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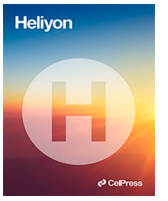

Ethiopian urban land allocation policy and its contribution to urban densification

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ABSTRACT

Urban densification is considered as the best tool for efficient urban land utilization, containment, and minimizing urban development costs. It is also a widely accepted approach to mitigate shortages of urban land and urban sprawl. With this in mind, Ethiopia has adopted a standard-based urban land allocation policy. The policy relies on population size during the urban planning process to address issues related to sustainable urban development by increasing the densities of its urban areas. However, the impact of the existing urban land allocation policy on urban densification has not been investigated adequately. Thus, this study examines the contribution of existing urban land allocation policies to urban densification in Ethiopia. A mixed research approach was employed to achieve the objective of the study. The study revealed that the policy gives more attention to the immediate and tangible conditions than the efficient use of land resources. Therefore, it allocated an average of 223 square meters of land to each person for urban development. The study implies that the country's urban land allocation policy is ineffective in achieving the intended outcome of urban densification. Instead, coupled with uncontrolled urban population growth, it has been exacerbating the rapid horizontal expansion of urban areas. With the current trend of horizontal expansion of urban areas, the country's land resources is expected to be converted into a built-up environment within the next 127 years unless the policy is radically changed. Thus, this paper calls for revisiting the existing urban land allocation strategy of the country in a way that responds towards efficient urban land allocation and sustainable urban development.

1. Introduction

Urbanization is accepted as a positive force for economic growth, poverty reduction, and human development [1]. It can be described in terms of the increase in population and/or geographic area. Globally, the rate of urban spatial expansion is much higher than that of urban demographic growth. Such a fast spatial expansion rate that results in low-density urban development is recognized as a negative sign of sustainable development because of its complex and unwelcome consequences [2]. Many individual case studies have verified that high rates of urban expansion over the last few decades have resulted in various unfavorable consequences [3–13]. Similarly, Ethiopia has also been bearing the burden of urban sprawl and its consequences for the last three decades [14–16].

Therefore, in many countries, including Ethiopia, urban densification strategies have been widely adopted [17] with combined

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measures to limit urban spatial expansion, restrain development in rural areas and prevent low-density urban development by focusing mainly on the redevelopment or increasing density of existing towns and cities [18,19].

In addition, studies showed that the land administration systems of some nations remain a factor in fast urban spatial expansion rates and low-density urban development [20]. Similarly, in Ethiopia, the land delivery system in general has also been criticized as a factor for fast urban spatial expansion rates and low-density urban development [21]. Nevertheless, studies have not been able to identify the specific parts of the land supply system that contribute to the phenomenon. Previous studies failed to explain the real problem in depth and emphasize which part should be focused on. Thus, the purpose of this study is to investigate the contribution of the country's existing land allocation policy to urban densification with a special focus.

2. Theoretical and empirical reviews

Concerns about the rapid spatial expansion of urban areas and their adverse consequences continue to focus on livable and sustainable urban development strategies and policies that ensure self-sustaining urban communities. The terms "livable" and "sustainable" raise questions between planners and decision makers about how they can meet the needs and desires of current and future inhabitants. "Livability" is about "now" and "here" and focuses on short-term, immediate and concrete conditions and interventions [22]. Sustainability, on the other hand, means meeting current needs without compromising the ability of future generations (long-term) to meet their own needs [23]. According to planning studies, livability and sustainability tend to reinforce each other rather than contradict each other. In addition, the unique link between livability and sustainability can be integrated by carefully designing the principles of livable sustainability [24].

The United Nations report predicted the urban population to increase only by 40%, i.e., from 6.1 billion in 2000 to 8.5 billion in 2030 [25], while urban spatial areas are forecasted to triple between 2000 and 2030 [26], which means that the global urban density will decrease by approximately 47%. These figures show that such a faster spatial expansion rate than the urban demographic growth rate results in low-density urban development, which can also be known as the major indicator for unsustainable urban development [27]. Although the main reason for the rapid spatial expansion of urban areas is urban population growth, previous studies show that there are many other factors, especially with regard to low urban density. The following subsections describe major factors, internationally recognized strategies and tools, and the benefits of the most widely used strategy and tool to prevent the rapid spatial expansion of urban areas and low urban density development.

2.1. Factors for rapid spatial expansion and low-density development of urban areas

Previous studies identified diverse factors resulting in a fast urban spatial expansion rate and low-density urban development that can be generally classified into social and geographical characteristics, availability of life facilities, economic incentives, land demand and supply, population increases, administrative services, technological innovation, and development plans [28]. Table 1 summarizes the literature reviewed on the specific factors that led to rapid urban spatial expansion and low-density urban development.

2.2. Internationally recognized strategies and tools to prevent rapid urban expansion and low urban density development

While the causes and consequences of a fast urban spatial expansion rate and low-density urban development may seem discouraging, researchers from different parts of the world have been trying to draw up different planning strategies to reduce the proliferation of unsustainable growth patterns in urban areas [38,39]. The "General Land Use Plan" (GLUP) is a well-known strategy to be implemented to control the growth of built-up areas and protect encroachment on agricultural land [40]. Critics concerning GLUP argue that the strategy is highly centralized and allows minimum municipality involvement; it focuses on controlling the development rather than managing, it is more rigid than flexible, it encounters major problems with predictions or assumptions, it faces coordination problems and difficulty in monitoring the implementation, and it addresses the issue of asymmetric information about land use caused by local governments hiding information regarding land use [41].

"Urban Growth Boundaries" (UGBs) is a popular strategy that can be defined as "a proactive growth management tool that seeks to contain, control, restrict growth in order to promote more compact, contiguous urban development". The area within the

Table 1
Factors resulting in a fast urban spatial expansion rate and low-density urban development.

