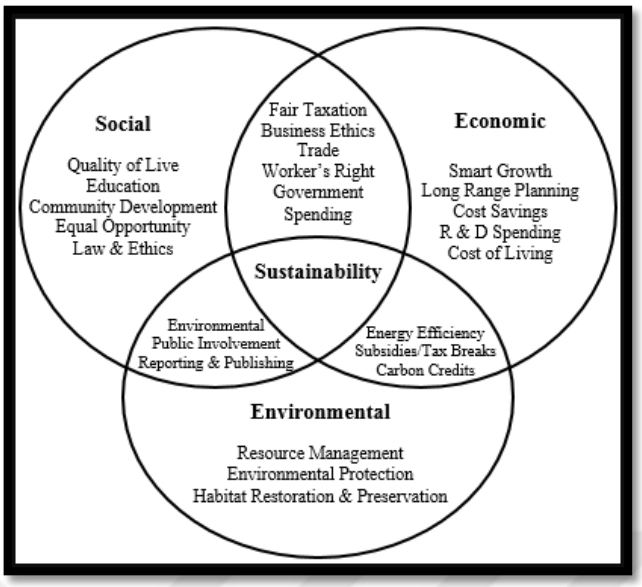

Figure 3.1: Significant three pillars of sustainability
Source: Hafizyar and Dheyaaldin (2019, figure 1)

Once the consequences of imbalances between these three pillars have been identified, sustainable development aims to establish a virtuous circle between them. It is an attitude that aims to be more global and qualitative, tending to emancipate itself from consumerism and the quantitative aspect.

3.2.2. The pillars of sustainable development

The pillars of sustainable development make it possible to achieve the 17 United Nations sustainable development objectives through: economic performance, social responsibility and respect for the environment. These pillars represent the essential dimensions required for balanced development. The interconnection between them is crucial to ensure the overall sustainability of a society. This model suggests that economic development must be supported by actions that are socially just and respectful of the environment. The three pillars of sustainable development work in synergy to create conditions conducive to economic growth, improving people's living conditions and preserving the environment.

- Economy: ensuring sound and sustainable management.
- Social: meeting the basic needs of humanity.
- Environmental: preserve natural resources in the long term.

Economic pillar

The economic pillars of sustainable development are essential to ensure sustainable and balanced growth. They include sustainable economic growth, economic equity, innovation and entrepreneurship. These pillars play a key role in creating jobs, reducing poverty and improving economic well-being. They advocate a strong, competitive economy that promotes both environmental sustainability and social prosperity. Sustainable economic growth guarantees an increase in the production of goods and services while minimising negative impacts on the environment. Economic equity aims to reduce inequalities, particularly between developed and developing countries, and to ensure a fair distribution of resources. Innovation and entrepreneurship encourage the creation of new ideas, technologies and economic models that promote sustainability and stimulate growth (Abbas et al., 2020).

Social pillar

The social pillar of sustainable development is essential for creating a more equitable and inclusive society. It aims to guarantee social justice by ensuring equal opportunities and combating inequalities. By promoting access to education and health for all, it helps to improve people's quality of life and reduce disparities. In addition, it encourages inclusion and diversity by promoting the active participation of all members of society, regardless of gender, ethnic origin, age or disability. Finally, the social pillar guarantees respect for human rights by protecting fundamental freedoms and combating all forms of discrimination (Fikri and Rhalma, 2023, p. 136).

Environmental pillar

According to Klorane Botanical Foundation (n.d.) "It is often confused with the whole concept of sustainable development, but the environmental pillar is only one aspect of it. More than the other two, it sets non-negotiable limits: those of the planet's finite resources. The environmental pillar seeks to provide a framework for human activities to ensure that they are carried out not only in harmony with ecosystems, but above all with a view to, at the very least, preserving or even restoring them. Starting from the premise that there can be no development of the human species without addressing environmental

issues, it is also the pillar that is the most forward-looking: our activities today must not impair the ability of future generations to carry out theirs in similar conditions".

3.3. Sustainable Architecture

Faced with these sustainability considerations, the approach to architecture has given rise to "sustainability" criteria for sustainable housing, aimed at development that respects both human and environmental aspects.

In the introductory section of Rheude et al.'s (2001) "Review of terminology in the sustainable building sector", the notion of sustainable architecture is raised as one of the factors of sustainability, the anthropogenic climate change, driven by escalating greenhouse gas emissions from the production of consumer goods and energy for modern living standards, poses significant global challenges. Economic and population growth have surged, intensifying the demand for energy and resources. Buildings contribute significantly worldwide energy use and carbon emissions, alongside other adverse environmental effects. The construction industry is expected to create more urban infrastructure in the next 40 years than it has in the past 4 000 years, further exacerbating environmental impacts. Despite its positive societal contributions, such as providing essential facilities and fostering economic growth, the construction industry cannot be disregarded in addressing climate change and environmental sustainability. The idea of sustainability needs to be integrated into the construction sector, even though it poses a substantial challenge for scientists responsible for its execution (Rheude et al. 2021).

At this point, it should be noted that Benmerzouk (2023, p. 26) define sustainable architecture as a concept that aims to design and construct buildings that respect the environment and are capable of meeting current and future needs. It encompasses various principles such as the use of sustainable materials, the optimisation of energy efficiency and the integration of recycling solutions. This approach to construction is part of a global vision of sustainability, taking into account environmental, social and economic issues.

3.3.1. Principles of sustainable architecture

Sustainable architecture is based on a number of fundamental principles to minimise its environmental impact. Designing "sustainable architecture" entails crafting living

environments that strike a harmonious balance between humans and their surroundings. This involves conserving resources and the environment, while also prioritizing the comfort and health of its residents (CAUE, 2007, p. 3)

These principles include the use of sustainable materials, energy saving and waste management. By combining these principles, sustainable architecture aims to create buildings that are ecologically responsible and satisfy current demands without depleting resources for future generations.

Use of sustainable materials

The use of sustainable materials is one of the key principles of sustainable architecture, which means choosing materials that have a low carbon footprint, are renewable and can be recycled or reused when they reach the end of their life. Examples of sustainable materials include certified wood from sustainable sources, recycled concrete, natural-fiber insulation and environmentally-friendly flooring (UPCYCLEA, 2023). By using sustainable materials, sustainable architecture helps preserve natural resources and reduce waste.

Saving energy

Saving energy is another important principle of sustainable architecture. It involves designing buildings that minimise their energy consumption by using strategies such as effective insulation, the use of double-glazed windows, the installation of high-efficiency heating, ventilation and air-conditioning (HVAC) systems, and the integration of renewable energy sources such as solar, wind and geothermal (Batizze. n.d.). These measures will decrease our reliance on fossil fuels and lower greenhouse gas emissions and deliver long-term energy savings.

Waste management

In the United Nations Environment Programme (UNEP, 2020), waste management is an essential aspect of sustainable architecture. In this programme, this means taking into account the reduction, reuse and recycling of waste in the design and construction of buildings. Techniques such as factory prefabrication, which reduces construction waste

on site, and modular design, which facilitates the reuse of building components, are used. In addition, selective waste collection systems within buildings encourage recycling. Waste management in sustainable architecture aims to minimise the amount of waste sent to landfill, reduce resource consumption and preserve the environment.

3.3.2. Examples of sustainable architecture

There are many and varied examples of sustainable architecture. Among them are low-energy buildings, which are designed to minimise their ecological footprint by using techniques such as thermal insulation, natural ventilation and the use of renewable energy sources. In addition, the use of recycled materials is increasingly common in sustainable construction. Some structures also incorporate nature into their design, using features such as green roofs, vertical gardens and tree-lined courtyards. Finally, renewable energy systems, such as solar panels and wind turbines, are used to power these sustainable buildings with clean, renewable energy. Here are some outstanding examples:

The Bullitt Center, Seattle, United States

This 6-storey commercial building (Figure 3.2) is LEED Platinum certified, the highest level of certification for sustainable construction (Peña, 2014). It stands out for its bioclimatic design, renewable energy systems (solar panels, wind turbine), efficient water management and use of sustainable materials.

Figure 3.2: The Bullitt Center, Seattle, (United States)
Source: Peña (2014, p. 42, figure 46)

Eastgate Tower, Harare, Zimbabwe

The Eastgate Center in Harare, Zimbabwe, stands out as a remarkable example of sustainable architecture and innovative design. Designed by architect Mick Pearce in collaboration with Arup engineers, this large office and retail complex utilizes biomimicry principles to achieve remarkable energy efficiency. Despite its size, this 13-storey skyscraper requires no traditional air conditioning or heating system (Figure 3.3). Instead, it draws inspiration from Zimbabwe's native masonry and the cooling mounds of African termites, resulting in year-round temperature regulation and significantly reduced energy consumption (Fehrenbacher, 2012).

Figure 3.3: Eastgate Tower, Harare, Zimbabwe
Source: Koschke (2020)

Hammarby Sjöstad, Stockholm, Sweden

Hammarby Sjöstad (Figure 3.4) is a neighbourhood in Stockholm entirely designed according to sustainable development principles. This neighbourhood is home to approximately 11 000 residents and includes social housing, offices, shops, and green spaces. The design of the neighbourhood focuses on energy efficiency, the use of sustainable materials, and alternative modes of transportation (EcoDistricts, n.d.).

Figure 3.4: Hammarby Sjöstad, Stockholm, Sweden
Source: EcoDistricts (n.d., p. 1, figure 1)

3.3.3. Benefits of sustainable architecture

Sustainable architecture, also known as green or ecological architecture, offers numerous environmental, economic, and social benefits. It aims to design buildings that minimize their environmental impact while creating healthy and comfortable spaces for occupants.

Environmental footprint reduction

According to Trad (2022, p. 5), sustainable architecture offers many tangible environmental benefits. Firstly, it reduces energy consumption through better insulation and the use of renewable energy sources. In addition, the use of sustainable and recycled materials helps to reduce the carbon footprint of buildings and limit the amount of waste produced. In addition, the sustainable construction techniques used in sustainable architecture help to preserve natural resources and protect biodiversity. Finally, by optimising the use of resources and reducing greenhouse gas emissions, sustainable architecture plays a crucial role in combating climate change and preserving the environment.

