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ADDIS ABABA UNIVERSITY

ETHIOPIAN INSTITUTE OF ARCHITECTURE, BUILDING CONSTRUCTION AND CITY DEVELOPMENT (EIABC)

ANALYSIS OF THE FORCES SHAPING URBAN EXPANSION IN THE CASE OF LAGATAFO LAGADADI TOWN, OROMIA SPECIAL ZONE

BY:

HUNDESA KASSAHUN

MARCH, 2021

ADDIS ABABA, ETHIOPIA

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CITY DEVELOPMENT (EIABC)

ANALYSIS OF THE FORCES SHAPING URBAN EXPANSION IN THE CASE OF LAGATAFO LAGADADI TOWN, OROMIA SPECIAL ZONE

By:

Hundesa Kassahun

A Thesis Submitted to the School of graduate studies of Addis Ababa University, Ethiopia institute of Architecture, Building Construction & City Development, in partial fulfillment of the Requirements for the Award of Master of Science Degree in urban planning.

Advisor:

Birhanu Girma (PhD)

March, 2021

Addis Ababa, Ethiopia

Declarations

I, Hundesa Kassahun, do hereby declare that this research work entitled "Analysis of the forces shaping urban expansion in the case of Lagatafo Lagadadi town, Oromia Special Zone " is my own original work, and it has not been submitted to any other university/ institutions for any degree/ diploma & for other purposes. Materials and information used in this study other than my own are dually acknowledged and cited.

By: Hundesa Kassahun Genemo

Signature: _____

Date: _____

Approval

As a member of the Examiners board of the final Master's thesis open defense of Hundesa Kassahun, we have read and evaluated the Thesis prepared by Hundesa Kassahun entitled **"Analysis of the forces shaping urban expansion in the case of Lagatafo Lagadadi town, Oromia Special Zone"** and recommended to Ethiopian Institute of Architecture, Building Construction and City Development, Addis Ababa University to accept the Thesis for the Fulfillment of Requirements for the award of Degree of Master 's of Science in Urban Planning.

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Abstract

The major objective of the study was to analyze the forces shaping urban expansion in the case of Lagatafo Lagadadi town. The study emphasized on descriptive research design. For the purpose of the study both qualitative and quantitative methods were employed. Both primary and secondary data source employed. The target population includes households, kebele leaders, land management agency and leaders of Lagatafo Lagadadi town. Probabilistic and non-probabilistic sampling techniques employed for this study. The participants of the study include 99 households; 43 employees and 6 key informants. The data was collected through questionnaires; interview; document analysis and field observations. Data collected using questionnaire to determine deriving force the urban expansion were analyzed using SPSS 24.0. Landsat images from the USGS were analyzed by using supervised classification technique in GIS to investigate the temporal changes of the land use land cover types. The results showed that only the built up land use shows an increment trend and the remaining land use land cover forest, agriculture, and open space showed a decline thought the years of 1995-2019 years. The yearly urban expansion rate was 5.70% for the past 24 years. The forces derived urban expansion in the study area were highly associated the factors of economic, infrastructure, proximity, neighborhood, physical, land values, land use policy and urban planning. On the basis of the major findings the study recommends the government authorities need to enforce strict urban growth policies in coming days. Proper urban planning is always needed to be emphasized. It is important for Lagatafo Lagadadi town municipality to enforce timely and appropriate land use planning which considers the requirements of social, economic, and environmental sustainability. Regular and up-to-date information on urban land use changes is required to visualize growth patterns and improve urban expansion.

Keywords: Urban Expansion; Forces Shaping Urban Expansion; Land use and Land cover type; and Land use land cover changes

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Acronyms/ Abbreviations

AVHRR	Advanced Very High Resolution Radiometer
CSA	Central statistical Agency
DIP	Digital Image Processing
EROS	Earth Resources Observation and Science
GIS	Geographic Information System
GPS	Global Positioning Systems
LULCC	Land use/Land cover Changes
MUDHCo	Ministry of Urban Development, Housing, and Construction
SDC	Swiss Agency for Development and Cooperation
TM	Thematic Mapper
USGS	United States Geological Survey

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Urban expansion has grown into important concern all over the world. Urban growth, in a particularly the alteration of commercial and residential land use to rural lands at the outcast of conurbation areas has been considered for a long time as regional economic strength (Yuan et al, 2005). Urbanization has been rising from the time when World War II, and has not shown any sign of decrement and continued into the twenty-first century (Oğuz, 2004).

Yue, Zhang, and Liu (2016) define urban expansion as an uncoordinated pattern of urban growth in the city periphery, which is described as single land use, low density, and poor connectivity. According to Bruegmann (2005), urban expansion is an inherent urban process related to the economic development of cities. Galster, Hanson, Ratcliffe, Wolman, Coleman and Freihage (2001) emphasizes the developing nature of urban expansion and considers it as a dynamic process rather than a state. A rough common understanding is that urban expansion is an uncontrolled outwards growth.

Urban expansion in so many cases leads to expansion of urban areas. Urban expansion is quite frightening, particularly in developing countries (Kumar et al., 2007). Haregewoin (2005) have shown that urban expansion in developing countries is largely a result of people interest to move to the town in pursuit of better employment opportunity which leads to an escalation in size beyond the boundaries of the city. The studies by Araya and Cabral (2010) have noted that the horizontal change of urban areas was in the direction of the periphery of urban areas due to the coalescence of a number of smaller settlements as well as through the consumption of agricultural land.

Urban expansion is a characteristic of developing countries due to high population growth (Zewdu, 2011). Urbanization and expansion of towns and cities pose a serious challenge to sustainable development and the conservation of heritage sites (Hayek et al., 2011). The extension of cities and towns, associated to problems of poverty, unemployment, inadequate health, urban slums, environmental degradation, and poor sanitation create uncontrollable challenge in several developing countries.

According to Mashagbah (2016) urban expansion have natural, cultural, and economic impacts, that escalate cost of infrastructure, increase consumption of energy and other environmental

resources, cause damage in farm and forest lands, cause crowding of roads and substantial traffic, raise land values, and decrease social interaction between people and other negative ecological impacts. Furthermore, Atalel (2014) stated that the serious concern of the world today on urban expansion, because recognizing and measuring the urban expansion and the situation determining factors is vital to put forward the precise strategies and controlling mechanisms on urban growth for decision making.

The speedy expansion of urbanization transforms a huge amount of land from rural to urban. Land cover change occurs through transformation and exaggeration by human intervention, shifting the balance of ecology, generating a response stated as system changes (Dale, 1997). The increasing necessity for land and associated resources frequently outcomes in changes in land use/cover (Assefa, 2012).

Rapid growth of economic activities and population implies a growing need for space. The high demand for space can be seen from the rampant phenomenon of land use changes that causes the decrease of forest area and agricultural lands. Research conducted by Adiwibowo et al. (2007) indicate that as a result of such rapid LUCC, Java is currently experiencing a threat due to its decreasing trend of its environmental carrying capacity which mainly due to the pressure of land uses change. The high density and population growth (due to urbanization) as well as the rapid growth of economic activity threaten sustainability in Java.

Several LUCC studies on Java, particularly from agricultural to non-agricultural land, such research conducted by Laudjeng et al. (1997) on the North Coast of Java from the period 1990-1993, it is known that the vast amount of agricultural land converted into non-agricultural land is 32,037 hectare of the area.

Land use and land cover are separate physical representation of surface of the earth but they have strong relationship (Alemayehu et al., 2009). Land uses are seen in terms of the manner and purpose of the usage resources by people actions the division of land might be for commercial, recreational, urban agriculture or other related land use type. Whereas land cover describe the state of biophysical features like grassland, vegetation cover, forests and other natural land surface landscapes (Mwavu & Witkowski, 2008).

Enlargement of urban areas has greater importance from the point of view of land use and land cover changes (LULCC), as of it has strong effect on the LULCC, such as on built areas, non-built up areas, Forest lands, Agricultural lands and the others (Atalel, 2014). Similarly, in the contemporary world Land-use and Land-Cover changing aspects are the key area emphasized for the reason that adverse effect they have on ecological and bio diversity, run off and flooding weather and climate, the general state of environmental degradation and socio-economic and health. In relation to this, Haregeweyn et al., (2012) reported that, the change in land-use/land cover is due to the reaction to the extension of urban land and the consequence of increasing the population in the urban peripheries of Bahardar area.

Identifying the causes and impacts of land-use/land cover change require understanding both how people make land-use decisions and how specific environmental and social factors interact to influence these decisions (Lambin et al., 2001). Similarly, Yeshaneh et al., (2013) reported rapid the causes resulted rapid extension of urbanization are due to the complex interaction of social, political, economic, technological and uniform human activity, such as increasing demand for agricultural land.

Similarly, Tekle and Hedlund (2000) noted recognizing the trend and driving forces behind LULC changes at the limited level is important to development arrangement and the examination of land associated policies and realizing of possible future choices.

Verburg et al., (2002) showed that forces shaping land-use/land cover can be categorized as direct (proximate) or indirect (underlying). The direct causes comprise human activities that could arise from the continuous use of land and directly alter land cover which reflect that human are driving forces. They are generally operated at local levels and explain how and why local land cover and ecosystem processes are modified directly by humans. On the other hand, indirect causes are major forces that contributed the more direct causes of land cover changes.

According to Lambin et al., (2001) factors driving expansion of urbanization include an increase in human population and population response to economic opportunities. Population growth is a major drives in the conversion of land and encourage to resource degradation (Woldamlak, 2002). Similarly, Dessie & Christiansson (2008) have been noted underlying driving forces of urbanization were combination of market (wood extraction), poor economic conditions, unclear land tenure, sociopolitical, and population growth factors.

1.2. Statement of the Problem

Urbanization brings both socioeconomic development opportunities and environmental challenges. Urbanization lifts urban economic growth, industrial progression, population growth, and social development (Seto et al., 2010). Urbanization is also related with a number of adverse environmental impressions, including water and air pollution; greenhouse gas emissions; urban heat island effect (Pauchard, Aguayo, Pena, & Urrutia, 2006). Therefore, determining the factors of urban expansion is still critical challenge, but it is very important for the purpose of understanding the contributory and the dynamics in urbanization, and for the supporting related decision making (Qu, Zhao, & Sun, 2014).

Similarly, UN-HABITAT (2010) stated that the unrestrained physical expansion of settlements in developing country create an impact on urban environment and economy. This unplanned and unrestrained development makes provision of housing, water supply, sewers, roads, and other public services too expensive. The other impact mentioned on the report was the agricultural land cover has been lost as most cities and towns built on productive agricultural land (Sudhira, et al., 2004). But the physical enlargement of urban areas is not to be considered as increase of urban lands in a given area. Expansion of urban areas is a scatter development which is mainly unplanned and uncontrolled.

