ORIGINAL ARITICLE

Land-Use Deviation from the Structural Plan in Injibara Town, Amhara National Regional State, Ethiopia

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Abstract

The study's overall goal was to examine Injibara town's land-use deviation from the structural plan. The town's land-use deviation has been a cross-cutting issue. As a result, the research looked at the degree of land-use deviation between the plan and actual land-development execution. Besides, the research demonstrated how much land-use deviation influences a town's land-use pattern. The study also looked at how residents felt about the urban governance that led to land-use deviation. The study used geospatial analysis, surveys of residents, and interviews with urban planning and land administration officials to comprehend all of the above. The study's findings then highlighted inconsistencies between the official plan and its implementation regarding land usage. The size of the land-use deviation was astounding. All land-use categories have increased or decreased in comparison to the plan. Residents believe that the deviation was caused mainly by lack of enforcement of existing laws. Consequently, the city administration did not adequately implement land-use development in the planning period. Accordingly, this improper implementation reshaped the land-use pattern. Land-use deviation negatively affected the implementation process of the land-use plan of the town. Finally, the study recommended ways to improve future land-use planning and implementation and further research the lesson.

Keywords*: Injibara, structural plan, land-use planning, land-use deviation, implementation*

Introduction

Land use is closely related to human activities and natural conditions. Agriculture and livestock raising, forest harvesting and management, urban and suburban construction, and development are all directly related to human land use (Owoeye & Ibitoye,2016). There is no single known source of land use deviation globally (Lutzenberger et al.,2014). However, population, economic development, institutions, technology, and culture are the significant reasons for land use deviation, according to a worldwide environmental research study (Mather,2006). Political, legal, economic, and cultural issues influence land-use deviation decisions (Lutzenberger et al.,2014). The dynamics of land-use deviation and the causes that drive it are complex and dynamic (Belayneh Bufebo & Eyasu Elias,2021). Political instruments, for example, were the cause of land-use changes in Argentina and Brazil (Lutzenberger et al., 2014).

Typically, land-use deviations occur when there is a lack of clear and rational urban land-use planning and when appropriate urban land-use development planning is neglected (Gao et al.,2021). Land-use deviation also attributes to urbanization, which results in significant changes in land-use patterns.

Demographic changes contribute more than any other causal element for land-use change.

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Belayneh Bufebo & Eyasu Elias' (2021) study and further researches imply that economic considerations are also the key drivers of land-use deviation. Other contributing elements to land-use deviation are land-use activities such as house development, agriculture, and deforestation (Owoeye & Ibitoye, 2016). Because of deforestation in Africa between 1990 and 2010, nearly 75 million hectares of forest land (10 percent of total forest area) had been converted to other uses, and Africa has the second-highest rate of net land cover change per year at 0.36 percent after Southeast Asia's 0.71 percent (Cotula et al., 2009). Africa has the second-highest rate of net land cover change each year, at 0.36 percent, behind Southeast Asia's 0.71 percent (Cotula et al., 2009). Grassland, woodland, and other vegetated regions in Africa are turned into agricultural and settlement areas, and this phenomenon is increasing (Alelgn et al., 2021). The same source indicated that, between 1975 and 2000, Africa lost 16 percent of its forests. In addition, 5 percent of its wood and grasslands result in the loss of almost 50,000 km2 of natural vegetation a year. The majority of forest land are converted to agricultural and urban settlement areas. According to a study by Owoeye and Ibitoye (2016), there have been large conversions from forest land use to farmland and agriculturally productive land and forestland to residential and other private and public uses. These conversions are primarily the result of land-use deviations caused by various factors that might intensify each other (Lutzenberger et al., 2014).

Another critical aspect of land use deviation is residents' perceptions of its causes. Reality does not always match our perceptions. The sugarcane production study by Ortolan et al. (2017) found that the perception of most respondents was in line with existing academic understanding about the effect of large-scale sugarcane production ecosystem services. According to Ortolan et al, perception was a powerful instrument for finding gaps in scientific knowledge communication and establishing better policies and regulations. However, perception studies prejudices seek a highly definite and objectively measurable sign. There is a need for subjective measurement that captures an individual's impression, aspiration, satisfaction, and disappointment. According to the land-use change study findings, there is a relationship between perceptions and future land-use change intentions (deviation) (Fenga et al.,2020).