Improvement of quality of life

Sustainable architecture aims to improve the quality of life of occupants by creating healthy, comfortable, and pleasant indoor spaces (Harvard T.H. Chan School of Public Health, n.d.). By using ecological and healthy materials, sustainable buildings reduce health risks related to the presence of toxic or allergenic substances. Furthermore, by

integrating nature into the design, such as green spaces or outdoor relaxation areas, sustainable architecture promotes well-being and connectivity with the environment. Sustainable buildings are also designed to optimize the use of natural light and ventilation, creating bright and airy spaces that enhance comfort and productivity of occupants (Trad, 2022, p. 6).

Long-term financial savings

Sustainable architecture offers long-term financial savings to building owners and occupants. Through the adoption of eco-energy practices, such as efficient insulation, the use of renewable energy systems, and the optimization of energy consumption, sustainable buildings significantly reduce energy costs. These energy savings result in lower electricity and heating bills, allowing occupants to achieve significant financial savings (United States Environmental Protection Agency [EPA], 2023).

3.3.4. Sustainable architecture and culture

The concept of sustainable development has traditionally been defined by three pillars: environmental, social, and economic. However, an increasing movement advocates for recognizing culture as the fourth pillar of sustainable development (UNESCO, n.d.). This recognition stems from the understanding that culture plays a fundamental role in shaping human values, behaviours, and relationships with the environment (Figure 3.5).

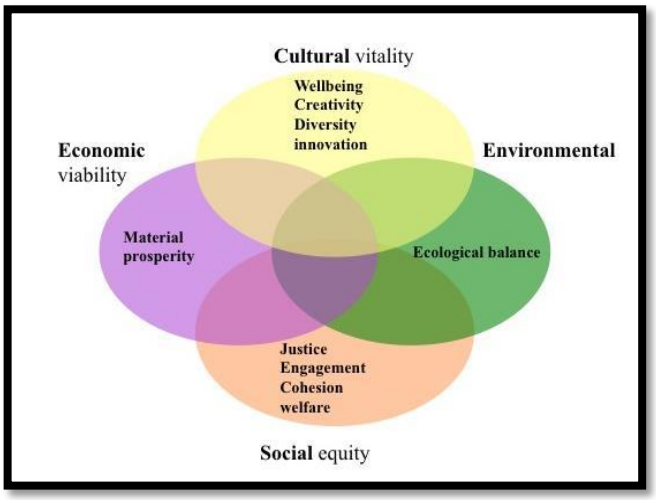

Figure 3.5: Sustainable development with four pillars
Source: Sharvina, Faqih and Santosa (2017, figure 4)

The integration of culture into sustainable architecture presents both challenges and benefits. Preserving cultural heritage, integrating cultural practices, and raising awareness of cultural diversity are key aspects to consider. Allileche and Bey (2021, p. 43) define culture as follows: "Culture includes knowledge, beliefs, customs, artworks, inventions, technology. Culture encompasses all elements assimilated by every member of a given society. It is universal as a human acquisition, but each of its local or regional manifestations can be considered empirical. The development of ethnological studies has shown that all cultures are equal. It is the sum of knowledge intended to elevate the individual morally and intellectually; it is a set of acquired knowledge, education, social and religious knowledge, intellectual or artistic manifestations, which characterize a society. The transmission of culture corresponds to the transmission of images that had previously been opposed to other members of society so that they understand their meaning and use. Through this transmission, the individual can increase his ability to use the culture he possesses."

Sustainable architecture is a rapidly expanding field, with many sustainable buildings being constructed worldwide. It is an essential element of the transition to a more sustainable world, including in social housing.

3.4. Sustainability of Social Housing Projects

The sustainability of social housing projects has become a crucial issue in addressing current environmental, social, economic, and cultural challenges. It is essential to design and construct social housing that is not only affordable and accessible but also minimizes its impact on the environment and contributes to the well-being of occupants. This involves using sustainable practices and materials, efficiently managing natural resources, and considering social, economic, and cultural issues.

3.4.1. Factors influencing the sustainability of social housing projects

Sustainable social housing projects are influenced by several factors that contribute to their sustainability. These factors include planning and design, choice of construction materials, and energy and resource management. Effective planning and design ensure that buildings are designed to minimize their impact on the environment and maximize

their energy efficiency. The choice of construction materials also plays a crucial role in sustainability, as some materials can be more environmental friendly and have a longer lifespan than others. Finally, effective energy and resource management help reduce consumption and waste, using technologies and strategies that promote energy efficiency and resource conservation (Nasrallah, 2023).

3.4.2. Measures to improve the sustainability of social housing projects

There are several measures that can be taken to improve the sustainability of social housing projects. These measures aim to reduce environmental impact, improve residents' quality of life, and ensure the long-term viability of infrastructure. Key measures include raising awareness and educating residents, regular maintenance of infrastructure, use of sustainable technologies, and collaboration with local partners. By implementing these measures, it is possible to create sustainable social housing that meets current needs while preserving resources for future generations (Fatourehchi and Zarghami, 2020).

3.4.3. Examples of sustainable social housing projects

There are numerous and varied examples of sustainable social housing projects. These include initiatives to renovate existing neighbourhoods as well as projects to construct new eco-friendly neighbourhoods. These projects are implemented with the goal of creating affordable and sustainable housing for low-income individuals, while also considering sustainability and energy efficiency principles. They also aim to promote social cohesion and residents' quality of life. These project examples are a source of inspiration and demonstrate the importance and feasibility of sustainable social housing.

"Windmill Green" Project in London, United Kingdom:

Windmill Green (Figure 3.6) is a sustainable development project that includes social housing, commercial spaces, and green areas. The project is designed to be energy-efficient and uses innovative technologies such as wind turbines and heat recovery systems. Windmill Green is an example of sustainable urban development that can be replicated in other cities (tp bennet, n.d).

Figure 3.6: Windmill Green
Source: tp bennet (n.d.)

4. SUSTAINABLE SOCIAL HOUSING PROJECTS IN CAMEROON

This chapter aims to give an overview of Cameroon and its social housing projects. It will provide a brief look at Cameroon's geographical location, climate and political-administrative organization. Following this, the chapter will introduce Cameroon's social housing policies and selected social housing initiatives aimed at improving living conditions for its citizens.

As Djatcheu Kamgain and Mounvera (2022, p. 1) indicate, "Cameroon has been experiencing remarkable urban dynamism for several years now, with an average annual growth rate of around 5.7% between 1987 and 2005. As the population increases, so does the demand for housing, which rises by 10% every year, or 100 000 homes a year in Yaoundé and Douala alone. However, the state supply for the whole of Cameroon is estimated at around 10 000 homes a year, a figure that is difficult to verify. What's more, with the economic crisis and the Structural Adjustment Plans (SAPs), the few decent homes that have been built are beyond the means of the overwhelming majority of city dwellers". Thus, social housing in Cameroon is a subject of great importance, as it directly affects the daily lives of many people.

4.1. An Overview of Cameroon

4.1.1. Geographical location and climate

Cameroon, a country in central and western Africa bordering the Atlantic Ocean, shares its borders with several nations: Chad to the north-east, Nigeria to the west and north, the Central African Republic to the east, and Equatorial Guinea, Gabon and the Republic of Congo to the south (Figure 4.1 and 4.2). The country is divided linguistically, with two English-speaking regions in the north-west and south-west, and the rest of the country French-speaking. Its currency is the Central African CFA franc. With a population of around 25 million and a surface area of 475 440 km^2, Cameroon is rich in natural resources, particularly agricultural (cocoa, coffee, cotton, maize, manioc), oil, gas, mineral and forestry resources (CAHF, 2020. p. 77).

Figure 4.1: Map of Cameroon in Africa
Source: Freepik (2024)

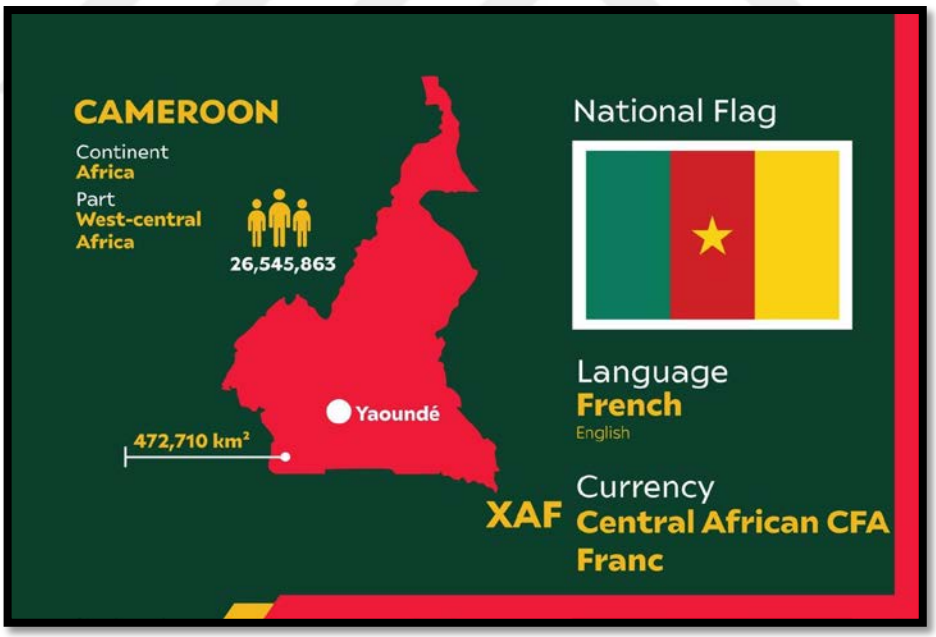

Figure 4.2: Map of Cameroon
Source: Vectors (n.d.)

According to Otsomotsi Mbida (2010), Cameroon has a great diversity of landscapes, ranging from the lush forests of the south to the arid steppes of the far north, via the savannahs of Adamaoua and the north. It has a balanced urban network, with Yaoundé as

the country's capital and one of the main urban centres (Figure 4.3). However, this city has its own geography. It is perched on the southern Cameroon plateau, with a hilly terrain that can reach an altitude of 1 200 metres. Despite the sometimes steep slopes, the topography has not slowed down the urbanisation of Yaoundé, even in areas at risk of flooding, where informal housing has largely developed. This diversity of landscapes and relief has shaped the urbanisation of Cameroon, creating towns with unique characteristics and specific challenges in terms of planning and sustainable development.