Factor	Author/s
Lack of public awareness	[20]
Preference for a large single-family home	[29]
Relatively low land value	[30,31]
Government investment and infrastructure subsidies	[20,32]
Proximity to the metropolitan city; Presence of employment opportunities, primarily industrial; Improper land administration system	[20]
Investments in transportation infrastructure and ICT improvements	[33,34]
Interlinkages between residential and industrial (commercial) areas; Negative aspects of inner city cores	[35]
Weak planning frameworks, such as single-use development schemes, and low mortgage interest rates,	[36]
housing typology, and deficiency in enabling environment (water supply, sewerage system, road network) and, lack of guidelines	[37]

limit will be allocated for urban development, but the region on the exterior of the boundary will be allocated for agriculture or maintained in its natural state [42]. In the U.S., over one hundred cities have adopted UGBs or similar policy initiatives to manage built-up area expansion [43]. Through zoning, land development permits, and other land-use regulations, UGBs demarcate urban and rural uses and aim to contain urban development within predefined boundaries [44,45].

"Circular Flow Land Use Management" is a concept developed in Europe to decrease land consumption by urban sprawl through encouraging brownfield and inner-city development. It can be described with the slogan "avoid—recycle—Reduce/Compensate". "Avoid" means, the conversion of current unbuilt open space or agricultural land into a new buildable area is to be avoided. "Recycle" means, areas with uses that were once active and now exhibit no viable use that should be recycled by either introducing new uses or through redevelopment. "Reduce/Compensate" means, reducing land consumption for new development, and compensation should be required when construction must take place on previously unbuilt land [46].

"Smart Growth" is also an alternative strategy that takes into account the continuity of growth and development and seeks to guide that growth in a deliberate and inclusive manner. It prioritizes the development of vacant parcels within previously built areas and replacing old constructions with new ones through an amalgamation of small parcels in existing communities rather than developing previously undeveloped sites or green lands [47]. It focuses on the development of dense and pedestrian-friendly urban centers to limit vehicle use and horizontal urban expansion. It also advocates for being compact, transit-oriented, walkable, and bicycle-friendly [48]. It is an alternative to car jams, fragmented districts, and the deterioration of an urban area. Its ideologies contradict the traditional views of urban planning, for example, the importance of the use of private cars and stand-alone houses [49]. In the USA, the term "smart growth" is commonly used. The terms "compact city", "urban densification" or "urban intensification" have commonly been used to refer to the same ideas, which have had an impact on government planning policies in many European countries, including the UK and the Netherlands. Smart growth gives more focus to long-term and regional sustainability than short-term and local considerations [50].

The most widely used tool for achieving smart growth is (modification of) local zoning laws to increase the density of development and redevelopment allowed in or near existing towns and neighborhoods and/or restrict policy tools for recent development in outlying or environmentally sensitive areas. Different incentive mechanisms can encourage developers to develop brownfield lands or public/green spaces. Adjusting the standards and regulations that play a role in increasing parking spaces will help ensure adequate availability of spaces for parks and other social services.

All the above-mentioned internationally recognized strategies result in higher urban density. Therefore, urban densification has been a common concept, although different arguments have been presented against all the above planning strategies [51,52]. However, none of the critics can come up with a sound solution to the unsustainable use of very scarce land resources. Consequently, urban densification remains a popular planning strategy for sustainable urban development, including in developing countries [53]. Developing countries borrowing policies from developed countries to prevent rapid urban expansion and low urban density development urban sprawl is not a problem. However, the question is whether these policies are adequate to solve the problem in developing countries.

2.3. Benefits of urban densification

The term "urban densification" is used by planners, designers, developers and theorists to describe the increasing density of people living in urban areas. Urban density has remained the central focus of planning strategies of many major cities around the world for the last few decades [2,54,55], as it seeks to meet the challenge of population growth while simultaneously responding to the environmental, social and economic issues posed by the rapid horizontal expansion of built environment [56].

It also maximizes the social, economic and environmental potential of cities. Density is associated with a wide range of urban benefits, including increased productivity because of agglomerated economies, improved accessibility to urban services, reduced travel times, and a smaller ecological footprint due to lower energy and land consumption [17]. In a denser city, the walking trip frequency is higher [57], and with walking and cycling, anyone can get anywhere quickly [58]. There is evidence that when people gather more closely and interact, innovation can happen more easily, and new ideas are generated more frequently [59]. Richard Florida (2010) noted that denser cities foster more collaboration and innovation [60]. In the 1970s, Jane Jacobs (1961) claimed that densifying settlements could reduce environmental damage. This point is eloquently spoken by David Owen in his book Green Metropolis [61]. Urban densification can lead to lower energy consumption in transportation, reduce flood problems while minimizing groundwater depletion [62], increase the efficiency of management of environmental resources [63], support the feasibility of public infrastructure, and the broaden economic viability of the city [64].

There has been evidence that dense and compact development may achieve sustainable development in rapidly growing cities in developing countries [53]. Therefore, in many countries, including Ethiopia, urban densification policies have been widely adopted [17] with combined measures to limit urban expansion, restrain development in rural areas and prevent urban sprawl by focusing mainly on the re/development of existing towns and cities [18,19]. Because of the above described and many other advantages of urban densification, in many countries, including Ethiopia, urban densification strategies have been widely adopted with combined measures.