Ethiopia's land-use change/deviation has followed a pattern comparable to the rest of the world in general and Africa in particular (Alelgn et al., 2021). Ethiopia's reactive and control-oriented approach to land-use planning and execution, notably in Injibara, is somewhat outdated. Uncoordinated and unplanned growth patterns are more likely to occur due to poor land-use planning and implementation, promoting urban sprawl and significantly damaging inhabitants' quality of life (Yin,2012). The administrative and legal structures for supporting urban development are insufficient, and there is little tradition of constructive land-use planning to make things happen. (UN-Habitat,2014). Land-use planning is undoubtedly the most effective tool accessible to planners, but they shouldn't be too concerned if it doesn't solve all of their problems. Because land-use planning has a powerful influence on urban policy, land-use planning requests shift from representative governance to good governance. Particularly, participatory governance enhances public participation and involvement mechanisms in policy development and vocal rights within decision-making structures in the land-use planning process (Hall & Jones, 2011). Besides, land-use planning has a collective potential to change urbanization processes (Harvey,2008, cited in UN-Habitat,2014). It is also an essential component of a plan because it dictates the quantity of land used by a municipality and the choices made about all of the other plan components (Yin,2012).

Disparities in land usage are common in cities due to a variety of variables. The concept of assessing a deviation from a plan is straightforward, but it might be challenging to do it

technically (Padiero,2016). In Israel, empirical assessments focused on conformity (Alfasi et al.,2012). The majority of research focused on achieving a goal by employing technology advancements in GIS and remote sensing to ensure that development followed the plan (Abrantes et al.,2016). The evaluation of plan execution has primarily taken place in industrialized countries, with less attention paid to emerging countries. On the other hand, cities in developing countries are growing fast, and the planning system is ineffective (Liu et al.,2020). Improper execution of urban land-use plans, referred to as land-use deviation, is caused by an inefficient urban land-use planning system.

In both emerging and developed countries, the land-use deviation is a severe problem. Despite its significance, there is no sufficient research on land-use deviation that analyses the deviation between planned and existing urban land use globally, notably in Ethiopia's Injibara town. Furthermore, available studies, notably in Ethiopia, were overly general and focused chiefly on rural land usage. Consequently, the study chose Injibara town because it has a high rate of urbanization and urban land-use implementation deviation. However, Injibara town's land-use plan hasn't been implemented properly. For a long time, the anticipated complete urban transformation has not been realized. Residents have also expressed their dissatisfaction with the land-use deviation.

In view of that, this study's goal was to determine how much Injibara town's land-use deviated from the structural design. Similarly, the study's specific objectives were:
• to assess the magnitude of land-use deviation
• to demonstrate how the land-use deviation shaped the town's land-use pattern, and
• to assess residents' perceptions of urban governance that triggered land-use deviation during the implementation of an urban land-use plan in Injibara town

In terms of contribution, this research looked at the Injibar land-use deviation that occurred during structural plan execution. It may also serve as an alarm call for towns and local governments to address land-use deviation issues. The study's findings lead to better governance in urban land-use planning and implementation. By the same token, the study can help urban land-use planners, decision-makers, and local governments to provide information and knowledge regarding the magnitude of land-use deviation, its extent, and people's perceptions of the critical reasons for land-use deviation. It can as well be used as a source of information for future research by other scholars.

Methods and Materials

Location of the Research Area

The researcher carried out the study in the Ethiopian town of Injibara, in the Awi Zone of the Amhara National Regional State. Injibara is the administrative center of the Awi Zone and is located in the Amhara Regional State. Its latitude and longitude coordinates are 10057'0" north and 36056'0" east, respectively. It's about 435 kilometers from Addis Ababa and 118 kilometers from Bahir Dar (Regional Urban Planning Institute, 2019).
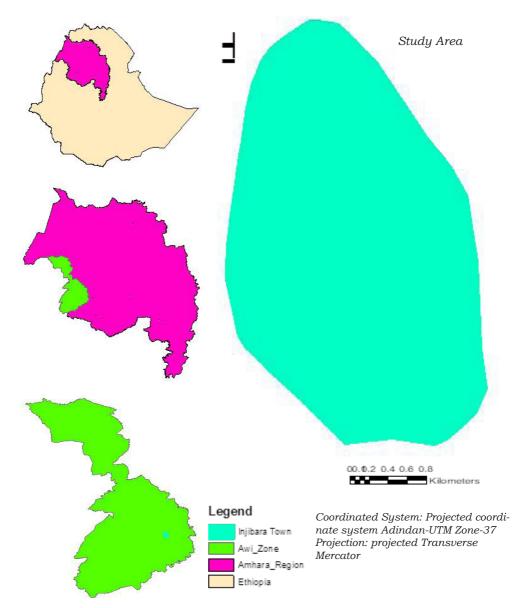
Figure 1: Location map of the study area (Sources: Extracted from Ethio-GIS & Amhara National Regional State Urban Planning Institute)