UN-Habitat (2010) stated cause of uncontrolled expansion of urban was because concerned government bodies pay little consideration to slums, services, transport and land. Moreover, they fail the ability to forecast urban growth and, as a result, incapable to offer land for the urbanizing poor. Also, the urban poor are not allowed land rights which are one of the major forces deriving people to the fringe of towns, linked with spatial development of urban land in developing countries. According to Ewing (1997), higher income inhabitants generally need larger amounts of housing and the cheap land to build it on is more likely on the fringe of developed urban areas.

In recent years the fiscal problems of many municipal governments have rapidly increased. Dobele (2004) reported the large investments in road, water and sewerage and other public services made in the last decade in many countries often comes from encouragement and financial assistance of the major international development donor agencies. The external aid helped to provide the initial capitalization for these extensive projects, but left the problem of their maintenance and repair to

local governments. As time has passed, the costs of maintenance have increased, forcing the government units responsible to search for new sources of revenue.

Urbanization brings both socioeconomic development opportunities and environmental challenges. While urbanization boosts urban economic growth, industrial upgrading, population aggregation, and social development (Seto et al., 2010) however, it is widely acknowledged that the causes, processes, patterns, and con- sequences of urbanization remain largely unknown (Kaza, 2013). Identifying the driving forces of urban expansion is still a fundamental challenge, but is essential for understanding the attributions and trends in urbanization, and for supporting related decision-making (Qu, Zhao, & Sun, 2014).

A few studies have examined the driving forces of urban expansion in a number of cities or counties (Deng, Huang, Rozelle, & Uchida, 2010). Identification of the determinant factors of urban expansion via a sampling approach on the national level, which is necessary for national policy planning (Jiang, Deng, & Seto, 2013), is still lacking. Also, a lots of have emphasized on investigation of driving forces over one specified period, not sufficient concerns has been paid to temporal changes in urban expansion and its driving forces (Li et al., 2013). The other was regional variation in urban expansion have been rarely studied. The driving systems and the factors might differ from region to region due to distinct features of geography nature, setting of environment, social and economic development futures (Jiang, Deng, & Seto, 2013).

In accordance with what is stated above, the researcher have noted through making a number of visits to the Lagatafo Lagadadi Town and review of organization's annual reports as well as discussions made through informal way with Lagatafo Lagadadi municipality there were rapid urbanization which has a undesirable impact on physical development and the sustainability of urban areas. In most cases, sprawl results an increase the cost of public infrastructure and of commercial and residential development and transport. Hence, the focus of this study was to analyze the urban expansion and the forces shaping at Lagatafo Lagadadi Town; during the period of 1995 to 2019. Therefore, this study has tried to show the appearances of Lagatafo Lagadadi town during the period of 1995 to 2019; the land use/land cover change; and the driving forces behind the expansion of the town.

1.3 Objectives of the Study

1.3.1. General Objective

The major aim of the study was to analyze urban expansion and the forces shaping the case study of Lagatafo Lagadadi Town.

1.3.2. Specific Objectives of the Study

The specific objectives of the study are as follows:

1) To analyze the land use and land cover class of Lagatafo Lagadadi town during the period of 1995 to 2019
2) To distinguish the changes that has taken place in land use/land cover and urban expansion in Lagatafo Lagadadi town during the period of 1995 to 2019
3) To Identify the forces shaping urban expansion of Lagatafo Lagadadi Town during the period of 1995 to 2019

1.4 Research Questions

The study attempted to answer for following basic research questions

1) What are the land use and land cover classes of Lagatafo Lagadadi town during the period of 1995 to 2019?
2) How does the land use/land cover and urban expansion have changed during the period of 1995 to 2019?
3) What are the driving forces behind the expansion of Lagatafo Lagadadi town?

1.5 Significance of the Study

The analysis of urban expansion and the forces shaping urban expansion would help to understand the degree of the impacts on the surrounding environment. The study helps to distinguish how the land was previously used, what changes have occurred and are expected in the future for the town land management offices as an inputs.

Knowing the spatial configurations and driving forces behind the expansion will help the municipality, planners and local officials to predict future development directions and monitor the development to ensure sustainable development.

It will also give insight policy and decision maker to propose appropriate policy and strategies. Generally results of this research may help urban planners and strategy makers in building and adopting the planning and promoting better decision-making. Recognition and measuring the trends of urban expansion changes and its driving forces for future forecasting is necessary to put forward the right strategies and managing mechanisms on urban growth.

1.6 Scope of the Study

The scope of the study area was limited to the premises of Lagatafo Lagadadi Town. The sequential scope conducted using GIS based analyses of Land use /Land cover classes, related on how land use/land cover change have changed between the period of 1995 to 2019. The motive behind the time scope starting from 1995 is to critically identify the past reality using land use land cover trend analysis till 2019. Thematically, the study concentrates on identifying the forces shaping urban expansion of the town and analyzing the extent expansion or spatial patterns using land sat imagery.

1.6 Limitation of the Study

Many researchers believe that any research work cannot be free from certain constrains. So this research paper also faced certain limitations. As an important measure to these limitations, time were judiciously managed to achieve the objectives of the study, however due to outbreak of pandemic disease Covid-19 study lagged to complete within the stipulated time frame for completion of the work. Also, some of the limitations faced in the process of the study were lack of resource material in the area specially some of land sat image of study area lack clarity and visibility, also limited number of previous recorded documents and reference material about urban expansion. The study collects information from the sample respondent where all population is not considered.

1.7 Organization of the Study

The study was organized in to five chapters. Chapter one presents background, statement of the problem, objectives, research questions, significance, scope, and structure of the study. Chapter two come up with the literature review which is both theoretical and empirical aspects of urban expansion, GIS methodologies of urban expansion analysis and land use modeling. Chapter three illustrate methodology of the study while, chapter four presented the result of the study such as discussion and interpretation. Finally, Chapter five presented conclusions and recommendations.

CHAPTER TWO: RELATED LITERATURE REVIEW

The Literature review is gateway for understanding the concept of urban expansion, the forces derived expansion of urban areas, types of urban expansion, forms of urban expansion consequence of urban expansion, measurement of urban expansion and methods of measuring.

2.1 Concepts of Urban Expansion

Urban expansion is unintentional, undesirable spreading of urban spatial increase in to areas adjacent the ends of a city (Mekuriaw, & Gokcekus, 2019). The physical extension of urban area is a dynamic element, subject to diverse sorts of activities, for example, social, physical activities and economic. These contributory elements are mainly subject for rapid growth of settlements in urban areas. It is a continuous process which is not mainly associated with industrialization but a combination of all factors underlying the process of economic growth and social change. Rapid extension of cities is creating both challenges as well as opportunities in the developing countries. From various challenges an inevitability of urbanization in its process is one of the main. Centers of urban areas expand horizontally due to pressure of rapid rate of urban expansion. (Mekuriaw, & Gokcekus, 2019; and Getahun, 2017).

Urban expansion considered as the spatial structure extension of the urban centers. The physical enlargement of urban centers is a phenomenon happening all over the world in the history of urban centers and due to the pressures it results loss of range landscapes, agricultural lands, and aesthetically attractive natural areas (Minwuyelet, 204) Urban horizontal extensions of in the outer part of urban areas are characterized by low density physical development; this type of expansion is considered as scattered and uneven leapfrog expansion (Tamirat, 2016).

According to Bruegmann (2005), urban expansion is an inherent urban process related to the economic development of cities. Galster, Hanson, Ratcliffe, Wolman, Coleman and Freihage (2001) emphasizes the developing nature of urban expansion and considers it as a dynamic process rather than a state. A rough common understanding is that urban expansion is an uncontrolled outwards growth. EEA. (2006).European Environment Agency Urban sprawl in Europe: The ignored challenge, 2006

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(2001) emphasizes the developing nature of urban expansion and considers it as a dynamic process rather than a state. A rough common understanding is that urban expansion is an uncontrolled outwards growth. At present, remotely sensed data are the primary data sources for extracting the information of urban expansion process

According to Yue, Zhang, and Liu (2016) urban expansion is defined as an unorganized spatial pattern of urban development in the margins of urban areas, which is labeled as separate and single segregated land use, low lacking compactness, and low physical connectivity. The common definition of urban expansion which roughly understood is that urban expansion is an unregulated horizontal growth.

Urban expansion has four physical growth components in terms of morphology which are; linear, concentric, multi nuclei and leapfrog expansion. The physical development flowing road or axis of transportation line is defined as linear expansion (Wu, 1990). The large scale urban horizontal change at every corners of the city resulting evenly distributed development is considered as concentric expansion. The expansion occurring indifferent location separated by open land is named as leapfrog expansion (Ottensmann, 1977). The other is city having more than one center separating from central business district is understood as multi-nuclei expansion (Wu, 1990).

Urban expansion is defined as the physical pattern of low-density growth of urban areas, mainly into agricultural areas around under certain market circumstances. Urban expansion is defined as the physical pattern of low-density growth of urban areas, mainly into agricultural areas around under certain market circumstances (European Environment Agency, 2006).Urban expansion is recognized as an important phenomenon as it offers increased opportunities for employment, production, and goods and services (Cohen, 2006). urban expansion is towards a more dispersed or compact pattern (Yeh and Li, 2001)

Urbanization is a form of metropolitan growth that is a response to often bewildering sets of economic, social, and political forces and to the physical geography of an area. Urbanization is a transformation process from a traditional agricultural society to a modern metropolitan society, associated with major changes in social and economic structures (Cohen & Reed, 2004) Urbanization refers to a growth in the proportion of a population living in urban areas and the further physical expansion of already existing urban centers (Samson, 2009; Alaci, 2010)

Urbanization refers to a process in which an increasing proportion of an entire population lives in cities and the suburbs of cities. It is the movement of population from rural to urban areas and the resulting in increasing proportion of a population that resides in urban rather than rural places (Alaci, 2010). Urbanization refers to an increase in the proportion or share of the population residing in urban areas as opposed to rural areas; whereas urban growth refers to an increase in the absolute number of people inhabiting urban areas (Brockerhoff, 2000).

There are three types of models, namely, leapfrogging, edge-expansion, and infilling, which are widely recognized for portraying the morphology of urban expansion (Yu & Zhou, 2017). Specifically, leapfrogging refers to new areas of developed land which are not next to remaining context spots of settled land; the edge expansion symbolizes the arrangement in which new development covers of established land grow outside the border of current covers of developed land; and infilling represents to new areas of settled land are enclosed by existing covers of settled land. In accordance with the model according to physical pattern expansion in urban land can be summarized as the locational change from one point of diffusion to other coalescence (Yu & Zhou, 2017).