2.4. Ethiopian urban land allocation policy: from a "part-to-whole" approach

Land can be allocated for various urban services through planning processes to satisfy the multiple goals defined in national policies and to implement sectoral policies [65]. Its allocation approaches have a significant impact on the efficient use of scarce resources [12]. According to the Ethiopian, urban land allocation comprises the following ten basic principles. 1) conformity with the hierarchy of plans; 2) sharing the national vision and standard as well as capable of being implemented; 3) consideration of inter-urban and urban-rural linkages; 4) delineation of spatial frame for urban centers in view of efficient land utilization; 5) ensuring the satisfaction of the needs of the society through public participation, transparency and accountability; 6) promotion of balanced and mixed population distribution; 7) safeguarding the community and the environment; 8) preservation and restoration of historical and cultural heritages; 9) balancing public and private interests; 10) to be found ensuring sustainable development. The Ethiopian land allocation policy follows an approach that can be termed in this paper as "Part-to-Whole". The term has been used in the field of education as an approach for analytical learners who want answers in specific and detailed terms [66]. Here, the term refers to an approach that involves allocating a plot of land for each urban service based on the pre-determined Land Area Allocation Standards, which ultimately determine the boundaries of the entire spatial area of the urban center. In other words, each part of the urban area (plot of each urban service) is allotted based on the pre-set Land Area Allocation Standards, and as a result, the whole urban area is defined by summing every piece of the plot of each urban service. In short, according to the Urban Planning Proclamation of Ethiopia, the approach explains the application of Land Area Allocation Standards in the development of the urban area from pieces of urban plots.

The Land Area Allocation Standards have been formulated for most of the urban services of the country, hoping to exert their influence over the urban planning practice in increasing the effectiveness and efficiency of land usage as well as bringing a balance between livable and sustainable development. Livability is more about "now" and "here," focused on immediate and tangible conditions and interventions [22], whereas sustainability is about meeting the (land resource) needs of the present without compromising the ability of future generations to meet their own (land resource) needs" [23].

Meeting all the Land Area Allocation Standards through the operating land allocation approach has become well-thought-out as some criteria for good quality of the urban plan by the local government in Ethiopia. Therefore, comparing land areas of the land use plan with these Land Area Allocation Standards set at national and regional levels is a major method for evaluating the quality of an urban land use plan. However, the aggregate effect of these existing Land Area Allocation Standards on increasing urban density and preventing urban sprawl has not been studied sufficiently thus far. Therefore, this investigation is not about the appropriateness of each Land Area Allocation Standards for urban services but their cumulative effect on increasing density. Since the impacts of these decisions can remain for many decades and many are irreversible [67], the study is helpful in understanding the effect of the applied planning framework on the densification efforts and gives a chance to make necessary corrections if required before things become worse.

3. Materials and methods

The general approach used to achieve the study's objective is to consider the difference in the area-to-person ratio resulting from the current land allocation policy in particular and from all factors in general. Because it helps to measure the role of the existing land allocation policy in increasing density by comparing the density resulting from all factors, it is used as a baseline. The study contains both quantitative and qualitative research methods. Because mixed methods can help to gain a more complete picture than a

Table 2
Secondary sources, types of data and information collected.

Document	Data Type	Information
The urban planning proclamation of Ethiopia https://lawethiopia.com/images/federal_proclamation/proclamations_by_number/574.pdf	Qualitative	Intention & influence on urban density.
The Urban Development Policy, http://196.188.93.162/c/document_library/get_file?uuid=65a180a2-7aca-4bde-bb7d-377be1459acf&groupId=10136	Qualitative	Intention & influence on urban density.
The Urban Plan Preparation and Implementation Strategy, (In Hard Copy Only)	•Qualitative •Quantitative	• Intention & influence on urban density. • General land-use proportion standard
The Urban Planning Proclamation https://lawethiopia.com/images/federal_proclamation/proclamations_by_number/574.pdf	Qualitative	Position & influence on urban density.
Structure Plan Preparation and Implementation Manual (In Hard Copy Only)	•Qualitative •Quantitative	• Urban Classification and Service Assignment". • Detailed Land-Uses Proportion Standard
Industry Urban Development Bureau: Plot size standards for urban services Regulation No. September 2016. (In Hard Copy Only)	Quantitative	Land Area Allocation Standards at the regional level
Density Standard" set by the Ethiopian Ministry of Urban Development and Construction in 2012 (In Hard Copy Only)	Quantitative	• Urban center Average population density standards • Land Area Allocation Standards set at the national level
Unpublished report of Bahir Dar Structure plan (In Hard Copy Only)	Quantitative	Land Area Allocation Standards set at the local administration (city) level
Assessment on Urban Density and Land Use Efficiency in the Ethiopian' [21] (Belete & Gezie, 2017)	Quantitative	The density of major urban centers of Ethiopia

standalone quantitative or qualitative study, it integrates the benefits of both methods.

Qualitative data are collected from primary and secondary data sources. Information from these sources was deemed of limited value for the purposes of this study, so stakeholders were excluded, and data were collected only from the planning team. Questionnaires and focus group discussions were used to collect primary data. Although the number of planning teams was more than 94, only 24 questionnaires were completed by participants who purposefully selected only one from each thematic study group. All participants fully understood the purposes of this research and gave informed written consent to participate in the research project. The study protocol was approved by the Institutional Review Board (IRB) of the CMHS, Bahir Dar University (IRB Protocol Number: 787/2023). Then participants were asked to answer both open- and closed-ended questions. Open-ended questions are required to see things from the respondent's point of view, as they provide their own word feedback freely instead of stock answers. Only a few closed-ended questions are introduced into the questionnaire to facilitate the comparison of answers and introduce open-ended questions. The project manager, 5 team leaders, and 3 technicians from Bahir Dar City Department were purposely selected as a group of individuals who participated in the focus group discussion. This allows the study to explore intentions and beliefs in defining area standards for urban functions. In addition, secondary data are collected from published and unpublished planning-related documents produced by relevant agencies at the national, regional and local levels (see Table 2) for understanding. intentions and influence of key legislation and spatial norms on urban density. Quantitative data, such as numerical standards, are also collected from the same primary and secondary data sources using the same tools.