Research Design

The researcher has purposefully chosen Injibara town as the case study area. The study then employed geospatial analysis, resident surveys, and interviews with professionals. The researcher used a land-use field observation survey to collect existing general land-uses in the planning area at the block level, which were then encoded to ArcGIS and used to create an existing land-use map of Injibara town using orthophoto. The current land-use development has been considerably revised based on the Injibara town structur-

al plan 2009-2019. Using ArcGIS 10.4, the geospatial analysis approach investigated the deviation between actual urban land usage and the town's formal structural plan. In addition, after taking a representative sample, the current perception of inhabitants toward urban-governance difficulties that caused land-use deviation in the research area was studied. For perception evaluation, the resercher established a case study on households in planning area of the town. The 12,082 households projected by the central statistics agency for current structural plan preparation comprised the study population for this research (Regional Urban Planning Institute Report, 2019). It was; however, costly to visit every resident in the planning area. As a result, the researcher drew a sample from the entire town's households, and the study population for this research consisted of household heads. The researcher decided to take the margin of error of 5%. Using the Yamane (1967) formula, the sample size for the research was calculated as follows:

$$(1)$$

$$n = \frac{N}{1 + N(e^2)}$$

n=12082/ (1+12082(0.05²)) =388

Where **n**= represents the sample size, the researcher used

N= represents the total number of households in the study area

e= represents maximum variability or marginal error (5%)

1= represents the probability of the event occurring

Following sample determination, the study employed the probability sampling technique of systematic random sampling to survey the entire target population. The researcher used non-random sampling with the purpose that the officers in charge of urban planning and land administration are generally used as judgmental sampling. Two officers from each profession were chosen as a sample to acquire important information regarding the root cause of land use deviation and to triangulate the residents' perception research results. Systematically, every fifth home interval, the researcher used a door-to-door survey approach to obtain primary data from the town's residents and conducted interviews with professionals.

The study acquired secondary data from books, journals, papers, and structural plan documents (both spatial and reports). Then, to evaluate and summarize, both qualitative and quantitative analytical approaches were used. The land-use deviation was also analyzed using geospatial analysis. The level of land use deviation and people's perceptions of urban governance drive land-use departure from the structural plan in Injibara town employed descriptive statistics. Finally, the study presented the study's findings as tables, numbers, percentages, area, descriptions, and maps.

Result

Extent Land-use Deviation from 2009 to 2019

Land use is a human attempt to meet life's demands by interacting with the land's physical resources. Accordingly, there has been a deviation in land use and pattern based on the data collected in this study. The following are the ten distinct land-use classes that the results of the amount of the land-use deviations presented in:

Residence

The structural plan proposed 362.10 hectares for residential land use, while the actual residential land use discovered under this analysis at the end of the planning period was

243.98 hectares. The geospatial analysis result of the residential land use type study in Inibara town revealed a deviation of 118.12 hectares from the structural plan. The general area of residential land-use implementation was less than anticipated in the town's structural plan. In terms of deviation from the plan, the residential land-use area came in fifth. The following map depicts the difference between the actual and the planned results.
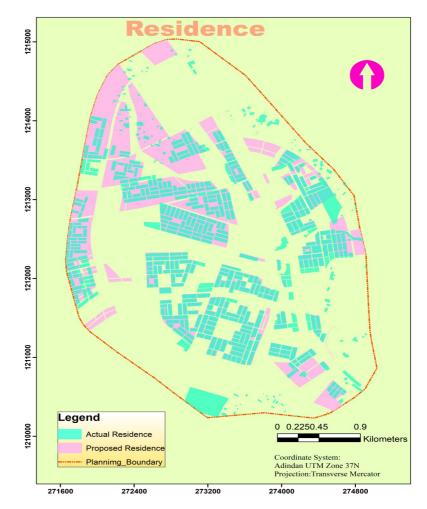