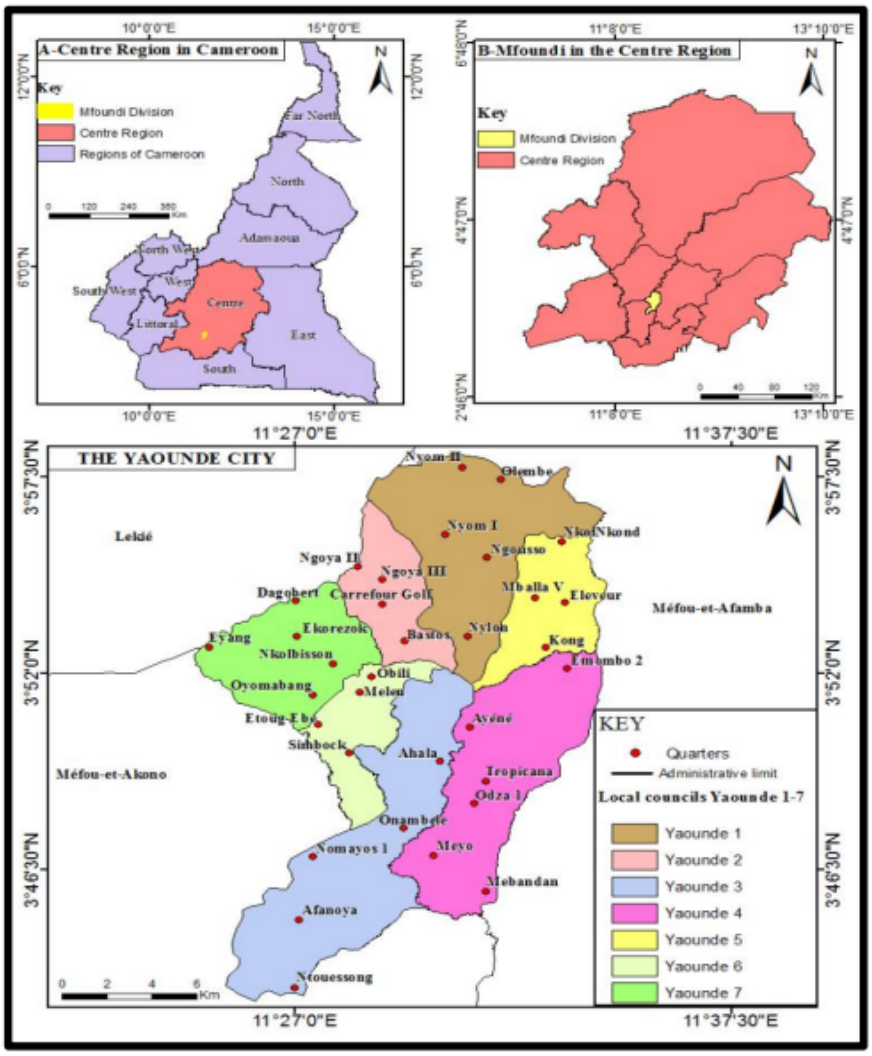

Figure 4.3: Geographic location of the Yaoundé region
Source: Tichafogwe (2021, p. 1, figure 1)

The general climate in Cameroon is influenced by the geographical location of the cities. Yaoundé, situated at altitude, enjoys a more temperate climate, with moderate annual rainfall and an average temperature of 22°C. By contrast, Douala, Cameroon's second-

largest city, known as the coastal city, experiences constant heat of around 26°C and heavy rainfall, especially from June to October. Humidity is also very high throughout the year. These climatic differences have an impact on urban development. Contrary to what you might think, Douala's topography, although flatter, is not a major obstacle to expansion. On the other hand, Yaoundé's uneven topography could potentially hinder its development, although this does not appear to be the case at present (Otsomotsi Mbida, 2010).

4.1.2. The political-administrative organization

Discovered by the Portuguese in 1472, Cameroon was colonised by Germany in 1884. After the First World War, the country was divided into two mandated zones: one French-speaking (Cameroon East) and one English-speaking (Cameroon West). Cameroon gained independence in 1960 (French-speaking part) and 1961 (English-speaking part), initially forming a federal state. In 1972, a referendum transformed the country into a unitary state, and in 1983 it became the Republic of Cameroon. A multi-party system was reintroduced in 1990, after a long period of single-party rule. The President of the Republic, elected by universal suffrage for a renewable seven-year term, exercises executive power with the government. Paul Biya, in power since 1982, was re-elected in 2018 (Akono, 2022).

4.2. Social Housing Projects in Cameroon

Cameroon, rich in natural resources, is facing galloping urbanisation, with its urban population expected to double by 2050 (UN-Habitat, 2018), and the growing challenges of climate change. It is at a crucial crossroads that is pushing it to explore new ways of meeting its needs, which is the need to provide decent, affordable social housing for its growing population, estimated at over 27.5 million (World Bank, 2024), while at the same time facing the imperative of building sustainably by incorporating local materials, eco-friendly construction techniques such as natural ventilation and solar energy, and participatory financing models such as those promoted by the World Bank (World Bank, n.d). These innovative initiatives could well redefine Cameroon's urban landscape, offering the potential for both social and environmental transformation, and inspire other developing countries.

4.2.1. History of social housing in Cameroon

The construction of social housing in Cameroon dates back to the 1960s after independence, as Akono (2022) points out, with the launch of projects aimed at resolving the problem of substandard housing in urban areas. Over the decades, these projects have evolved to take account of the population's growing housing needs. Major innovations have been introduced to improve the sustainability of housing, including the promotion of eco-friendly building materials and renewable energies to ensure minimal impact on the environment. This ecological approach means that natural resources can be conserved while offering quality housing to a greater number of people. At the same time, government policies have also played a crucial role in promoting sustainable social housing. The authorities have introduced tax incentives and funding programmes to encourage property developers to build affordable and sustainable housing, creating a dynamic market for these initiatives. These incentives have not only enabled more social housing to be built, but have also catalysed economic growth by creating jobs in the construction sector. Thanks to these joint efforts by the government and actors in the property sector, Cameroon has been able to meet the growing demand for housing while embarking on a transition towards more sustainable development. As the country continues to make progress towards its goal of improving access to housing for all, it is essential to continue investing in innovative projects, strengthening existing public policies and encouraging public-private partnerships to guarantee high-quality, sustainable social housing for all Cameroonians.

4.2.2. Nature of urban planning in Cameroon

The rapid pace of urbanisation in Cameroon, particularly in large metropolises such as Douala (Figure 4.4) and Yaoundé (Figure 4.5), presents significant challenges for urban architecture, but innovative solutions can be found. The article by Fossi (2023) examines the various aspects of urban architecture in Cameroon, looking at the current situation and discussing the emerging trends and concepts that are influencing the field. The history of urban planning in Cameroon begins in colonial times, when the colonial authorities began to structure and develop towns. Initially centralised, the approach evolved into greater participation by local communities, recognising their in-depth understanding of the specific needs of their neighbourhoods. Today, the development of Cameroon's cities

is guided by land-use plans, which set out long-term objectives for land use, infrastructure and public services. It is crucial to implement these strategies in order to build sustainable and practical cities, avoiding urban sprawl and uncontrolled development. Despite the efforts made, urban planning in Cameroon faces a number of challenges, including the key issue of social housing.

Figure 4.4: The urban landscape of Douala
Source: Still from BlackBoxGuild (2023)

Figure 4.5: The urban landscape of Yaoundé
Source: Still from Envato elements (n.d.)

4.2.3. Governmental policies and programs supporting sustainable social housing projects in Cameroon

In a proactive approach, the government recently launched the Special Program for the Construction of 10 000 Social Housing Units, a large-scale initiative aimed at providing affordable, sustainable housing adapted to the specific needs of low-income populations (MINHDU, n.d.a). According to the CAHF's Yearbook on Housing Finance in Africa (2023, p. 68), land and social housing policies in Cameroon are primarily the responsibility of the state, through three ministries: the Ministry of Housing and Urban Development (MINHDU), the Ministry of Finance (MINFI), and the Ministry of Lands, Surveys, and Land Tenure (MINDCAF). MINDCAF manages the issuance of land titles, while a tripartite approach involving the Cameroon Real Estate Corporation (SIC), the Cameroon Mortgage Bank (CFC), and the Mission for the Development and Maintenance of Urban and Rural Land (MAETUR) guides operational aspects. MAETUR, now a public company, ensures project compliance with urban planning documents and collaborates with decentralized local authorities for the approval of subdivisions.

Cameroon has a well-developed legislative and regulatory framework for housing development, including laws on urban planning and real estate development, as well as standards for social housing. These include:

- **Law N° 97/003 of January 10, 1997, on real estate development in Cameroon**: This law aims to stimulate the construction sector and facilitate access to housing. It defines the rules applicable to property developers, notably in terms of financing, guarantees and responsibilities. The law also encourages investment in social housing (MINHDU, 1997).
- **Law N° 2004/003 of April 21, 2004, governing urban planning**: This law establishes the legal framework for land use planning and management in Cameroon. It aims to ensure orderly, sustainable and environmentally-friendly urban development. The law covers aspects such as zoning, building permits, planning regulations and the protection of green spaces (MINHDU, 2004).
- **Law N° 0009/MINHDU of August 21, 2008, establishing social housing standards:** This decree specifies the technical and qualitative criteria to be met by

social housing in Cameroon. It covers aspects such as minimum living area, sanitary facilities, access to drinking water and electricity, and security. The aim is to guarantee decent living conditions for low-income populations (MINHDU, 2008).