2.2 Land Use and Land Covers

Land cover refers to the observed biophysical cover on the earth's surface including vegetation, bare soil, hard surfaces and water bodies. Whereas land use is the utilization of land cover type by human activities for the purpose of agriculture, forestry, settlement and pasture by altering land surface processes including biogeochemistry, hydrology and biodiversity (Di Gregorio and Jansen, 2000).

Land use and land cover (LULC) are distinct yet closely linked characteristics of the Earth’s surface (Solomon, 2016). Land use describes the way and the purposes for which human beings employ the land and its resources (Alemayehu et al., 2009). While land cover refers to the ecological state and physical appearance of the land surface (such as Closed forests, woodlands or grasslands) Land use/cover is a composite term, which includes both categories of land cover and land use (Ioannis and Meliadis, 2011). The land use/cover pattern of a region is an outcome of natural and socioeconomic factors and their utilization by the man in timeand space (Zubair, 2006).

Land use change occurs through the interactions of people, place and environment. There are two levels of factors behind land use change. Land use decisions are generally viewed as a function of

both macro and micro level processes and changes. Land use land cover change is the transformation of land due to human interference for numerous purposes, such as settlement, for agriculture, transportation, recreation uses, parks, infrastructure and manufacturing, fishery and mining (Meyer & Turner, 1994).

Land cover represents the physical surface and biotic features of the spatial surface of the land, e.g. forest, homogenous or heterogeneous vegetation, asphalt; ice is considered the essential determinant of ecological structure and function (Bockstael & Irwin, 1999). In addition Land covers defined as the bio-physical features of earth surface whereas; land use in other way it refers to the human purpose applied to these biophysical attributes (Lambin, et al., 2001).

Many books uses land-use/ land-cover change interchangeably, although they are different. Land use is a chemical change and physical change attributable to management, it may comprise changing of grazing to cropping, change in fertilizer use, drainage improvement, connection and use of irrigation and plantation, and land degradation, vegetation removal, , spread of weeds and exotic species, and conversion to non-agricultural uses (Quenitn et.al., 2006).

Land cover class refers the spatial characteristics of the earth's, captured in the distribution of vegetation, desert, ice, water, and other physical features of land, including those created by solely by human deeds such as settlement (Billah & Anisur, 2004). According to UNFAO land use is the "total of all arrangement, activities and inputs that people undertake in a certain land cover type." However, the land use is clearly determined by ecological factors such as climate, soli characteristics, vegetation, topography, and water body and etc. but also reflect land's importance fundamental factor of production.

According to Meyer (1999) every plot of land on the Earth's surface is exclusive in the cover it possesses. Land use features and land cover features are different yet strictly linked features of the Earth's surface. The usage to which we considered land might be agriculture, grazing, logging, mining, urban development, and among many others. While land cover classes could be crop-land, forest, wet-land, roads, pasture, urban areas and others. The term land-cover formerly denoted the type of vegetation situated in the earth surfaces which are like grass cover or forest but recently it has included other stuffs such as the human structure, soil-type, surface, biodiversity, and ground water as stated by (Ibid, 1995).

Land cover data forms how much of the province is covered by wet lands, forest, and impervious surfaces and crop lands, other land and water types (wet lands or open water). Land use indicates the usage of landscape by people whether it is mixed uses or conservation. But here there are classes which are both land use/land cover at the same time, so both term is the most preferable. Wogderes (2014), as cited in MaD CAT Manual (2011) land cover can be transformed 'by forces other than anthropogenic'. Nature based happenings such as flooding, weather, fire, ecosystem dynamics and climate fluctuations may also initiate alterations upon land cover. Globally, land cover these days is altered primarily by direct activities of human: through agronomy and livestock rising, forestry harvesting and managing and urban and sub-urban building and development. There are also related effects on the land cover in relation to social arrangements such as forest and lakes smashed by acid rain from fossil fuel ignition and crops near cities damaged by troposphere ozone resulting from automobile exhaust (Meyer, 1994).

Several LUCC studies on Java, particularly from agricultural to non-agricultural land, such research conducted by Laudjeng et al. (1997) on the North Coast of Java from the period 1990-1993, it is known that the vast amount of agricultural land converted into non-agricultural land is 32,037 hectare of the area.

2.4 Driving Force of Urban Expansion

Urban centers expansion is determined by means of the relations of the three broad types of phenomena. These are the physical or geographic factors, the demand for land by the households or firms who inhabit the city and the policy constraints that govern land use and spatial interactions in the city (Seto et al., 2013).

Urban expansion contributes for the transformation of landscapes and creates a lot of massive of environmental and biological impacts. The impacts are not limited in the setting of urban areas only but it also occurs beyond the boundaries of urban area. Expansion of urban area is impressively endangered by socio-economic, geophysical, and institutional circumstances (Wu, 2003). There are five elements which are mostly recognized as the force derived the expansion of urban areas, i.e., proximity, socioeconomic, accessibility, physical, and neighborhood factors (Li et al., 2018).

Many studies have undertaken behind the expansion of urban land in Chinese cities (He, Ke, & Song, 2011) and have found that China's urban expansion exhibits a great number of spatial

differences, resulting from different levels of demographic change, economic growth, and changes in land use policies and regulations (Liu, Zhan, & Deng, 2005).

Urbanization has been one of the most irreversible anthropic activities driving global environmental changes over the past few decades (Wu, Jenerette, Buyantuyev, & Redman, 2011). The Earth's eco and socioeconomic systems have been profoundly changed by urbanization (Seto, Sánchez-Rodríguez, & Fragkias, 2010). Urban expansion is strongly influenced by geophysical, socio-economic, and institutional conditions. Previous studies have shown that urban expansion is driven by socioeconomic factors (Jiang, Deng, & Seto, 2012).

2.4.1 Socioeconomic Factors

According to Zhang et al. (2013) there are two positive socioeconomic factors namely, GDP and population. The positive impacts shows that in China economic growth and population increase were important urban expansion factors. In agreement with previous statement economic growth has been often associated with industrial reconstruction that shifts economic activities from the first industry, usually in rural areas, to the second and third industries, usually in urban areas, which likely promotes urbanization.

According to Salem (2015) showed the economic factor effects a lot in the urban expansion process in the great Cairo metropolitan region. Economic development is sometimes actually defined as a process that shifts a nation's population from rural to urban. Transferring relatively less productive rural labor to the non-farm sector is one of the main engines of the development process (Beauchemin & Schoumaker, 2005). Based on UN (2014), urban living is often associated with higher levels of literacy and education, better health condition, greater access to social and economic services, and enhanced opportunities for cultural and political participation. In the margins of urban areas agricultural activities as well as non-agricultural activities is under taken side by side due to this the spatial development is beyond the boundaries of city or urban centers McGee, (1991) also described the socio economic factors pushing farmers from agricultural activities to non-agricultural activities because the demand their farming product fluctuate from time to time, as a result they change their job to petty trade, wage price, and small-scale industry.

The study done Jabodetabek Megacity demonstrates that trend of horizontal spatial change of the City has been derived by the economic factors contributory element such as industrialization and introduction new satellite towns, due to this in the peripheries mixed land use is added to the

previous boundaries of the town (Rustiadi & Panuju, 2002). Asian megacities have huge of population and rapid growth of economic so that they become magnets for people, investments, businesses, and organizations. Since, they facing urban expansion into their periphery areas, they bring both benefits and the problems of urbanization (ADB, 2008).

Studies have used standard economic factors to investigate the causes of urban expansion or urban sprawl. The key determinants of urban expansion in China are population, income, and agricultural land rent, and urban core growth is affected by industrialization (Deng, Huang, Rozelle, & Uchida, 2008). More recently, McGrath (2005) has confirmed this result, and has further stated that unexplained effects beyond conventional economic factors also contribute to urban expansion.

Zhang et al., (2013) have found that fundamental economic factors, including population, income, and agricultural land rent, are of primary importance in determining urban spatial sizes. They further stated that "urban sprawl is the result of an orderly market process rather than a symptom of an economic system out of control."

Liu et al., (2005) considered gross domestic product (GDP) is a crucial factor that drives urban expansion, because it is closely linked to rigid demand, urban market, and agglomeration capability. Economic development often drives urban expansion by promoting urban land and construction demands (ibid). Beauchemin and Schoumaker, (2005) stated transferring relatively less productive rural labor to the non-farm sector is one of the main engines of the development process.

China has been subject to dramatic urbanization since the economic reform in 1978 China (Li et al., 2013). Many studies have examined the relationship between urban expansion and influencing factors, the results of which have advanced our knowledge on driving mechanisms of urban expansion.

Urbanization is predicted as a process that will continue in the coming years, so that sustainable development challenges will be increasingly concentrated in cities, particularly in the lower-middle-income countries where experiencing fastest urbanization (UN, 2014). Asian megacities have huge of population and rapid growth of economic so that they become magnets for people, investments, businesses, and organizations. Since they facing urban expansion into their periphery areas, they bring both benefits and the problems of urbanization (ADB, 2008).

Gross domestic product and population are often considered socioeconomic factors. The density of population is important force derived the expansion of urban areas because it has strong relationship with urban market, rigid demand and agglomeration capability. Economic development frequently drives urban expansion through endorsing land in the urban areas and the demands of construction (Li et al., 2018).

Generally, the driving effect of economic growth on urban expansion tended to decrease. The effect of economic growth on urban expansion on the national scale does not hold when evaluating impacts at the regional scale. Urbanization is crucially linked to migration. Based on Bhagat and Mohanty (2009), whether migration is a strong or weak force in the urbanization process depending upon the nature and pattern of migration. The two socioeconomic factors, population and GDP, had positive effects on urban expansion for most regions and time periods. The consistently positive effects imply that population and economic growth were critical drivers of urban development (Zhang et al., 2013). The impacts of population were always significant for all time periods in the four regions.

2.4.2 The Infrastructure Factors

Attempts have been made to investigate how infrastructure provision can affect urban expansion. Increased public expenditures in infrastructure are also related to urbanization urban expansion (Liu, 2010). Mahamud et al., (2016) found that the distance to public amenities/services, affordable housing, and the distance to the working area are the most significant factors of urbanization in the George Town conurbation in Malaysia. Demurger (2001) provides empirical evidence demonstrating the relation between the economic growth and infrastructure investment and also relates to urbanization or urban expansion. Appiah et al., (2014) found two different factors as the most significant in Ghana: the increased demands for new housing in the city and the good accessibility of the settlements in the PUAs.

In addition, infrastructure, employment opportunity, foreign investment, and land category (Gustafson, Hammer, Radeloff, & Potts, 2005) are linked to urban expansion. Three variables characterizing the traffic distance, i.e., distances to a highway, national way and railway, were considered as transportation accessibility factors. Transportation accessibility usually guides urban expansion (Wu & Yeh, 1997). Urban expansion along traffic lines is one of the most common

urban expansion patterns. As a result, a negative effect of the distance to a traffic line on urban expansion is expected.