Figure 2: Manipulated by researcher, 2020

Commerce and Trade

The structural plan proposed 95.32 hectares for commerce and trade land use, while the actual commerce and trade land use identified under this analysis at the end of the planning period was 41.13 hectares. The geospatial study of the commerce and trade land-use type revealed a departure of 54.19 hectares from the structural plan. According to the geospatial analysis, there was a discrepancy between the present use and the plan. It revealed that the town's structural plan was implemented lower than the proposal of com-

merce and trade use. The land-use area for commerce and trade ranked sixth in terms of deviation from the plan. The following map depicts the difference between the actual and the planned results.
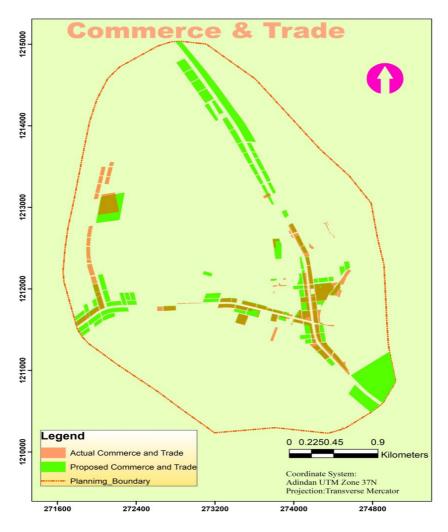

Figure 3: Manipulated by researcher, 2020

Administration

The administration land-use proposal in the structural plan was 23.82 hectares, but the actual administration land-use found under this study at the end of the planning period was 13.00 hectares. The geospatial analysis result of administration land-use type in Injibara town showed that 10.82 hectares deviation from the proposal of the structural plan. The general area of administration land-use implementation was lower than expected, but the area deviation was slightly lower than other land-uses. Administration land-use area was 9th in its deviation from the plan. The deviation between the plan and actual land-use
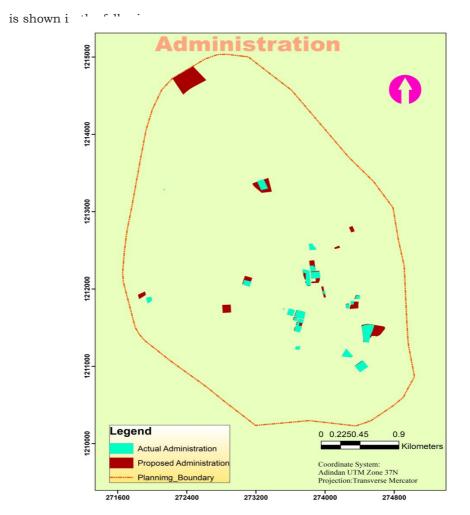
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Figure 4: Manipulated by researcher, 2020

Service

The service land-use proposal in the structural plan was 107.32 hectares, but the actual service land-use found under this study at the end of the planning period was 410.24. The geospatial analysis indicated that the deviation levels for service correspond to 302.92 hectares from the proposal of the structural plan. It consumed beyond land allocated in the structural plan to fulfill the demand of the community. The result showed that the highest level of deviation from the structural plan. The service land-use deviation study also identified that service land-use consumed land outside the town's planning bound-ary. The service land-use area was the 1st in its deviation from the plan. The deviation between the the plan and actual land-use is shown in the following map.
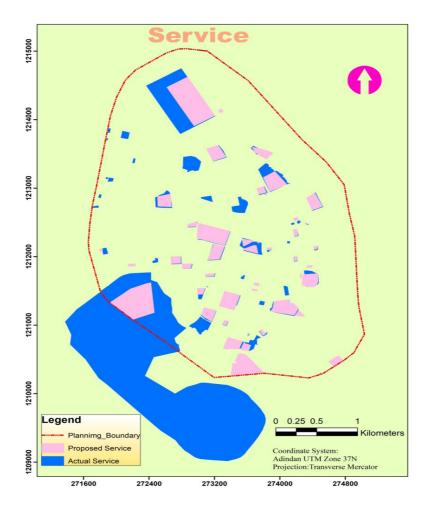
Figure 5: Manipulated by researcher, 2020