These initiatives clearly reveal the Cameroonian government's unwavering commitment and ongoing concern to promote sustainable social housing throughout the country. By providing financial resources, technical experts and a solid support infrastructure, the government is striving to ensure that every individual, regardless of their socio-economic status, has access to adequate, safe housing. It is vital for the government to ensure that these homes are not only ecologically sustainable, but also socially inclusive and adapted to the needs of each individual. These concerted efforts help to eliminate housing disparities and create balanced, harmonious communities (Kpassokro, 2023).

Ambitious and indispensable, its government policies and programs testify to a genuine desire to create better, more equitable living conditions for all citizens (Figure 4.6). Thanks to these initiatives, the Cameroonian government is positioning itself as a regional model and aspires to become a world leader in sustainable social housing. The sustained commitment of the government, combined with the active participation of the population, will enable us to achieve these objectives and build a sustainable future for all.

Figure 4.6: National Housing Policy
Source: adapted from Bello (2023, p. 19)

4.3. Actors Involved in the Implementation of Sustainable Social Housing Projects

In the implementation of sustainable social housing projects in Cameroon, there are various actors who play an important role. These include the government, non-governmental organisations (NGOs), construction companies, financing institutions, town planners and architects. Each of these actors makes a significant contribution to the implementation of these projects, and it is with this in mind that the World Bank (2020) presents the various actors as follows:

First and foremost, the government plays a crucial role in developing policies to promote and support sustainable social housing. It allocates financial and material resources for these projects. What's more, the government is actively involved in providing the land and infrastructure needed to build sustainable social housing. And so, in support of President Paul Biya's efforts to solve Cameroon's housing crisis, the Ministry of Housing and Urban Development (MINHDU) has launched a pilot project for the construction of earth-cement housing in Pitoa (Figure 4.7). This project, the fruit of a partnership with Société Immobilière du Cameroun (SIC), Mission de Promotion des Matériaux locaux (MIPROMALO) and Cimenteries du Cameroun (CIMENCAM), aims to offer a more affordable and sustainable alternative solution to reduce the country's shortage of decent housing (237infos, 2021).

Figure 4.7: Earth-cement pilot project in Pitoa
Source: 237infos (2021)

Complementing the government, NGOs provide important support to disadvantaged communities. They provide technical and financial support for these projects. They work closely with local residents, helping them to access safe, sustainable housing while meeting their specific needs (Urban Agenda Platform, 2023).

Construction companies are also key actors in the implementation of sustainable social housing projects. They are responsible for the design and construction of social housing. Their technical expertise and know-how guarantee the quality and durability of these houses. These companies work in collaboration with other actors to ensure the implementation of innovative, environmentally-friendly solutions.

As for financing institutions, they play an essential role in providing loans and incentives to encourage investment in sustainable social housing. They offer financial solutions to residents, enabling them to access affordable housing. These institutions work closely with other actors to ensure the financial viability of sustainable social housing projects (World Bank, 2020).

Finally, urban planners and architects contribute their expertise to the design and planning of sustainable social housing projects. This contribution testifies to the effectiveness of urban development policies in Cameroon by examining the roles of the various actors, collaboration between the public and private sectors, and the imbalances noted in the implementation and evaluation of urban projects. The aim of all these actors to lead constructive reflections based on sound empirical and theoretical research, in order to facilitate decision-making that guarantees quality and controlled urbanization, thus improving the quality of life of citizens in Cameroonian cities (Calenda, 2022).

Together, these actors play a critical role in the success of sustainable social housing projects in Cameroon. Their close collaboration enables the creation of sustainable social housing that meets the needs of disadvantaged communities while preserving the environment. Thanks to their collective work, they are helping to improve the living conditions of many inhabitants and to build a better future.

4.4. Selected Social Housing Projects Supported by the Cameroonian Government

This section examines four major social housing projects that have received significant support from the Cameroonian government. These projects are crucial to understanding the government’s role in addressing the housing needs of its growing urban population.

The 100-unit PLANUT (Three-Year Emergency Plan) social housing project in Bertoua, in Cameroon's Eastern region, was completed in 2020 (Figure 4.8 and 4.9). This was an ambitious project aimed at improving the living conditions of the inhabitants and stimulating the region's economic growth. The project was built with sustainable materials such as wood, construction and demolition waste crushed and reused as aggregate for concrete or roads; as stated by the Minister of Housing and Urban Development, and therefore with environmentally friendly construction techniques (Bioclimatic design: natural ventilation, renewable energy systems: solar panels) - an asset for the sustainability of the project (Libam, 2020). The project has been hailed as a major achievement for the eastern region, helping to reduce the housing deficit and improve access to basic infrastructure. It also created jobs during the construction phase and boosted the local economy (Stopblablacam, 2020).

Figure 4.8: Social housing in Bertoua
Source: Stopblablacam (2020)

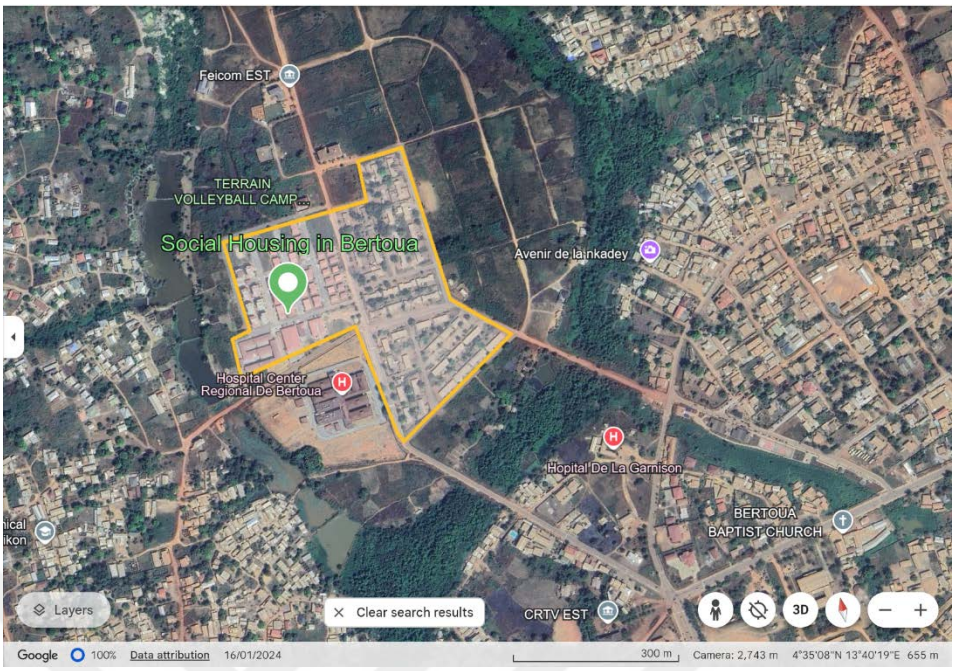

Figure 4.9: Aerial view of social housing in Bertoua
Source: adapted from Maps Data: Google, @2024 Airbus and Maxar Technologies

The Cité Verte social housing project is located in a central area of Yaoundé, a consolidated urban zone known as the Cité verte district (Figure 4.10, 4.11 and 4.12). The district includes numerous social housing projects built at different times, and its social housing development is growing.

Cité Verte social housing embodies a model of sustainable urban development in Yaoundé, harmoniously combining environmental, social and economic dimensions. The integration of green spaces, such as planted inner courtyards, green islands and the adjacent green corridor, promotes biodiversity, improves quality of life and provides spaces for community relaxation and recreation. The diversity of public spaces, the presence of local amenities and services, and the safety enhanced by a hierarchical road network, all contribute to the social cohesion and well-being of residents. What's more, the district's good accessibility and functional mix stimulate the local economy and enhance its attractiveness. Cité Verte demonstrates that it is possible to reconcile urban development with respect for the environment, while promoting the social and economic well-being of residents (TAMassociati, 2018, p. 34).

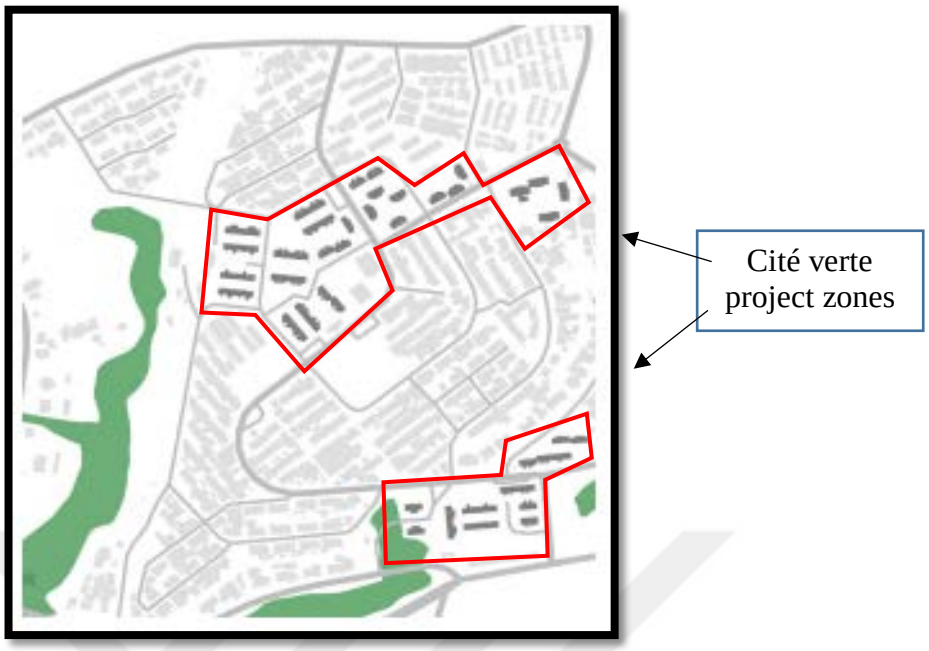

Figure 4.10: Urban zone of the Cité Verte
Source: TAMassociati (2018, p. 34)

Figure 4.11: Social housing in Cité Verte
Source: TAMassociati (2018, p. 27)

Figure 4.12: Aerial view of Cité verte project zones
Source: adapted from Maps Data: Google, @2022 Maxar Technologies

After the towns of Bertoua and Cité Verte, the town of Bafoussam, in the West Cameroon region, also took delivery of 100 social housing units (Figure 4.13 and 4.14). These social housing units were built as part of the three-year emergency plan to accelerate economic growth and boost development. A nursery and elementary school, one health centre and one supermarket have also been built on the site, and this project aims to improve conditions for the local population, not forgetting that it stands out due to the geographical and strategic location of the new town under construction, while providing it with well-integrated facilities and services, as well as a sustainable development framework (Kaze, 2020).