Since the Land Area Allocation Standards have not been set for all urban services yet, Ethiopian local administrations are allowed to fill the gap in preparing their local plans. Therefore, because of such cases, the 2020–2030 Bahir Dar City structure plan (BDCSP) is taken as a case study to obtain these Land Area Allocation Standards that were utilized to fill the gap. According to the Urban Plan Preparation and Implementation Strategy of Ethiopia, a structure plan is a framework plan that guides the development or redevelopment process of an urban center in an integrated and holistic manner.

The BDCSP was selected for the study for three major reasons. First, the city can be representative of the fast-sprawling large cities of Ethiopia [68]. Second, it has the latest structure plan that can show the current urban planning policy of the country. Third, it has covered approximately nineteen additional standards by adopting best practices from other countries or by maintaining the existing land coverage for the specific urban service. Using collected spatial standards, the land areas that are allotted for each urban service are identified. Next, they are converted into the same ratio, i.e., in the form of a 'land area-to-person ratio' to make them uniform. This form of presentation is helpful to give a clearer understanding of land-to-people relations within an urban area and to make the statistical analysis simpler.

To compute the ratio and other related statistical analyses, national-level data such as the population numbers, average population growth rate, etc., are collected from the Central Statistics Agency of Ethiopia (CSA), and data such as land areas, urban land cover, etc., which are not covered by CAS, are collected from the World Bank's Open Data. Then, case studies that were undertaken on urban density are also reviewed to determine the magnitude of the density of other urban centers in the country due to all the identified sprawling factors. The computed densities and reviewed densities of different urban centers are compared to evaluate the contribution of the existing urban land allocative approach for greater urban density. Finally, based on these statistical analysis results, descriptive analysis was undertaken to draw a conclusion regarding the contribution of the land allocation approach to increased urban density.

4. Results & discussion

Efficient land allocation and ensuring sustainable development are two of the ten basic principles of the urban plan, as stated in the urban planning proclamation of Ethiopia. The principles are expected to guide the urban land use planning practice of the country towards increasing urban density. The country's subsequent related policies and legal frameworks are therefore formulated and approved according to these principles. For example, the "Urban Development Policy" and "Urban Planning and Implementation Strategy" aim to influence urban planning practices, increase urban density and achieve sustainable development through various instruments. The following subsections describe in detail important tools that influence urban density.

4.1. The Urban Population Density Standard

The "Urban Population Density Standard" established by Ethiopia's Ministry of Urban Development and Construction in 2012 is the first key tool influencing urban density. According to the tool, urban density is described as population density only, i.e., the ratio of the

Table 3
Urban population density planning standard.

Range of total population size	Average population density standards
2001 to 20,000	100 in/ha
20,001 to 50,000	200 in/ha
50,001 to 100,000	300 in/ha
100,001 to 1,000,000	400 in/ha
Above 1,000,000	500 in/ha

Source: The "Urban Population Density Standard" set by the Ethiopian Ministry of Urban Development and Construction in 2012

number of inhabitants in the urban center to the total urban area. As seen in Tables 3 and If the population of cities will exceed 1 million by the end of their planning period, their average density should be 500 inhabitants per hectare. Therefore, this standard forces the case study area (as its population exceeds one million by 2030) to have no less than a density of 20 square meters per person on average, which means a significant change in density compared to 2009, i.e., approximately 400 square meters per person [68]. This tool is similar to the concept of the "Circular flow land use management" (subsection 2.2.) which was developed in Europe to decrease land consumption by encouraging brownfield and inner-city redevelopment. Consequently, similar to this concept, density standard tools can face the same criticisms because the reuse of previously used sites often has complex social, environmental, economic, political and legal issues [46].

4.2. Urban Centre Classification and Service Assignment

The second important tool that influences urban density is the "Urban Classification and Service Assignment". Ethiopian urban planning law considers a settlement as an urban center if its population size is 2000 and above. According to the tool, urban centers are classified into five different levels or grades of urban service density, which is described in terms of the ratio of the number of urban service types to an urban center. Therefore, urban centers are classified into five levels or grades to determine the type and the number of urban services that should be provided by them (Table 4).

Therefore, Bahir Dar City, the case study area, falls under the fifth-level category, as its population is above 250,000. Then, the urban density, i.e., the number of urban services to be comprised by the city, is determined based on the Urban Service Assignment Standard that is provided based on the Urban Centre Classification (see Table 5).

Although this tool has an important impact on increasing urban density, it has resulted in negative consequences. In this regard, this tool is largely similar to the "General Land Use Plan" (section 2.2.) because both are highly centralized, allow minimum involvement of the municipality, and control development rather than management. In addition, their focus is on not only strictly limiting the horizontal expansion of the urban centers but also the types of development need within the urban areas. They also forbid urban centers to introduce different urban services based on their needs other than those permitted without considering the unique and dynamic nature of the urban center [41].

4.3. General Land-Uses Proportion Standard

The third important tool that influences urban density is the "General Land-use Proportion Standard". Established by the Ministry of Urban Development, Housing and Construction of Ethiopia, this standard applies to all urban areas of the country to create a livable urban environment by balancing the urban density within an urban center. According to this tool, urban density is described in terms of the ratio of land use coverage to the total urban area. Therefore, the tool categorizes all urban land uses into three general categories, as shown in Table 6.