Recreation and Open Space

Recreation and open space land-use proposal in the structural plan was 54.05 hectares but actual recreation and open space land-use found under this study at the end of the planning period was 220.40 hectares. Recreation and open space land-use deviated to 166.35 hectares from the proposal of the structural plan. Recreation and open space use tend to experience a higher deviation compared to its proposal. The deviation was due to unused open spaces proposed for other uses were used for recreation and open space by the town. The study identified recreation and open space consumed additional land from the structural plan. There was a lack of proper land-use utilization for specified uses. Recreation and open space land-use areas were 4th in their deviation from the plan. The deviation between the the plan and actual land-use is shown in the following map.
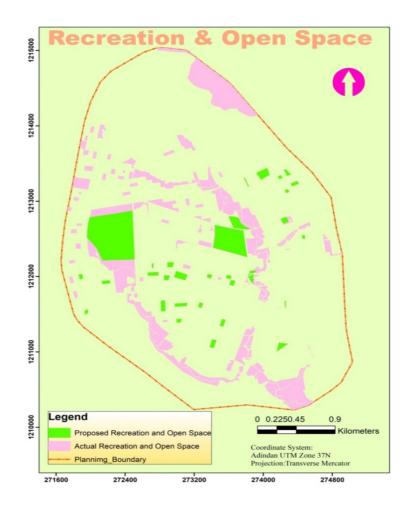
Figure 6: Manipulated by researcher, 2020

Road and Transport

The road and transport land-use proposal in the structural plan was 145.52 hectares, but the actual road and transport land-use found under this study at the end of the planning period was 135.96 hectares. Road and transport land-use deviation from the proposal of the structural plan was 9.56 hectares. Road and transport land-use area was 10th in its deviation from the plan. Road and transport use tended to experience the slightest deviation from the formal plan. The deviation between the actual and the plan is shown in the following map.
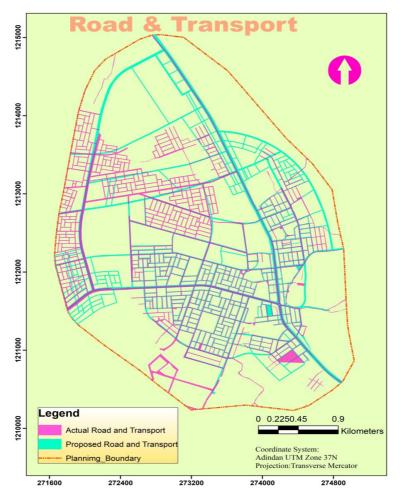
Figure 7: Manipulated by researcher, 2020

Manufacturing and Storage

The manufacturing and storage land-use proposal in the structural plan was 48.88 hectares. Still, the actual manufacturing and storage land-use found under this study at the end of the planning period was 34.46 hectares. Manufacturing and storage land-use deviation from the proposal of the structural plan was 14.42 hectares. Manufacturing and storage land-use area in deviation was 8th in its deviation from the plan. The result showed that the town administration hasn't played an important role in expanding industries and related activities. The deviation between the actual and the plan is shown in the following map.
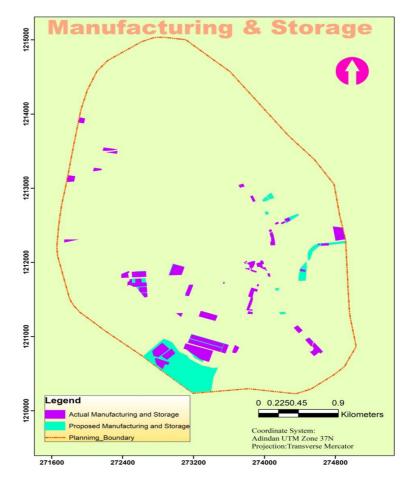
Figure 8: Manipulated by researcher, 2020

Forest

Forest land-use proposal in the structural plan was 210.50 hectares, but the actual forest land-use found under this study at the end of the planning period was 33.08 hectares. Forest land-use deviation from the proposal of the structural plan was 177.42 hectares. There was lesser conformity to the structural plan. Forest land-use area was 3rd in its deviation from the plan. The analysis showed the lower structural plan implementation for forest use in the study area. The deviation between the actual and the plan is shown in the following map.
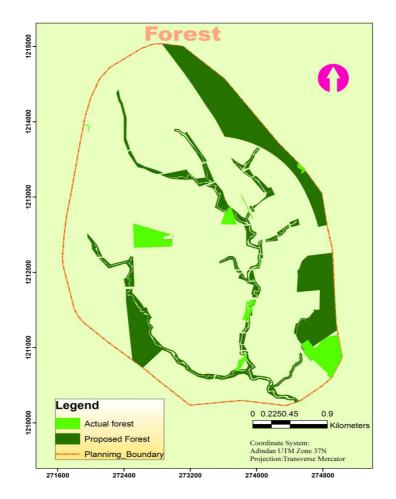
Figure 9 Manipulated by researcher 2020

