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Evaluating Implementation of Adama City Land Use Plan Using Conformance-Based Approach

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Abstract

Fundamental goal of urban land use plan is to ensure sustainable development of urban areas. By controlling urban development scale and limiting urban construction scope it will conserve ecological sensitive areas; ensure effective use of existing resources and balanced development; and support smart growth. However, presently it is unclear that how well urban land use plan is being implemented after plan adoption and major factors contribute to the variation of its implementation in Adama City, Ethiopia. The research examines the extent to which Adama City Land use plan functioned from 2004 to 2014 is guided and controlled the spatial development of the City by measuring the degree to which actual land use outcomes over a ten-year period conform to the plan intention. First, existing land uses of the City are spatially mapped; and digital land use plan map is generated. Second, conforming, non-conforming, and unfulfilled developments are identified through morphological conformity assessment using spatial overlay analysis in Geographic Information System (GIS) environment. Third, two indicators on construction boundary control are used, through which the effectiveness of boundary containment, and proposed land sufficiency are explored to highlight the effectiveness of the plan. The findings of the study demonstrate that despite the area proposed by the plan is large enough to accommodate new developments; the plan has met difficulties to control and guide new spatial developments of the City. Moreover, the limited implementation of the plan mainly attributed to geographic variables, monitoring and evaluation, lack of commitment, and political influence. The study provides insight into land use plan implementation as sufficient plan design only by itself will not insure plan implementation. Moreover, it would support sustainable spatial policy and direction of spatial development with respect to sustainable urban environment and creating a balance between ecological and socio-economic needs.

Key words: *land use plan, master plan, urban planning, green spaces*

CONTENTS

INTRODUCTION

1.1. Background and Justification

Fundamental goal of urban land use plan is to ensure sustainable development of urban areas. By controlling urban expansion within the planned boundary, it will conserve ecological sensitive areas; ensure effective use of existing resources and balanced development; and support smart growth. Controlling urban development to follow the guidelines formulated in urban plans is a crucial and indispensable part in urban planning. Moreover, understanding and appraisal of urban land use plan implementation determines the plans' effectiveness and success, consenting for the enhancement of plans and the planning process in subsequent planning (Oliveira & Pinho 2009; 2010). In this regard, evaluation of urban plan implementation receives more and more attention to determine whether and how well urban plans have been implemented (Loh 2011). Moreover, it will support sustainable spatial policy and direction of spatial development with respect to a sustainable urban environment and creating a balance between ecological and socio-economic needs.

Evaluation of plan implementation has been studied for decades using the most acknowledged theories: conformance-based approach and performance-based approach (Berke et al. 2006, Loh 2011, Mastop & Faludi 1997). Conformance-based approach highlights conformity between actual physical development and plan's intention, which fits physical-oriented plans. In this regard, plan implementation is considered as a success if actual land use outcomes fit into plan intentions (Faludi 2000, Laurian et al. 2004). On the other hand, performance-based approach explores how the ideas within a plan are delivered and implemented. It is well suited to evaluate strategic plans. A plan is considered implemented if it is used or consulted in decision-making

processes, no need to be strictly adhering to the actual outcome. Departures from a plan may be also considered implemented if they are rational or inevitable (Mastop & Faludi 1997).

Conformance-based approach has been used in variety of studies; For instance it is used in evaluation of the degree to which actual land use outcomes conforms to plan intention (Alterman and Hill 1978, Tian & Shen 2007, He 2012, Ranasighe and Silva 2013); examination the effectiveness of urban growth boundary (Nelson and Moore 1993, Han 2014, Long et al. 2015); assessment of the efficiency of land-use planning and plan implementation (Brody D.S et al 2005); studying major land use conflicts and problems of the land use plan implementation with respect to environment (Merga 2012); and investigating the challenges of urban plan implementation and land management (Habtamu 2011, Ingda 2013).

Although these studies have provided insights into the case, evaluation of plan outcomes should be considered in a broad context, encompassing specific physical location of the area and human, socio-economic, and environmental factors. In addition, plan implementation is a rather complex process that is influenced by various factors, and suggests the need for more researches to develop a sufficient understanding with regard to the factors influencing plan implementation (Laurian et al. 2010). On top of this, like other urban centers in Ethiopia, land use plan for Adama City have been prepared and implemented since 1937. The latest plan is prepared in 2004 and denoted by LUP04 in this study. LUP04 is functioned from 2004 to 2014. However, presently it is unclear that how well the plan is implemented.

With this aim, the study intends to evaluate the extent to which LUP04 was guided and controlled spatial development of the City during the planning period using conformance-based approach.

1.2. Objectives

General objective

To evaluate the extent to which Adama City land use plan functioned from 2004 to 2014 is implemented using conformance-based approach.

Specific objectives

- To identify variables for evaluation of LUP04 implementation
- To generate existing land use map of the study area
- To identify conforming and non-conforming developments
- To identify variables related to LUP04 implementation success
- To highlight major driving factors for non-conforming developments

1.3. Research Questions

Primary research question

- To what extent the plan has been implemented to guide and control actual spatial development of the City?

Secondary research questions:

- What are appropriate variables to evaluate LUP04 implementation?
- How does actual land use outcome of Adama City as of 2014 can be mapped?
- Where is spatial location and distribution of conforming and non-conforming developments?
- Which variables are related to LUP04 implementation success?
- What are major driving factors related to LUP04 implementation contributing to non-conforming developments?

1.4. Significance and Beneficiaries

The findings of this research highlight implementation successes or failures of LUP04. This can creates awareness the effectiveness of the plan in guiding the physical development of the City during planning period. It also helps planners to recognize where there is nonconformity or significant deviation from original plan design that may adversely influence urban environments. It serves as a monitoring tool with which to guide the direction of plan implementation, to adjust course to updated information, or to plan a new heading before negative outcomes become irreversible.

The study provides a better understanding of major factors contributing to nonconforming development and sprawling growth of Adama City in particular and possibly serves as spring board for the country's urban centers in general. Identification of why development occurs in unintended areas can support the government to formulate sustainable spatial policies and direction of spatial development with respect to sustainable urban environment and creating a balance between ecological and socio-economic needs.

Most importantly, adaptive approach and techniques used in this study provide a basis for monitoring and evaluation of other master plan implementation in the region and country as well.

Finally, it can initiate further researches on issues in line with Master Plan Implementation in the country and Adama City.

1.5. Scope of the study

There are some demarcating lines up to which the study extends. These are potential variables, level of detail, and spatial extent which the analysis uses as inputs to produce the aimed result. Latest revised master plan of Adama City is functioned from 2004 to 2014. The proposal is

through structural plan (SP) which defines major land use categories or zones and local development plan which indicates detail land use to support implementation of SP. The study analyzed the implementation of the plan at land use zone level using structural plan. Which means the detail specific locality, density, height regulation etc. are not gone through as it takes more time, budget, and detail data.

The conceptual framework for the Adama City Structure Plan consists of elements that have direct and strong impact on the development of the City. They are the main framing elements used in revised structural plan. The study used these elements or variables to evaluate the level of implementation of the plan. These variables are total land growth, housing development, social services, manufacturing and storage, infrastructure, and green frame.

Spatially, Adama City has total 14 smallest administrative units (Kebeles). Kebeles located at the central part of the City were fully covered with mixed built-up during LUP04 preparation. As a result, spatial expansion of the City is manifested at the periphery Kebeles since beginning of implementation of the plan. Due to this, analysis of developments in these Kebeles is considered more appropriate. Hence, the study is conducted using developments in Kebele 01, Kebele 04, Kebele 14, Kebele 02, Kebele 03, Kebele 09, and Kebele 05.

1.6. Limitations

Some limitation ought to be known concerning the study. First, beside the delay of budge release, the limit for the budget to be released in different phases set by the School (maximum of 50% of granted budget in each phase) did not consider the nature of activities in the study. This was one of the main causes of additional overhead cost in data collection phase, delay of data analysis, not to follow time schedule, and additional burden to a researcher. Second, change in

rules and regulation in budget handling especially in the second phase, did not create supportive environment and rather it hinders facilitation and results unnecessary time extension. New regulation of financial management set especially related with rental instruments and purchase of instruments hindered utilization of more than 35% of the granted budget for the study that significantly affect the research. For instance, required satellite images and land use map as of 2004 are not purchased. Hence, image of 2007 with relatively low resolution and field investigation are used for identification of land use as of 2004. This partially affected detail analysis of unfulfilled developments and therefore it is not dealt in-depth in the study. GPS instruments are not rented. Hence, the researcher forced to establish ground control points using less accurate surveying instruments and more time consuming techniques with more labors. Moreover, digital orthophoto used in spatial mapping is acquired with additional research's personal expenses. Above all, transportation could not be facilitated as per submitted action plan. To overcome this problem, the researcher used extra expenses for transportation and additional expenses thus required.

LITERATURE REVIEW

1.7. Urban Land Use Plan in Ethiopia

According to "Urban Planning Proclamation No. 574/2008", Part Two #7 and 8, hierarchy of plans are National Urban Development Scheme, Regional Urban Development Plan, and Urban Plans. Urban plan as a tool for urban development has been practiced in Ethiopia since 1930's. The types of urban plans recognized in the proclamation are City-Wide Structure Plan (SP) and Local Development Plan (MUDC 2012).

Contextually, Structure Plan is strongly linked with global and national plans, strategies and policies, and regional plans on one hand and sectoral development plans, local development plans and projects, on the other. However, based on the Urban Plan Proclamation No. 574/ 2008 which acknowledges only four levels of plans.

