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Evaluation of urban planning practices in Bol City, Lake Province (Chad): Challenges and prospects

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Abstract: Urban planning is critical to managing rapid urban growth, particularly in African regions experiencing high urbanization rates. This study focuses on Bol, Lake Chad Province, a city facing significant challenges due to inadequate planning frameworks compounded by recurrent humanitarian and climate crises. It fills an empirical gap by analyzing how local planning mechanisms respond to these socio-environmental complexities, with a focus on the interplay between institutional structures, legislative frameworks, and resource allocation. The study assesses urban planning practices in Bol to identify challenges and opportunities, with the aim of improving institutional effectiveness, aligning policies with realities, and integrating climate resilience strategies. Using a qualitative methodology, it combines field surveys, stakeholder interviews, and document analysis, using SWOT (Strengths, Weaknesses, Opportunities, Threats) and PESTEL (Political, Economic, Sociocultural, Technological, Environmental, Legal) frameworks for data analysis. The findings reveal that ineffective institutions, poor inter-sectoral coordination, outdated legislative frameworks and resource constraints hamper sustainable urban development in Bol. To address these issues, the study proposes to strengthen local institutional capacities, foster stakeholder collaboration, and modernize urban planning policies through participatory approaches. The study highlights the need to integrate resilience strategies into urban settings to mitigate climate change impacts and improve governance. These measures not only address immediate challenges, but also advance urban planning theory and provide a basis for future research on adaptation strategies in crisis-prone regions. This study offers practical insights for policy makers and contributes to developing more sustainable and resilient urban planning systems in similar contexts.

Keywords: urban growth; urban planning; city of Bol; sustainable development; Lake Chad

1. Introduction

Urbanization is a global phenomenon that significantly affects developing countries, including Chad. With an urbanization rate of approximately 26% (National Institute of Statistics and Economic Studies, 2023), Chad is facing rapid and uncontrolled population growth in its urban areas. This expansion is mainly concentrated in the capital, N'Djamena, but is also manifested by the anarchic sprawl

of secondary urban centers (Ministry of Land Use Planning, Housing and Urban Development, 2017). This anarchic urbanization exacerbates territorial inequalities and poses increasingly complex challenges, including inadequate infrastructure management, increased environmental risks, and growing social vulnerabilities (Ministry of Land Use Planning, Housing and Urban Development, 2014). Bol, a secondary city in Lake Province, exemplifies these dynamics, highlighting the urgent need to assess and improve urban planning practices.

Current studies of urbanization in developing regions often focus on the impacts of uncontrolled growth, climate change, and governance deficits. In Bol, these problems are particularly pronounced. The city's strategic importance as a hub for trade, agriculture, and fisheries has not protected it from the adverse effects of rapid and uncoordinated urban expansion. Bol faces significant pressures from climate change-induced threats such as desertification, flooding, and population displacement (Niang et al., 2014). These challenges are further exacerbated by limited institutional and financial capacities, weak governance frameworks, weak inter-sectoral coordination, and minimal stakeholder participation—issues that resonate across many cities in the Sahel (Jabareen, 2013; Naringué et al., 2024). In addition, the outdated urban planning legislation, established in 1967, fails to address contemporary challenges such as climate change adaptation, natural resource management, and urban resilience. As a result, urban growth in Bol remains largely informal, perpetuating poverty, poor infrastructure, and environmental vulnerabilities (Watson, 2015).

While the literature highlights these challenges, little research exists on concrete strategies for sustainable urban development in medium-sized cities such as Bol. This study fills this gap by analyzing current urban planning practices, identifying key challenges, and proposing opportunities for improvement. Unlike previous studies focusing primarily on large cities or theoretical frameworks, this research offers practical recommendations tailored to Bol's unique socio-economic and environmental context. The study aims to strengthen the city's capacity for sustainable urban development by integrating governance, regulatory frameworks, and resilience strategies.

The objectives of this research are threefold: (1) to assess the effectiveness of existing urban planning practices in Bol; (2) to identify critical gaps in governance, infrastructure, and stakeholder participation; and (3) to propose concrete recommendations for achieving sustainable urban development. These recommendations are designed to guide policymakers, planners, and local stakeholders in addressing urbanization challenges in Bol and other similar medium-sized cities in sub-Saharan Africa. Ultimately, this study seeks to contribute to the broader discourse on urban resilience and sustainable development, by offering insights that fill knowledge gaps and support practical implementation.

2. Literature review

2.1. Analysis of urban planning practices

2.1.1. Legal and regulatory framework for urban planning

Urban planning in Chad is constrained by conflicting land rights and ineffective enforcement mechanisms, which fail to incorporate citizens' preferences and often involve land expropriation without consultation. Additionally, zoning regulations and law enforcement remain inadequate (Udessa et al., 2023). Land reforms, while intended to address these challenges, may aggravate conflicts when they uncritically incorporate customary practices, thereby undermining the rights of vulnerable groups (Collins and Mitchell, 2018). Neoliberal reforms have further transformed land tenure systems, amplifying social and institutional inequalities (Chimhowu, 2019).

Furthermore, historical land disputes inherited from the colonial era require alternative dispute resolution mechanisms to expedite legal processes and mitigate conflicts (Home, 2020). Regular evaluations of land laws are essential to ensure their effectiveness and alignment with developmental policy objectives, avoiding outcomes that could undermine urban planning goals (Adekola et al., 2021). The repression of informal urban development in certain East African cities, for instance, has not only increased housing costs but also jeopardized the livelihoods of the urban majority (Mottelson, 2020). Although post-colonial land reforms have been implemented, they have failed to resolve conflicts stemming from socioeconomic and demographic changes, highlighting the need for cautious reform to prevent negative socio-economic consequences (Kalabamu, 2019).

2.1.2. Diversified institutional framework for urban planning

The institutional framework for urban planning in Chad reflects a complex and fragmented system, paralleling challenges observed across sub-Saharan Africa. Centralized and well-coordinated planning frameworks are associated with compact urban development, whereas decentralization and weak coordination often result in dispersed urbanization (Schmidt et al., 2021). Chad faces similar issues of institutional fragmentation as seen in South Africa, underscoring the necessity of revising urban policies to address the economic and demographic drivers of rapid urbanization (Ruhiga, 2014).

In cities like Bol, unplanned urban development mirrors patterns observed in Kampala, where political influence and rural-urban migration have necessitated integrated policy frameworks to manage urban growth (Bidandi and Williams, 2017). Informal urban management, as documented in Maputo, further complicates planning efforts, as residents themselves shape urban structures with limited state intervention (Andersen et al., 2015).

Governance challenges are also critical in Chadian cities, where infrastructure management is fragmented among local administrations and informal service delivery systems, making coordinated efforts for sustainable urban development exceedingly difficult (Cirolia and Harber, 2021a). Effective governance is essential for designing and implementing sustainable development initiatives in Chad, particularly in response to climate and demographic challenges (Meyer and Auriacombe, 2019).