Urban Agriculture

The urban agricultural land-use proposal in the structural plan was 85.58 hectares. Still, the urban agriculture land-use found under this study at the end of the planning period was 314.02 hectares.Urban agriculture land-use deviation from the proposal of the structural plan was 228.44 hectares. This land-use area was the 2nd highest deviation from the plan. Farmers living in the built-up and non-built-up areas of the town are engaged in agricultural activities such as crop growing. Most of the areas found in the expansion are currently utilized for agriculture. The deviation between the actual and the plan is shown in the following map.
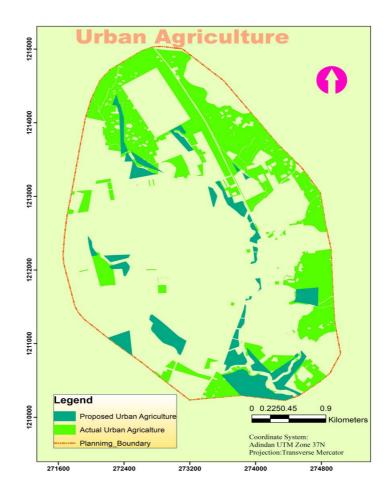
Figure 10: Manipulated by researcher, 2020

Special Function

Special function as land use in this study incorporated streams, gullies, and reserved land for unforeseen development. Special function as a land-use proposal in the structural plan was 59.40 hectares, but actual special land-use found under this study at the end of the planning period was 16.28 hectares. Special function land-use deviation from the proposal of the structural plan was 43.12 hectares. Special function land-use type was 7th in its deviation from the plan. The study result showed that the deviation was mainly because of land allocated for unforeseen development but used for other uses. The deviation between the actual and the plan is shown in the following map.
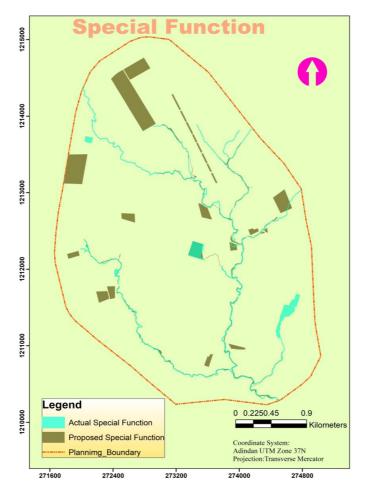
Figure 11: Manipulated by researcher 2020

Perception of residents, urban planners, and land administrators on urban-governance that triggers land-use deviation

The respondents replied that different causes have resulted in Injibara town's urban land deviation. Table 1 describes the significant causes of land-use deviations in the town. In terms of problems of planning, it has been reported that 77% of the respondents occurred to agree and 23% has reported to disagree in the study area. Ninety percent of the respondents agreed and 10% disagreed that the lack of proper implementation regulations was a cause in the study area. Furthermore, Weak enforcement of the existing law also took place. Ninty two percent agreed that the cause of land-use deviation was weak enforcement of existing law and 8% disagreed.

At last, another major cause of land-use deviation was the lack of public participation in the urban development plan of the study area. It is reported that 87% of the respondents agreed and 13% disagreed on the above cause. Overall, 87% of the respondents agreed,

and 13% disagreed on land-use deviation's causes.

The study undertook interviews with urban planners and land administrators of Injibara town about the causes of land use deviation in the town. The interview responses were similar to the residents' survey results. It revealed that the fundamental reason for land use deviation in Injibara town was the weak enforcement of the existing law.

The table below shows the results of the causes of land-use deviation in the study area.

Table 1: Perception of residents on urban-governance that triggered land-use deviation

No.	Urban governance that triggered land-use deviation	Categories	Number	Percent
	Problems of planning	Strongly agree	157	40.3
		Agree	141	36.4
		Disagree	78	20.1
		Strongly disagree	12	3.2
		Total	388	100
	Lack of proper implementation regulations	Strongly agree	215	55.3
		Agree	135	34.7
		Disagree	30	7.9
		Strongly disagree	8	2.1
		Total	388	100
	Weak enforcement of the existing law	Strongly agree	196	50.5
		Agree	164	42.2
		Disagree	21	5.4
		Strongly disagree	7	1.9
		Total	388	100
	Lack of public participation in the urban development plan	Strongly agree	184	47.3
		Agree	154	39.8
		Disagree	28	7.3
		Strongly disagree	22	5.6
		Total	388	100