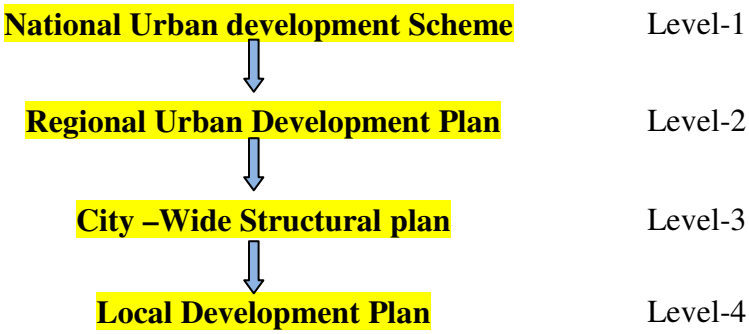


Figure 0-1: A framework of the Hierarchy in the Current Ethiopian Urban Planning System (source: MUDC 2012)

Structural plan indicates the distribution and extent of major land use categories. It contains the general mandatory provisions for the development of a planning area. It sets out the basic minimum requirements regarding spatial developments whose fulfillment would produce a

coherent urban development in social, economic and spatial spheres. The structure plan is a basis for rational decisions regarding an urban areas' long-term physical development. It serves as a bridge between community values, visions and objectives on one hand and decisions on physical developments on the other (UPIM 2004).

Structural plans shall be valid for the period of up to 10 years from the date of approval. SP is guided by a long term (20 years or more) Regional Urban Development Plan, which in turn is guided by National Urban Development Scheme, that gives an overall long term policy direction, strategies, vision and goals. Though Regional Urban Development Plan may not be part of SP, influence area study that also consists rural - urban and urban - urban linkages should be considered as part of SP and should be conducted while preparing SP (MUDC 2012).

According to the Urban Plan Proclamation, any structure plan shall indicate: the magnitude and direction of growth of the urban center; principal land use classes; Housing development; the layout and organization of major physical and social infrastructure; urban redevelopment intervention areas of the urban center; environmental aspects; and industry zone.

1.8. Importance of Planning Evaluation

Planning is the process of analyzing information, making decisions and formulating plans of action for future. It can be undertaken by government in many sectors with appropriate methodologies and techniques to achieve relevant goals and objectives. Development plan will provide the spatial framework for promoting and regulating the physical development of lands and buildings in each of the urban area to ensure the sustainable urbanization (Bruton and Nicholson 1987). Patton (1989) states that plan evaluation is the systematic assessment of plans, planning processes, and outcomes compared with explicit standards or indicators. It is important

as it can contribute to the accountability of, and trust in, public managers and institutions, and guide improvements in plans and practices (Kaiser et al. 1995, Lunt 2003). Understanding the degree to which plans are implemented and the determination of effective implementation benefit planners for making better plans.

Since land-use plans and planning activities regularly come under attack for being costly, imposing undue controls and burdens on land-owners, and failing to make a difference, there is an increased demand for confirming the value-added outcome of planning (Newcomer 1997). Planning evaluation can be conducted for different purposes as a priori or ex ante evaluation (Alexander 2006) on-going monitoring or formative evaluation (Scriven 1967) and ex post facto or retrospective evaluation (Baum 2001, Snyder and Coglianese 2005). While "in the final analysis, outcome evaluation is the true test of management effectiveness" (Hockings et al. 2000) ex post facto attempts to evaluate the outcomes of land-use planning are rare (Carmona and Sieh 2008). Most ex post studies evaluate planning outputs (that is, policies, programmers, projects, regulations) rather than outcomes (Baum 2001), and most show how scarce ex post outcome evaluations are in planning practice rather than evaluate implementation (exceptions include Berke et al 2006, Day et al 2008, Laurian et al. 2004a, 2004b).

1.9. Methods of Urban Plan Evaluation

Since evaluation is concerned with the "success" of plans, the theories used for plan evaluation should be able to identify how successful plans are. In order to achieve a proper evaluation for different plans, evaluation theories need to be selected based on the nature of plans. According to the Dutch school of plan evaluation (Faludi & Valk 1994; Faludi & Alexander 1989), urban plans can be categorized into two types: project-oriented plans and strategic plans. Projected-oriented plans refer to traditional plans which mostly provide

blueprints of the designated end-state of the physical environment. On the other land, strategic plans deal with the coordination of diverse actors. Apparently, project-oriented plans are more physical and material while strategic plans are concerned with decisions and more characterized as a dynamic process. Faludi and Valk (1994) summarized the differences between project-oriented plans and strategic plans.

Table 0-1 : Summary of project orented and Strategic plan (Source: Faludi and Valk 1994)

	Project plans	**Strategic Plans**
Object	Material	Decisions
Interaction	Until adoption	Continuous
Future	Limited to phasing	Central to problem
Time element	Blueprint	Minutes of last meeting
Effect	Detriment	Frames of reference

There exists a divergence of approaches proposed in plenty studies to evaluate urban planning implementation and they are generally categorized into two approaches: conformance-based approach and performance-based approach. Selection of approaches to evaluate planning implementation depends on ones understanding of spatial planning.

1.9.1. Conformance–based evaluation

Planning conformance refers to the conformity between plan and actual development. This theory follows a technocratic view and emphasizes the role of planning as a rational tool to draw a blueprint. Specifically, planning conformance theory assumes that once a plan is adopted, a definite image of the future is confirmed. The underlying tenet of this plan is to fulfill the designated task precisely. Thus, the plan evaluation can be undertaken by identifying how closely plan outcomes conform to plan prescriptions or whether plan goals are achieved (Oliveira

& Pinho 2010). Planning conformance theory lends itself particularly to the evaluation of project-oriented plans (Faludi 1989, 2000).

Hence, conformance-based evaluation means judging the success or failure of planning by measuring the conformance degree between the outcomes of urban development and the previously designed plan proposals. It concerns planning outcomes and the linkages between plans and actual development. It assumes a rational model of planning, which are specific enough to guide future development (Wildavsky 1987). Conformance-based evaluations are best suited to evaluate the outcomes of discrete plan elements (Laurian 2010). A high conformance degree indicates the implementation is well achieved and vice versa. In other words, a plan is considered implemented if development patterns adhere to plan intention.

1.9.2. Performance-based evaluation

Performance-based approach focuses on whether and how the plan is consulted in subsequent planning process. It insists that planning is a process of decision making under conditions of uncertainty, as long as the outcomes are beneficial, departures from previous plans may be considered acceptable. Performance-based evaluation is well suited to evaluate comprehensive and strategic plans (Mastop and Faludi 1997). This approach should correspond to a detailed analysis of the decisions and actions of a number of actors that are supposed to receive the plan messages (Oliveira & Pinho 2010). In this regard, a plan is considered implemented if it is used or consulted in decision-making processes, no need to be strictly adhering to the actual outcome. Departures from a plan may be also considered implemented if they are rational or inevitable (Mastop & Faludi 1997).

1.10. World Experiences on Evaluation of Plan Outcomes

Facing the issue of urban planning implementation evaluation, no uniform approach could be adopted. Standing at different positions, scholars, planners and urban managers adopt different approaches and plenty of effort has been devoted to urban planning implementation evaluation in either conformance-based approach or performance-based approach. Since the late 1970's several categories of conformance approaches have been developed with the advancing computer technology to provide solid support to the assessment of plan implementation by comparing the actual outcome with plan intension using selected indictors.

At the earliest, Alterman and Hill (1978) used grid overlays to quantify "accordance and deviations" between land use plans and actual land use for evaluation of implementation of land use plan for Krayot area in Israel. Nelson and Moore (1993) evaluated the urban growth boundary (UGB) in Portland by using 'residential density" as indicator. By comparing the actual residential density within UGB with the residential density allowed in the plan, they concluded that the effectiveness of UGB in Portland was not high.

Brody D.S et al (2005) have assessed the efficiency of land-use planning and plan implementation in Florida by measuring the degree to which wetland development over a ten-year period conforms to the original design of adopted comprehensive plans of Southern Florida. They spatially identified concentrated areas of wetland alteration permits and compare with the adopted future land-use maps of the Southern portion of the state. As a the result, they indicated a well-defined spatial pattern of nonconforming wetland development and isolate specific socioeconomic, demographic, and geographic variables impacting these deviations from the original spatial intent of local plans. Tian & Shen (2007) evaluated the Implementation of Guangzhou City Master Plan and identified accordance and deviation between the land use plan

(LUP) and physical land use (PLU) through grid overlays. They concluded that the degree of accordance with the master plan is very low, except the land for open space. In addition, there has been substantial deviation from the land use plan in Guangzhou, and these deviations are due to rapid population and economic growth.

More recently, Jinghuan He (2012) evaluated planning implementation of Shanghai Master Plan: 2001-2020 (01SHMP) through comparing the 01SHMP and actual spatial development based on conformance-based approach. They conclude that the 01SHMP has been strategically successful in guiding urban restructuring and peripheral development. However, enormous breakthroughs such as extra land development, urban expansion on the edge of the central City, extensive population growth has occurred. Degree of planning implementation also varied between measuring variables, locations and indicators. Ranasighe and Silva (2013) evaluated the outcomes of Moratuwa urban development plans focusing on ex post facto evaluation considering the outcomes of action projects of development plans using Plan outcome evaluation method. Zhong et al (2014) assessed the implementation of China's National General Land Use Plan (1997-2010) using combined conformance-based and performance-based criteria. The conformance analysis was carried out by contrasting outcomes with planning goals. Regarding the performance-based criteria, they focused on the role of decision-making elements in plan implementation, such as subsequent plans relevance to the plan being evaluated, policies developed to implement the plan being assessed, and, local government's strategic response to the implementation of subsequent plans. They highlighted the critical role of uncertainty, as well as the structure related to the plan implementation. The results showed that the National General Land Use Plan (1997-2010) conformed and performed poorly, and failed to achieve its goals. The study also indicated that the failure of the plan implementation was a result of uncertainty, difficulty in coordination, policy bugs and redundant governance, and weak plan implementation monitoring. Han (2014) analyzed the effectiveness of UGCB in Beijing by

comparing the morphology of planned UGCB with that of the actual urban boundary using GIS technique. They concluded that UGCB in Beijing failed to curb in urban expansion because there were a plenty of developments occurring out of the boundary.