The BUA land use category is the only determinate that defines the land area of its detailed land uses and other general land uses (i.e., NE and RI) as well as the limit of the entire urban center, regardless of vertical density (expressed in the form of "Floor Area Ratio (FAR)" or "Floor Space Index (FSI)" development codes) of the land uses. Consequently, the total land area of the urban center will be calculated based on their proportion provided by the tool. The rationale behind this tool is to address the lack of road networks and green areas in existing urban development as well as the urban sprawl problem of the country, which makes a sense of a balance among these three general land use categories.

The proportion standard can be represented mathematically as follows:

$$BUAL = UAL\ X\ (40–45\%)$$

$$RIL = UAL\ X\ (30\%)$$

$$NEL = UAL\ X\ (25–30\%)$$

where.

UAL = total land area required for the "Urban Area"
BUAL = total land area required for the "Built-Up Areas"
RIL = total land area required for the "Road and related Infrastructure"

Table 4
Urban center classification.

Population size	Hierarchical classification
Above 250,000	Fifth-level
60,000–249,000	Fourth-level
20,000–59,999	Third-level
5000–19,999	Second-level
2000–4999	First-level

Source: Structure Plan Preparation and Implementation Manual

Table 5
Urban service assignment standard by urban hierarchy/level.

Types of Urban Services	No. of Detailed Urban Services per each general type	Required no. of detailed urban services by Urban Hierarchy				
		Fifth level	Fourth level	Third level	Second level	First level
Education	8	8	8	5	5	5
Health	10	9	9	6	5	3
Recreation	10	9	5	5	5	2
Culture	12	12	11	9	8	3
Green Frame	8	8	8	6	6	0
Infrastructure	28	28	26	20	14	8
Commercial and Trade	12	12	10	9	7	3
Total No. of detailed Urban Services	**88**	**86**	**77**	**60**	**50**	**24**

Source: Structure Plan Preparation and Implementation Manual

Table 6
Proportional standard for general categories of urban land Use.

General Categories	Proportion	Application	Remark
Road and related infrastructure (RI)	25%–30%	the older urban centers would have the lesser proportion	Dedicated for road right of way (ROW) which includes pedestrian ways and crossings, vehicular ways (major, collector & local), bikeways, green areas along (side & in the middle) roadways, utilities (water, drainage, electricity, water, etc.) lines along with roadways, road junctions and roundabout areas, car parking and bus stop areas, street market areas.
Built-up areas (BUA)	40%–45%	the older urban centers would have a larger proportion	Includes housing, working and production, worshiping, etc.
Natural environment (NE)	30%	–	Includes parks, garden/agriculture and green areas (public & privately owned), recreational areas, playgrounds, urban forest, wetland areas, grass & bush areas, quarry (rock and other minerals) sites, river and stream areas, sports areas, cemeteries and open-worshiping areas, open market areas, plazas, and squares

NEL = total land area required for the "Natural Environment"

Similar to the above-mentioned "Urban Centre Classification" tool, the "General Land-Uses Proportion Standard" tool is also greatly similar to the General Land Use Plan (section 2.2.) because it is also highly centralized and allows minimum municipality involvement, it focuses on controlling development rather than managing it [41]. In addition, this tool is more important to bring uniformity in urban density among the urban centers than increasing urban density or preventing spatial expansion of the urban center. However, if this tool is integrated with the Detailed Land-Uses Proportion Standard and the Land Area Allocation Standards tools, the combined result can have a significant impact on urban density. Still, the standard should pay more attention to increasing the general urban density and using the available land efficiently and effectively than responding to only the immediate and concrete problems. Otherwise, the result could be the opposite.

4.4. Detailed land-use proportion standard

The fourth important legal tool is the "Detailed Land-Uses Proportion Standard". It is a proportional standard for subcategories of the BUA general land use category, which account for only 40% of the total urban area (Table 7). According to the tool, the BUA general land use category is classified into detailed land use subcategories. Similar to the above-mentioned tools, the "Detailed Land-Uses Proportion Standard" is also very similar to the "General Land Use Plan" (section 2.2.) because it is also highly centralized and

Table 7
Proportional Standards for Sub-categories of the BUA general land use category (40%).

Land use components	Proportion in percent (Out of the total 40%)	Remark
Residence	50–60% (20–24/40)	Out of the residential housing proportion
• Pure	• (60–70%)	
• Mixed	• (30–40%)	
Business & commerce	15–20% (6–8/40)	
Social & municipal services	10–15% (4–6/40)	
Manufacturing & storage	5-10 (2–4/40)	
Administration	5–7% (2–2.8/40)	
Urban agriculture	1–3%(0.4–1.2/40)	
Special services	1–2%(0.4–0.8/40)	

Source: Structure Plan Preparation and Implementation Manual

allows minimum municipality involvement, it focuses on controlling development rather than managing it [41]. Therefore, this tool is also more important to bring uniformity in urban density among the urban centers than increasing urban density or preventing spatial expansion of the urban center. The total land area of the BUA land use category will be the sum of every piece of the plot area of each subcategory (i.e., urban services). The plot size of each urban service is determined by the Land Area Allocation Standards tool (section 4.5) to exert its influence on urban planning practice in bringing about a livable urban environment. In this study, such an urban land allocation approach is termed "part-to-whole" because it ultimately defines the limit of the total urban area.

4.5. Land area allocation standards

The fifth important tool that influences urban density is the "Land Area Allocation Standards". This tool determines the urban service density more significantly than the General Land-Use Proportion Standard tool by setting land area standards for detailed urban services. As per the Urban Service Assignment Standard (Table 5), approximately eighty-eight detailed urban services are provided to be assigned for urban centers of the country. However, on the one hand, the type and quantity of these urban services to be assigned are not the same but vary from level to level in the urban centers. On the other hand, the Land Area Allocation Standards are provided for only sixty-three detailed urban services, which is only 71.6% of the total number of provided detailed urban services (see Table 5). Nevertheless, the land area allocation standards for the remaining twenty-four urban services are filled locally through different mechanisms during urban plan preparation. The subsequent tables show the average (median of the minimum and the maximum) plot

Table 8
Land Area Allocation Standards set at the regional level.