Figure 4.13: Social housing in Bafoussam
Source: Ngon (2017)

Figure 4.14: Aerial view of social housing in Bafoussam
Source: adapted from Maps Data: Google, @2023 Airbus

The Mbanga-Bakoko social housing project in Douala presented by Ndam (2019) was launched in 2010. It is a major government initiative aimed at addressing the housing crisis in Cameroon's economic metropolis (Figure 4.15, 4.16 and 4.17). Located in the Mbanga-Bakoko district, the project calls for the construction of 1 175 housing units (Figure 4.13). Despite some delays, over 300 units have already been delivered to their owners. The remaining units were scheduled for completion with new deliveries expected

in April 2023. However, as of 2024, no further information has been released regarding the progress of these deliveries or the overall completion status of the project. This project is part of the government's vast program to build 10 000 social housing units and develop 50 000 building plots across the country. It bears witness to the government's determination to facilitate access to decent housing for Cameroonians, while stimulating the local economy by involving national SMEs (small and medium-sized enterprises) in the construction.

The Mbanga Bakoko housing project offers a number of advantages in terms of sustainability. It features the successful integration of existing green spaces and the preservation of the delta's river landscape, creating a pleasant, nature-friendly environment. In addition, the region's urban development has been carried out with an environmentally conscious approach, favouring long-term sustainability. Finally, the diversity of building typologies offers the potential for a social mix and variety of housing, contributing to the richness and dynamism of the district.

Figure 4.15: Mbanga-Bakoko urban social housing zone
Source: TAMassociati (2018, p. 34)

Figure 4.16: Aerial view of social housing in Mbanga-Bakoko
Source: adapted from Maps Data: Google, @2023 Airbus

Figure 4.17: Social housing in Mbanga-Bakoko (Douala)
Source: Ndam (2019)

5. SUSTAINABLE SOCIAL HOUSING PROJECTS IN CAMEROON: THE CASES OF THE OLEMBE PROJECT AND LES PETALES

In the previous chapter, an overview of Cameroon was provided, including its geographical location, climate, political and administrative organization, and an introduction to its social housing policies and initiatives. Building on that foundation, this chapter will focus on two notable sustainable social housing projects in Yaoundé supported by the Cameroonian government: the Olembe Project and Les Pétales. These projects represent significant efforts in advancing comprehensive and sustainable housing solutions in Cameroon.

5.1. Yaoundé: A New Urban Vision

The city of Yaoundé, the capital of Cameroon, is experiencing rapid population growth, resulting in a high demand for housing (Franqueville, 1984). The government has launched two major projects to meet this need: Olembé, located to the north of the city of Yaoundé, and Les Pétales, located to the south, in the commune of Mbankomo, Yaoundé (Figure 5.1, 5.2 and 5.3).

5.1.1. Rationale for selecting Olembé and Les Pétales Projects

The selection of Olembé and Les Pétales social housing projects as case studies in this thesis was driven by several key factors, each reflecting both immediate and long-term considerations crucial for addressing and understanding the housing challenges in Cameroon.

Representativeness:

Olembé and Les Pétales, due to their scale and visibility, illustrate the current efforts of the Cameroonian government to address the housing crisis. Their analysis allows for the identification of key trends and challenges in the sector.

Innovative character:

Les Pétales, with its ecological garden-city concept, stands out for its environmental integration, social mix, and urban dynamism, offering a glimpse into potential solutions for more responsible urban development (TAMassociati, 2018).

Strategic location:

Located in Yaoundé, these projects face the specific challenges of rapid urbanization and demographic pressure, allowing for the study of social housing issues in a rapidly changing urban context. Olembé, in particular, was chosen for its accessibility, land availability, and development potential in this area (Mendouga, 2013)

Diversity of approaches:

Olembé, with its more traditional approach, and Les Pétales, with its ecological garden-city concept, offer an interesting contrast, allowing for the comparison of different sustainable development strategies (Mendouga, 2013; TAMassociati, 2018).

Potential impact:

If successful, these projects have the potential to positively transform the urban landscape of Yaoundé and improve the quality of life for many residents. Their study allows for the assessment of their potential impact and the formulation of recommendations to optimize their success.

These factors collectively demonstrate a thoughtful and strategic approach to site selection, considering not only the immediate needs of the projects but also their long-term impact on the surrounding environment and communities. They highlight a commitment to sustainable development, social inclusion, and economic growth, and are the key reasons for choosing Olembé and Les Pétales as case studies.

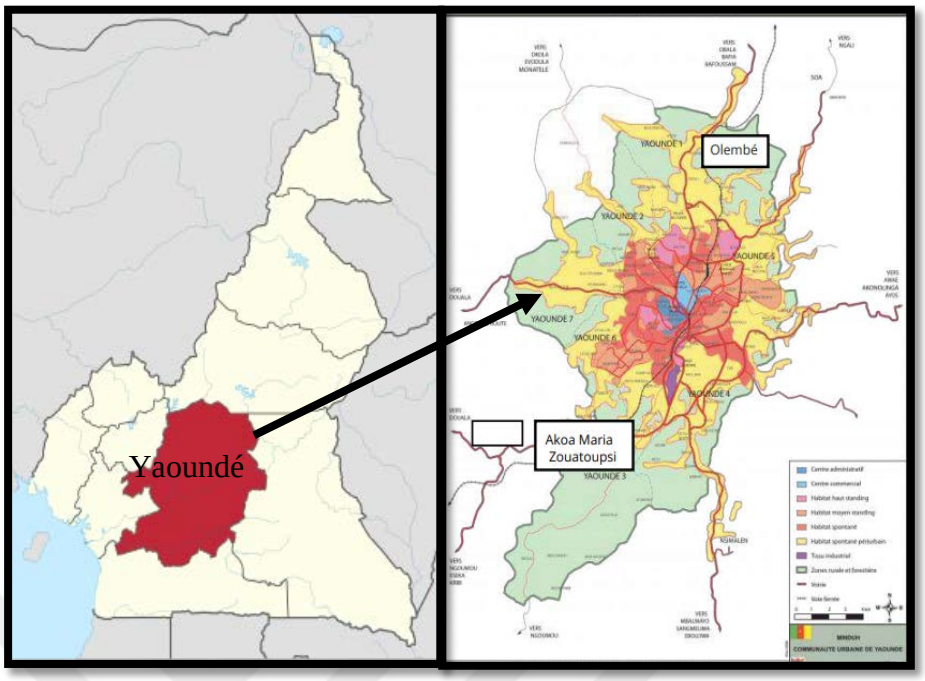

Figure 5.1: Map of Yaoundé, locations of the Olembé and Les Pétales projects sites.
Source: Voundi et al. (2018, figure 4)

Figure 5.2: Aerial view of social housing in Olembé
Source: adapted from Maps Data: Google, @2022 Maxar Technologies

Figure 5.3: Aerial view Les Pétales project
Source: adapted from Maps Data: Google, @2023 Airbus and Maxar Technologies

5.2. The Olembé Project

Cameroon has a governmental social housing plan since 2010, and the implementation of this new social housing program to reach 2035 is being carried out in a different way to the projects of the 1980s, when the State was actively building. Cameroon Real Estate Corporation (SIC), which is in charge of certain projects, has restructured and created a new concept that differs from previous projects: the Olembé SIC neighbourhood, as described by Njouonang (2022). The Olembé social housing project, located in Yaoundé, is part of a wider government program to build 10 000 units of social housing across Cameroon (MINNHDU, n.d.a).

The main objective of this ambitious 18-hectare project, comprising 65 buildings with 20 apartments each, is to facilitate Cameroonians' access to decent housing, in order to improve their living conditions and contribute to the country's development (Njouonang, 2022). This project is one of the first examples of the transformation of the working-class town and its housing problems into a pleasant, sustainable place to live, with the construction of social housing, the creation of green spaces, public facilities and road

infrastructure (Figure 5.4), as well as actions to promote social diversity and employment (Mendouga, 2013).

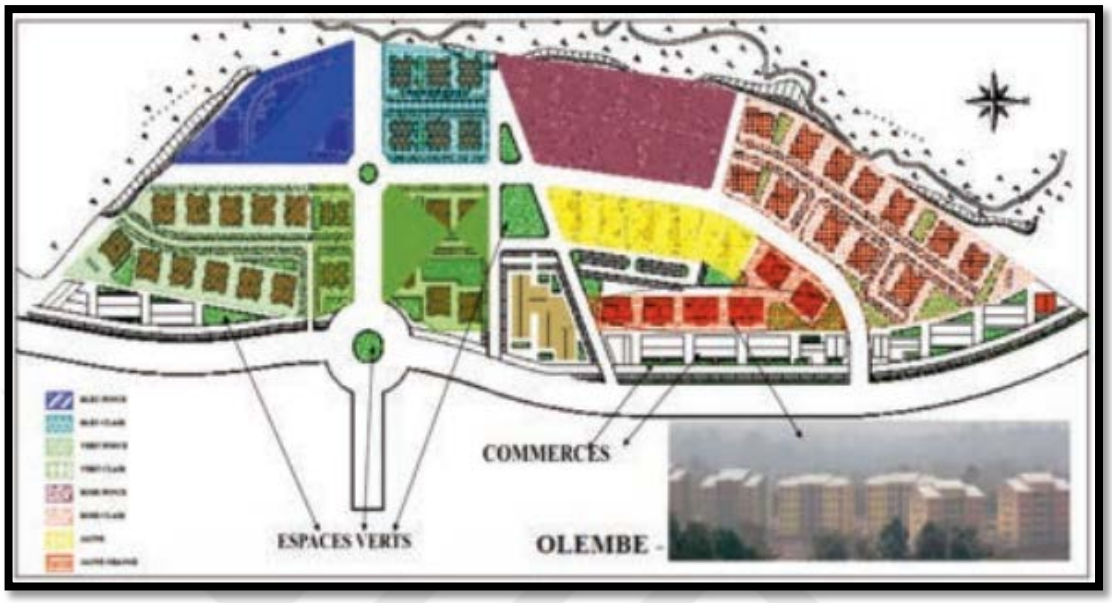

Figure 5.4: Model of the Olembé project
Source: Njouonang (2022, p. 162, figure 4)

The Olembé project is divided into two distinct phases:

Phase 1:

This initial phase saw the construction of 500 homes by 13 national SMEs (small and medium-sized enterprises). To date, 80 show homes have been completed, 40 are 90% complete (Figure 5.5) and 380 are almost 70% complete (Figure 5.6). At the same time, a Chinese company is building 660 homes as part of a larger project involving 1 800 homes in six Cameroonian towns (MINHDU, n.d.b).