In the context of Ethiopia, Merga (2012) has evaluated land use planning and implementation with respect to environmental issues in Sululta town. He evaluated the major land use conflicts and environmental problems of the land use plan and implementation with respect to environment in the study area. He identified that different land uses are proposed on environmental sensitive areas, proposal of incompatible land use in a plan. Moreover, the study boldly rationalize that the misuse of urban greenery, dumpsite, abattoir, industrial development and quarrying activities during plan implementation. Habtamu (2011) attempted to investigate the challenges of urban plan implementation in Gelan town. He drew a conclusion that structure plan of the town was implemented poorly which is manifested by irregular and irrational development as well as incompatible land uses. Ingda (2013) examined the practice of master planning and the extent of its implementation and challenges of land management in Arba Minch.

Overall, it can be seen that evaluation of land use plans mainly focused on the planning outcome. By identifying the level of conformity between planning proposal and actual outcome, researchers judged to what extent urban land use plans had successfully implemented.

1.11. Factors Affecting Plan Outcomes

Identifying the factors affecting implementation is as important as plan implementation. According to Laurian et al. (2010), plan implementation was a rather complex process that was

influenced by various factors, and suggests the need for more researches to develop a sufficient understanding with regard to the factors influencing plan implementation.

In the aforementioned studies, Alterman and Hill (1978) highlighted that accordance and deviation identified in a master plan implementation of Krayot area in Israel is related to political influence exerted by persons with political or economic interest during effectuation, attribute of a plan, and urban system factor such as population growth. Nelson and Moore (1993) concluded that the effectiveness of UGB in Portland largely depended on the capaCity and commitment of local planning agencies

Bengston et al. (2004) summarized the factors influencing UCP's implementation in more systematic way. Their findings showed that (1) administrative efficiency and other details of policy implementation; (2) the use of multiple policy instruments; (3) vertical and horizontal coordination; and (4) meaningful stakeholder participation throughout the planning process and implementation are rather crucial in determining UCP's effectiveness. Couch and Karecha (2006) found the growing market force became the major challenge for implementing UCP. Yang and Zhou (2007) believed (1) an unrealistic forecast of urban growth in Beijing; (2) absence of key stakeholders in the planning and implementation process; and (3) overemphasis of functional separation mainly contributed to the failure of UCP in Beijing.

In the context of Ethiopia, Merga (2012) identified that poorly implementation of Sululta land use plan is related with lack of public participation as well as shortage of the commitment of officials, experience and disciplinary gap of the plan preparation team, lack of policy, shortage of implementation tools, skilled man power, and community awareness. Ingda (2013) conclude that the Limited emphasis of professional exercise and lack of community participation have mainly contributed to failure of master planning implementation of Arba Minch town. According to

Yohannes (2012), the major problem contributes to implementation of Master plan of Dilla town is associated with plan quality. And direct implementing bodies at the local government level (the Dilla municipality at the top level and Zonal urban development department). Similarly, challenges such as Absence of action plan, implementing bodies & time schedule in line with legal framework of structure plan, poor quality of the plan were manifested in Gelan town master plan implementation (Habtamu 2011).

In summary, influential factors of land use plan implementation mentioned in the relevant literature into three main categories: plan quality, implementation quality and contextual characteristics. Plan quality encapsulates elements in the plan formulation process, such as the suitability of the planning techniques, involvement of different stakeholders and so on. Implementation quality refers to elements in the implementation process, like plan monitoring, supportive regulations and legislations, etc. These two categories cover factors that are directly related to plans. Contextual characteristics mainly contain external factors that influence plan implementation like policy environment and socioeconomic changes.

MATERIALS AND METHODS

1.12. Description of the study area

Adama City is one of fast growing cities in Ethiopia with an estimated total population of 343,212. It is situated in Rift valley within Awash River Watershed in Oromia Regional State of Ethiopia. It was established in 1916 on flat terrain characteristics and surrounded by plateaus, mountainous and ridged topography along Addis Ababa (capital City of Ethiopia) to Harar road at distance of about 96 km. It is located between $8^0$26'15"–$8^0$37'00"N, $39^0$12'15"-$39^0$19'45"E.

It is located at a distance of about 96 km from capital City, Addis Ababa. Altitude of the area ranges from 1489 m - 1976 m a.s.l. Average annual rainfall of Adama City is about 866.25 mm. Most of the rain occurs in rainy season (June - September). The minimum wind speed occurs during September is about 1.65m/s, while the wind with high velocity occurs during December, January and February ranging 3.05 m/s - 3.2 m/s. Mean temperature in the City varies from 11.5 °C to 31 °C. Flooding is a significant natural hazard in Adama City mainly attributed to its location within the flat lying rift and its impervious surface due to urban construction.

The City has totally 14 smallest administrative units called Kebele. 6 Kebeles are located at the central part covering 5.8 square kilometer. They were dense mixed built up areas when LUP04 is prepared. The rest 8 kebeles are located at the periphery covering 127.9 square kilometer. Even though the LUP04 proposal covers the whole Kebeles, new expansions were mainly proposed in periphery Kebeles (figure 3-1) including Kebele 01, 04, 14, 13, 02, 03, 09, and 05. Hence, these Kebeles are deemed to demonstrate new developments under LUP04 control in planning period and selected for this study.

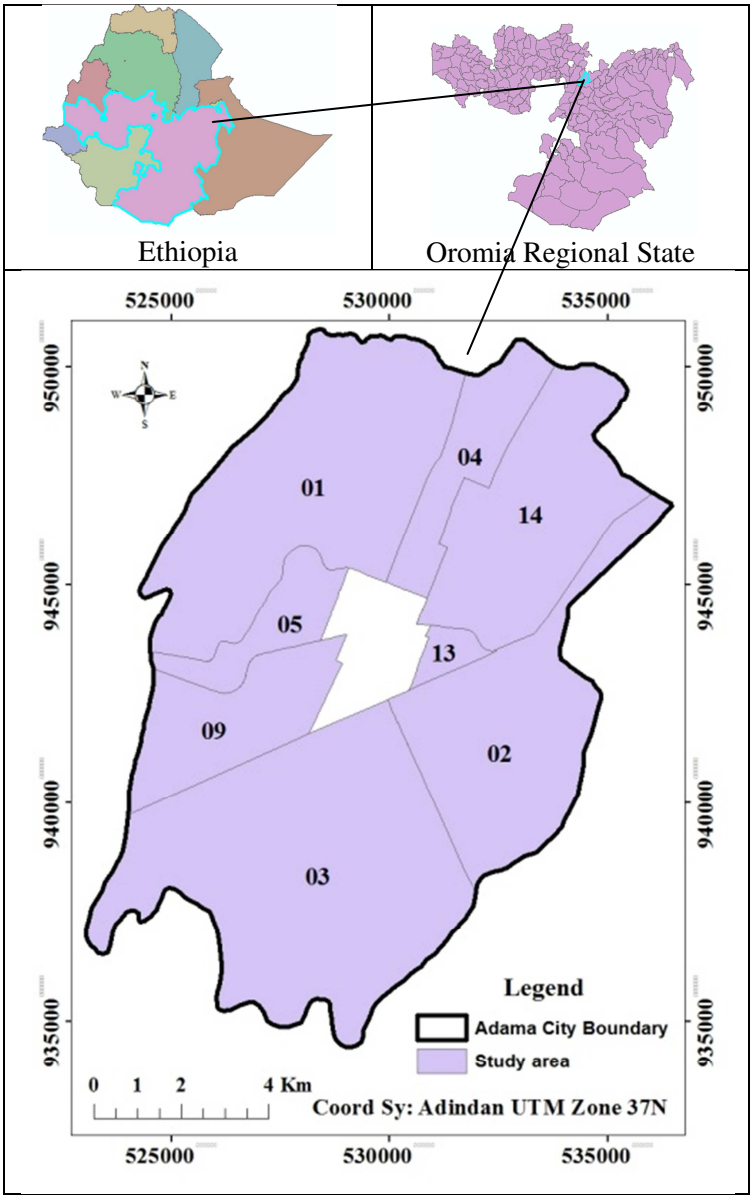


Figure 0-1: Location map of the study area

1.13. Data, Data sources, and Data Acquisition Techniques

1.13.1. Data and Data Sources

The study involves analysis of physical development of the City compared to the land use plan. Required data were collected from both primary and secondary sources. Existing land uses

data were collected using ground surveying techniques and digital orthophoto of the City as of 2004. Proposed land uses by the plan were extracted from structural plan map of LUP04.

1.13.2. Data acquisition Techniques

i. Proposed land use

The sources of input data in GIS includes: ground surveying, satellite image, aerial photographs, and hard copy map. Extraction of spatial data from existing map to standard required for GIS spatial analysis involves scanning of maps, geo-referencing, creation of Geodatabase, digitization, creation of topology and correcting digitization errors.

In this research, one of the data sources of land use plan was a scanned map of structural plan maps in .JPG format. The map contains important cartographic information. Ground coordinates of map grid lines are labeled in both Easting and Northing directions. Intersection of these lines was selected for control points in geo-referencing process as they can be easily identified on the map. Hence, eight intersections as control points with uniform distribution are selected and their ground coordinates are recorded. In ArcGIS software, using geo-referencing function coordinates of all control points are entered into their respective grid intersection point. Finally the image is rectified with acceptable root mean square error of each point.