Urban Services/Land Uses	Average Land Size Per a Service (In Hectares)	Average Population Served	Plot Size Per Person (In m^2)
Administration			
Wereda/Sub City Level Administration	1.75	90 K[a]	0.1944
City Level Administration	0.571875	1.2 M[b]	0.0048
Police Station	0.38125	90 K	0.0318
Court	0.38125	90 K	0.0318
Prison + Related Facility	14.44938 + 2.795025	1.2 M	0.1437
Health Facility			
Health center	0.5250	25,000	0.21
General Hospital	1	1,250,000	0.008
Specialized Hospital	3	4,250,000	0.007
Educational Facility			
Technical Vocational Education & Training	11.2242	90 K	1.2471
Municipality Service			
Waste Treatment Plant	2	1.2 M	0.0167
Water Reservoir, Disinfection/Chlorination Points	.03	90 K	0.0033
Recreational Facilities			
Residential Play Lot	0.13076	1500	0.8717
Neighborhood Play Ground	0.1868	6250	0.2989
Kebele Level Sport Field	2.33481	6000	3.8914
Woreda/Sub City Level Sport Field	4.24563	90K	0.4717
Regional Level Sport Field	5.90712	1.2 M	0.0383
Multipurpose Sport Center (Gymnasium, Swimming Pool, Circus Center)	1.5	90 K	0.1667
Cultural Center	0.1868	1.2 M	0.0016
Large Sport Fields Horse Race Ground, Golf Field	1	1.2 M	0.0083
Passengers Transport Terminal (Medium)	2.2650	1.2 M	0.0189
Passengers Transport Terminal (Large)	2.2650	1.2 M	0.0189
Freight Transport Terminal (Medium)	4.0650	1.2 M	0.0339
Freight Transport Terminal (Large)	4.0650	1.2 M	0.0339
Airport	126	1.2 M	1.0500
Residence	0.0176	4.5 (average house hold)	39.1111
Religious Center	0.25	1000	2.5
Telecommunication	0.2	90 K	0.0222
Substation	0.2	90 K	0.0222
Metrology Station	0.04	1.2 M	0.0003
Museum	0.1868	1.2 M	0.0016
Library	0.1364	90 K	0.0152
Children & Youth Center	0.0925	90 K	0.0103
Elderly Center	0.0985	1.2 M	0.0008
Orphanage	0.039	1.2 M	0.0003

[a] 90,000 population (sub city level) of the city can be served by the service.
[b] 1.2 million population (total city level) of the city can be served by the service.
Source: Industry Urban Development Bureau: Plot size standards for urban services Regulation No. September 2016.

size for the detailed urban services per capita that are currently utilized during the preparation of the 2020–2030 Bahir Dar city structure plan, corresponding to the sources of the Land Area Allocation Standards.

Internationally, the application of spatial standards as planning benchmarks has grown, and most nations now include them into planning practice. [69,70], including Ethiopia. In Ethiopia, most of the Land Area Allocation Standards are legally binding, similar to most Western European countries, except in English [71,72]. They are formulated to standardize the urban services and the land they should occupy across urban centers of the country. They are expected to exert their influence over urban planning practices in increasing the effectiveness and efficiency of land usage, giving more emphasis to a livable urban environment.

As already stated above, Bahir Dar City, the case study area, is categorized as the fifth level because its population is above 250,000. Thus, it is allowed to have eighty-six urban services. According to the respondent, i.e., the planning team, the majority (thirty-three or 38.4%) of the Land Area Allocation Standards of the total urban services assigned to the fifth-level urban centers are directly taken from the standards set at the regional level by the Amhara national regional state - Industry Urban Development bureau (see Table 8). As seen in the table, 39.1111 square meters is the largest plot size among the existing Land Area Allocation Standards, which is dedicated to the detailed urban service of "Residence" per person and has the greatest impact on urban density decline.

In addition, twenty–seven (31.4%) of the Land Area Allocation Standards for the total urban services assigned to fifth-level urban centers are taken directly from the standards set at the national level. Twenty-six of these are set by the Ethiopian Ministry of Urban Development and Construction, and the remaining one (Railways with Buffer land use) is set by the Ethiopian Railways Corporation (see Table 9).

According to the planning team, the standards, set at both the national and the regional levels, have been strongly insisted on being implemented during the preparation of the BDCSP by concerned local government planning agencies. Professionals and personnel from appropriate urban institutions, municipal administration, regional bureaus, and institutions may be a part of the local government planning agency. In this regard, the local authority (city administration) does not have the right to change these standards but is obliged to implement them as they are. However, by default, the local authority has the authority to set spatial standards for those that do not have standards yet. Therefore, according to the respondents, the planning team has used four different mechanisms to fill the

Table 9
The Land Area Allocation Standards set at the national level.