Rustiadi et al. (2014) mentioned this tendency has been growing at an increasingly faster rate in the globalization era. The urban areas, especially large cities and megacities offer infrastructures and facilities as well as access to capital, labor and market for secondary and tertiary economic activities. The large cities and megacities have developed as concentrated economic activities, capital, and people facilitated by relatively better transportation facilities and communication technologies (Rustiadi et al., 2014).

The accessibility factors, i.e., distances to different roads, were negatively linked to urban expansion, suggesting that a road benefited urban development with easier transportation access. The regression coefficients of these factors did not follow a monotonic pattern because the value of these accessibility variables of one pixel may vary over (Luo & Wei, 2009).

Similarly, Luo & Wei, (2009) stated the influence of a railway to be more significant than the other two factors in all regions, with more frequent significant negative coefficients in the study periods. In addition, the national way also played an important role in urban development in Western China with a significant negative effect detected in all periods .the accessibility factors, i.e., distance to a highway, national way and railway, had no significant, or a negative effect on urban expansion in different regions.

The distance to a lake or a river generally showed a positive relationship to urban expansion, indicating an increasing likelihood of urban development of a location with increasing distance to a lake or river. This result is consistent with previous findings in Wuhan and Nanjing (Cheng & Masser, 2003; Luo & Wei, 2009). The factor of distance to a lake had primarily a positive effect on urban growth in Eastern, Northeast, and Central China, consistent with results from the national analysis.

In Western China, the impact of distance to a lake on urban expansion changed from positive to negative, implying that the dominant effect of a lake changed from constraining to promoting urban development. The distance to a river showed varied effects on urban expansion in Eastern China over time, while this factor did not appear to exert a significant impact on urban expansion in Northeast, Central, and Western China.

Based on UN (2014), urban living is often associated with higher levels of literacy and education, better health condition, greater access to social and economic services, and enhanced opportunities for cultural and political participation. Nevertheless, rapid and unplanned urban growth as well as urban expansion threatens sustainable development when the necessary infrastructure is not developed or when policies are not well-implemented. Unplanned or inadequately managed urban expansion leads to rapid sprawl, pollution, and environmental degradation, together with unsustainable production and consumption patterns (UN, 2014).

2.4.3 Physical Factors

There are four physical factors, slope, elevation, distance to a lake, and distance to a water body or river, were considered. Elevation and slope are usually restrictive influences urban expansion. Urban expansion can be affected by the distance to river or a lake in two ways. First, urban enlargement is limited by the existence of a river or a lake. Secondly due to the presences of water resources like river and lake an opportunity that contributes urban expansion near the resources (Luo, & Wei, 2009)

Previous studies indicate a positive relationship between elevation and physical development of urban areas. Osman, Divigalpitiya, & Arima (2016) studied that accessibility was the major contributory factor for urban expansion in the villages. According to Mohamed, (2012) the regional topography was an influencing factor which drove the urban expansion toward agricultural lands, particularly in the northern frontiers.

Furthermore, physical factors such as slope and elevation' proximity factors neighborhood and land use policy and urban planning have influenced urban expansion. Due to differences in environmental conditions between regions, the impact of the four physical factors on urban expansion also showed regional differences(Luo & Wei, 2009).

Physical factors Slope and elevation (Tian, Qiao, & Zhang, 2012) four physical factors, i.e., elevation, slope, distance to a lake, and distance to a river, were considered. Elevation and slope are usually restrictive factors to urban expansion, especially for areas with poor natural conditions and low development level (Braimoh & Onishi, 2007). The distance to a lake or a river affects urban expansion in two ways. First, urban expansion is restricted by the presence of a lake or a river. Second, a lake or river presents water resources advantages and waterborne possibilities that

benefit urban development in surrounding areas (Luo & Wei, 2009). It should be noted that conditions represented by these factors do not vary over time.

The elevation was negatively correlated with urban expansion in earlier periods in Eastern and Northeast China, which agrees with the relationship detected in the enacting the revised Land Administrative Law in 1998. In Western China, elevation was occasionally positively related to urban expansion, probably because low-lying non-urban areas are restricted by other factors from urban development. Slope was only negatively correlated with urban development in the earliest period (1990–1995) in Eastern China, implying that the constraining effect of slope weakened over time. The impact of slope in Northeast and Central China on urban expansion was insignificant. In Western China, the slope remained a constraining factor on urban expansion, with negative impacts in most periods.

The two physical factors of elevation and slope showed negative effects on urban expansion, revealing that urban development has been dependent on natural conditions. High altitude and steep areas are less likely to be developed because higher costs are needed to construct built-up areas in these areas compared to flat areas (Liu, & Wu, 2013).

2.4.4 Proximity Factors

Proximity factors are measured by the distance to country center or city center. The proximity factors apply effects on the expansion through the effect of site location in the small scale. The closer the site is to an administrative midpoint, the greater its possibility of urban expansion. Distances to highway, national way and railway characterize the traffic distance and they are considered as transportation accessibility factors (Li et al., 2018).

Proximity factors Distance to socioeconomic center, such as central business district (CBD), city center, and subcity center (Li et al., 2013). The distances to a city or county center were considered as proximity factors. These two variables exert impacts on urban expansion via locational effects at a small scale (Wu & Yeh, 1997). It is expected that the closer a region is to an administrative center, the higher its likelihood of urban expansion. The continuous urban expansion pattern is a main explanation for this phenomenon, because areas closer to an administrative center have more opportunities to access socioeconomic resources with lower transportation costs.

The proximity factors of the distance to a city or county center had a negative effect on urban expansion, indicating an declining likelihood of urban development with increasing distance to an administrative center (Dubovyk et al., 2011). This observation can be explained by easier access to socioeconomic resources and better development opportunities in areas closer to an administrative center (Li et al., 2013). The impact of an administrative center on urbanization declined over time, as observed from the decreasing absolute values of the regression coefficients over different study periods.

The two proximity factors, distances to a city or county center, were negatively linked to urban expansion in Eastern and Northeast China in later periods, indicating higher likelihoods of urban expansion in areas closer to an administrative center. Nevertheless, for some periods in Central and Western China, a significant positive effect from these factors was found, revealing a possible leapfrog urban development pattern in these regions, resulting from the construction of new towns and urban districts encouraged by government in these regions (Osman et al., 2016).

Hu & Lo (2007) found the two proximity factors, distances to country or city center, were indicating higher likelihoods of urban physical extension more of in a place with walking distance to administrative centers in Eastern and Northeast China in later periods (2000–2010). The expansion will probably continue to proceeds in locations near developed areas due to the other factors which will lead to more informal areas. Osman et al., (2016), also determined that proximity as one of the most vital aspect influencing the physical change in the PUA located around Giza City in Egypt.

Another important description on drives of extension of urban is given by Caragliu (2015) a distinction into geographic (material or physical) proximity and nongeographic (relational, social or other) proximity. The concept of proximity is not only related to physical distances between points or actors in space but, may relate to any gravitational force that creates an above-average attractiveness between these points or agents that supersedes the physical gravity friction between them. According to Caragliu (2015), it makes sense to generalize distance in terms of relational proximity, defined as the intensity of interactions and cooperation among local actors, including firms and individuals.

2.4.4 Neighborhood Factors

Neighborhood factors are determined by the localities closer to urban centers having better physical development quality than the previous and urban infrastructures.

Neighborhood nearer to urban place having good development status has easier availability to urban physical infrastructures and other infrastructures and requires lower costs for the development of new settlement in the area. Therefore, the neighborhood factor is direct contributory for urban expansion (Cheng & Masser, 2003). According Sefidi (2016) the impact of Neighborhood on urban expansion is positive because of the expansion of urban area takes place by being closer to the context of existing urban areas. The mostly known physical development mode was through edge extension, this often happen in the peri-urban areas (Shi, Sun, Zhu, Li, & Mei, 2012). The development of urban area and factors of neighborhood positively related because there is good infrastructure accessibility and the development in lower costs in peri-urban areas (Li et al., 2013)

Neighborhood factors are proportion of urban land in the surrounding area (Dubovyk et al., 2011). Although neighborhood has been identified as an important driver of urban change in urbanization studies based on cellular automata models (Yeh & Li, 2001), this factor was frequently neglected in urban expansion studies using regression based techniques. Here, we used the fraction of the urban surface in a 3 km 3 km window to determine neighborhood information. Generally, locations closer to developed urban areas have easier accessibility to urban infrastructures and require lower costs for new urban development. Hence, the neighborhood factor is usually positively linked to urban expansion (Cheng & Masser, 2003).

2.4.5 The Land Value Factors

Almost all agricultural land is privately held, so agricultural lands are easily bought and sold and subdivided into residential lands. Moreover, there is no the intervention of urban planning or the land management involvement done by government on agricultural land for these reasons, the speculation on lands for settlements is very common in these areas (World Bank, 2008).

Appiah et al., (2014) argued as there are two driving factors related to the land value the first is new housing demand and the second one is the accessibility of land values for settlements is the most critical factor for urban expansion. Based on Salem (2015) the land values factor became one of the main driving reasons for urban expansion. The expansion process is very gainful, where

the price of the changed land use (from agriculture to buildings) exceed between 8 to 12 times the prices of the same agricultural land.

The Kathmandu valley, the capital of the nation, is an economic, sociocultural, political, and educational hub with extant fertile land for agriculture. It is one of the fastest growing urban regions of South Asia and the urbanization of the Kathmandu valley has gained complete momentum since the late 1950s. All these previous studies have explored the rapid, unplanned, and unmanaged urban sprawl, high population concentration, LULC change and complexities in the valley and the trend is likely to be more intense in the future.

2.4.6 Urban Planning and Land use Policy Factors

Government, utilize policies to restrict and adjust urban expansion on agriculture lands. On the other hand, Nada (2014) clarified about the legal factors on periphery areas in which government doesn't reach to manage and control agricultural sites were prone for the physical horizontal enlargement in Egyptian cities.

Urban expansion is rife in the cities of developing countries and discrete and inconsistent with the local plans and policies (Nada, 2014). Scientific analysis in these areas is highly essential to better understand the growth patterns and processes. Generally, cities in developing countries surpass the coping capacities, resulting in squatter settlements and shanty townscapes. Therefore, the precise projection of future urban growth and its management based on reliable statistics and a complete understanding of the patterns and urbanization trends is essential(Pradhan, 2017).

Accurate, consistent, and updated information on the urbanization trend is crucial for the need analysis and policy formulation to ensure a sustainable urban future. Over time, land-use change maps provide essential information for land-use planning that can help to understand the drivers and dynamics of land-cover transformation and predict the future economic and environmental influences. Accelerated urban expansion not only influences socioeconomic change, but also influences farm land loss, impacts ecology and the environment, and often threatens sustainable urban development(Chawla, 2012).