Common Geodatabase was built using Universal Transverse Mercator projection system. Feature data sets are created for the three feature geometry (Area and Line). Using ArcGIS functions, proposed land use categories, road network and green frame are digitized from Georeferenced map into a common Geodatabase. Next, topology was created and applied for all datasets and digitization errors are corrected.

ii. Existing land use

Spatial mapping of existing land uses for urban land use classification involves ground control point establishment, collection and integration of spatial data and non-spatial data, and mapping. Spatial data for this study was existing locational data of major features of the study area such as different land use classes and road network. It was collected using surveying instruments in conjunction with orthophoto acquired from Adama City Administration. All spatial data were transferred (downloaded) to computer and processed. Topological errors were corrected in ArcGIS environment and projected to common Geodatabase.

iii. Non-spatial data

Non-spatial data such as actual function of a plot of land (land use) as of 2004 were collected using simple questionnaire comprising of both open and ended questions to contact and make conversation with residents to collect valuable land use information. For that of 2014, the non-spatial data were collected during spatial data collection in 2016 supported by interview questions to trace back information of land use as of 2014. Moreover, for more significant nonconforming developments archives and ownership documents were consulted.

1.14. Methods of Data Analysis

1.14.1. Selection of variables and indicators

The conceptual framework for the Structure Plan of the City identified elements that have direct and strong impact on the development of the City (NRSO 2004). The plan was mainly focused on six framing elements: Urban growth, Housing, Social Services, Manufacturing and storage, road network, and Environment and Green space. Hence, the present study selected these as variables and explained under since they are significant to demonstrate the conformity of actual land use outcome with plan intention.

1. **Urban growth:** Land development crucially shows the direction of urban growth. Period of land development reflects spatial organizations according to the economic situation and policies. The main aim of LUP04 is to rein all developments in planed urban growth boundary. It addressed importance to the land use plan and identified functions and their densities deliberately in different locations. It proposed new expansion areas and thus redefined urban construction boundary targeting at bringing compact development as much as possible and practicable in view of the local climatic conditions.
2. **Housing:** Housing expansion area was proposed to accommodate fast growing population in the City. The proposal is mainly at periphery areas focusing to the north and south. Some parts of vacant areas within the City boundary are also proposed to be used for new housing construction.
3. **Social service:** Location and spatial distribution of social services were proposed in such a way that to be integrated with hierarchy and size of centers to provide social services in the deprived parts of the City. Moreover, it identifies their density in different locations to ensure balanced development and to provide uniform services.
4. **Manufacturing and storage:** Industrial restructuring was the most important target of the LUP04. Lands for industrial use were proposed at different parts of the periphery Kebeles. Locations of Sites for manufacturing and warehouses were mainly intended to decentralize activities and minimize the need for transportation and also bring about balanced development. Moreover the plan was aimed at relocating existing manufacturing and warehouses that create disturbance at the City core. In accordance with this, large areas for manufacturing and storages are reserved at the north, south, southwest and southeast.

5. **Road network:** development of infrastructure was the most important strategy in LUP04 to improve living environment and enhance City competitiveness. It influences the future urban development through establishing a transport framework.
6. **Environment and Green space:** LUP04 provided green space as an important strategy to prevent unplanned urban expansion, to protect natural setup of the City through proposal of open spaces: formal green, informal green, farmland, and ground water protection area. Hence, evaluation of planning implementation in terms environmental preservation would be interesting.

Each variable was measured through different indicators (table 3-1) depending on the degree of indicators' significance. These are quantitative objectives (Quantitative conformity) and spatial distribution (Morphological conformity).

Table 0-1: Indicators of the selected variables for evaluation LUP04 implementation

Variables		**Indicators of conformity**	
Main	**Sub variables**	**Quantitative**	**Morphological**
Urban growth	Built up land	Area	Growth boundary
Housing	Residential	area	Spatial distribution
Social Service	Education	area	Spatial distribution
	Health		
	Religion		
	Cultural		
Manufacturing and storage	Manufacturing, warehouse	area	Spatial distribution
Road network	Road network	length	Spatial distribution
Environment & Green space	Farmland	area	Spatial distribution
	Informal green		
	Formal green		
	Ground water protection zone		

1.14.2. Delimitation of UCCB in LUP04

LUP04 map encompasses different principal land use categories. In order to delimit urban construction control boundary (UCCB), proposed land uses were categorized into two classes: Constructible and construction forbidden areas (table 3-2). This classification was a base for generation of map of "two areas". The delimitation of the boundaries of these areas provide reasonable basis for studying the spatial growth boundary of the City, deciding the construction land scale and identifying the scope of construction lands.

Table 0-2: Reclassification of proposed land use categories in LUP04 into "two area"

Proposed Land use category in LUP04	New class
Centers & markets, Housing expansion, Mixed land use, Social service, Health service, General service, Manufacturing & Storage, Government office, and Transport	Constructible area
Children play ground (formal green), Informal green, farm land, ground water protection zone, Horticulture	Construction forbidden area

1.14.3. Conformance-based approach

LUP04 is essentially a material-oriented blueprint plan with a clear envisaged end-state (such as the total amount of proposed construction land, reserved open spaces for future development, etc.). In other words, the future is closed in the framework of the plan. Additionally, the time element in the plan is limited to specific period. The effect of all the arrangements set in the plan starts when the plan is approved and terminates when the planning period comes to an end. In this study, considering that more features of project plans are embedded in LUP04, the theory of planning conformance is hence deemed as the most appropriate theory to guide the evaluation.

i. Morphological conformity assessment

Morphological conformity was examined through spatial overlay analysis of actual land use outcomes as of 2014, map of proposed each variable in LUP04, and land use as of 2004. Conforming, nonconforming and unfulfilled developments were identified. Their spatial location and patterns are determined. In this regard, for every variable, three indices were defined:

- *Conforming:* If the use of land as of 2014 is the same with the variable and consistent with proposed land use
- *Unfulfillment*: If the use of a piece of land as of 2004 and 2014 are consistent, but different from plan proposal for the variable, then the plan is not yet implemented. But the plan might or might not be implemented in the future.
- *Nonconforming:* if actual land use as of 2014 is the same with the variable but different from plan proposal

ii. Quantitative conformity assessment

Quantitative conformity was assessed to evaluate the level of spatial extents of actual land use outcomes of each variable conform to the extent proposed by the plan. It is examined using two basic indicators: Boundary Containment Ratio (BCR) and Boundary Sufficiency Ratio (BSR). Figure 3-2 helps to illustrate these indictors.

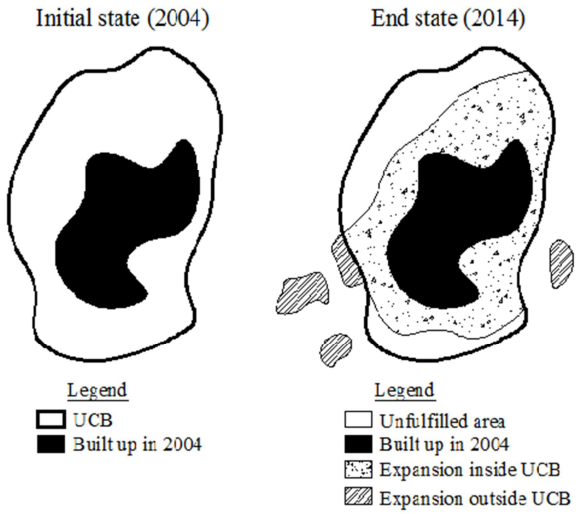


Figure 0-2: Illustration of the area analysis

a) Boundary Containment Ratio

BCR was used to identify to what extent actual land use outcome as of 2014 deviates from intended land use in LUP04. In this regard, if the plan is to be considered effective to contain the specific variable development, less nonconforming developments should occur than conforming developments. It is measured by the ratio of "area of nonconforming developments to area of conforming development". The higher values of BCR indicate limited implementation and vice versa.

$$BCR_i = \frac{(Nonconforming\ area)_i}{(Conforming)_i}$$

Implies

$$\begin{aligned} BCR = 0, &\quad complete\ effectiveness \\ 0 < BCR < 1, &\quad \text{limited effectiveness} \\ BCR \geq 1, &\quad \text{complete failure} \end{aligned}$$

b) Boundary Sufficiency Ratio

BSR was used to define the total possible increase of developed land for selected variable. In this case, in order to achieve effective containment, total developed land of selected variable

should be less than or equal to total area of proposed land for the variable in LUP04 at the beginning of planning period. In other words, the area of actual total development of the variable should not be more than area of proposed for the variable. It was measured by the ratio of "total area of actual developments to area of proposed land in LUP04". BSR is inversely proportional to sufficiency of the size of proposed area.

$$BSR_i = \frac{(Total\ \ development\ of\ the\ variable\ from\ 2004\ to\ 2014)_i}{(proposed\ area\ for\ the\ variable\ in\ CMP04)_i}$$

Implies

BSR ≤1, planned area is large enough to accommodate the development
BSR > 1, planned area is insufficient to accommodate the development

1.14.4. GIS Spatial Overlay Analysis

Spatial Overlay analysis is a technique frequently used to process geographic information. In this research, this technique was realized through the use of ArcGIS software package. The advantages of ArcGIS consist is that it can process a large amount of information at the same time and present the information in a visualized way. This makes an evaluation of LUP04 from both morphologic and quantitative perspectives possible.