Figure 5.5: SIC Olembé neighbourhood
Source: MINDHU (2015)

Figure 5.6: SIC Olembé neighbourhood
Source: MINDHU (2015)

Phase 2 (in progress):

This phase involves the construction of a further 3 060 social housing units. The foundation stone for 60 show homes was laid in December 2023, and work on the remaining 3 000 homes is scheduled to start in the second half of 2024, with an estimated duration of four years (Investir au Cameroun, 2023).

5.2.1. Sustainability aspects of the Olembé Project

Through its desire to respond to the housing crisis in Cameroon in a sustainable and inclusive way, it offers a diversity of housing ranging from social to high-standard that adapts to the needs of a varied population (MINHDU, 2015). In addition, the integration of essential community facilities such as schools, a health centre, shopping malls, sports fields and playgrounds, green spaces etc. contributes to creating a pleasant and dynamic living environment, thus promoting the well-being of residents (Njouonang, 2022).

Social sustainability:

The project aims to reduce Cameroon's housing deficit by facilitating access to decent housing for all Cameroonians, regardless of their income level (MINHDU, 2015). This is a crucial issue for the country's social development and is illustrated by planned public spaces (Figure 5.7, a); fluid Mobility of traffic (Figure 5.7, b); a good social infrastructure layout strategy with a bilingual school, a supermarket and a couple of restaurants nearby (Figure 5.8, a) that could help create a centre for the community; while demonstrating an H-shaped typology (Figure 5.8, b), which generates a homogeneous urban fabric and good social diversity.

Figure 5.7: Public space and mobility in the Olembé project
Source: TAMassociati (2018, p. 31 and 32)

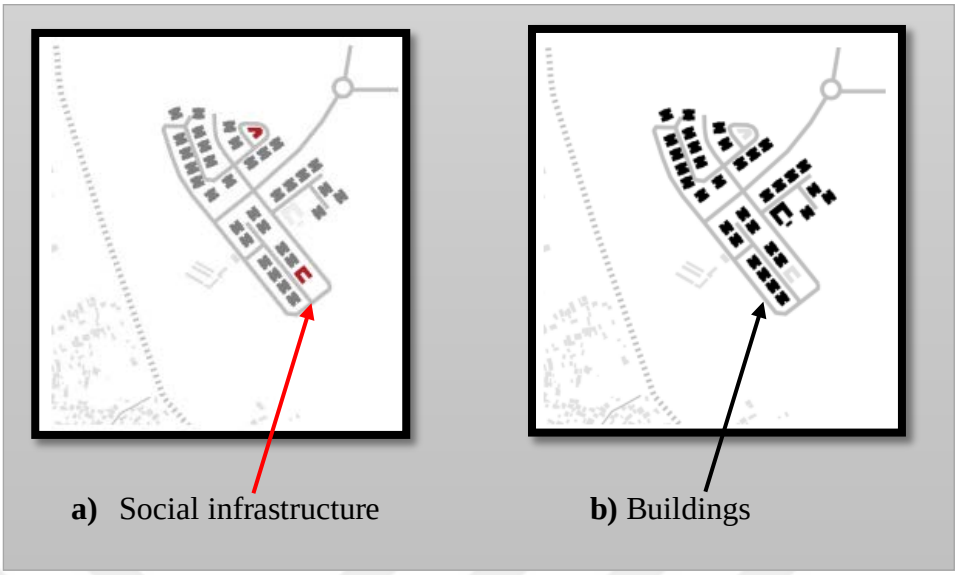

Figure 5.8: Social infrastructure and Buildings in the Olembé project
Source: TAMassociati (2018, p. 33 and 30)

Economic sustainability:

The diversity of housing on offer creates a viable economic model for the project, generating income that can be reinvested in improving infrastructure and services.

The project aims to improve the living environment of Yaoundé's inhabitants by increasing the supply of decent housing, a positive impact in the long term but limited by high demand. The creation of the project will also lead to the creation of domestic and technical jobs, improving the income and purchasing power of local residents, a positive long-term impact but of moderate intensity. Finally, the presence of new residents will stimulate the local economy by encouraging the opening of more shops and services, generating additional jobs and income for the population (Mendouga, 2013).

Environmental sustainability:

Although the information available on the environmental aspects of the project is limited, the integration of green spaces (Mbala, 2023) and the bioclimatic design (building orientation, natural ventilation, solar shading, etc. to reduce heating and cooling requirements) of some homes (MINHDU, 2015) suggest a desire to minimize the project's environmental impact. The use of local materials (stone, wood, bamboo, pozzolan, bamboo plant fibres) and bioclimatic design can help to reduce energy consumption and

greenhouse gas emissions, while improving comfort for residents. However, the environmental impact of the project would need to be assessed to confirm these hypotheses.

The vegetation removed during the construction of social housing at Olembé is offset by the creation of 18 000 m² of green space during the operational phase, in accordance with the development plan (Mendouga, 2013) (Figure 5.9). This positive impact, although limited to a restricted area, will help restore biodiversity locally, improve the living environment for residents, and the bioclimatic design of some of the Olembé project's housing units are guarantees of environmental sustainability (Mbala 2023; MINHDU, 2015). These architectural choices aim to reduce the project's ecological footprint by minimizing energy consumption and greenhouse gas emissions, while enhancing comfort and well-being.

Figure 5.9: Olembe project restored green space
Source: TAMassociati (2018, p. 34)

So, by combining economic performance, social responsibility and respect for the environment, this project, from an overall viewpoint (Figure 5.10), demonstrates its determination to pave the way for a more balanced urban development model that is more respectful of people's present and future needs, although more in-depth studies of the project's life cycle are also required.

Figure 5.10: View of the olembe project
Source: Ngari (2017)

5.3. Les Pétales Project

In response to the growing demand for social housing, the Cameroon government, in collaboration with the Pizzarotti company designed by TAMassociati (2018), has launched a vast programme to build social housing and public infrastructure under the name ‘Les Pétales’. This pilot project, located in the commune of Mbankomo in Yaoundé, began in earnest in 2022 and aims both to respond to the housing shortage and to stimulate the local economy (Investir au Cameroun, 2022). This ambitious project involves the construction of 10 000 homes and 61 public buildings, as well as the creation of an industrial zone over six years. The main objective is to design a dynamic, inclusive and sustainable urban environment that meets the needs of the population while respecting the environment.

The name "Les Pétales" draws inspiration from the French word "pétales," meaning "petals" in English, reflecting the petal-shaped design of this sustainable social housing project.

5.3.1. Project design principles: Masterplan

Providing an effective, attractive and sustainable response to the pressing demand for social housing is the aim of Les Pétales project. The Masterplan is presented as follows:

A vision:

This innovative project embodies a modern vision of the city of the 21st century (urbanization of rural areas), combining economic development, social progress and respect for the environment (Figure 5.11), through an approach based on the definition of a compact, flexible and reproducible city model, while allowing for a gradual extension of the project to the selected sites, and even to other sites in the future, in order to guarantee urban coherence and a strong identity for the project as a whole, which addresses one of the major problems facing African cities (TAMassociati, 2018, pp. 10-23).

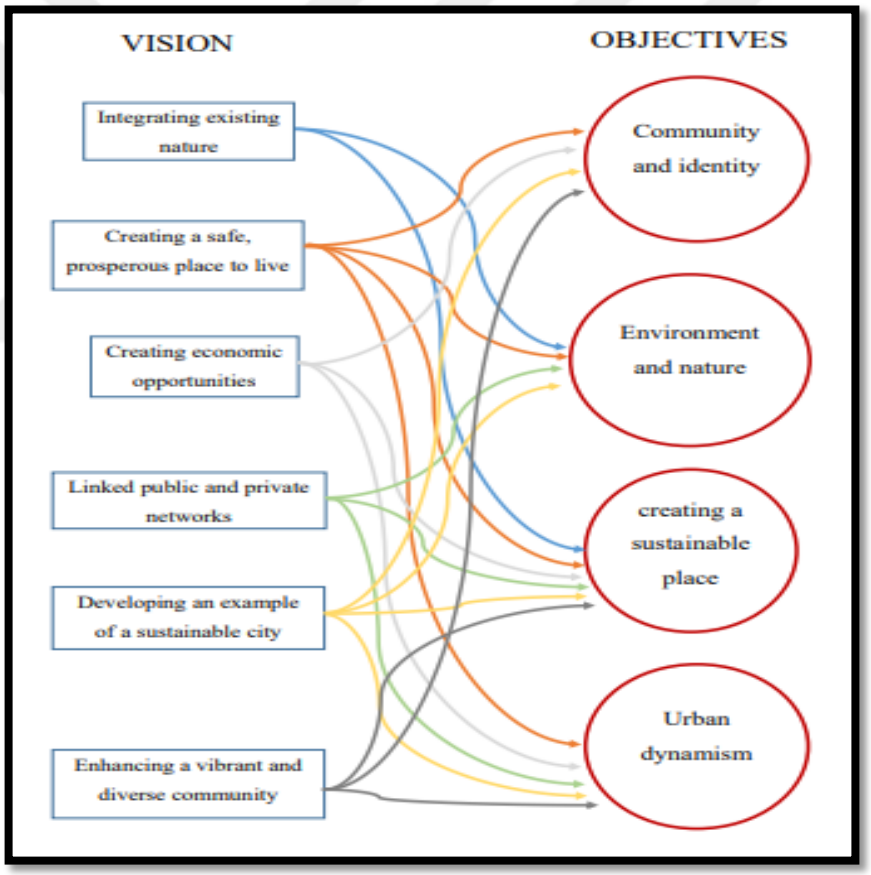

Figure 5.11: Vision and objectives of the project Les Pétales
Source: Tadida (2023, p. 4, figure 5) adapted from TAMassociati (2018)

Reference:

To revolutionize the development of urban social housing, an innovative approach was chosen. The project team drew on its solid experience in sustainable community design

and drew inspiration from Cameroonian projects such as Olembé. The lessons learned from these examples have been adapted to the particularities of the Les Pétales project to develop a unique scheme that meets its ambitions. The Masterplan was designed taking into account six key indicators of a sustainable community: "place and character", "public space", "mobility", "social infrastructure", "nature" and "buildings" (TAMassociati, 2018, p. 28). These indicators are used to assess the performance of the Les Pétales project in relation to other social housing projects in the region.