2.5 Forms of Urban Expansion

Expansion of urban areas goes substantially in different forms. In any city, new urban spreading out can occur using the same densities (person per square kilometers) as those prevailing in

remaining developed areas, with amplified densities or with reduced densities (Goytla, 2015). It can come about by the renovation of developed zones at higher densities, through infill of the remaining open-spaces in already built up areas or through new "green field" development in areas previously in non- urban use. New green field development can either be contiguous with the existing built up areas or can leapfrog away from them, leaving swaths of undeveloped land that separate it from the existing built up areas. It can encroach upon watersheds, wetlands, forests, and also other sensitive nearby settings that has to be protected from the damage (Angel & Shlomo, 2005).

There are several forms of urban expansion exist, such us compact or sprawling, clustered or dispersed, leapfrog or continuous. Self-organizing or spontaneous, and organic or planned Compact and sprawl developments are the most general forms of urban growth. Other forms are normally defined and characterized based on the two forms (Pradhan, 2017).

Compact development is characterized by centralization and high-density built-up area where as sprawl development is mainly a low-density, scattered, and decentralized urban form (Abdullahi et al., 2015). Sprawl is defined as "the uncontrolled dispersal out of a given city and its suburbs over more and more semirural land at the margin of an urban area (Chawla, 2012).

2.6 Types of Urban Expansion

Type's expansion of urban analyzed and classified in the following categories based on Angel and others 2010: Infill: New development takes place in all the open spaces contained in the existing urban area. Extension: New development takes place in contiguous clusters immediately adjacent to the existing urban area. Leapfrog: Development skips out and away from the existing urban area, leaping over swaths of open space. Sources: (Goytla, 2015).

2.7 Consequences of Urban Expansion

According to the world urbanization prospects reported by the United Nations (UN, 2019), from an predicted 7.7 billion people worldwide in 2019, the medium-variant forecast indicates that the universal population could raise to nearby 8.5 billion in 2030, 9.7 billion in 2050, and 10.9 billion in 2100 (UN, 2019). Beside, with the population growth, more and more societies chose to live in urban areas. By 2030, 60% of all humanity which will be nearly 5 billion people is expected to be

urban inhabitants. Worldwide, the coverage of urban land is rising double faster than the rates of urban population (Güneralp & Seto, 2013).

Unmatched urbanization causes rapid urban expansion, which can be unhealthy without rational urban planning. Some researchers employ the term "urban sprawl" to describe unwholesome urban expansion (Angel et al., 2011). Unwholesome urban expansion, or in other words, urban sprawl, refers to an abandoned and dispersed process of urban growth regarded as by automobile-dependency, low urban area density and low population density (Bhatta et al., 2010).

2.8 Urban Expansion in Ethiopia

According to the world urbanization prospects reported by the United Nations (UN, 2019), Ethiopia is one of the country from nine countries in which more than half of the anticipated rise in the global population up to 2050 will be concentrated.

Ethiopia is the second-most populated country in Africa. Ethiopia has been facing a fast urban expansion process since from the start of economic development and privatization policy. The urbanization processes in the country consequently, resulted with unplanned and uncontrolled urban growth, environmental degradation, and loss of farmland. And also, the expansion rates of urban areas are more rapid then the allocation of services and infrastructures in Ethiopoa (Berhanu et al., 2019).

2.9 Analysis of Urban Expansion using Remote Sensing and GIS Techniques

2.9.1 Remote Sensing and Geographic Information System

Remote Sensing is defined as acquiring information using technology that helps to record information without being directly contacted with the phenomenon (Levin., 1999). There are numerous areas very wide application areas of application for Remote Sensing, in data acquisition procedures, data processing methods and techniques (Craig 1998).

The definition of remote sensing is reflected as a science of gaining Information about objects and phenomena without being in direct interaction with the entity (Lillesand & Kiefer, 2004). GIS enables: the gathering of spatial data from diverse kinds of sources from them Remote Sensing being one of it (Anson & Ormeling 1993). Geographic information systems (GIS) first appear in the mid-1960 as a result of the inspiration quantitative revolution in geography and the advancement in the technology (Weng., 2010). Among the various use of GIS it enables,

Performing tabular and spatial analysis, Relating spatial and tabular data, Symbolize and design the layout of a map. Both vector and raster data can be handled in GIS where as some of other software cannot handle both in once. Anson & Ormeling (1993).

GIS technique offers the possibility of combining and analyzing geographic data by using computer technology (Mundia & Aniya, 2005). Integrating remote sensing and GIS practices makes it possible to quantify urban expansion, do the post-classification comparison, and further identify the reasons and magnitudes of urban expansion.

According to Wilkinson (1996) there are three main ways in which remote sensing and GIS technologies can be collectively used to improve each other: Remote sensing is applied to collect evidence for use in GIS, GIS data are used as subsidiary information to improve the remote sensing information, and remote sensing and GIS are used collectively for the purpose of analysis.

2.9.2 Applications of Remote Sensing and GIS Techniques

Among the various use of remote sensing and GIS in different discipline GIS technology has been used in the analysis of urban expansion or urban physical configurations. The usage of GIS and Remote Sensing in urban studies presently has got more weight on the acquisition of urban land use information and contrasting of land cover changes based on trend analysis (Barnes et al., 2001). For the land use and land cover management old methodologies based on population data, census and simple representative maps produced using inventory were not satisfactory Remote sensing and GIS methods to analyze Urban Expansion Trends techniques for physical urban expansion research is needed because it requires qualitative and quantitative information about land cover classes (Maktav et al., 2005).

Remote sensing can be applied in the areas of the following related to land use/land cover: in the management of natural resource, in the protection of wild life habitat, for the purpose of mapping baseline for GIS use, for the study of urban expansion, for the purpose of exploration of resource, to extract activities, for damage delineation (Flooding, tornadoes, fire, volcanic, and seismic), for the purpose of tax and property evaluation and etc (Levin., 1999).

Remote sensing techniques are important methods in analyzing spatiotemporal pattern, for the purpose of land management and the analysis result of LULC maps evidence helps for future appropriate planning and utilization of natural resources and their management. LULC studies

encompass enhancement of the first hand satellite image, classification of LULC and detection of change that have been occurred using GIs (Rimal et al., 2017). And also, Geographical information system allows the analyses of rate and the pattern of urban enlargement quantitatively (Epstein, Payne, and Kramer 2002).

Because of the spatial-temporal characteristics, remote sensing techniques can effectively detect land cover pattern changes caused by rapid urban growth over a certain time period (Martinuzzi et al., 2007). Remotely sensed data provides an opportunity to detect historical land use changes in the same area by comparing satellite image acquired at different times

2.9.3 Landsat

The Landsat earth observational satellites have been in operation since 1972, with the blastoff of ERTS-1, later named Landsat, and with the blastoff of the second satellite in the series in 1975 (Angel et al., 2005). Landsat has continuously collected remote sensing imagery around the world for over 40 years and offers invaluable information for researchers in geosciences (USGS, 2014). On February 11 8th, 2013, NASA launched an 8 Landsat satellite, named Landsat-8. (The previous satellites were named Landsat-1, Landsat-2, Landsat-3, Landsat-4, Landsat-5, Landsat-6 (failed), Landsat-7.) The Landsat ETM+-7 and Landsat OLI-8 are two Landsat satellites still working (Zhang, 2016).

2.9.4 LULC Change Detection

Change detection is the procedure of identifying variances in the state of an object or occurrence by detecting it at different times (Singh, 1989). Change detection procedure is mostly done through the using remotely sensed data to temporal effects of the phenomenon quantitatively (Lu et al. 2004). The primarily aim of change detection is to contrast the contextual representation of two classified images different in a time by controlling all the changes due to differences in non-target variables and to quantify the changes due to differences in the variables of interest (Lu et al, 2004).

Change detection is a significant process in inspection and administration natural resources and urban development since it provides measurable analysis of the altitudinal distribution of the population of interest. Essentially, it also comprises the ability to enumerate temporal applications of remotely sensed facts obtained from Earth-orbiting satellites (Zhang, 2016).

There are two broadly Known approaches change detection: bi-temporal change detection and temporal trajectory analysis. The first one measures changes based on a simple 'two-epoch' timescale comparison. The second one analyses the changes based on a 'continuous' timescale, focusing both changes between dates and the progress of the change over the period (Jianya et al. 2008).

2.9.5 Basic Concept in Image Analysis

Remotely sensed data includes a variety of data source that are defined from the range of Spectrum of electromagnetic radiations. Aerial photography is used to capture reflective signal from the visible and near infrared portion of the spectrum. Most digital scanners operate in similar portion of the spectrum. Thermal and radar sensor systems are sensitive to the different portion of the energy spectrum. Remotely sensed data provides an operational GIS with timely and synoptic data. Image analysis techniques are commonly utilized to perform regional vegetation mapping and to update existing vegetation maps. According to Jensen (1996), the utility of a sensor system for the detection of surface phenomena must be assessed along four dimensions: spatial resolutions (area or size of features that can be identified), spectral resolution (number and width of electromagnetic bands for which data are collected), radiometric resolution (detector Sensitivity to various level of incoming energy) and temporal Resolution (frequency of satellite overlaps). Airborne and satellite digital sensor collect and store data values for discrete units of the Surface of the earth. A scene is composed of large matrix of these cells. Each cell is referred to as a picture element or pixel and may correspond to a square meter, hectare or square Kilometer, depending on the sensor. The spatial resolution sensor usually expressed as the length of one side of the cell. Advanced Very High Resolution Radiometer (AVHRR) has spatial resolution of 1.1 km (Kidwell, 1988); Thematic Mapper (TM) 30 m; (Jensen, 1996). Digital Image Processing (DIP) refers to the manipulation and interpretation of digital images, by a Computer system, to prepare an image for display and interpretation and/or to extract valuable evidence from the image. The possible forms of digital image manipulation are literally infinite Digital Image Processing is principally concerned with four elementary operations: image rectification and restoration, image transformation, image enhancement, and image classification (Lillesand et al., 1998).

2.9.6 Image Classification

The primary task of the study was downloading satellite imageries from remotely sensed data sources and in the second stage preparing the satellite images and classification proceeds. The satellite images has it is own color representation resulted from complied bands, to get the exact representation of the realities the images has to be classified. According to (Gecena, & Sarpb 2008), image classification is the procedure of sorting image pixels into classes to acquire a thematic representation. There are various methods for image classification; the method used was according to the types of the image and the kind of analysis being done. The frequently used image classification method in literature is pixel based classification which further classified into classification supervised and unsupervised.