Source: Field survey 2020

Discussion

The study results on the magnitude of land-use deviation determined high land-use deviation from the formal plan. All land-use categories under the study have significantly deviated from the formal structural plan of Injibara town. Likewise, the deviation was illustrated in figures 2,3,4,5,6,7,8,9,10 and 11. The research found that the land-use implementation and the land-use pattern of Injibara town deviated from the structural plan significantly in its planning period. The land consumption in Injibara town exceeded the capacity of the town stipulated in the structural plan. The overall land-uses overran the plan by 270.06 extra hectares of land. The non-conforming land-use significantly shaped the land-use pattern of Injibara town differently. These were some of the indications of poor planning and implementation in the town. The land provided for Service

within and out of the town's planning boundary was enormous. It consumed extra 302.92 hectares, and it is the first massive non-conforming land-use development of the town (figure 5). The land-use plan implementation was not as predicted in the planning stage of the town's structural plan. Moreover, massive non-conforming land-use developments in other land-use categories such as urban agriculture consumed 228.44 extra hectares. It was the second-largest massive non-conforming land-use (figure 10). However, contrary to service and urban agriculture, forest and residence consumed less than what was proposed in the formal plan. The land-use deviation for forest and residence were massive non-conforming land-use that deviated by 177.42 and 118.12 hectares, respectively, from the structural plan (figure 2 & 9). Service, urban agriculture, forest, and residence were among huge land-use deviations. Such kinds of unintended massive land-use deviations in urban land-use plan implementation were due to complex and competing demands of urban and regional situations (Stevens et al.,2018). Aspinall & Hill (2008) identified four broad approaches to measure and report land-use deviations. These were area deviation (loss or gain in the area extent), transformation (the pattern of transition from one land-use to another), dynamics (rates of change and periodicity in area extent of transformations), and prediction. Among the aforementioned types of deviation, agricultural land was remarkable in cities of developing countries (Islam & Hassan,2011). In Injibara, the highest and remarkable deviation was service. Agriculture was the second. Here the urban plan implementation is likely to contradict specific land-use deviation (Friedmann, 2011). The study results on the extent of land-use deviation and change in the land-use pattern of the study of Injibara town from the structural plan revealed that the land-use development implementation was not according to the formal structural plan. The land use deviation from the structural plan has led to improper urban land use plan implementation, consequently low utilization efficiency of land resources (Cai et al.,2020).

The study considered the locals' perceptions of the causes of land-use change in the study. Perception is widely recognized as influencing land-use decision-making processes (Fenga et al.,2020). It is also crucial because humans use the information to construct perceptions, according Fenga et al. There is a lot of evidence that numerous circumstances impair our capacity to process this information objectively. Perceptions directly impact a person's decisions and can have a significant impact on land-use changes. As a result, we must comprehend the level of public opinion of land use deviation, which leads to urban governance issues.

The study results also showed the residents' perception of the significant causes of land-use deviation in the town. According to residents's perception study result, the leading cause for deviation (92% of respondents agreed) was weak enforcement of the existing law, which was the most noticeable cause of land-use deviation in the study area. The lack of proper implementation regulations was the second most significant cause for the deviation. Concerning existing law, urban planning law, proclamation 574/200 has been enacted. The law aimed to establish a legal framework to promote planned and well-developed urban centers and regulate and facilitate development activities in urban centers to enhance their economic development. However, the proclamation has no rules and regulations to apply at the local level. The absence of rules made cities weak in terms of enforcement capacities because the declaration has enacted broader and general issues. It needs further detail enacting rules and regulations, for it lacks in Ethiopia, particularly in Injibara town.

Another critical factor of land-use deviation in the research area was public participation. One of Ethiopia's urban development process problems explicitly addressed in the federal urban development strategy document was participation. It has become a perpetual prob-

lem for land use deviation in Injibara town (87% agreed). Therefore, urban land use development planning and implementation were not practical due to the lack of participation in the process. Sense of ownership did not ensure land use implantation.