Regarding inclusivity, centralized governance structures in Chad and similar sub-Saharan African contexts hinder the integration of informal economic spaces into urban planning frameworks, thus limiting inclusive development (Attia et al., 2016). Lessons can be drawn from Johannesburg, where decentralization and the

integration of metropolitan governance have facilitated more effective responses to urban conflicts, offering a model for institutional reforms in Chad (Pieterse, 2019). Overall, urban governance in Chad requires a comprehensive institutional overhaul to promote inclusive and sustainable development. The multiplicity of governance levels and social actors complicates the implementing of cohesive strategies (Resnick, 2020). Collaborative approaches are crucial to developing inclusive strategy and addressing the challenges of rapid urbanization and fragmented governance that increasingly characterize Chadian cities (Rezende, 2023; Razak et al., 2024; Smit, 2018).

2.1.3. Urban space production in Bol

The production of urban space in Bol reflects dynamics like those observed in other sub-Saharan African cities, characterized by the coexistence of formal and informal processes. Urban planning in Africa must account for these dual realities by integrating natural and human resources into development strategies (Cobbinah, 2023). In Bol, the formalization of urban spaces began in the 1960s through subdivision initiatives designed to organize the city using an orthogonal grid, thereby facilitating the allocation of plots in its historic districts.

Research by (Leffers and Wekerle, 2020) highlights the significant role of local developers in urban governance, particularly in influencing land-use regulation. This observation is especially pertinent to Bol, where, since the 1960s, the administration, in collaboration with traditional local authorities, has undertaken alignment operations to formalize and regulate rapidly expanding neighborhoods. This underscores the normalized role of these actors in shaping urban spaces (Olu-Owolabi et al., 2024).

Additionally, contemporary urban planning models are strongly influenced by transportation and housing decisions (Newman et al., 2021). In Bol, this influence is evident in the city's northern expansion along its primary axis, where urban growth is guided by pre-existing infrastructure. However, this expansion has frequently been unregulated, necessitating interventions to align development with the guidelines outlined in the 2011 Reference Urban Plan.

The findings of (Muchadenyika and Waiswa, 2018) on urban redevelopment in sub-Saharan Africa, which often entails the demolition of informal settlements and displacement of populations, also hold relevance for Bol. Unstructured neighborhoods like Bol Tandal require urgent intervention to regularize informal settlements and enhance residents' living conditions. These challenges illustrate the complexities of producing organized urban spaces amidst rapid development pressures.

2.2. Urban planning challenges

The urban planning challenges in Chad are multifaceted, stemming from structural deficiencies and external threats that undermine the effectiveness of urban policies. One of the most pressing issues is the lack of coordination among local authorities, which hampers the coherent implementation of urban plans. This disjointed governance leads to inconsistent policies that fail to address local realities and the rapidly evolving needs of urban areas (Yatta, 2018). Like other African

nations, Chad also faces institutional limitations that hinder the application of laws and regulations necessary for effective urbanization management (Güneralp et al., 2017).

A critical constraint is the insufficient financial resources allocated to urban projects, compounded by widespread poverty. This financial shortfall reduces household capacity to improve housing conditions, driving the proliferation of informal settlements. Furthermore, unequal access to essential urban services such as water, electricity, and transport exacerbates social disparities. In the context of aging and poorly maintained infrastructure, these challenges intensify tensions within urban communities (Toit et al., 2018). Rapid demographic growth further stresses the already insufficient infrastructure, a challenge that is prevalent across many African countries (Lwasa, 2014).

The limited adoption of modern technologies and the scarcity of local technical expertise significantly impede the realization of sustainable urban projects. Urban infrastructure management is undermined by the absence of technological innovation, compromising the long-term viability of urban development initiatives (Sutherland et al., 2016). Moreover, the effects of climate change, including flooding and soil degradation, exacerbate these challenges by making cities increasingly vulnerable to extreme weather events (Ruppel and Funteh, 2019).

Unregulated urbanization and the proliferation of informal and irregular constructions further complicate urban planning efforts. These practices often arise from weak enforcement of existing laws and outdated urban policies (Paszkowski, 2018). Such uncontrolled growth exacerbates inequalities in access to urban services and disrupts the implementation of coherent planning strategies. Administrative rigidity and limited institutional capacity to enforce regulations impede the necessary reforms to manage urban growth effectively.

External factors, including political instability and armed conflicts, aggravate urban planning difficulties in Chad. Conflict-induced population displacements disrupt the spatial organization of host towns, such as Bol, complicating the implementation of fragile urban plans (Ajam, 2020). Economic dependence on global market fluctuations further restricts financial resources, creating uncertainty about the feasibility of long-term urban planning initiatives (Hassanein et al., 2015).

In an era of rapid technological change, urban planning must also contend with technological obsolescence and the risks posed by cyber-attacks on digital infrastructure. However, budgetary, and institutional constraints limit investments in modern technologies needed to sustain functional urban systems (Mpandeli et al., 2020). Additionally, conflicts with local stakeholders advocating for traditional land practices hinder the reforms required to adapt cities to contemporary urbanization challenges (Obeng-Odoom, 2017).

The growing impacts of climate change further exacerbate urban planning challenges, particularly in vulnerable regions like the Lake Chad Basin. Here, the interplay of humanitarian crises, resource-based conflicts, and climate-related vulnerabilities presents significant concerns for sustainable urban development (Ehiane and Moyo, 2021).

3. Materials and methods

3.1. Research area

The town of Bol is in the Lake Province of Chad, about 153 km North of the capital N'Djamena, in the Sahelian zone. It lies at Latitude 13°27'31" North and Longitude 14°42'53" East. Bol is not far from the borders with Nigeria, Niger, and Cameroon. Administratively, the town was established as a commune by decree no. 564/PR/87 of 28 October 1996 and now has 12 districts. The economy of the town of Bol is based on agricultural activities in the polders of Lake Chad, according to the National Spatial Planning Scheme (NSPS). Bol's climate is arid, with an average annual temperature of 28 °C and annual rainfall of around 234 mm. **Figure 1** below is a map showing the location of the town of Bol.