2.9.6.1 Supervised Classification

Supervised Classification is user oriented classification using training data within a remote sensing data. In the supervised classification procedure, classification samples/classes and training points can be decided according to goals of application and landscapes of study area (Yueliang & Ruisong, 2010). Supervised classification is a technical ways of determining identical ground truth on the satellite through identification of training points of identifiable targets and then after generalizing those spectral signatures to other areas of unknown study area targets (Feizizadeh and Helali, 2010). There are three parameters for supervised classification; maximum likelihood techniques, the minimum distance, and parallel pipelined.

2.9.6.1.1 Maximum Likelihood Algorithm

Maximum Likelihood (ML) is a supervised classification procedure derived from the Bayes theorem (Ahmad & Quegan 2016). The maximum likelihood algorithm is based on relating likelihood identical pixel to produce land-use/ land cover class. In the maximum likelihood model it is assumed that the likelihoods are equal for all land use and the input bands are regularly distributed for all classes (Mulu, 2018).

2.9.6.1.2 The Minimum Distance

The minimum distance procedure of image classification determines every pixel's 'distance' from the class means, and allocates them to the adjacent class. If the pixel is further from analyst-defined distance from any group, it remains unclassified or 'unknown'. The minimum distance procedure

does not estimate opposing degrees of difference within the class, as a result it has a lower overall precision than the Maximum Likelihood classification (Rajalakshmi et al., 2013).

2.9.6.1.3 Parallel Pipelined

It is the classification method based on the uses of threshold of every class signature to decide if a given pixel falls inside the class or not. The threshold specifies the size of every side of a parallelepiped neighboring the mean of the class in feature space. When the pixel is contained in the parallelepiped, it is allocated to the class. However, if the pixel contained within more than one class, it is put in the overlap class (Rajalakshmi et al., 2013).

2.9.6.3 Unsupervised Classification

Unsupervised classification is not based on training data as supervised classification but it is direct identification of configurations within a remote sensing data. (Rajalakshmi et al., 2013). Unsupervised methods are advised when the researcher has no enough knowledge about the study areas features or if there is no available ground truth data for the study. (Fadi 2015).

2.9.7 Accuracy Assessment

Accuracy assessment is the final part in the image classification. According to Rossiter (2004) Accuracy assessment is a process of compering how the ground reality matches with satellite sources. Every satellite based imageries classified based on the maximum likelihood approach has to be checked using accuracy assessment methods. (Congalton, 1991).

From various methods of proving the correctness land-cover data confusion matrix is the major and mainly used by different researchers, it is in the form of an error matrix (Congalton, 1991). Producer accuracy is a degree of the accuracy of a specific classification arrangement and indicates the percentage of a specific ground class that is properly classified. It is calculated by dividing each of the diagonal elements in Table by the total of each column respectively (Ahmad, & Quegan 2016). The formula to determine producer accuracy, the user accuracy and overall accuracy is described blow according to (Ahmad, & Quegan 2016)

$$\text{Producer accuracy} = \frac{C_{aa}}{C_{\bullet a}} * 100$$

$$\text{User accuracy} = \frac{C_{ii}}{C_{i\bullet}} * 100$$

$$\text{Overall Accuracy} = \frac{\sum_{a=1}^{U} C_{aa}}{Q} \text{ x } 100\%$$

Where, C_{aa} = element at situation a th row and a th column; $C_{\bullet a}$ = column totalities, $C_{i\bullet}$ = row sum , Q is the total number of pixels and U is the total number of classes. (Ahmad, & Quegan 2016)

For land-use land cover data needed for planning and management purposes, the accuracy of interpretation at the generalized first and second levels is satisfactory when the interpreter makes the correct interpretation 85 to 90 percent of the time.

2.10. Conceptual Frame Work

A conceptual framework is described as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation; (Cooper & Schindler, 2008).

The conceptual frame work model summarized the relationship among several factors that has been identified as important to the problem. As indicated in the figure socioeconomic, infrastructure, physical, proximity, neighborhood, and land value are driving force of urban expansion (independent variables) of the urban expansion (dependent variable).

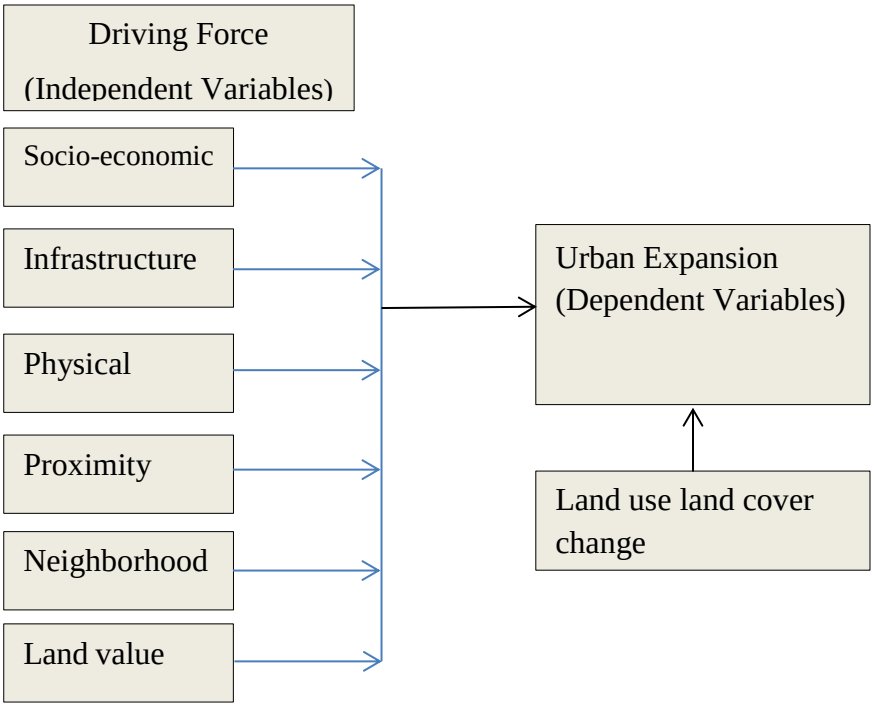

Figure 2. 1 Theoretical framework

Source: Researcher adoption from literature, (2021)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This research was employed different alternative approaches that incorporate different methods and techniques in the gathering and examination of data. From the methods that this research was deployed mixed research methods which incorporate quantitative and qualitative methods of data gathering and analysis.

3.2 Description of the Study Area

3.2.1 Location

This study is conducted in the Oromia Special Zone Lagatafo Lagadadi Town. Lagatafo Lagadadi Town is situated in Oromia Regional State, at a distance of 21 km from Addis Ababa, Ethiopia. Geographically it is between 9°01'29"N - 9°06'0”N latitude and between 38°53'42"E - 38°55'30"E Longitude. It is located at altitude 2,316 to 2,500 masl (Lagatafo Lagadadi Town Municipality, 2020). Oromia Special Zone was established in 2008 by Oromia Regional State. Lagatafo Lagadadi Town Administration has four sub cities/kebeles ; Lagaa Tafo (01), Laga Dadi (02) Dambal(03), and Ekadalle (04) with in an area of 24,350 hectares.

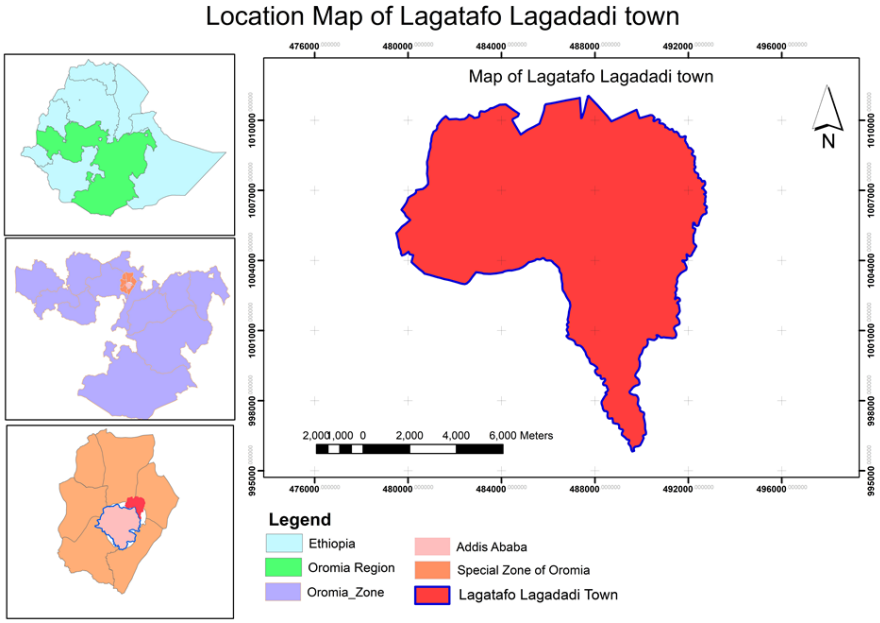

Figure 3. 1 Location Map of the Study Area

(Source: Organized by the Author, 2019)

3.2.2 Economic Situation

Basically from its foundation the town administration was established from the farmer kebeles. Thus, agrarian societies are practicing their agriculture, cattle and traditional pottery. Lagatafo Lagadadi town economic situation currently grown to the national level investments previously it was characterized by small scale trades, cottage industries and urban agricultures. More over the town administration was well known by different kinds of investments 106 in number among these 10 of them are real estate.

3.3. Research Approach

In the study, both quantitative and qualitative approaches were employed. According to Maxwell (2013), research approach refers to techniques and procedures used in the process of data gathering. The study employed the mixed methods, quantitative as major data gathering technique whereas qualitative data are supportive and concurrently throughout the same study. The mixed methods research method concurrently collected quantitative and use qualitative data as supportive and that the researcher looks critically at the results of the quantitative and qualitative analysis to determine if the sources revealed similar findings.

3.4. Research Design

Burns and Grove (2000) describe a research design; as “a blueprint to conduct a study with maximum control over factor that may interfere with the finding”. A research design as “a design that refer to how, where and when data are to be collected and analyzed”.

In this study descriptive research design, used to undertake study. A descriptive research design is a procedure of gathering information from a sample of people who have been selected to represent a defined target population. By descriptive research method, a researcher collects information that describes, explores, and quantifies social phenomena, particularly issues, conditions and problems that are prevalent in the society at a particular point in time (Mugenda & Mugenda, 2012; Cooper & Schindler, 2011). Descriptive research design helps to have general understanding of the problem by studying the current status, nature of prevailing conditions, practices and trends through relevant and precise information. Descriptive design is chosen because it is convenient to conduct through interviews or questionnaire instruments or both. Moreover, the other advantage of selecting this descriptive method is the researcher use questionnaires, and interviews in order to

assure the study. Descriptive research design enables in investigating the forces shaping urban expansion the case of Lagatafo Lagadadi Town.