Urban Services/Land Uses	Average Land Size Per a Service (In Hectares)	Average Population Served	Plot Size Per Person (In m^2)
Administration			
Zonal Level Administration	0.571875	1.2 M	0.0048
Kebele Level Administration	0.30	6 K[c]	0.5000
Health Facility			
Primary Hospital	0.75	40,000	0.1875
Commerce & Trade			
Local Market Area	0.25	5000	0.5
Open Market Area	0.375	2000	1.875
Tertiary Market Area	1.75	6 K	2.9167
Secondary Market Area	5	90 K	0.0556
Primary Market Area	9	1.2 M	0.0750
Local Livestock Market Area	0.42	2000	2.1
Tertiary Livestock Market Area	0.725	6 K	1.2083
Secondary Livestock Market Area	1.34	90 K	0.1489
Primary Livestock Market Area	2.17	1.2 M	0.0180
Educational Facility			
Nursery	0.01225 (400 m radius)	753.6	0.1626
KG	0.1750 (1 km radius)	4710	0.3716
Primary School (1–4)	2 (2 km radius)	18,840	1.0616
Secondary School (9-12)	4.5 (4 km radius)	75,360	0.5971
Specialized High School	4.25 (4 km radius)	75,360	0.5640
Higher Educational Institution (College, University, Etc.)	4.25 (4 km radius)	75,360	0.5640
Municipality Service			
Higher Abattoir	2.25	1.2 M	0.0188
Fire Brigade	0.38	60,000	0.0633
Railways With Buffer	5.3 m gauge	1.2 M	0.1970
Cemetery	0.0002	1	0.0002
Electric & Communication System			
Regional Post Office	0.08	1.2 M	0.0007
Brunch Post Office	0.05	90 K	0.0056
Manufacturing & Storage			
Manufacturing & Storage	139.9012	1.2 M	11.6584
Civic, Cultural & Social Welfare			
Assembly Hall	0.8	90 K	0.0889
Theater/Cinema	0.8	90 K	0.0889

[c]6,000 population (kebele level) of the city can be served by the service.
Source: The "Urban Population Density Standard" set by the Ethiopian Ministry of Urban Development and Construction in 2012

gap in the Land Area Allocation Standards for the remaining 26.7% of the urban services.

4.5.1. Merging urban services

During the preparation of the BDCSP, the first mechanism used to fill the gap was merging urban services that did not have spatial standards into those that had already. Therefore, these urban services are determined locally to share the land with other urban services instead of allocating their own, which can contribute greatly to increasing the urban density. Hence, three detailed urban services are included in "commercial Activities Building" land use; one detailed urban service is determined to be included in any other land use as needed, and one other detailed urban service is included in NE (see Table 10).

4.5.2. Maintaining the Proportional Standards

The second mechanism used during the preparation of the BDCSP was maintaining the Proportional Standards for sub-categories of the BUA general land use category. As seen in Table 7, the Business & Commerce sub-category should account for 15–20% of total urban land use. To maintain the proportional standard of the sub-category of the land use, BDCSP dedicated 31.8184 square meters of land per capita for the "Commercial Activities Building Area" detailed urban service which is the second-largest plot size of the existing Land Area Allocation Standards that has the greatest impact on urban density decline, next to "Residence".

4.5.3. Adopting/adapting spatial standards

The third mechanism used during the preparation of the BDCSP was adopting or adapting spatial standards from other practices to fill the gap in the Land Area Allocation Standards for urban services. According to the respondents, these standards were not chosen with the idea that they would increase the density of the general urban area, but they were chosen based on the fact that they are sufficient and convenient for the intended specific urban service. Five detailed urban services are adopted/adapted from other similar experiences (see Table 11).

4.5.4. Taking the existing plot size

The fourth mechanism used to fill the gap is taking the existing plot size of the urban service or the number of existing similar urban services in the city as land area or quantity standards, respectively. According to the project office, a lack of adequate study and justifications are major reasons for using the mechanism. Hence, eight existing plot sizes of urban services are taken as the space standard and one of the existing numbers of similar urban services (the Federal Level Institutions) as the quantity standard (see Table 12). The average plot size of the urban service is calculated by multiplying the existing number of offices with the space standard set at the regional level.

In general, the results show that the existing urban land allocation approach, which is based on the Land Area Allocation Standards, results in approximately 127.4716 square meters in total for BUA per person for the city, i.e., fifth-level urban centers. Based on the general land-use proportion standard, this figure accounts for only 40% of the total urban land. Therefore, the land allocated for the RI and the "total urban land" per person would be 95.6037 and 318.679 square meters per person, respectively. On the other hand, as seen in Table 13, previous empirical studies discovered that the density of different major cities of the country was much less than the density, i.e., 318.679 square meters per person, resulting from this standard base urban land allocation approach [21].

Previous studies have also already revealed that the spatial expansion rate of urban areas in developing countries, including Ethiopia, is much higher than their population growth rate. This means that urban densities in these countries are steadily declining. On the other hand, if the existing urban land allocation approach were to be applied strictly all over the country, the spatial area of an urban center in 2010, i.e., 5166.716 sq. km [73] will be forced to become 20,666.864 sq. km in 2040, while the urban population will be 150 million by 2040 [74]. The projected land area will be equivalent to 1.8% of the total land area of the country, i.e., 1,129,300.4 km^2 [75] or approximately 12.8% of the arable land of the country, i.e., 161,870 sq. km in 2015 [76].

From the above discussion, three major points regarding the performance of the existing urban land allocation approach can be identified. First, it could not meet the required population density, i.e., 20 m squared per person, or bring about a significant change in minimizing the density of the urban centers compared to previous trends. Second, the findings indicate that more than half (70.9295 square meters) of the land size per person is dedicated to only two (2.3%) of the eighty-six urban services: residential and Commercial

Table 10
Merged urban services that do not have spatial standards but are included in those that have already.

Urban Services/Land Uses	Remark
Health Facility	
Clinic	Included in commercial Activities Building
Pharmacy & Drug Store	Included in commercial services
Commerce & Trade	
Financial Institutions	Included in commercial Activities Building
Municipality Service	
Communal/Public Toilet	Included in any land uses
Civic, Cultural & Social Welfare	
Public Space/Square/Plaza	Included in NE

Source: Planning Team/Unpublished report of BDCSP

Table 11
Adopted/adapted spatial standards for urban services.