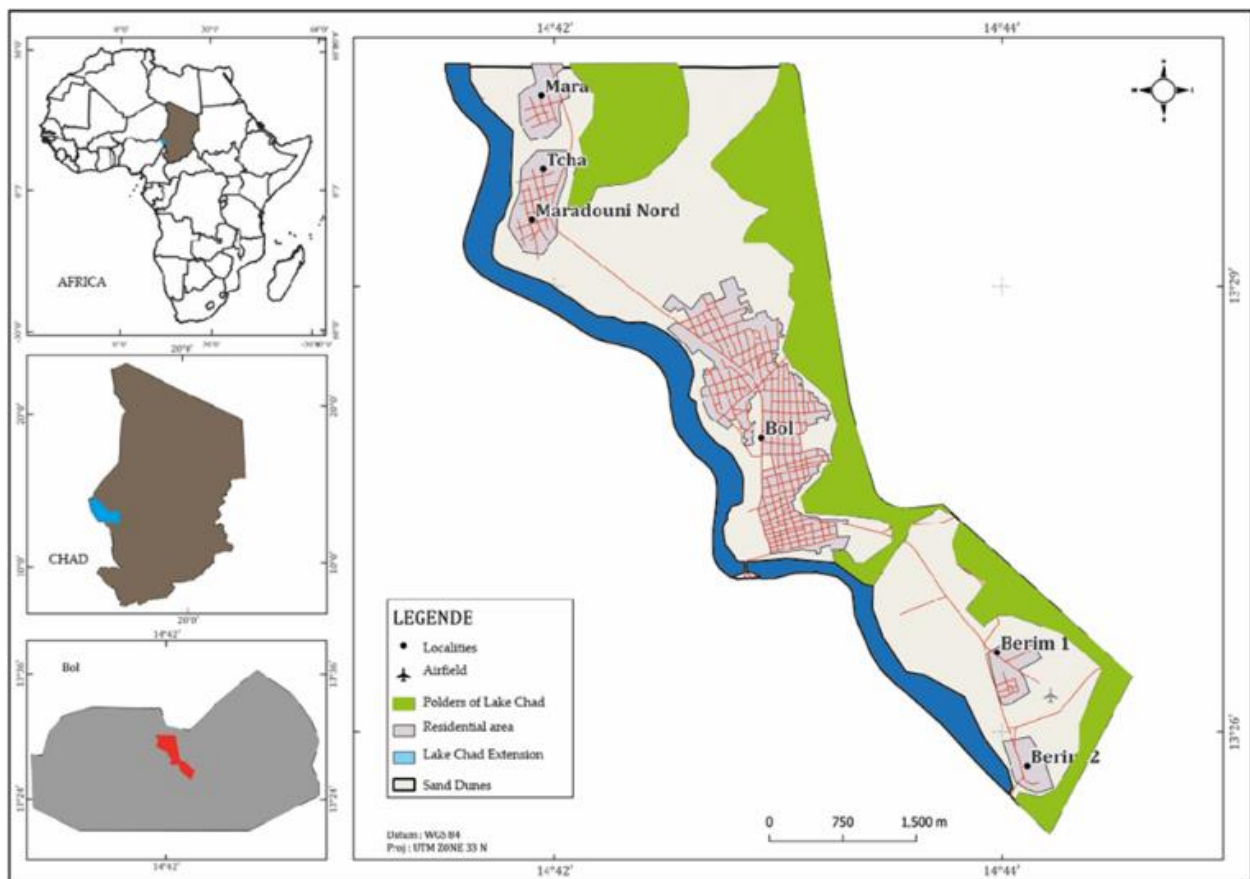


Figure 1. Geographical location of the city of Bol.

3.2. Data collection, processing, and analysis

This study utilized diverse data sources to conduct a thorough examination of urban planning practices and challenges in Bol, Chad. The foundational documents for this research included the National Spatial Planning Scheme (NSPS), the Reference Urban Plan (RUP), and the Municipal Development Plan (MDP). These documents were critical for evaluating existing planning practices. Complementary analyses of legal texts and laws provided insights into the regulatory and institutional frameworks.

Empirical data collected through fieldwork were incorporated to enhance the data extracted from strategic documents. Additionally, statistical datasets from both international (World Bank) and national (INSEED) sources were analyzed to investigate demographic trends and the dynamics of urbanization.

A qualitative methodological approach was adopted for this research. The framework comprised four phases: literature review, documentary analysis, empirical data collection, and data integration and analysis. This comprehensive methodology was designed to address gaps identified in prior studies and to contextualize the urban challenges of Bol within the broader framework of urban governance in sub-Saharan Africa.

The initial phase involved a detailed literature review to establish the conceptual basis for the study (Dash et al., 2024; Mulya et al., 2024). This review encompassed the domains of urban planning, climate change, and sustainable development. Keywords such as “urban planning,” “climate change adaptation,” “sustainable urban development,” “urban governance in the Sahel,” and “medium-sized cities in Africa” guided the exploration (Barbieri et al., 2024). The review extended to the analysis of national regulatory and institutional frameworks and documents specific to Bol. This process allowed for the evaluation of the effectiveness of current frameworks in integrating climate change adaptation measures and highlighted the challenges impeding their implementation.

Semi-structured interviews were conducted with various stakeholders, including municipal authorities, deconcentrated departmental heads responsible for urban and land-use planning, community leaders, representatives of non-governmental organizations (NGOs), and residents. These interviews adopted qualitative and participatory methodologies, consistent with similar studies (Lochmiller, 2021; Raynor et al., 2017). The interviews aimed to elicit stakeholder perspectives on prevailing practices, urban challenges, and sustainable development opportunities (Cantelmi et al., 2021).

Focus group discussions were also organized to investigate emerging themes and assess the dynamics of participatory governance and climate adaptation strategies. This method has been effectively utilized in related research (Kurtz et al., 2022).

Data integration was achieved through triangulation analysis, cross-referencing findings from various data sources to ensure a robust understanding of urban planning practices and challenges in city of Bol. This method was selected to enhance the validity of the results by incorporating multiple perspectives (Halepoto et al., 2015; Natow, 2020).

Qualitative data analysis utilized a combination of SWOT (Strengths, Weaknesses, Opportunities, and Threats) and PESTEL (Political, Economic, Sociocultural, Technological, Environmental, and Legal) frameworks. These methods were applied to assess institutional, technical, and financial capacities at both national and local levels. The focus was on addressing the specific challenges related to urban planning. SWOT analysis has been extensively used in strategic urban assessments (Bacter et al., 2024; Pazouki et al., 2017; Voukkali and Zorpas, 2021), while the PESTEL approach enabled the evaluation of variables influencing urban development, including climate change, population growth, resource scarcity,

and technological advancements (Abou Jaoude et al., 2022; Madureira et al., 2024).

The specific procedures used in this study involved a structured application of the SWOT and PESTEL frameworks to assess urban planning challenges in Bol. For the SWOT analysis, data were collected through interviews with key stakeholders, including municipal authorities and community leaders, to identify internal strengths and weaknesses of urban planning processes. External factors, such as opportunities and threats, were assessed by reviewing urban planning documents and government policies, as well as conducting expert interviews. For the PESTEL analysis, political, economic, socio-cultural, technological, environmental, and legal factors were examined through a combination of document analysis, stakeholder discussions and expert interviews. Data from both frameworks were synthesized and categorized, with the results organized into matrices to provide a comprehensive assessment of urban planning capacities and challenges at the national and local levels. These procedures are detailed in **Table 1** for clarity and transparency.