The quality of structural plan components extensively studied globally (Park.,2020). It was one of the primary causes of land use inconsistency. In Injibara town, the study identified land use deviation as an issue (77% agreed) due to low structural plan quality. The overall good-governance problems were the cumulative results of planning, lack of proper implementation regulations, weak enforcement of the existing law, and public participation in the urban development plan. Urban planning has played a good-governance role within the planning area. Still, it has led to a disorderly development in the surrounding area adjacent to the planning area, which caused a greater spatial scope of governance failure (Deng & Srinivasan, 2016). Land-use follows a multi-level governance set of land-use planning procedures such as setting town vision, goals, implementation strategies, and the likes. The quality of design of the plan is a fundamental tool to confirm the generating and governing principles of urban space and, more generally, the overall development of the town and territory (Maria et al., 2019). Almost all planners (97 of 104 respondents) indicated that plan quality is an important consideration when creating new plans (Guyadeen, 2018). According to a study by Guyadeen(2018), updating existing plans and plan quality is also directly linked to implementation, and quality means that the plan is legible, easily understood, and tackles complex problems clearly and transparently
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o effectively manage and alleviate problems and ensure sustainable development, land-use planning has been applied as a policy tool. In the Netherlands, land-use plans are planned following a strict guideline called 'standard comparable land-use plans'. It allows for a strict distinction between what kinds of activities with zoning and land-uses can be regulated by multiple planning instruments (Yilmaz et al.,2018). Proper enforcement might influence citizens, businesses, and governments towards a more conservative approach. Most studies provide evidence for positive outcomes of properly implemented growth management instruments on land-use systems, but poorly managed tools and approaches might contribute to inflated land-use deviation. Current urban development control, mainly concerned with land-uses and building details, tends to be reactive and ineffective in guiding positive management of change to land development. And planning policy/law/regulation has not addressed some of the most defining and ongoing land development of the town (Lei et al., 2021).

Conclusion and policy implication

The study result of the extent of the land use deviation revealed that the land-use development in the planning period of the Injibara town was not correctly implemented, and there were massive land-use deviations and plan violations. The deviations either increased or decreased from the proposal as they are illustrated in figures 2,3,4,5,6,7,8,9,10 and 11. Every land-use type was not implemented free of deviation in the town. Three land-use categories such as service, urban agriculture, recreation & open space were among massive deviations due to an increase in area used from the structure plan of the town. The other use deviations were decreasing in size from the plan proposed use for them. Every land-use type's deviation reshaped the land-use pattern of the town. The land-use deviation negatively affected the implementation process of the land-use plan in the town, and it did the land-use development of the town unsuccessfully implemented.

The study evaluated the residents' perception of urban governance that triggered land-use deviation in Injibara town. The main contributing factors arisen from the failure of good

government were poor planning, lack of proper implementation regulations, weak enforcement of the existing law, and lack of public participation in the urban development plan. Among the good-governance problems, weak enforcement of the current law to which 92% of respondents agreed was the leading factor that triggered land-use deviation. Weak enforcement is the characteristic of weak local government. Moreover, the town administration was weak to land use-related policy/regulation devising and empowerment.

Ethiopia is among fast urbanizing countries and has moved away from a command-and-control economy into a market-oriented economy and encountered rapid urbanization as a consequence. To ensure a desired urban growth pattern entails tremendous challenges for the planners. Without proper urban land-use planning and implementation of towns and cities, trends would face a significant challenge. It requires both realistic urban land-use plans and effective urban land-use development control mechanisms. Besides, the planning system must be applied to good urban governance to cater to new demands for the social and economic development of the country in general and towns and cities in particular. The urban growth and land-use pattern can efficiently examine the plan by employing GIS and remote sensing techniques. The deviation between the actual land use and the planned one can be identified and analyzed at different scales. It provides an efficient measure to monitor urban development and to inform planners about the land-use deviation. More importantly, it gives planners feedback about the plan's effectiveness and the urban land development control. It also helps update the plan or strengthen the development control, which is very important for establishing a proper urban planning system. The researcher believes variables are relevant to a better understanding of the complicated issues of land use deviation and their causes concerning the future urban growth of developing countries in the world. As a result, the following policy implications for future urban land-use planning and implementation have been proposed based on the current findings:

- It is necessary to formulate appropriate national and regional land-use development policies which can tackle land use deviation. For proper implementation of land use plans in the future, a policy followed by different land-use strategies, proclamations, regulations, and rules to a local level to foster the country's economic development is mandatory. There should be legally binding documents that cities and towns should appropriately implement to cope with the land use deviation.
- The impact of land-use deviation should be studied and reviewed regularly for socio-economic and environmental changes.
- Land-use deviation analysis with remote sensing techniques may help policymakers and the local government for urban land-use development.
- Urban land-use planning and implementation should be undertaken with the actual good-governance application for improving poor planning, preparation of detailed implementation regulations, vigorous enforcement of the existing law, and engagement of the public in all urban development plans.

Finally, the researcher recommends further research on the impacts of land-use deviation on residents, which was not covered in this and other studies.

Declaration of Competing Interest

The author declares no conflict of interest.

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