Urban Services/Land Uses	Plot Size Per Person (In M^2)
Municipality Service	
Solid Waste Transfer Station Sites	0.006
Solid Waste Disposal Site	0.0167
Transport	
Rail Station/Terminals	1.9022
Civic, Cultural & Social Welfare	
Rehabilitation Center	0.1854
Special Service	
Reserved Area	6.9128 (5% of the total built up area)

Source: Planning Team/Unpublished report of BDCSP

Table 12
Existing plot sizes of detailed urban services taken as standards.

Urban Services/Land Uses	Plot Size Per Person (In m^2)
Administration	
Federal Level Institution (office)	0.0095
Regional Level Administration	0.0064
Sectoral Offices	0.6354
Ngo	0.1589
Health Facility	
Referral hospital	0.0588
Animal Clinic	0.0115
Transport	
Harbor	0.0021
Civic, Cultural & Social Welfare	
Historic And Heritage Site	1.0554
Special Services	
Military Camps	2.7516

Source: Planning Team

Table 13
Urban density resulting from major challenges hindering the density of development.

Sample Cities	Urban density in square meters per person
Addis Ababa	76.923
Hawassa	91.743
Dire Dawa	93.458
Dessie	156.250
Jimma	227.273
Mekelle	243.902

Source [21].

Activities, even though five (5.8%) of the urban services are included in the "Commercial Activities Building Area" (see Table 7). In other words, the existing framework allocates 55.6% of the urban land for only 8.1% of mandatory urban facilities for all urban levels, which makes the rapid horizontal expansion of urban centers inevitable, as it allocates land (buildup) areas not space (floor) areas. Because the required space area can be easily achieved by increasing the vertical floors, i.e., densification. Third, the land approach allocated 223.0753 square meters of urban land per capita solely to the built environment, excluding NE. Meaning, when the urban population increases by just one person, 223.0753 square meters of natural ground will inevitably be converted to an impervious surface with its other negative consequences on the environment [77].

Moreover, taking the national annual urban population growth rate, i.e., 4.732% in 2020 [78], the existing land allocation approach of the country with the total BUA requirement standard for a person, i.e., 223.0753 sq. m, will force the consumption of all rural land areas, i.e., 1,117,893.375 [79] of the country after 127 years, i.e., by 2147. If the population growth rate becomes higher, as Statista reported, the current rural lands would be consumed much earlier. According to the report, the 25 million urban population of the country in 2020 will be 74.5 million in 2050 [80]. This means that, as per the projection, the urban population of the country will triple within 30 years, which can have a direct impact on land consumption by the urban areas.

To date, this study is limited to examining the contribution of the aggregate effect of existing Ethiopian urban land allocation criteria to urban densification. Therefore, it does not refer to the appropriate land area that should be allocated to each urban service to achieve the desired urban density from an Ethiopian perspective.

5. Conclusion & recommendation

Among the problems observed in many developing countries in relation to the growth of cities, the rapid geographic expansion of urban areas and the related multidimensional problems are widely mentioned. Therefore, these countries, including Ethiopia, have been struggling to tackle the problem. Accordingly, Ethiopia's "Urban Development Policy" and "Urban Planning and Implementation Strategy" were legal provisions designed to influence urban planning practices in terms of increasing urban density and sustainable development. In this regard, "Urban Population Density Standard", "Urban Classification and Service Assignment", "General Land-use Proportion Standard", "Detailed Land-Uses Proportion Standard", and "Land Area Allocation Standards" were the most important tools. However, this study revealed that the tools could still not bring about the desired higher urban density compared to the previous densities [21]. Conversely, Ethiopia's land allocation policy has also been one of the main reasons for the declining urban density and rapid horizontal spread.

The Land Area Allocation Standards are the backbone of the country's existing urban planning and land allocation policy. Currently, they determine the urban density more significantly than the other tools by setting land area standards for detailed urban services. The policy involves allocating land from a "part-to-whole" approach. As the Land Area Allocation Standards have already determined the plot size for every urban service, ultimately, the policy makes up and defines the limit of the total spatial area of the urban center. However, the findings of this study show that the existing "part-to-whole" allocation approach gives more emphasis to "livability" than "sustainability". Because the approach does not consider the needs of the rural people and the future generation, it pays more attention to the immediate and concrete conditions and allocates an average of 223 square meters of land for urban development for every additional urban inhabitant. The study also reveals that in countries such as Ethiopia, where rapid urban population growth is occurring, such a population-based land allocation approach is ineffective in achieving high density.

Thus, unless corrective measures on the existing land allocation policy are taken, all natural and agricultural land might be consumed by the built environment rapidly. In Particular, as most of the urban centers of the country are found in the middle of agricultural lands [81], these fertile agricultural lands will be consumed much earlier than other areas. Hence, the study recommends that the existing Land Area Allocation Standards need to be reexamined to improve land efficiency according to local contexts and from the perspective of a balance between the concept of sustainability and livability. Moreover, the results show that more than half of the urban land size per person is dedicated to "Residential" and "Commercial Activities Building" areas, so the study suggests that interventions should focus primarily on these urban services.

6. Policy recommendations

This study suggests revisiting the existing land allocation policy and proposing a "from Whole-to-Part" approach as an alternative urban land allocation approach. Like an approach for global learners who want answers in terms of the overall goal or purpose of the assignment [66], the proposed approach may involve, first, understanding the land resources available and then, developing flexible land area standards for efficient and effective use of the scarce land resources. However, to minimize land consumption significantly, further investigation into the proposed approach and other alternative strategies should be carried out.

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Author contribution statement

Behailu Melesse Digafe: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Achamyeleh Gashu Adam, Gebeyehu Belay Shibeshi: Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

No data was used for the research described in the article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2023.e17557.

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