Ethical standards were rigorously observed throughout the data collection process. Informed consent was obtained from all participants, and their data were anonymized to safeguard confidentiality.

The participants included a diverse array of stakeholders from the municipality of Bol. These stakeholders encompassed municipal authorities, deconcentrated departmental heads, community leaders, NGO representatives, and residents (**Table 1**).

Table 1. Participants in the study.

Participants	Interviews/ Focus Group	Finding data
	Interviews (16)	
Municipal authorities (maires adjoints, conseillers municipaux)	4	Local policies and urban priorities.
Decentralized services responsible for urban planning (urbanism, land use planning, environment)	2	Strategies and institutional challenges.
Community leaders (neighborhood chiefs, traditional authorities)	3	Community needs and local dynamics.
Representatives of local NGOs involved in urban development	2	Impact of field actions on urban planning.
Specialists in infrastructure and natural resource management	2	Evaluation of infrastructure and environmental impacts.
National technical services in charge of urban planning	3	National standards and guidelines for urban planning
	Focus Group (6)	
Services Youth of Bol	2	Services Infrastructure needs for young people. Involvement of young people in urban development
Local merchants	2	Services Impact of the state of infrastructure on trade. Considering the need for commercial infrastructure in urban planning
Representatives of informal neighbourhoods	2	Needs for the development of informal neighborhoods

Figure 2 below provides an overview of the various stages involved in the

research process. It highlights the key steps undertaken to ensure a comprehensive approach to the study.

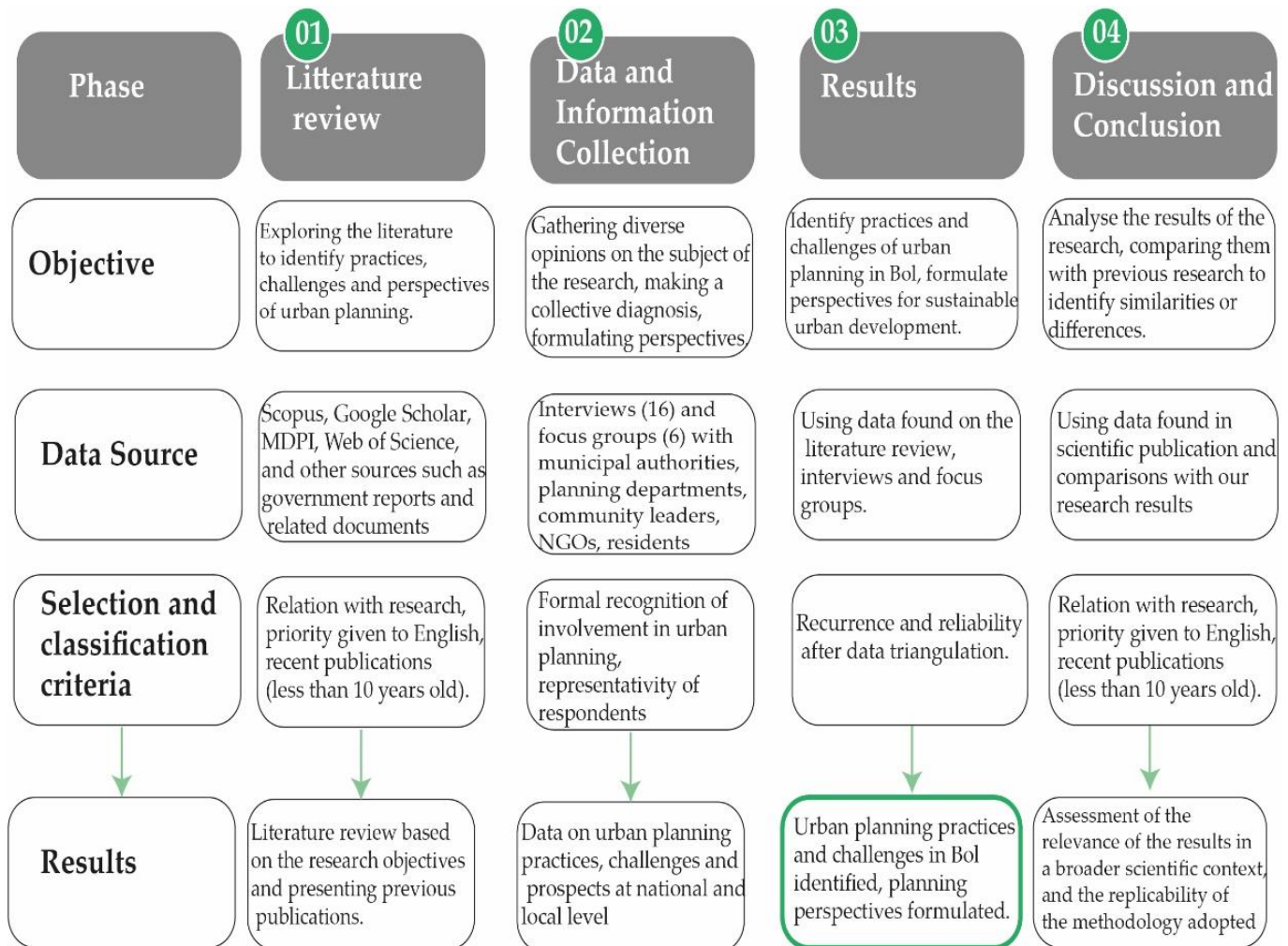


Figure 2. Different stages of the research.

4. Results

4.1. Analysis of urban planning practices in Chad: Legislative, regulatory, institutional frameworks, and land development

4.1.1. The legislative and regulatory framework

The legislative and regulatory framework for urban planning is still under development. Law No. 15/PR/98 of 2010 on urban planning, for example, establishes fundamental principles for urban planning but suffers from shortcomings in terms of implementation and updating. The associated regulations and decrees are often outdated, mostly inherited from the colonial administration, or initiated 50 years ago, compromising their relevance in the face of contemporary challenges of rapid urbanization and climate change. Moreover, the legislation does not sufficiently consider the specific needs of secondary agricultural economy cities, which limits the effectiveness of policies and their adaptation to local contexts.

Figure 3 below illustrates the evolution of urban planning legislation in Chad

over time. It showcases key milestones and changes that have shaped the legal framework governing urban development.