Project site:

The areas destined to host the project have been carried out at different levels of detail, from the regional scale to the local scale of Mbankomo (TAMassociati, 2018, pp. 37-69). The natural environment, climate and infrastructure development have already emerged as the major themes to be considered in the development of the project (Figure 5.12). The natural environment, with its generous presence of large trees that coexist harmoniously with agricultural areas (inhabited by a small number of farmers), is the scenario in which the new residential development will take shape. On the other hand, TAMassociati (2018) indicates how the current system of basic infrastructure (roads, energy, water), which is currently inadequate or non-existent, represents one of the main challenges of the project.

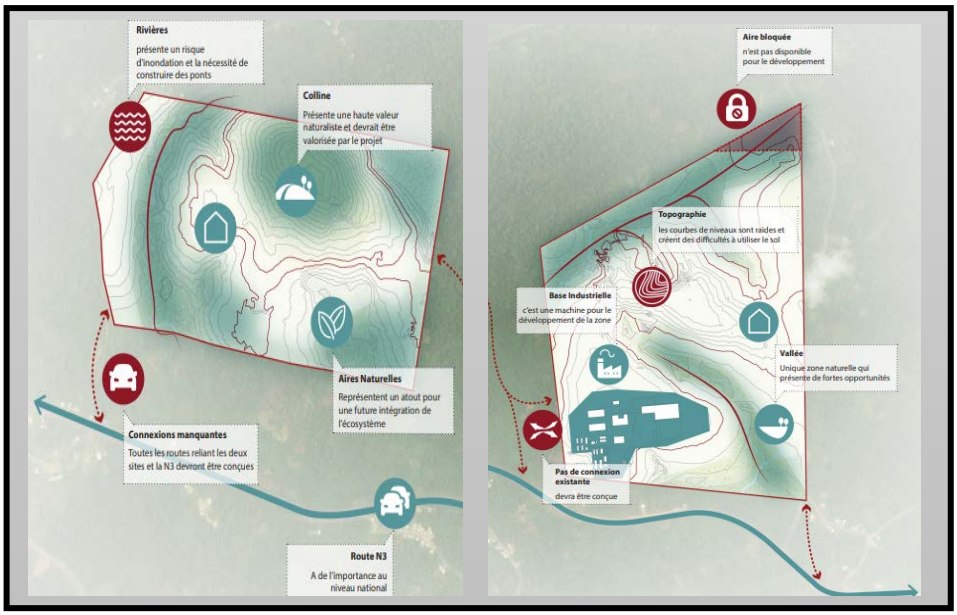

Figure 5.12: Constraints and opportunities at the site
Source: TAMassociati (2018, pp. 68-69)

Key project diagram:

The diagram illustrates the master plan's key principles aimed at creating a sustainable and dynamic community. It emphasizes the creation of urban attractors to foster social interaction and economic vitality by enhancing the main streets. The harmonious integration of the industrial base and the preservation of the environment is also emphasized. It highlights efficient connectivity with the main road, while encouraging sustainable mobility through a soft-transport network. It also aims to create a pleasant living environment by reinforcing the site's natural assets and integrating nature into the built space; finally, flexibility and adaptability are ensured by designing evolving spaces to meet society's changing needs (Figure 5.13). The ultimate goal is to create an environment where residents can live, work and play in harmony, in balance with nature and within a dynamic community.

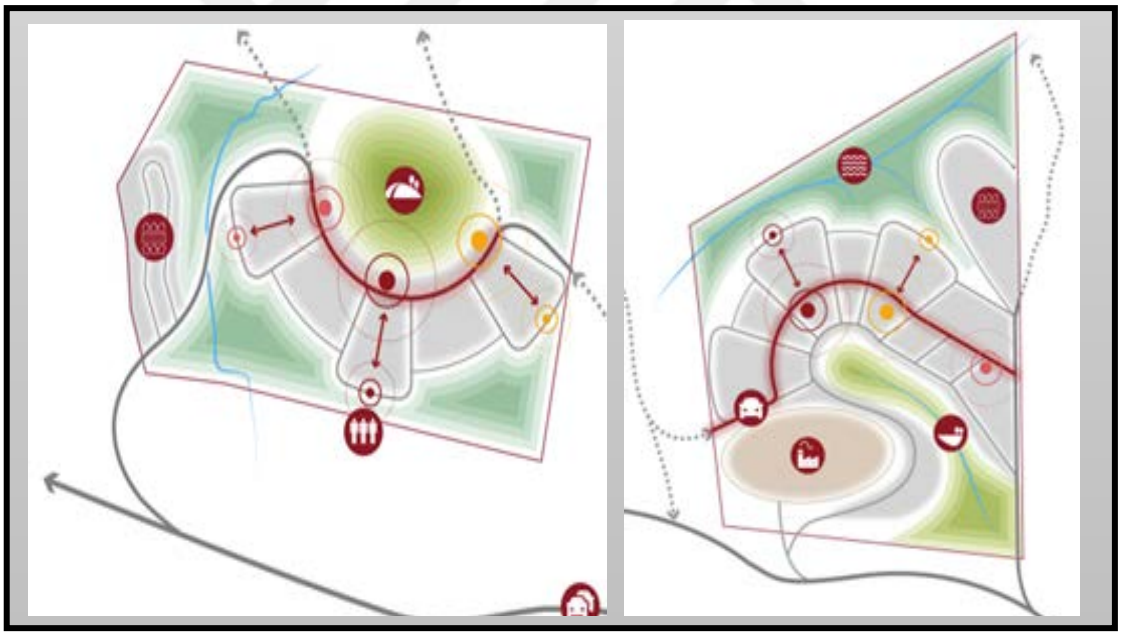

Figure 5.13: System for representing the shape of a petal
Source: TAMassociati (2018, pp. 84-85)

Master plan concept**:**

The demand for new housing and services as part of an urban development that is being built from scratch requires careful thought. On the one hand, the possibility of forming a small town undoubtedly represents an excellent opportunity for all concerned: the community, the customer and the designers. On the other hand, we need to take into

account the deep sense of responsibility that must accompany this idea of a city. International experience suggests that the key to success lies precisely in the desire to give shape to living, active communities that are well connected and integrated into their territory (Hassan, 2017). With the ambition and hope that the master plan can become a reference model for urban quality in the region, social integration and a low ecological footprint.

5.3.2. The principle of project sustainability

Like all projects, Les Pétales project has to be sustainable, and this is reflected in the principles it has developed and implemented, which will enable it to become part of sustainable development as a present and pilot project that should be extended throughout the country.

Urban structure:

The environment in which we live and work is essential to our well-being and fulfilment. Pride, dignity and a sense of belonging are the foundations of a prosperous and ambitious society. Urban areas therefore have a responsibility to foster the social and professional development of their inhabitants, by creating unique, diverse and dynamic places where everyone can flourish.

In Les Pétales project, the space is conducive to an active and dynamic community, creating a strong identity and sense of belonging based on an urban model that will become a benchmark in urban quality (Figure 5.14). The diversity of uses, buildings and open spaces, as well as attractive places to gather, will support social integration and local recognition (TAMassociati, 2018, p. 28).

Figure 5.14: Urban structure of Les Pétales
Source: TAMassociati (2018, p. 28)

Public space:

Public space has a key role to play in community dynamics. It can become a space for interaction and sharing. Spaces of different character and design allow multiple activities and events to take place. Providing a unified palette of public realm components that includes trees, landscape elements, street furniture and fountains, which are coordinated and work as a network, is essential to creating an ordered and coherent public realm.

The aim is to design a high-quality public space that is harmonious and conducive to social exchange, acting as a genuine social infrastructure. The organization of open spaces is based on a hierarchy ranging from vast public squares to intimate alleyways, main streets and inner courtyards (Figure 5.15). These spaces are a continuation of the natural environment, which blends into the urban fabric (TAMassociati, 2018, p. 31).

Figure 5.15: Public spaces of Les Pétales
Source: TAMassociati (2018, p. 31)

Mobility:

Offering a variety of mobility options and good road connectivity is crucial for access to employment, reducing commuting times and improving quality of life. What's more, a good mix of nearby uses and amenities significantly reduces the need to travel, helping to reduce congestion and air pollution. Linking these services by safe, attractive pedestrian walkways encourages the transition to more sustainable modes of transport.

The Les Pétales development features a hierarchical mobility network. The layout is structured to provide a direct connection to the road linking Douala and Yaoundé (Figure 5.16). From this main artery, secondary streets are designed in loops, one for each "petal" of the neighbourhood, with internal pedestrian paths that will link public spaces and green areas in a safe and pleasant way (TAMassociati, 2018, p. 32).

Figure 5.16: Mobility of Les Pétales
Source: TAMassociati (2018, p. 32)

Social infrastructure:

Social buildings are often intended to become the heart of neighbourhoods and districts. Their proximity to housing is very practical, not only to better serve the community, but also because they concentrate activity and can become a rallying point for residents (Figure 5.17). When planning and designing them, it is crucial to take into account the scale and type of facilities to meet the needs of a diverse population.