1.14.5. Field investigations

Field investigations deliver empirical research value for they are evidence-based. This method serves the purpose of collecting further detailed information of the land developments. Through analysis of the result of spatial overlay analysis and appropriate satellite image of the City as of 2004, it was feasible to differentiate whether the existing non-conforming developments are before or after LUP04 preparation. However, due to the limitation of the study, further identification of the nature of built-up areas was realized through field investigations.

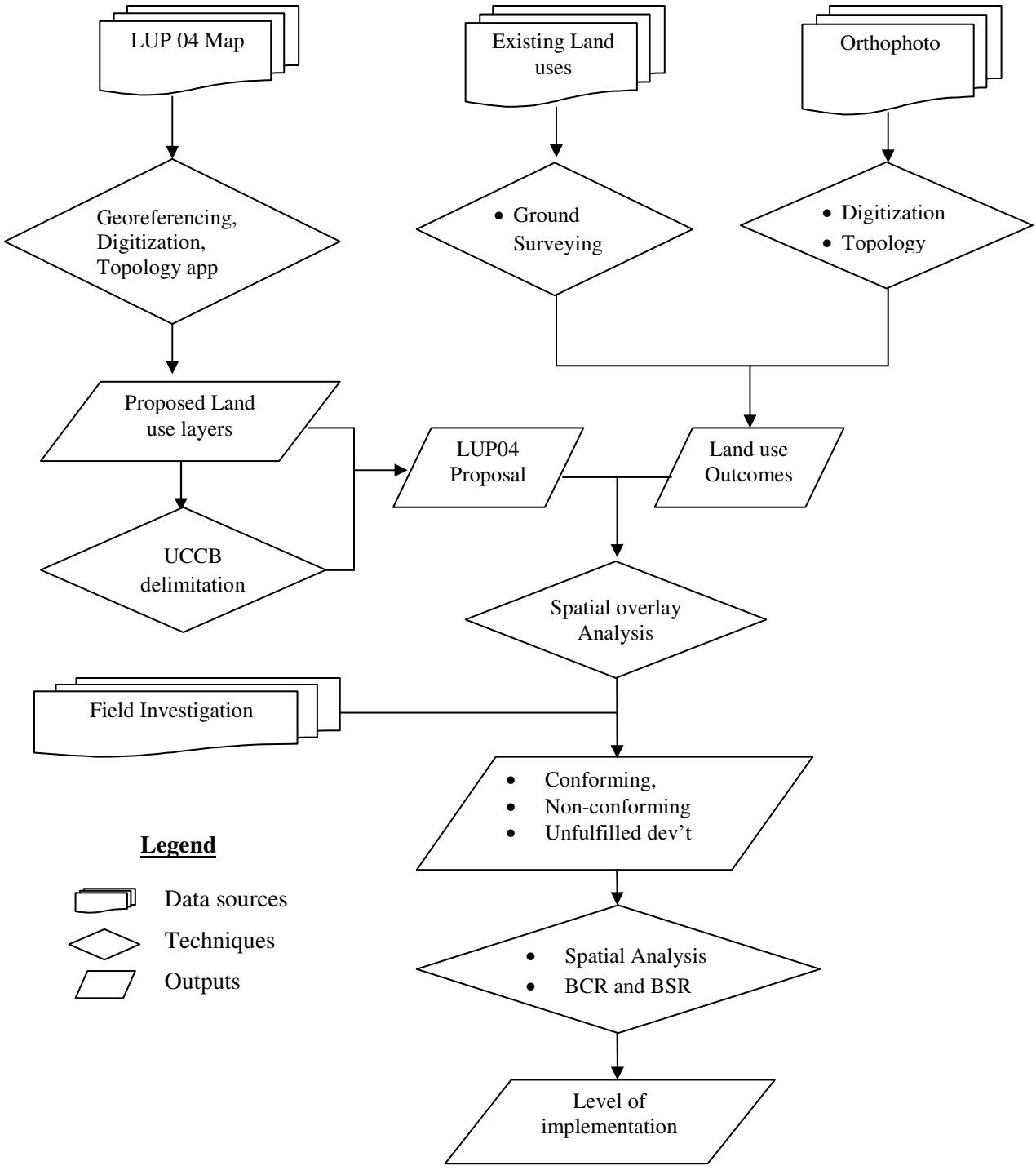


Figure 0-3: Flowchart of study workflow

RESULTS

1.15. Proposed UCCB by LUP04

LUP04 was targeted at bringing compact development as much as possible and practicable in view of the local climatic conditions (NRSO 2004). Based on this, urban growth boundary was redefined. By controlling the total amount and regulating the spatial location of urban built-up land, LUP04 is expected to be able to rein the development in proposed urban construction boundary. Result of aggregated two area classification for UCCB delimitation in this study is depicted in figure 4-1. Area within UCCB is the land that reserved to meet the urban growth need in planning period.

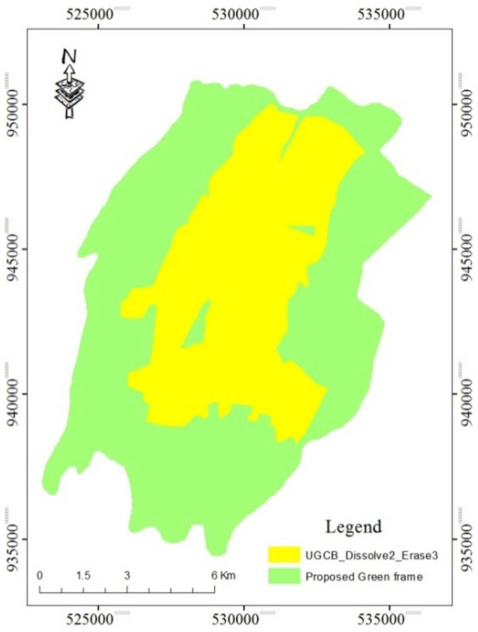


Figure 0-1: Aggregated proposed constructible and non-constructible areas by LUP04

UCCB in LUP04 is predictive type formulated based on the prediction of urban land development required for expected population growth in planning period. Spatial analysis

indicates that the total area inside UCCB is 5579.6 ha and 7887.9 ha for open spaces using strategic green frame to conserve resources for future development and support smart growth.

1.16. Urban Growth

Result of spatial overlay of actual built up and planned urban growth boundary in LUP04 (figure 4-2) shows that non- conforming developments occurring outside of planned boundary during planning period. Majority of these open space encroachments are adjacent to UCCB at western and eastern parts of the City along the main road from Addis Ababa-Harar. In addition, significant leapfrogging developments away from the dense nodes were also identified in North-West, South-West, and South-East directions, regardless of the UCCB set in between. This shows the limitation of the plan in controlling the location of urban construction and preserve open spaces for future development.

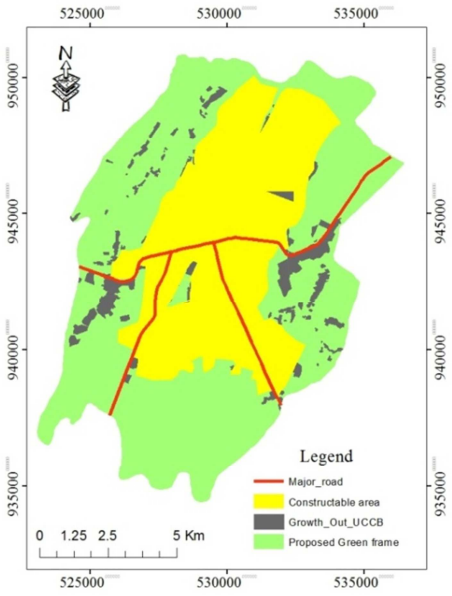


Figure 0-2: Spatial distribution of developments occuring outside of UCCB in Adama City as of 2014

Further spatial analysis of total actual urban growth in planning period reveals that new built up land inside the UCCB is 1615.2 ha consisting of 74% of the total built up expansion. At the

same time, built up land outside UCCB is found 570.44 ha consisting of 25% of the total built up expansion. Most of non-conforming developments are informal developments as of 2004 and not considered during plan preparation. They are supposed to be removed gradually by City administration. However, spatial expansion occurred around them. On the contrary, despite it is reserved for urban growth, 1124.6 ha of land inside UCCB located at northern and southern parts of the City is not yet developed indicating poor implementation of the plan in guiding direction of spatial growth.

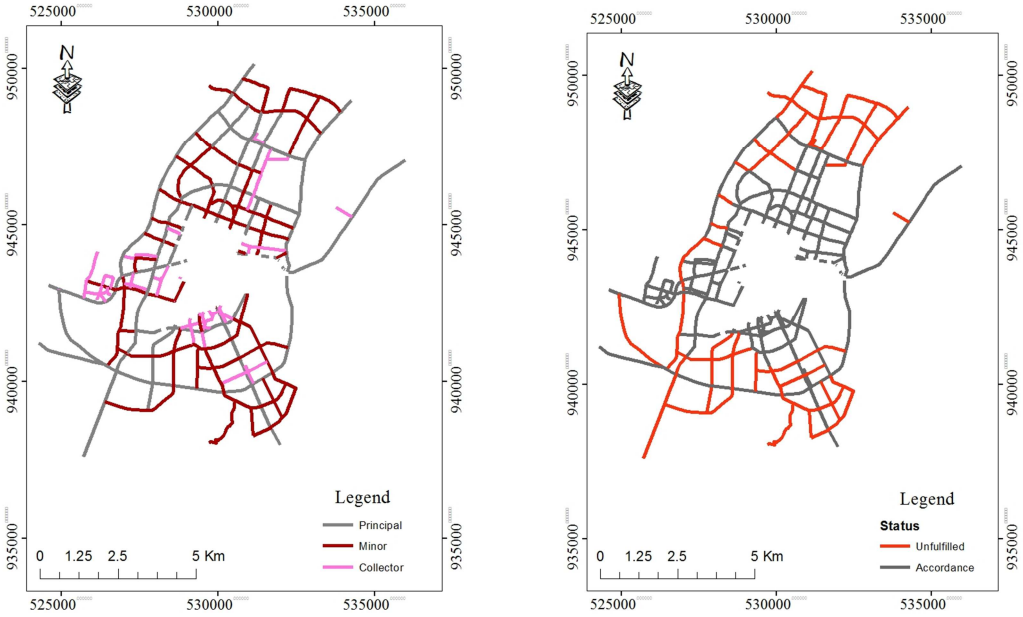
Effectiveness of the plan in controlling urban growth is analyzed using computed value of selected indicators. BCR from area of built up outside and inside UCCB; and BSR from area of total built up expansion in planning period and area of proposed land for urban growth in LUP04. The result shows that value of BCR is 0.35 indicating urban growth outside the UCCB has a significant share of the total growth indicating the plan has not effectively controlled the spatial location of new developments. On the other hand, value of BSR was found 0.21. It indicates that UCCB in LUP04 was planned encompassing area large enough to accommodate all new urbanization if measured by the actual development density. The values of both indicators underline that even the most well intentioned spatial planning designs cannot guarantee conformity or prevent the adverse impacts of sprawling growth patterns.