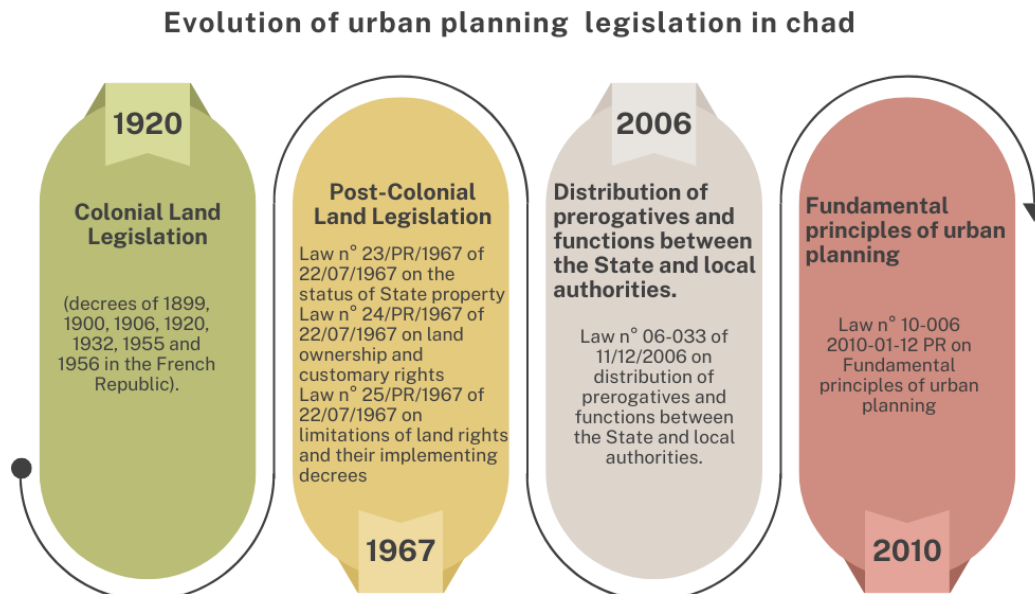


Figure 3. Evolution of urban planning legislation in Chad.

4.1.2. Urban planning institutional framework

Urban planning in Chad is characterized by a complex institutional structure and a constantly evolving legal and regulatory framework. The diverse institutional framework reflects a mosaic of responsibilities among national, regional, and local authorities. At the national level, the Ministry of Urban Planning and Housing is the main actor in urban planning policy. However, responsibilities are often shared with other ministries, such as the Ministry of Territorial Administration and the Environment, which can lead to overlaps and conflicts of interest. Local structures, such as municipalities and communes, play a crucial role in the implementation of urban plans, but insufficient resources and a lack of technical training often limit their ability to manage planning effectively. This decentralization can lead to a fragmentation of planning efforts and an inconsistency in urban policies across the country. The collected data also show the lack of coordination between the different institutional entities and the difficulty of integrating environmental concerns into planning processes. The shortcomings in the development and application of construction standards, as well as the lack of rigorous control mechanisms, exacerbate urban planning and organization issues.

To improve the situation, it is crucial to adopt a more integrated and coordinated approach that includes legislative reforms and better training for local actors. The strengthening of institutional capacities, the updating of regulatory frameworks, and the improvement of collaboration between various levels of government are essential for effective and sustainable urban planning in Chad. **Table 2** below highlights the key stakeholders involved in urban planning in Chad and their respective functions. It identifies the roles and responsibilities of various actors, including government agencies, local authorities, and community organizations. This framework underscores the collaborative efforts required to address urban

development challenges effectively.

Table 2. Key stakeholders involved in urban planning in Chad and their functions.

Stakeholders	Fonctions
Ministry of Land Planning, Housing, and Urban Development (MATDHU)	Definition of urban development policies; support for local communities; Head of several Departments and Provincial Delegations (cadastre, urban planning, housing, land planning)
National Directorate of Urban Planning	Design and implementation of urban development policies; updating, dissemination, and preservation of urban planning documents
National Urban Planning Commission	Proposes urban planning directions and priorities; develops national strategy; approves Plans and projects before their design and implementation.
Ministry of Territorial Administration and Local Governance (MATGL)	Oversight of decentralized local authorities such as municipalities, responsible for implementing urban planning-related policies.
Province	Advisory on PUR (Urban Reference Plans) and SDAU (Master Urban Planning Schemes); establishment of regional priorities; acquisition and disposal of real estate and land.
Department	Participation in the development of Urban Reference Plans (PUR) and Master Urban Planning Schemes (SDAU); Assistance to municipalities and rural communities in urban planning and housing matters.
Municipalities	Development of PUR, SDAU, and PUD (Urban Development Plans)
International Partners	Technical and financial support (UN-Habitat, UNDP, World Bank, AFD); Capacity building; facilitation of policy implementation.

Figure 4 below illustrates the level of interactions between the various institutions engaged in urban planning. It highlights the degree of collaboration, coordination, and communication among key stakeholders. These connections play a critical role in shaping the effectiveness of urban planning strategies.

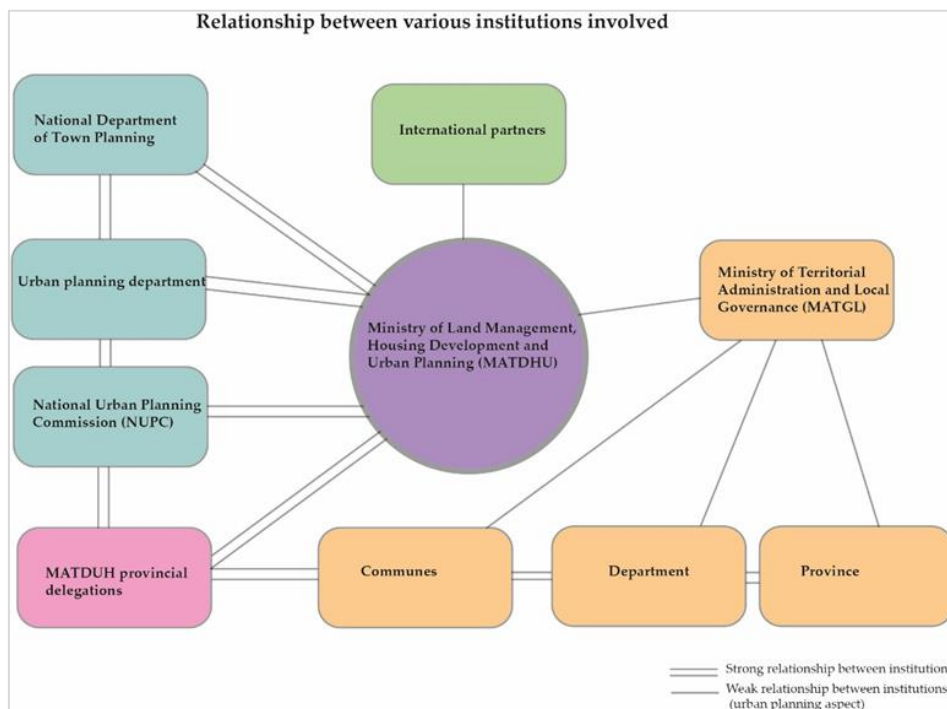


Figure 4. Interactions between the various institutions involved in urban planning.