3.4 Data Sources and Types

3.4.1 Primary Data Sources

To address the stated objectives; questionnaire, field observation, and key informant interview were used to get primary data. To triangulate the data combination of methodologies, qualitative and quantitative approaches were applied.

3.4.2 Secondary Data Sources

All necessary secondary data also were collected from written document reports of Lagatafo Lagadadi Town Municipality, the data sources obtained from Landsat images from the USGS site by registering in Earth Resources Observation and Science (EROS). Secondary data sources from Landsat images regarding land use land and land cover changes and change detection help to investigate urban expansion based on remote sensing data of Lagatafo Lagadadi Town.

Table 3. 1 Data Type and their Sources

No	Layers	Format	Data Source	Scale or Resolution
1	Land use land cover classes (1995, 2000, 2011, 2015 & 2019).	Raster	USGS	30*30
2	Population data	Soft copy	CSA,	No
3	Lagatafo Lagadadi Town Structural Plan	Vector	Lagatafo Lagadadi Town Municipal office	1:50,000

Source: Secondary Data Sources, 2019

Table 3. 2 Data from Satellite Image

NO.	Space craft id	Path/row	Acquisition date	Resolution
1	"LANDSAT 5"	168/ 54	Dec 16, 1995	30m*30m
2	"L7 ETM"	168/ 54	2000-12-05	30m*30m
3	"L7 ETM"	168/ 54	2011-01-10	30m*30m
4	"LANDSAT 8"	168/ 54	2015-01-18	30m*30m
4	"LANDSAT 8"	168/ 54	2019-01-16	30m*30m

Source: USGS Satellite Images, 2019

3.5 Population of the Study

Based on population projection by Oromia Urban Planning Institute the estimated population of Lagatafo Lagadadi Town population in 2007 was 8402. Projecting the population based on Oromia population growth rate was 2.90% per year (CSA, 2007) expected to reach 12184 by the end of 2019. However the reality on the ground is different i. e. currently the population of the town is estimated to be greater than the projected number. The tremendous increase of human population can be attributed to rapid urbanization and migration from neighboring cities and town. The driving factors for the flow of people might be because of the cost of rental housing and living expense might lower than Addis Ababa relatively. The target population includes households, kebele leaders, land management agency higher professionals and leaders.

Lagatafo Lagadadi Town has four kebeles namely Laga Tafo (01); Laga Dadi (02); Dambal (03); and Ekadalle (04). The total populations of kebele households were 4181 Laga Tafo (01); 2947 Laga Dadi (02); 3455 Dambal (03); and 1601 Ekadalle (04) and totally 12184 households were populations from which sample of households were drawn. Similarly, 47 employees (4 heads and 43 staff) of Lagatafo Lagadadi Land Management Office were the target populations of the study.

Table 3. 3 Lists of Kebele and Number of Target Population

No	Categories of Stockholders	Stockholders	Total population
1	Kebele households	Laga Tafo (01)	4181
		Laga Dadi (02)	2947
		Dambal(03)	3455
		Ekadalle (04)	1601
2	Professionals	Lagatafo Lagadadi Land Management Office	43
		Heads of Lagatafo Lagadadi Land Management Office	
3	Local representatives	Kebele Leaders	4
	Total		12231

Source: Lagatafo Lagadadi Town Municipality Report (2019)

3.6 Sampling Technique and Sample Size Determination

The sampling techniques used for this study were both probabilistic and non-probabilistic. The study area, Lagatafo Lagadadi Town, selected based on purposive sampling technique and respondents were selected by using systematic random sampling technique. The researcher was got a complete list of households, and land management agency higher professionals kebele leaders. In the case of probabilistic, the systematic random sampling technique was used to select household respondents. Each unit in the population has a chance of being selected when random sampling technique employed. The researcher used probability sampling to keep sampling error to a low minimum. In the case of non-probabilistic, the purposive sampling was deliberately used to select the study Lagatafo Lagadadi Town. All the target populations were listed in numerical order which is represented by 'N' and to determine the sample (size of the sample) which is represented by n. Therefore; to get the sample interval from each sector, dividing of the total workers by the sample size i.e. population/sample = N/n= kth element was carried out for each respondent. Then

every respondents in each site of the study list were arranged in numerical order and the first number of the sample were randomly selected from the first kth (N/n=kth) number on the list and after that, every element was selected based on the above procedure until the required number of the sample were obtained.

The study holds four kebele in the Lagatafo Lagadadi town. These kebeles are: Laga Tafo (01); Laga Dadi (02); Dambal (03); and Ekadalle (04). The total summary of the selected kebeles included in the study was indicated in Table 2. The sample respondents selected using systematic random sampling technique. The sample size for collecting quantitative data were determined using Cochran's formula as indicated in Hussein (2014). This study employs the following formula to calculate sample size:

The total populations of households in Lagatafo Lagadadi Town were 4181 Laga Tafo (01); 2947 Laga Dadi (02); 3455 Dambal (03); and 1601 Ekadalle (04) and totally 12184 households.

$$n = \frac{N}{1 + N(e)2} = \frac{12184}{1 + 12184(0.1)2} = 99$$

Where:

n= designates the sample size

N=Designates total number of households in towns

n= Designates the sample size

e=Designates maximum variability or margin of error 10% (0.1)

l=Designates the probability of the event occurring.

Table 3. 1 Sample Size and Sampling Technique

No	Stockholders		Total population	Sample Size	Sampling technique
1	Kebele households	Lagatafo (01)	4181	34	Simple random sampling
		Lagadadi (02)	2947	24	Simple random sampling
		Dambal(03)	3455	28	Simple random sampling
		Ekadalle (04)	1601	13	Simple random sampling
2	Professionals	Lagatafo Lagadadi Land Management Bureau	43	43	Availability
3	Local representatives	Kebele Leaders	4	4	Availability
Total			12231	146	

Source: Compiled by the researcher (2019)

To gather information about the driving forces urban expansion the case of Lagatafo Lagadadi town about 146 respondents were selected by Cochran's formula. Generally, to gather information about the forces shaping urban expansion the case of Lagatafo Lagadadi town about 99 respondents were selected by Cochran's formula. Similarly, 47 employees (4 heads and 43 staff) of Lagatafo Lagadadi land management office were the target populations of the study. This has been helped the researchers to investigate the forces shaping urban expansion the case of Lagatafo Lagadadi town.

3.7 Data Gathering Tools

In order to accomplish the objectives of this study, the data was collected through various data gathering instruments. These are questionnaires; key informant interview; document analysis and field observations were applied.

3.7.1 Questionnaires Survey

Both open and close ended questionnaires were used. The researcher prepares a set of questions in the same wording and order as specified in the interview questionnaire. After setting the questionnaire, two assistant data collectors were employed and given a training to enable them

understand the questions and also to provide them the skill on how to approach during data collection. The researcher and assistants manage the different wordings during data gathering process. The questionnaire was prepared in English language and translated to the local language (Oromiffa) and Amharic necessary, for uniform understanding of each question by different respondents. In each day the researcher cheek the data gathering procedure, ways of conducting the data collectors and the selected respondent at the field and give constructive comments for data collectors. The questionnaires have two parts. The first part deals with general background of the participants. The second and the largest part contain the whole number of closed- ended items that address the basic question of the study. The questionaries' was adopted to answer each research questions. Five point Likert scale was employed to identify the extent to which the respondent agree or disagree. Because it is easy and takes less time to construct; simplest way to describe opinion and provides more freedom to respond.

The purpose of collecting data using questionnaires from sampled kebele households and professionals employees was to answer the third basic research question regarding the forces shaping urban expansion the case of Lagatafo Lagadadi Town.

3.7.2 Key Informant Interview

Key informant interviews comprise interviewing of knowledgeable persons who are capable to deliver the required information, perceptions and ideas on a specific issue (Kumar, 1989). In this study about six informant people were carefully chosen one kebele leader from each kebele and two from urban land management agency. For this purposes semi-structured interview employed to answer the third basic research question regarding the forces shaping urban expansion the case of Lagatafo Lagadadi Town.

3.7.3 Document Analysis

The main data applied in the study were secondary data sources generated from the landsat images USGS site. Multi-temporal data Landsat imageries of the town downloaded freely from Earth explorer/USGS by registering in Earth Resources Observation and Science (EROS) Center. Remotely sensed images used and processed for identifying the extent of land use/land cover change and unban expansion.

Data from document analysis describes detail about the data requires for the study and the causative factors required for LULCC detection. So, from secondary data sources the researcher

gathered relevant data's such as scale (resolution) of data and the layer data. In document analysis the researcher going to answer analysis of urban expansion based on remote sensing data of Lagatafo Lagadadi town which include:- the first, and second proposed research question concerning the land cover of the place prior to establishment of Lagatafo Lagadadi town during the period of 1995; and the changes that have occurred at Lagatafo Lagadadi town during the period of 1995 to 2019.

3.7.4 Field Observations

The field observations also employed as data gathering tools using Global Positioning Systems (GPS). During field observation the researcher observe existing ground reality of study area.

Table 3. 2 Category of Respondents Based on Data Gathering Tools

No	Tools	Stockholders	Sample respondents
1	Questionnaires	Households	99
		Land Management Office	43
2	Interviews	Heads Of Land Management Departments	2
		Kebele leaders	4
	Total		146

Source: Field Survey, 2019

3.8 The study's variables and Measuring Techniques

Different studies had developed and also wide literature had been experienced variables to evaluate the analysis of urban expansion and the force driving urban expansion. Some of these variables were related to socioeconomic characters of respondents; temporal dynamics of land use/cover classes; detect changes that has occurred in land use/land cover; measuring urban/built up area expansion rate; and to identify the forces shaping urban expansion during the period of 1995-2019. All types of variables used for this study along with their analysis and measurement techniques are presented in the Table 3.5.