1.17. Road network

Improvement of infrastructure became the most important strategy in order to enhance living environment and City competitiveness (NRSO, 2004). A strong ring system consisting of an inner and outer ring is introduced to collect and tie traffic flow from and to the center and different parts of the City. These are extended south and north to further facilitate mobility from intermediate and periphery areas. According to LUP04, improvement of the existing road

network, development of streets in expansion areas were through increasing length of three main components of the road network proposal: 91.444km Principal Arterial Street (30-50m width); 74.099km Minor Arterial Street (20-30 m width); and 29.466 collector roads (12-20m width) as computed from plan proposal.

The main objective of LUP04 was to direct the urban growth to North and South (NRSO 2004). However, result of spatial analysis of existing road network shows that total actual length of existing road as of 2014 in study area is only 131.629km indicating 64.142km is not yet developed. Unfulfilled road development is distributed mainly at northern and southern part of the City (figure 4-3b). However as transportation is the main engine of development, the limitation of implementation directly affects other developments to follow the plan. Further, the spatial extent of each road type is computed and summarized in table 4-1.



(a) (b)

Figure 0-3: (a) proposed road network in LUP04; (b) Spatial distribution of existing roads and unfulfilled road development proposed in LUP04

Table 0-1: Total length of existing road network compared to LUP04 proposal

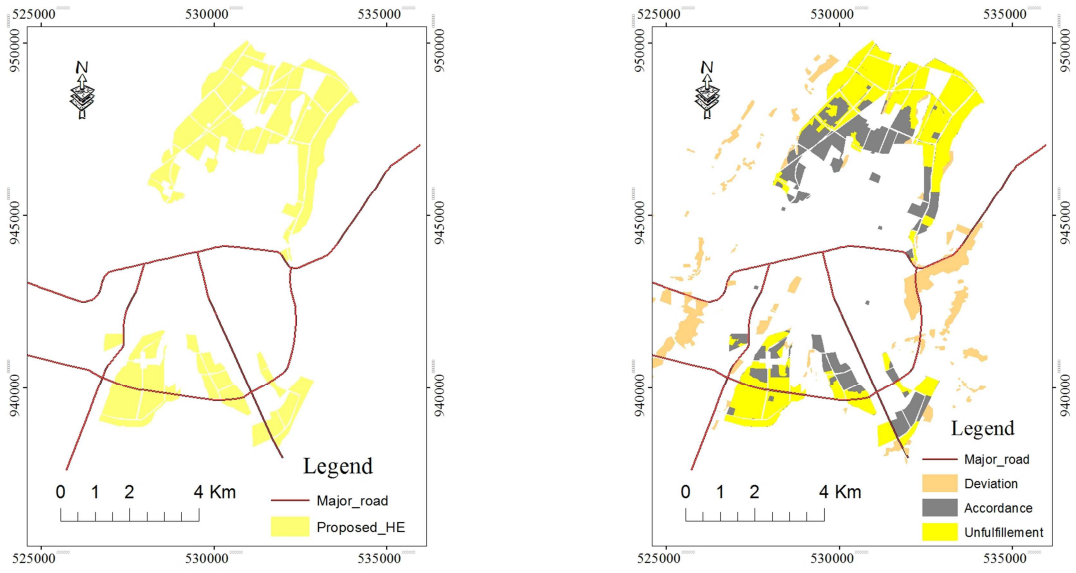
Type	Length in kilometer		
	Accordance	**Deviation**	**Unfulfillment**
Principal arterial	69.13	2.650	19.663
Minor arterial	33.371	-	40.728
Collector street	26.477	-	2.989
Total	**128.978**	**2.65**	**63.380**

Further spatial analysis of the result depicted in Figure 4-3 and tables 4-1 demonstrates that principal Arterial Street is reached about 78.5%; minor arterial is about 45%; and Collector Street about 89.9% of plan intention. In this regard, collector streets are more implementaed than others. This might be due to their smaller width thus relatively required less budget. In addition to this most of these roads are Cobbele stone roads financed by donares/NGO. On the other hand principal Arterial streets including Expressway and main road passing through the City are mostly constructed by National government. Deviation occurred at western part of the City is due to design change of expressway at western end. In contrary, development of minor arterial street is very less compared to the others. This might be due to shortage of budget as it needs larger width and better paviment material usually asphalt than collector and requires large budget.

1.18. Housing development

Residential development was one of the main planning issues for LUP04. Accordingly, new housing development areas were proposed predominantly 1071.262ha at the northern and 605.112ha at southern part of the City. This area caters for land requirement of housing and related facilities. However, spatial mapping shows total actual increased residential development during planning period is found 1215.508ha. The result of spatial overlay of proposed land use and spatial mapping of actual residential developments as of 2014 is depicted in figure 4-4b. It demonstrates

that despite of undeveloped reserved land area exists; significant non-conforming residential developments are occurred at Western, Eastern, and Northwest parts of the City.



(a) (b)

Figure 0-4: (a) Proposed land for housing expansion in LUP04; (b) Spatial distribution of accordance, deviation, and unfulfilled housing development compared to LUP04

Further spatial analysis conducted in this study reveals that spatial extent of accordance, deviation, and unfulfilled actual land use occupies 657.023ha, and 512.485 ha, and 1019.35 ha respectively. The spatial distribution of each type in different Kebeles is summarized in table 4-2.

Table 0-2: Spatial extent of evaluated housing developments in Adama City

Kebele	Spatial extent in hectare		
	Accordance	Deviation	Unfulfillment
03	140.75	31.149	329.695
09	17.12	104.155	5.54
05	1	7.754	-
02	77.427	225.684	51.531
14	85.35	30.513	251.01
04	95.126	8.241	148.192
01	240.251	104.989	233.382
Total	**657.024**	**512.485**	**1019.35**

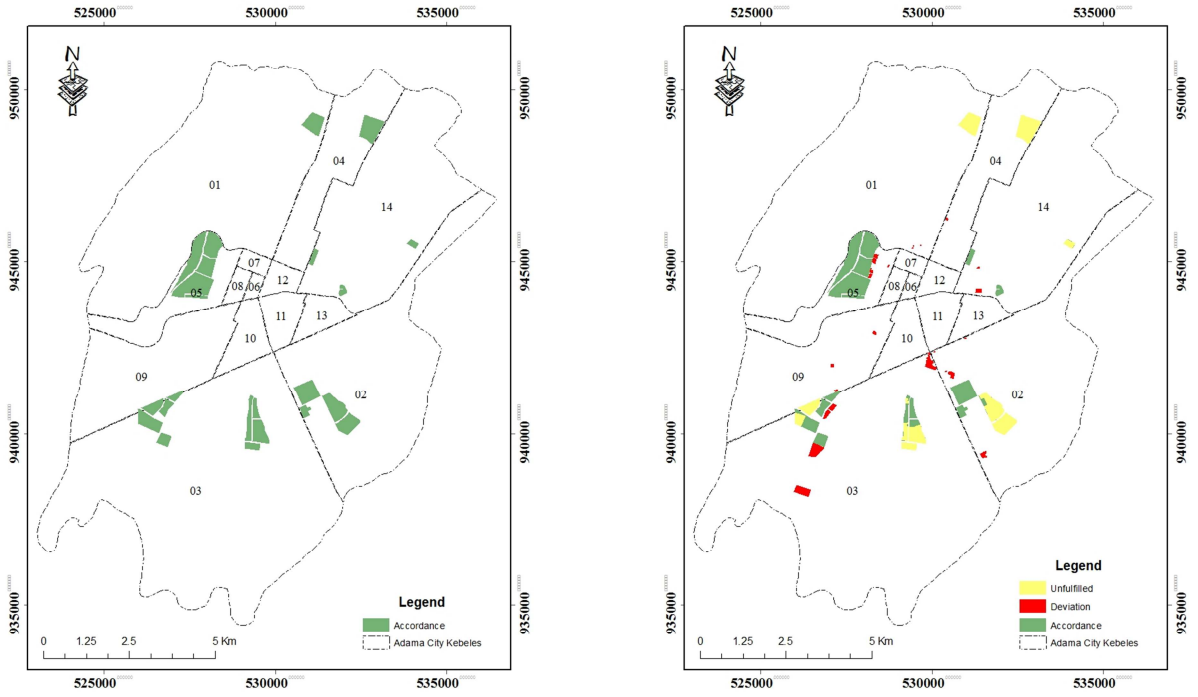
Results in the figure 4-4b and table 4-2 show that residential development was not fully covered the reserved area. It suggests that Kebele 01 and Kebele 03 have attracted many developments compared to the others. Moderate residential development during planning period is perceived in Kebele 04, Kebele 14, and Kebele 02. In contrast, Kebele 09 and Kebele 05 did not attract new housing development, as they are mainly industrial area. The result also indicates that new residential developments along the main road in both east and west part of the City are unplanned. These non-conforming developments are identified in an area having better infrastructure developments in addition to Addis- Adama expressway. On contrary, proposed land for residential development has not fully utilized. Mainly large area of reserved land but not yet developed was identified in the northern and southern parts of the City; despite it is supplied to developers. Further, field observation reveals that these areas are manly characterized by low infrastructure development and serving for farming activities.