The MATDHU maintains very close relations with the National Department of Urban Planning and the National Urban Planning Commission (CNU). The MATDHU is responsible for defining urban development policies, while the National Department of Urban Planning is responsible for implementing these policies. These two institutions work closely together to draw up, update, and disseminate urban planning documents. In addition, the National Commission of urbanisme (CNU), under the aegis of the MATDHU, plays a central role in proposing national urban planning guidelines and approving urban plans and projects before they are implemented. The complementary nature of the missions of the MATDHU, the National Department of Urban Planning and the CNU creates a synergy that is essential for effective urban governance.

On the other hand, the relationship between the MATDHU and the Ministry of Territorial Administration and Local Governance (MATGL) is moderate. Although these two ministries are involved in territorial management, their direct cooperation is relatively limited. The MATGL supervises the local authorities, particularly the communes, which are responsible for implementing the urban development plans drawn up with the support of the MATDHU. However, their interaction is mainly through local authorities, which limits direct collaboration between the two ministries.

The provinces, on the other hand, have strong relationships with the MATDHU. The provinces are actively involved in drawing up the Urban Reference Plans (PUR) and Master plans for Town Planning and development (SDAU). Their consultative role is crucial in ensuring that national strategies are adapted to local priorities and realities. In addition, they work with the MATDHU to formulate opinions on national guidelines and their implementation at a regional level, thus ensuring better harmonization between the different scales of planning.

The Departments play an essential support role for the municipalities and provinces. They maintain functional links with these institutions, participating in the preparation of the PUR and SDAU. The departments act as relays between national and local bodies for the implementation of urban policies.

The communes are also key players in urban planning, with very close relations with the MATDHU and the provinces. They are responsible for drawing up PURs and PUDs, which puts them at the heart of the implementation of national strategic guidelines. In addition, they receive technical and institutional support from the MATDHU to ensure that local urban projects meet national standards, while taking account of specific local features.

Finally, international partners such as UN-Habitat, UNDP, the World Bank, and AFD provide strategic support to MATDHU. Their contribution is technical and financial support and facilitating the implementation of national policies. In addition, these partners ensure that Chad's urban projects are in line with international standards, particularly in sustainable development and inclusive urban planning.

In conclusion, the relationships between these institutions vary in intensity, ranging from close and strategic collaboration to more functional support. These interactions are crucial to ensuring coherent and effective urban planning in Chad, taking account of national, regional, and local scales.

4.1.3. Main urban planning documents in Chad

The practice of urban planning in Chad is based on a set of urban planning documents whose validity periods, objectives, and key characteristics. **Table 3** below summarizes the main urban planning documents in Chad.

Table 3. Summary of the main urban planning documents in Chad.

Planning Document	Duration	Main Objective	Keys Characteristics
Master Plan for Development and Urbanism	20 to 25 years	Define the medium and long-term orientations for urban space planning, including land use, major facilities, and urbanization or preservation zones.	Sets the main guidelines for urban development, integrating environmental and social considerations.
Reference Urban Plan	15 years	Provide a quick overview of the urban situation, identify the main problems, and propose solutions.	Summary exploration of the existing situation, less detailed than the SDAU or the PDAU. Used to plan short-term development.
Master Plan for Development and Urban Planning	10 to 15 years	Specify and detail the SDAU orientations for specific areas, adapting the main lines of the SDAU to local realities.	Translation of the main lines of the SDAU into operational plans for specific areas, definition of urban development priorities
Detailed Urban Planning Plan	10 to 15 Years	Translate the main lines of the PDAU into concrete and specific projects at the municipal level, while respecting the orientations of the SDAU and the PDAU.	Detail the areas to be developed or redeveloped, define the construction standards and necessary infrastructures, and establish the management mechanisms.

4.1.4. Land production in Bol

The results obtained from interviews with the urban planning services, the municipality, and the analysis of urban plans reveal that the urban space of the city of Bol has been structured by a series of urban planning operations aimed at supporting its growth dynamics. These interventions, marked by processes of subdivision, alignment, and densification, along with an Urban Reference Plan, are characteristic of a city during average expansion.

First, since the 1960s, the city of Bol has been organized around a structured orthogonal grid, centered on the historic neighborhoods of Tandal 1 and 2, Bornoti, and Boudoumari. This urban planning model, based on subdivision operations, facilitated the allocation and management of plots in this initial phase of urban development. Subsequently, the colonial administration, in collaboration with local authorities, implemented alignment operations to formalize and regularize urban space. These interventions, based on the use of markers and ropes to delineate the blocks, contributed to the establishment of an orthogonal urban model, still observable today in the restructured neighborhoods of the city. Starting from the 1990s, the municipality invested in a multiplication of subdivision plans, particularly in the northern part of the city along the main axis towards Matafo according to the Urban Reference Plan. This rapid, sometimes anarchic urbanization reflects an increased need for regulation to ensure the coherence of urban planning.

The densification of restructured neighborhoods, such as Bornoti and Boudoumari, constitutes another important aspect of urban development. These areas, initially dominated by traditional houses locally called “Dourdour,” have gradually adopted more modern building materials.

Finally, some unstructured neighborhoods, like Bol Tandal, require urgent urban planning interventions. These areas, marked by “secko” constructions and an irregular road network, require restructuring operations to regularize land occupancy

and improve the living conditions of the residents.

However, it should be noted that a Reference Urban Plan for the city of Bol was developed in 2011 by the URBAPLAN study office as part of the Urban Development Support Project, funded by the Chadian State and the World Bank, which aimed to develop Reference Urban Plans for eight Chadian cities. As an urban planning document, this plan aims to plan the urban development of Bol and remains the reference framework for spatial production operations.

4.2. Urban planning challenges in Chad, with a focus on Bol

Urban planning in Chad, particularly in the Lake region, faces numerous challenges, including rapid population growth, infrastructure degradation, humanitarian crises, and governance issues. These difficulties are exacerbated by insecurity, armed conflicts, and the effects of climate change, such as desertification and extreme weather events. The lack of financial resources and investments limits the ability of local authorities to meet the growing needs for infrastructure and basic services, thereby exacerbating socio-economic inequalities.

Table 4 presents the challenges (Weaknesses and Threats) of urban planning in Chad, particularly in the city of Bol, also as well as the assets (Strengths and Opportunities) on which it is possible to rely to overcome the challenges. The SWOT analysis was carried out using the different themes of the PESTEL approach (Political, Economic, Sociocultural, Technological, Environmental, Legal) frameworks.

Table 4. Challenges and advantages of urban planning in Chad, particularly in Bol.