In addition to the new facilities already installed nearby, the area is home to the sports complex, which includes a 60 000-seat stadium, training facilities, a swimming pool, as well as tennis, basketball and volleyball courts (TAMassociati, 2018, p. 33).

Figure 5.17: Social infrastructure of Les Pétales
Source: TAMassociati (2018, p. 33)

Nature:

Urban areas generally lack access to natural environments, although contact with nature has proved highly beneficial to mankind. It has a direct impact on physical and psychological well-being, and is an important contributor to creating healthier communities for development that respects the physical conditions of the ecosystem.

This agglomeration is very respectful of nature and has transformed it into an asset that enhances the value of the urban area. The various surrounding landscapes - mountain, river and farmland - are enhanced and integrated into the design. Land with high slopes and a higher risk of landslides is left unoccupied, as are river courses (TAMassociati, 2018, p. 34) (Figure 5.18).

Figure 5.18: Nature of Les Pétales
Source: TAMassociati (2018, p. 34)

Buildings:

Residents' quality of life is strongly influenced by the quality of housing, building materials and the harmonious integration of buildings into the urban environment. Encouraging a diversity of building and housing types contributes to a social mix and a more cohesive community. Affordable housing often lacks careful design and relies on standardized solutions, problems that could be solved by a more creative approach right from the design and planning stages.

The proposal encompasses a wide variety of housing, from social to high-end, fostering a more heterogeneous community in terms of family composition, age and income level. The petal-shaped design (Figure 5.19), adapted to the topography and orientation of the site (Figure 5.20), enables the buildings to be better integrated into their surroundings (TAMassociati, 2018, p. 35).

Figure 5.19: Petal-shaped design
Source: TAMassociati (2018, p. 35)

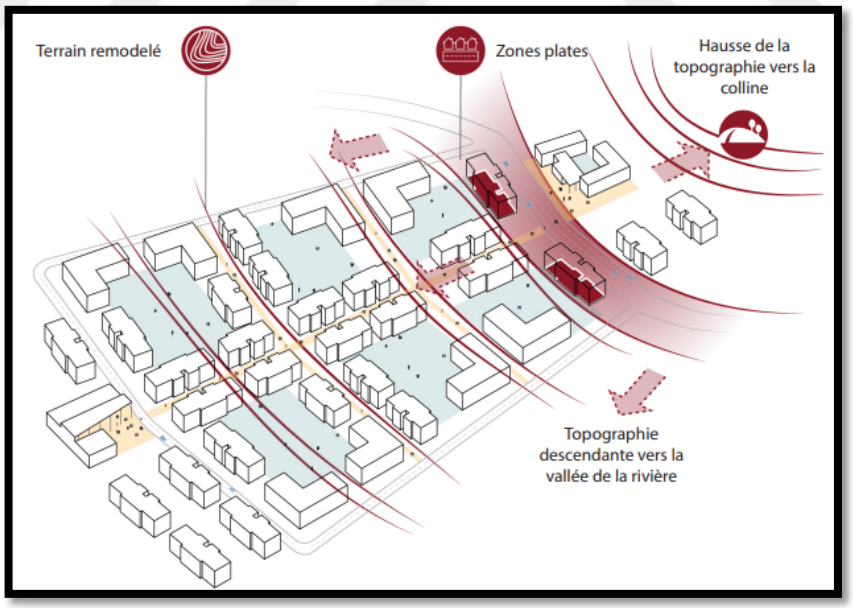

Figure 5.20: Settling into the topography
Source: TAMassociati (2018, p. 119)

Taking into consideration the 17 United Nations Sustainable Development Goals, (IDEAS for Us, n.d) three main drivers were identified for the Petals Sustainable

Masterplan: sustainable design, clean energy, comfort and wellbeing. In particular, the proposed strategy was developed with the following objectives in mind: Creating an environment that has positive effects on the health of its occupants; designing buildings with low energy consumption, reducing waste production, the use of fuels and non-renewable resources; creating a space that is accessible to society and contributes to its development.

This innovative project proposes an even more holistic approach to sustainable development through natural ventilation, which ensures a pleasant, healthy indoor climate, reducing dependence on energy-hungry air conditioning. Solar thermal energy for environmentally-friendly water heating, while daylight floods the living spaces, reducing the need for artificial lighting. The vegetable garden provides a source of fresh, local food, promoting healthy, sustainable eating. And last but not least, the shade provided by trees creates natural cool spaces, providing protection from the sun and reducing urban heat.

Despite delays in starting the project since the presentation of its masterplan (Figure 5.21) in 2018, work finally began in 2022 and should be completed in 2026 (Investir au Cameroun, 2022).

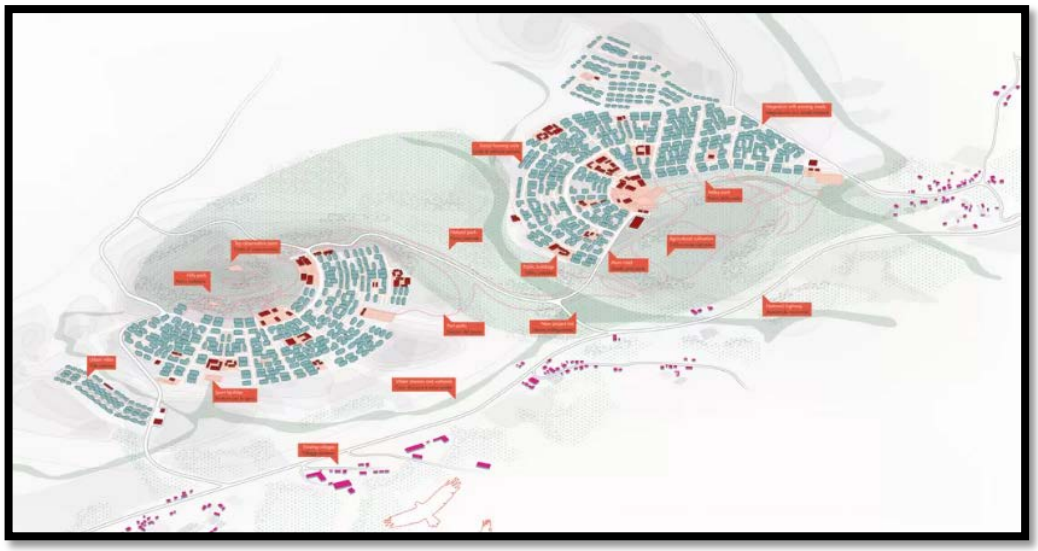

Figure 5.21: Social-housing-masterplan of Les Petales
Source: TAMassociati (n.d)

In order to better understand the differences and similarities between Olembé and Les Pétales Projects, a table is proposed based on the three pillars of sustainability: environmental, social, and economic (Table 5.1).

Table 5.1: Sustainability in comparison: Olembé and Les Pétales

Sustainability Criteria	**Olembé Project**	**Les Pétales Project**
Environmental sustainability		
Landscape Integration	Limited consideration, focus on functionality	Strong integration, preservation of existing vegetation, utilization of topography
Energy Efficiency	Use of local materials, but little information on construction techniques	Bioclimatic design, use of ecological materials, renewable energy
Water Management	Collective sanitation system, little information on rainwater management	Rainwater harvesting system, filter gardens, green spaces promoting infiltration
Social sustainability		
Social Mix	Majority social housing, limited mix	Social mix favored by diversity of housing typologies
Accessibility	Good accessibility due to proximity to the national highway	Accessibility to be improved, development of public transport necessary
Facilities and Services	Basic facilities planned (schools, health centers), potential for development	Facilities and services integrated into the design, community spaces, local shops
Resident Participation	Little information on resident participation in project design and management	Active resident participation encouraged from the design phase
Economic sustainability		

Job Creation	Job creation during the construction phase, potential for local economic development	Creation of green and sustainable jobs, circular economy favored
Affordability	Affordable social housing, but allocation criteria to be specified	Diversity of housing to meet different income levels
Economic Sustainability	Long-term economic model to be defined, infrastructure management and maintenance	Economic model based on circularity and resilience, resident involvement in management

Source: adapted from Mendouga (2013) and TAMassociati (2018)

6. CONCLUSION

This study assessed sustainable social housing projects in Cameroon, focusing on their urban aspects. In-depth analysis of the emblematic Olembé and Les Pétales projects in the capital city Yaoundé has highlighted the challenges, but also the considerable potential of sustainable construction in a context of rapid urbanization and limited resources. Although still in the development phase, these projects embody a desire to respond to the housing crisis in a responsible and innovative way, integrating the environmental, social and economic dimensions of sustainability.

Analysis of these projects has revealed some encouraging successes, such as the promotion of a social mix, the integration of green spaces, the use of local materials and bioclimatic design. The Olembé project, in particular, stands out for its commitment to creating a pleasant, sustainable living environment, with social housing, green spaces and community facilities. The Les Pétales project, meanwhile, proposes an innovative approach to urban development, with a compact, flexible and replicable city model that promotes social integration and a low ecological footprint. Another positive aspect of these projects is that they take account of local culture, through the integration of traditional architectural elements and the use of local materials, demonstrating a desire to create a built environment in harmony with Cameroonian cultural identity.

However, challenges remain, notably in terms of financing, citizen participation and assessing the real impact of these projects over the long term. The success of these projects depends on close collaboration between the various players involved, such as government, the private sector and civil society. It is also essential to strengthen citizen participation from the earliest design phases, develop specific evaluation tools and promote research into best practice in sustainable social housing.

Despite its limitations, this study opens up new perspectives for the development of sustainable social housing in Cameroon. It underlines the importance of a holistic approach, integrating the needs of populations, environmental preservation and economic viability. The Olembé and Les Pétales projects, while imperfect, are inspiring examples for the future of social housing in Cameroon and other developing countries. They

demonstrate that it is possible to build more sustainable, more inclusive and more resilient cities, with human well-being and environmental protection at their core.

In short, sustainable social housing in Cameroon is a major challenge, but also a unique opportunity to build a better future for all. By pursuing the efforts already underway, strengthening collaboration between the various players and integrating the lessons learned from these pilot projects, Cameroon can become a model of sustainable urban development in Africa and the world. It's time to take action for social housing that is not only affordable, but also respectful of the environment and conducive to the development of all.

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