Moreover, the computed value of BCR is 0.78 indicating LUP04 has limited effectiveness in controlling the spatial location of newly residential development. On the other hand, value of BSR was found 0.68 indicating the planned area for residential land use was much enough to encompass all new housing developments.

1.19. Manufacturing and storage

Manufacturing and storage is also one of the main planning issues for LUP04. The plan reserved 463.535 ha of land for new development at the north, west, southwest and southern parts of the City (figure 4-5a). It was mainly intended to decentralize activities and minimize the need for transportation and also bring about balanced development (NRSO 2004). However, spatial overlay of proposed land and actual development (figure 4-5b) shows that non conforming developments identified mainly at south and southwest and west parts of the City. In contrary, majority of reserved

land at southern, northern parts are not fully utilized. Some unfulfilled developments especially at southern part are existing warehouses during LUP04 preparation and proposed to be removed by City administration gradually during planning period.



(a) (b)

Figure 0-5: (a) Proposed land for manufacturing and storage in LUP04; (b) Spatial distribution of accordance, deviation, and unfulfilled manufacturing and storage development compared to LUP04

Further spatial analysis revealed that actual land use outcome utilized by manufacturing and storage within planned area (accordance) is about 277.738 ha and that of outside of the planned area (deviation) is found 51.615 ha. On the other hand despite the proposal of the plan, 185.78ha reserved land is not yet developed. Spatial distribution of all types along with their spatial extent is summarized in table 4-3.

Table 0-3: Spatial extent of evaluated manufacturing and storage development in Adama City

Kebele	Spatial extent in hectare		
	Accordance	**Deviation**	**Unfulfillment**
01	-	-	25.901
02	43.63	6.242	56.173
03	59.696	33.878	62.785
04	-	0.528	36.184
05	153.166	5.557	-
09	9.158	2.986	-
14	12.088	2.424	4.754
Total	**277.738**	**51.615**	**185.797**

Result of this study depicted in figure 4-5b and table 4-3 demonstrate that more non-conforming industrial developments mainly warehouses are identified in Kebele 03, 02, and 05. The area located in Kebele 03 is characterized by low infrastructure developments, illegal construction and low living standard. For warehouse developers completely market-oriented, the decisions they made for the locations were mostly based on cost-benefit analysis. And in order to fulfill required need with a minimum cost, investors will see where they could find land with low cost and cheap labor. And this might encourage non-conforming developments in the area as it fits the need of the developers. Non-conforming developments in Kebele 05 are adjoining planned boundary. This is a type of adjacent boundary developments which mainly encouraged by nearest neighborhood land values. The rest are existing developments before LUP04 approval and proposed to be removed. However, City administration did not remove them indicating lack of commitment.

Conversely, reserved land is not fully utilized which results unfulfilled developments distributed in five Kebeles. Unfulfilled land in Kebele 04 might be due to its location at about extreme northern part of planning area. This area mainly lacks infrastructure developments and used for farming activities. According to a worker in Adama City administration, compensation payment for farmers was not effective for long time due to budget constraint and it is considered as challenges in using the land for proposed use during planning period. Other unfulfilled area in Kebele 03 and 02 are

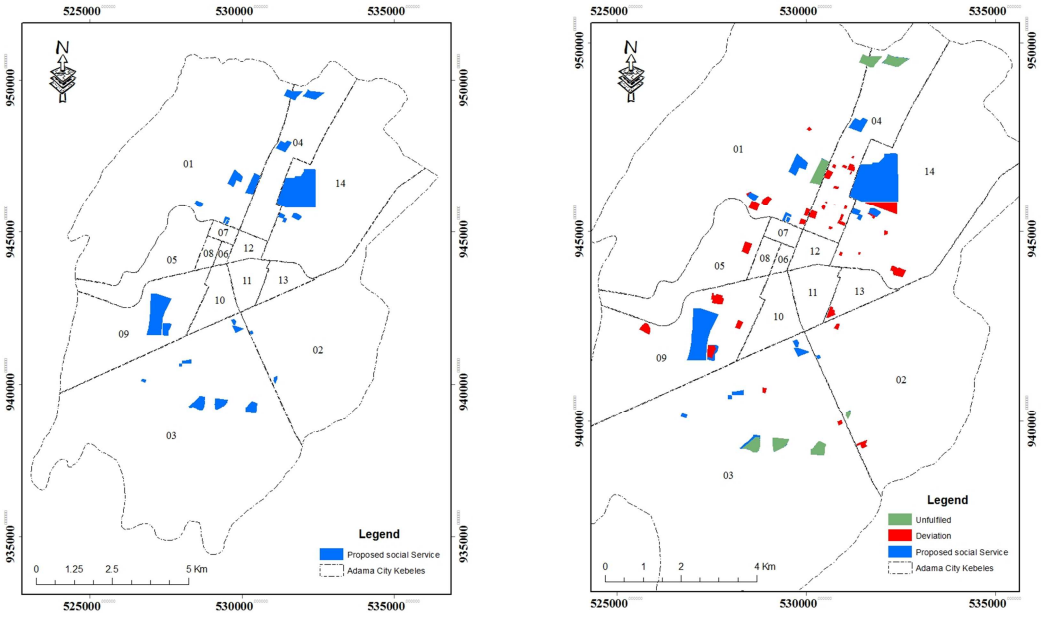
occupied existing unplanned and illegal developments as of 2004 proposed to be removed gradually to implement land use proposal indicating lack of commitment of City administration.

Further, the computed value of BCR is 0.19 indicating LUP04 has limited effectiveness in controlling the spatial location of manufacturing and storage. On the other hand, value of BSR was found 0.71 indicating the Plan was designed encompassing area large enough to accommodate all industrial developments. This means the total area of developed land is within a land use quota proposed by the plan.

1.20. Social services

Social service sites were proposed using equitability, efficiency, centrality, and accessibility issues as the main principles. Accordingly 336.989 ha of land was reserved at different parts of the City. The aim was to optimize service providing to the community. To ensure balanced developments, the spatial distribution of reserved land focused at North, south, and southwest parts of the City (figure 4-6a). However, the spatial overlay analysis result (figure 4-6b) shows that significant non conforming developments are occurred at different parts of the City. In contrary majority of proposed land at southern and northern parts of the City are not fully utilized.

Further spatial analysis revealed that actual developed land is found 353.9 ha of which only 263.1ha is developed following the plan. The rest 90.8 ha is unplanned developments. On the other hand, 73.889ha within planned area is waiting for development. Quantitative conformity assessment also shows that the actual social service land use development exceeded what was planned in the LUP04. The spatial distribution among Kebeles is shown in table 4-4.



(a) (b)

Figure 0-6: (a) proposed land for social service in LUP04; (b) Spatial distribution of accordance, deviation, and unfulfilled social service developments compared to LUP04

Table 0-4: Spatial extent of evaluated social service developments in Adama City

Kebele	Spatial extent in hectare		
	Accordance	**Deviation**	**Unfulfillment**
01	42.711	14.072	-
02	2.908	4.62	-
03	16.309	2.489	33.255
04	11.259	17.845	19.132
05	0	5.521	-
09	76.202	20.875	-
14	113.711	25.378	21.502
Total	**263.1**	**90.8**	**73.889**

Results depicted in figure 4-6b and table 4-4 demonstrate that deviation of social service development is more perceived in Kebele 14, 09, 04, and 01. Further analysis of misused land especially in Kebele 14, shows that land in front of Adama Science and Technology University covering large land area supplied for expansion and land occupied by T/Haimanot Orthodox church located at eastern part of the City within this Kebele are significant non-conforming developments.

Majority of misused land in the rest Kebeles are primary and secondary schools. On the other hand, majority of unfulfilled development area identified in Kebele 03 might be related to low development in the area and might not attract developers. In Kebeles 04 and 14, even though the areas are supplied to developers, geographical location at extreme north and absence of infrastructure developments may be affected the development.

Computed value of BCR is 0.35. This indicates that LUP04 has limited effectiveness in controlling the spatial location of newly developed social service land. Value of BSR equals 1.05 indicating the social service development a bit exceeds the proposed land area. This may be due to existing schools located in proposed mixed built up.

1.21. Environment and Green Space

The result of spatial overlay analysis (figure 4-7) depicts significant nonconforming developments occurred in construction prohibited areas in LUP04 (table 4-5). Spatial distribution indicates that open space encroachments are composed of 412.35ha (72.3%) from farmland, 73.68ha (12.9%) from formal green, and 84.42 ha (14.8%) from informal green.