Pestel Variable	Strengths	Weaknesses	Opportunities	Threats
Political	Existence of institutional and political frameworks for urban planning. Government support for certain sustainable urban development initiatives.	Problems of urban governance and coordination between local authorities impacting the implementation of urban plans. Limited institutional capacity to implement urban planning policies.	Development and implementation of urban resilience strategies to address humanitarian and climate crises. Strengthening international cooperation and developing public-private partnerships to finance urban planning projects.	Political instability and armed conflicts leading to population displacement, disrupting spatial organization and urban planning. The risk of frequent changes in local administrative authorities, creates instability in the implementation of urban plans.
Economic	Potential for economic development through urban expansion and improvements to local infrastructure Opportunities for economic growth through the creation of new urban business parks.	Low financial resources to carry out urban projects. High poverty rates, limiting households' ability to finance housing improvements and contributing to the spread of informal settlements.	Mobilizing international funding for urban infrastructure projects Developing the local economy by improving urban infrastructure	The country's economic dependence on fluctuations in the world market limits the resources available for urban planning. Difficulty for local authorities to access credit, hampering the completion of major urban projects.
Socio-cultural	The dynamism of local young people is conducive to the implementation of participatory urban planning projects. Cultural richness and diversity can enrich the design of urban spaces and strengthen social cohesion.	Rapid population growth creating pressure on existing resources and infrastructure. Unequal access to basic urban services, exacerbating social deprivation.	Promoting community involvement to support participatory and inclusive urban planning. Integrating displaced people into urban planning processes for an inclusive and coherent approach	Risk of social tensions due to unequal access to urban infrastructure and services. Unplanned urbanization leading to uncontrolled and disorderly growth of residential and commercial areas.

Technological	Potential for innovation in the use of green technologies to improve urban quality.	Lack of advanced technologies for urban infrastructure management Poor access to modern urban management technologies slows down the efficiency and sustainability of projects. Aging and poorly maintained infrastructure. Lack of local technological skills.	Integration of green technologies to reduce the carbon footprint. Use of innovative technologies for urban planning and land-use control. Promotion of local technological innovation.	Rapid technological obsolescence requires ongoing investment to maintain modern, functional urban systems. Risks of cyber-attacks on digital infrastructure and urban management data.
Environmental	Potential for integrating sustainable solutions and green infrastructure. The wealth of natural resources to develop environmentally friendly urban infrastructure.	Increased impact of climate change on urban infrastructure Increasing urban pollution due to inadequate waste management and water treatment infrastructures	Adoption of climate-resilient town-planning schemes. Strengthening environmental conservation initiatives. Promote renewable energies and energy efficiency.	Increased pressure on natural resources due to the rapid expansion of the city.
Legal	The existence of legal frameworks for urban planning Support from international organizations to strengthen legal and regulatory frameworks for urban planning.	Weak application of and compliance with existing laws. Lack of up-to-date and coherent urban policies. Proliferation of informal and irregular construction, disrupting the implementation of cohesive planning.	Revision and reinforcement of laws for controlled, sustainable, and orderly urban growth. Working with international organizations to improve policies. Setting new standards for sustainable construction.	Weak institutional capacity to apply laws. Administrative rigidity slowed down the necessary reforms. Potential conflicts with local players promoting traditional land practices.

4.3. Perspectives

These perspectives were mostly formulated during focus groups with participants in the study. The focus group participants' contributions demonstrate their interest in the formulation of urban planning perspectives. By way of illustration, we noted the following verbatims: 'we need to adapt the rules to what is happening here, not just copy foreign stuff' and 'there is a real lack of training to manage infrastructures with digital tools. **Table 5** below shows short-term (1 to 2 years), medium-term (3 to 5 years), and long-term (more than 5 years) perspectives.

Table 5 Short, medium, and long-term perspectives.

Pestel Variable	Short-term perspectives	Medium-term perspectives	Long-term perspectives
Political	Strengthen local urban governance through training for municipal authorities. Improve coordination between local and national authorities.	Consolidate public-private partnerships to finance urban planning projects. Develop urban resilience systems in response to humanitarian crises.	Sustainably stabilize local governance structures. Ensure the sustainability of urban planning frameworks despite political changes. Strengthening institutional frameworks for long-term continuity
Economic	Quickly mobilize international financial resources for urgent infrastructure projects. Develop temporary employment programs for local youth.	Develop attractive economic activity zones for private investors. Encourage the diversification of the local economy through community initiatives	Facilitate access to credit for local authorities. Create specific urban funds for large-scale projects. Reduce dependence on global market fluctuations through large-scale economic diversification

Sociocultural	Launch rapid social inclusion programs for displaced persons. Promote participatory community forums for inclusive planning.	Strengthen equitable access to basic services in new urban neighborhoods. Implement education and awareness programs on urban citizenship.	Sustainably integrate young people into urban decision-making processes. Promote orderly urbanization by planning the expansion of residential and commercial areas.
Technological	initiate pilot projects for the integration of green technologies in urban management. Strengthen local technological skills through targeted training.	Develop digital management solutions for urban infrastructure and their maintenance. Encourage the adoption of innovative technologies for urban resource management.	Investing in research and technological innovation to ensure the sustainability of urban infrastructures. Implement digital security strategies to protect infrastructures.
Environmental	Conduct an environmental audit to measure the impact of climate change on the city. Promote environmentally friendly waste management practices.	Develop green infrastructures (parks, public spaces) and renewable energy solutions. Integrate climate change adaptation policies into urban planning documents	Maintain a sustainable balance between urban expansion and the protection of natural resources. Ensure continuous and sustainable environmental management to reduce the city's carbon footprint.
Legal	Update policies and legal frameworks to meet the immediate needs of sustainable urbanization. Strengthen the enforcement of existing laws through better coordination between local and national authorities.	Collaborate with international organizations to develop stricter standards for sustainable and orderly construction. Harmonize legal frameworks with local realities and urban needs.	Ensure the integration of new legislation adapted to the challenges of future urbanization. Sustainably strengthen local institutional capacities to ensure continuous law enforcement.

5. Discussion

5.1. Urban planning practices

The study's findings shed light on critical challenges in urban planning practices in Chad, notably institutional fragmentation, outdated legislative frameworks, the complexities of urban space production, and the limitations of planning documents. These challenges, while prevalent in many African contexts, are uniquely manifested in rapidly urbanizing cities like Bol, where they pose significant barriers to sustainable urban development.

The findings underscore the fragmented nature of urban governance in Chad, characterized by the involvement of numerous stakeholders, including ministries, directorates, local authorities, and international organizations. This multiplicity creates overlapping responsibilities and coordination gaps, as noted in previous studies (Cirolia and Harber, 2021b). In Bol, these challenges are compounded by limited capacity among key actors, poor decision-making, and weak integration of environmental concerns into planning. Without addressing these issues, urban planning efforts are unlikely to meet the demands of rapid urbanization or foster sustainable development. A reformed governance structure that promotes collaboration, inclusivity, and efficiency is essential to overcome these obstacles and advance urban resilience.