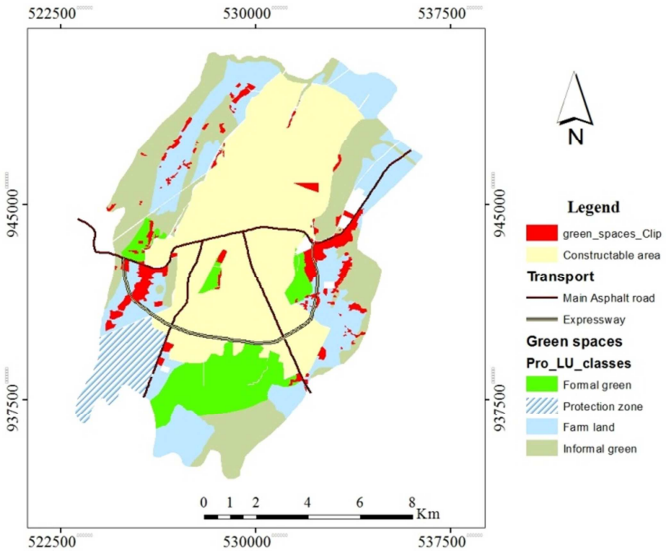


Figure 0-7: Spatial distribution of unplanned developments encroaching proposed green frame

Table 0-5: Spatial extent of Misused strategic green frame

Land use class	Area in ha		
	Proposed	**Preserved**	**Misused**
Farmland	3149.6	2737.2	412.35
Formal green	1291.4	1217.7	73.68
Informal green	2758.1	2673.7	84.42
Ground water protection	688.9	688.9	0
Total	**7887.9**	**7317.5**	**570.5**

The result reveals that proposed ground protection area is well preserved while farmland, informal green, and formal green areas are meet more difficulties to follow the plan. Further analysis of spatial extent and location of each land use indicates that agricultural land use was highly encroached by nonconforming developments. This encroachment is perceived at the outlet to Addis Ababa in front of "Abba Geda". It is strategic site suited close to main road and office of regional government and considered potential business site. Furthermore, nonconforming developments are located at the junction point of Adama-Addis Ababa expressway and Main road passing through the City at both ends. These sites are perceived suited to ease transportation access.

DISCUSSIONS

In summary, the primary function of urban master plan is to guide and control spatial development of urban areas during planning period. Thus, the effectiveness of the plan should be measured by the level of conformity between actual land use outcomes and proposed land use in the plan from both morphological and quantitative perspective.

This study evaluated effectiveness of LUP04 using six variables: manufacturing and storage, housing, road network, social service, total land growth, and green frame. The findings reveal that the level of conformity is acceptable when measured by the size or quantity. In other words, the total area of increased developed land in planning period remains in the limit of the land use quota proposed by the plan.

In contrary, level of conformity between the plan intention and actual land use outcomes is low when measured in terms of the morphology. There are significant new developments occurring outside of proposed land indicating limitation of LUP04 in controlling spatial location of new developments. This limitation is indicated by computed value of BCR. It is more in Housing followed by social service and total urban growth. Non-conforming development areas are spatial indicators of urban and suburban sprawl (Brody and Highfield 2005). On the other hand the plan has meet difficulties to preserve strategic green frame indicated by encroachment of farm land, informal green, and formal green indicating limitation in preventing urban sprawl.

Based on these evidences, it is enough to conclude that LUP04 has met difficulties to play its role in guiding and controlling spatial development of Adama City. In spite of the morphological deviation, the total area of new developments occurring during 2004-2014 has not exceeded the area allowed by LUP04, which at least shows that the size of reserved land is reasonable. Furthermore, the level of non conformity is different for selected variables. Since the area allowed by the plan for

development is large enough, one might ask why there are non conforming developments. The non conforming developments might result from the following four potential factors.

i. Spatial variables (Proximity to public infrastructures)

Proximity to likely public infrastructures and major transportation corridors significantly affects the degree of plan conformity. The spatial variables support the visual results of the study and indicate that most of non-conforming developments occurred outside of UCCB are close to major road and expressway passing in the planning area due to better transportation access. It is also perceived that other infrastructures development in these areas is relatively good than undeveloped area. These variables might attract the development. In the contrary, lack of these variables at extreme north and south boundaries retarded the development of housing, social services, and manufacturing and storage indicating an inefficient use of land resource.

ii. Monitoring and evaluation

Non conforming developments indentified in this study might be occurred due to lack of supervision and monitoring in a timely manner. Technically, through regular monitoring and evaluation, land use changes using geospatial technologies i.e. geographic information system and remote-sensing, it would be possible to identify unplanned developments and take measures to stop the construction in a timely manner.

In addition to this, despite the developments outreach the plan intention, proposed area has not been fully urbanized. Apparently, 11.25km^2 of land within UCCB remains undeveloped. It is larger than the area of non conforming developments identified indicating despite the possibility to develop within reserved area, a large proportion of construction activities happened outside. On the other hand, most of reserved land for new development at extreme north and south of the

City is already supplied to developers before 3years of end of planning period. However, it is not developed within the time limit given by City Administration usually six months. Through close monitoring and supervision it would be transferred to potential developers and ensure balanced development in planning period. These all explain limitation of monitoring.

iii. Lack of commitment

Illegal and informal developments in 2004 were not considered during plan preparation and they would be removed gradually in planning period. However, in practices, the City administration has not removed many of these developments. Instead, spatial expansion occurred around them. Even the City Administration recognized some developments that outreached UCCB. On top of this existing land use during plan preparation and proposed land use change by the plan were not implemented. It explains why the majority of illegal developments and most of unfulfilled residential and warehouse developments as of 2004 existed in 2014. Surprisingly, National and regional land administrations have not design and implement any instruments i.e. mandatory requirements, enforcement, penalties and incentives to support the implementation at local level.

iv. Political factor

Of all the reasons, unsupported political leadership is perhaps the most essential reason that led to the deviation between plan and outcome. Because LUP04 is mainly a 'government-led' plan, the extent of support from regional government will thus largely decide the extent of implementation success of the plan. In Adama, socio-political acceptance and economic development is given the first priority. Hence, in most cases City administration chose to secure political acceptance and support development rather than control. With this aim, political leaders in the City administration, Mayor and its advisory team (cabinet) would place their primary

focus on economic development and political security, since both are the principal criterion when regional government assesses their political achievements. Hence, political leaders in the City provided little support in the implementation of the plan. Instead, the success of investments in Adama made the City administration believed that attracting developers through land supply was an effective way to maintain a rapid economic growth. Moreover, regional government could obtain a considerable sum of land-transferring fees when lending lands to investors, which largely helped the government to maintain its fiscal balance.

Therefore, when development projects come to Adama, the City administration and regional government would satisfy the site selection proposed by developers as much as possible even areas out of UCCB were chosen. Especially ones with large economic added-value showed their interests in the City, investors were almost free to select any sites they needed regardless of the limit of UCCB. For investors were completely market-oriented, the decisions they made for the locations were mostly based on cost-benefit analysis. Thus, they seldom took the implementation of UCCB into account. If the sites out of UCCB were economic and appropriate in their opinions, they would definitely apply for that land than within UCCB. In order to retain the investment, City administration ultimately accepts their applications. This explains why developments occurred out of UCCB at the outlet to Addis Ababa in front of “Aba Geda” are high standard hotels. Hence, political context in Adama has not created a supporting implementation environment for the plan.

CONCLUSIONS AND RECOMMENDATIONS

1.22. Conclusions

By spatial mapping of actual land use under LUP04 control and measuring the degree of plan conformance, this research evaluates the effectiveness of the plan implementation. The value of the study can be explained in different ways.

First, the variables used in this study: manufacturing and storage, housing, road network, social service, total land growth, and green frame are highlighted the level of conformity between actual land use outcomes and plan intention. Second, morphological conformity assessment using spatial overlay analysis provides spatial extent and distribution of conforming and nonconforming developments. This can be important information to be considered in the next planning course. And also keeping a plan on track and ensuring effective implementation of unfulfilled planned areas over the planning period. Moreover, it can help planners recognize where there is nonconformity or significant deviation from original plan intention that may adversely influence urban environments. It serves as a monitoring tool with which to guide the direction of plan implementation, to adjust course to updated information, or to plan a new heading before negative outcomes become irreversible. Third, quantitative conformity assessment using BCR and BSR is highlighted the effectiveness of the plan in guiding and controlling spatial development of the City. This provides insight into land use plan implementation as sufficient plan design only by itself will not insure plan implementation. Fourth, the findings of the study provide a better understanding of the major factors contributing to nonconforming development and sprawling growth in Adama City. Identification of why development occurs in unintended areas can help planners to reduce such an occurrence in the future. Moreover, it helps the government to design spatial policies to the context to improve plan implementation, to mitigate

sprawling development patterns, and to conserve environment. Most importantly, the techniques used in the study could facilitate an adaptive approach to evaluate land use plan of other urban centers in the country. An adaptive approach to long-term planning can more effectively reduce undesirable outcomes such as sprawl or prevent development patterns from taking major detours from the originally intended path.

1.23. Recommendations

Although this study provides important information on the implementation of Adama City Land use plan and major influencing factors, the results should be considered only an initial step towards understanding the links between urban land use plan and its implementation. Hence, further researches are needed on several fronts.

First, only one approach is outlined to examine the implementation of urban plans, which by itself is not sufficient. Other evaluation techniques must be used, and plan implementation should be evaluated with the use of multiple approaches of analysis. In addition, the study has examined Adama City Land use plan of single planning period. Future research should analyze plans in different planning periods to identify the trend of effectiveness of plans prepared and implemented in different planning periods. It is recommended that level of implementation urban land use plans in more urban centers in Ethiopia should be examined. Comparative analyses would provide an increased understanding of the effectiveness of spatial planning and plan conformity in general. Finally, more researches are needed on compatibility of nonconforming developments and its effect on spatial distribution of public facilities.

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Appendix

Structural plan map of Adama City 2004