The study highlights the inadequacy of existing urban planning laws, many of which date back to colonial times, such as Law No. 23/PR/1967. These outdated legal instruments fail to account for modern urban challenges, including climate change and rapid urban expansion. This mirrors trends in other African cities, where colonial-era tools continue to hinder adaptive planning (Jean-Pierre, 2019). Legislative reforms tailored to contemporary needs are necessary to address conflicts

arising from urban sprawl, density, and emerging design principles (Daramola, 2019; Morgan, 2012). In Chad, this legislative inertia is particularly detrimental, limiting the country's ability to respond effectively to pressing urban and environmental challenges.

Rapid, often unregulated urbanization in Bol has resulted in widespread informal settlements and unstructured urban areas. These trends exacerbate social and economic inequalities, as vulnerable populations face limited access to essential services (Bosch et al., 2019). Similar patterns are observed across African cities, where urban densification and sprawl intensify disparities (Michalina et al., 2021). The precarious housing conditions in Bol demand targeted interventions to promote equitable access to resources and foster more inclusive urban growth. Integrating vulnerable communities into the urban planning process and prioritizing affordable housing solutions are crucial steps toward reducing these inequalities.

Urban planning documents, such as the SDAU and PUR, are pivotal tools for guiding development in Bol. However, they often lack the adaptability and specificity needed to address the unique dynamics of emerging cities. This aligns with observations from other West African contexts, where limited financial and human resources hinder the effective implementation of planning tools (Lynch et al., 2020). Additionally, formal planning systems frequently overlook peri-urban and low-income areas, further entrenching informal settlement growth (Atkinson, 2024; Cobbinah, 2023). To ensure sustainable urban development, Chad must revamp its planning frameworks to reflect local realities, prioritize resource allocation, and enhance community participation.

5.2. Challenges of urban planning

The analysis of urban planning challenges in Bol highlights a range of institutional, economic, sociocultural, technological, environmental, and legal issues. These challenges align with the findings of several studies on the difficulties faced by African cities in urban planning. Institutional fragmentation and weak infrastructure, compounded by humanitarian crises, undermine sustainable urbanization (Bianchi and Richiedei, 2023). The lack of coordination between local and national actors, as demonstrated in our study, has been widely recognized as a barrier to effective urban policies (Keil, 2006). To overcome these obstacles, it is crucial to promote a more integrated approach that fosters urban sustainability.

Economically, the results of our research indicate that the scarcity of financial resources significantly impacts the implementation of urban projects. This finding aligns with other studies that have highlighted the reliance of African cities on national and external funding, which complicates the execution of local initiatives (Mitlin et al., 2018; Mohamed and Vadeveloo, 2023). Diversifying funding sources could reduce this dependency while supporting local businesses and strengthening financial institutions (Liu et al., 2015). Additionally, urban poverty, exacerbated by climate crises, represents a significant obstacle to improving living conditions, necessitating the implementation of targeted strategies to support vulnerable populations (Manjengwa, 2016; Vilar-Compte et al., 2021).

In the sociocultural dimension, our findings suggest that rapid population

growth places substantial pressure on urban infrastructure. Although the participation of youth and local communities is often limited, it plays a crucial role in the success of urban policies. However, rapid and unplanned urbanization can result in issues such as urban congestion and poor land use, underscoring the importance of active stakeholder involvement to ensure sustainable urban management (Desalegn and Solomon, 2021; Ochunga and Nairobi, 2016).

From a technological perspective, our study affirms that the adoption of green technologies presents both a challenge and an opportunity for Bol. While renewable energy development could improve energy efficiency in African cities, limited access to these technologies hinders their widespread implementation. These findings corroborate previous research (Sergeevich et al., 2020; Sergeevich et al., 2020), highlighting the need to promote accessible technological solutions to enhance urban infrastructure resilience in the face of climate challenges (Qi et al., 2024).

Environmentally, the effects of climate change on urban infrastructure in Bol, as related to urban planning, reflect trends observed in other Sahelian regions. Extreme phenomena, such as floods and desertification, disrupt urban planning and call for more resilient adaptation strategies. Our findings align with prior research, indicating that in cities exposed to the impacts of climate change like Bol, integrating resilience strategies into urban planning is essential for improving the living conditions of the most vulnerable populations, provided that institutional barriers are addressed (Harahap et al., 2024). This call to overcome institutional challenges in developing resilient urban planning documents is consistent with the work of (Chelleri et al., 2015).

Lastly, the results of our study reveal that although legal frameworks for urban planning exist, their application remains weak, and the laws are not always enforced. These findings are consistent with (Ahmad and Anjum, 2012), who argue that inconsistencies and gaps in legal and institutional frameworks hinder the effective implementation of urban development plans in Pakistan. To address this issue, it is necessary to revise laws, establish new sustainable construction standards, and enhance institutional capacity, despite potential conflicts with traditional land practices' proponents, as (Boamah and Amoako, 2020) suggested. These results support the argument made by (Agbola and Falola, 2016) that urban planning law reforms in Africa must urgently be overhauled to improve urban governance and reshape the urban models and structures of African cities.

6. Conclusion

In conclusion, urban planning in Bol must be strengthened through improved institutional coordination, diversification of funding sources, increased citizen involvement, and the adoption of green technologies, all underpinned by a revised legal framework to address contemporary challenges

This study explored urban planning practices in Bol, a rapidly growing city in the Lake Province of Chad, where population growth, recurring humanitarian crises, and climate challenges compound urban development issues. Key findings revealed critical weaknesses in the urban planning framework, including insufficient planning

structures, fragmented coordination among stakeholders, limited resource availability, and an outdated regulatory framework that inadequately addresses contemporary urban challenges. The implications of these findings are multifaceted. Practically, they underscore the urgent need to reform urban planning processes in Bol to better accommodate population growth and mitigate climate-related vulnerabilities. At the policy level, the study highlights the necessity of updating legal frameworks and fostering stronger stakeholder collaboration to enable effective and sustainable urban development. From a knowledge perspective, this research contributes to understanding the unique urban challenges faced by secondary cities in the Sahel region, which are often overlooked in global urban studies. Despite its contributions, this research has limitations. The reliance on qualitative methods constrains the ability to quantify the impact of urban policies, and the findings are context-specific, limiting their generalizability to other sub-Saharan African cities. Future research should address these limitations by conducting quantitative analyses to measure the effectiveness of urban policies and by undertaking comparative studies to explore planning practices in other secondary cities within similar contexts. In addition, future research could also ensure better integration of vulnerable groups such as women, people with disabilities, displaced persons and the elderly in the sampling for data collection for urban planning research. By shedding light on the urban planning challenges in Bol, this study advocates for an integrated approach that combines updated legal frameworks, enhanced resource allocation, and multi-stakeholder collaboration to promote sustainable urban development in Chad and beyond.

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