Table 3. 3 Types of Variables and Measuring Techniques

No	types of variables	Categories of variables	Their analysis and measurement techniques
1	Demographic variable age, sex, education..	Independent	descriptive statistics and graphs were used
2	LULC analysis.	Independent	image processing and LULC area anlysis detection
3	LULC change analysis.	Independent	Areas of LULC in square meter (m2) analyzed by descriptive statistics such as frequency and percentage and presented in the table. The rate of change was calculated for each land use/cover using formula developed by Tirusew Abere (2020) for the trends of land use/cover change.
4	Urban expansion rate	dependent	Image processing from USGS and using LULC change detection method
5	The forces shaping urban expansion		Variables with ranked data by Likert scale of five points which is from strongly agree to strongly disagree were used and descriptive statistics such as mean and standard deviation computed, also mean rank computed to indicate the major and the least factor of . urban expansion

Source: Organized By the Author (2020)

Table 3. 4 Land Use/Cover Classes

LULC	Working Definition
Forestlands	Areas covered with dense growth of trees that form nearly-closed canopies (>40%). Some trees (mainly eucalypts & acacia) commonly found around homesteads were included in this category
Agriculture	Land used for growing crops, with perennial and annual crops (teff, wheat, barley, etc.) and associated with the cultivated fields
Built-up	All types of artificial surfaces, including residential, commercial, and industrial areas as well as transportation infrastructures
Open space	Uncultivated farm lands or spaces without vegetation consisting of exposed soil; or small trees with little wood mixed and areas of grazing lands dominantly covered with grasses and shrubs

Source: Organized By the Author (2019)

3.9 Validity and Reliability Checks

Pilot test of the instruments was done before launching in to the actual investigation. The purpose of the pilot test is, to check whether the responses fulfilled the objectives of the investigation; to determine the extent to which the questionnaire was promoted an appropriate relationship with respondents; and to check whether or not the respondents understand the instrument. To ensure validity of instruments, the instruments was developed under close guidance of the advisors and also a pilot study was carried out on 23 households of Burayu town to pre-test the instrument. The pre-test was providing an advance opportunity for the investigator to check the questionnaires and to minimize errors due to improper design elements, such as question, wording or sequence.

Additionally the reliability of the instrument was measured by using Cronbach's alpha. A reliability test was performed to check the consistency and accuracy of the measurement scales. The content validity of the instruments was confirmed by preparing sufficient number of questions, which was include all objectives of the study. Finally, the instrument was modified based on the feedbacks of the pilot test

Table 3. 5 Reliability Statistics

No	The driving forces of urban expansion	Cronbach's Alpha	N of Items
1	Economic factors	.990	7
2	Infrastructure factors	.981	5
3	Proximity factors	.989	8
4	Neighborhood factors	.989	5
5	Physical Factors	.989	7
6	Land values	.949	5
7	Land use policy and urban planning	.983	5

Source: (SPSS Out of Scale Analysis, 2020)

Cronbach's alpha coefficient normally ranges between 0 and 1. George and Mallery (2003) provide the following rules of thumb: "_ > 0.9 – Excellent, _ > 0.8 – Good, _ > 0.7 – Acceptable, _ > 0.6 – Questionable, _ > 0.5 – Poor and _ < 0.5 – Unacceptable". It is noted that an alpha of (0.82) is reasonable good to use the question for the research. Tech-Hong and Waheed (2011), suggests that the reliability coefficients greater than 0.70 are generally found to be internally consistent. Thus the instrument was found to be reliable.

3.10 Methods of Data Analysis

Raw data was collected through questionnaires, interviews, document analysis and observations were carefully tallied, tabulated and organized manually. Both quantitative and qualitative approaches of data analysis were used. The qualitative methods were used to describe the findings qualitatively which were gathered through participatory assessment involving; key informant interviews, observations, secondary data acquired from the USGS site.

3.10.1 Methods of Image Processing

The data sources obtained from Landsat images from the USGS downloaded from Earth explorer/ USGS by registering in Earth Resources Observation and Science (EROS) Center processed for identifying the extent of the town expansion land use/land cover change using Arc GIS software. The Software is selected based on the capability to work on the existing scenario in achieving the predetermined objectives. Hence, software package like; ArcGIS10.5 was used for image processing activities on satellite images for the preparation of land use/land cover types. The

factors that are input to for multi-criteria analysis should be pre-processed in accordance to the criteria set to develop change detection analysis. So using Spatial Analyst, some relevant GIS analyses were undertaken to convert the collected shape files of Lagatafo Lagadadi Town.

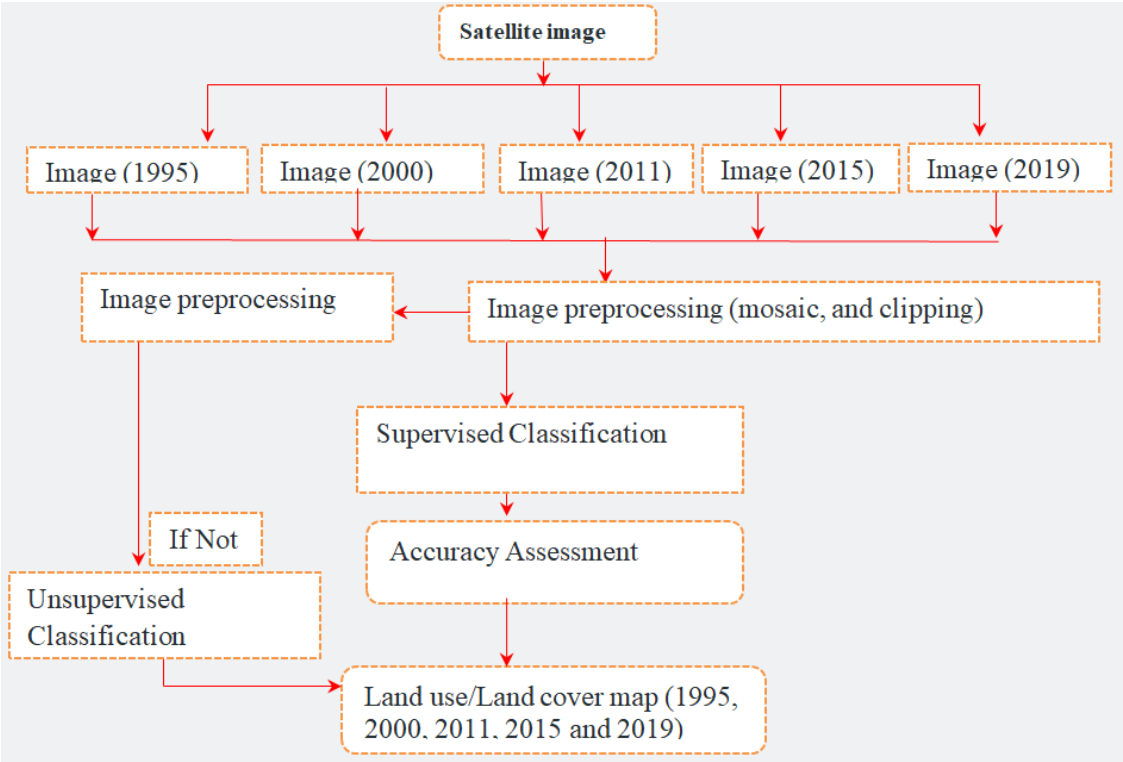

Figure 3. 2 Methodology of Image Processing

Source: Organized By the Author (2019)

3.10.2 Methods of Measuring Change in LULC

The change in LULC for the periods 1995 to 2019 was analyzed by using post-classification method the change can be detected in a GIS. Post-classification change detection was selected as it reduces the possible effects of spectral resolution and sensor differences (Lu et al. 2004).

The method allows determining the changes of land use/land cover in the specified period to differentiate LULC types and to compute the coverage area of LULC conversion persuaded by the urban expansion. The area in square meter (m2) LU/LC change was calculated for each land use/cover classes as

$$\text{Change}\left(\frac{m2}{\text{year}}\right) = \frac{\text{P} - \text{R}}{\text{Y}} \quad (1)$$

Where: R = Recent area of LU/LC in ha

P = Previous area of LU/LC in m^2

Y = time interval in year between R and P.

Similarly, the percentage change statistics for LULC maps of two time periods was calculated as

$$\text{Percentage Change \%} = \frac{A_{\text{final year}} - A_{\text{initial year}}}{A_{\text{initial year}}} x100 --------------(2)$$

A is the area coverage of each LULC type (in M^2). Positive percentage values suggest an increase whereas negative values imply a decrease in area coverage.

3.10.3 Methods of Analyzing Urban/Built-up Area Expansion Rate

To calculate the urban expansion rate between 1995 to 2019 years in the study area, the total transformation of the built-up areas were taken into consideration (Rimal, etal 2017). The urban expansion rate refers to the average annual urban area growth in the following years. According to, Goldstein, and Clarke (2003), built-up areas refer to commercial, residential, industrial complexes including surface pavement and other infrastructure that are closely related with built-up environment.

$$\text{Change} = \frac{\text{B2} - \text{B1}}{T2 - T1} x100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .. (3)$$

Where, BER measures the urban expansion rate in (m2/year); B1, B2 represents the urban area (m2) in the year; and T1, T2 indicates the time.

$$\text{Change} = \frac{\text{BUAi} + \text{n} - \text{BUAi}}{n * (BUAi)} x100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .. (4)$$

Where, BUA_{i+n} and BUA_i are the built-up area (in ha) at time i + n and i, respectively, and n is the interval of the calculating period (in years).

3.10.4 Methods of Analyzing the Driving Forces of Urban Expansion

From the literature there were many factors drives of urban expansion, however the current study emphasized weather economic factors; infrastructure; proximity; neighborhood; physical; land values; and land use policy and urban planning were the drives of urban expansion in the study area. Accordingly, questionnaires were prepared and distributed for sample of randomly selected households in Lagatafo Lagadadi town. In this study quantitative data which was gathered by questionnaire from household were analyzed using software Statistical Package for Social Science

(SPSS 24). The results presented in descriptive statistics such as mean/ average values and percentage. The results of mean values help to determine if or not the factors were the driving force of the expansion of Lagatafo Lagadadi Town.

3.10.5 Methods of Analyzing the Qualitative Data

The qualitative data was analyzed by transcribing from the interview and open ended questionnaires in thematic ways. The data collected by using semi-structured interview with municipal head of Lagatafo Lagadadi Town were analyzed thematically and in meaningful qualitatively ways.

3.11. Ethical Consideration

The purpose of the study was explained to the participants and the researcher has asked their permission to answer questions in the questionnaire or interview guide. The researcher was also informed the participants that the information they provided was only for the study purpose. Accordingly, the researcher was used the information from his participants only for the study purpose. For that matter, any communication with the concerned bodies was to accomplish at their voluntarily consent without harming and threatening the personal and institutional wellbeing. And also the researcher has ensured confidentiality by making the participants unnamed. Furthermore, all the materials used for this research has been acknowledged.

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter contains two main parts. The first part deals with demographic characteristics of sample household heads. Under demographic characteristics sex, age, educational background, family size and land holding size of the household heads are included. The second part assesses land use and cover class in the study area. In third part land use land cover change and rates of urban expansion dynamics explored. The forth part deals with effect driving forces of urban expansion.

4.2 Background of Respondents

The information on the respondent's sex, age, work experiences, and educational background, data collected with an aim of providing an overall profile of the research participants. The gathered data presented as follows.

4.2.1. Sex of the Respondents

As shown in the (Figure, 4.1) below, 102 (75.6%) of households were male while the other 33 (24.4%) of households were females respectively. Most of the households were males.

4.2.2. Age categories

Farmers of the study area are classified under different age group. According to the below Figure 3, about 15(11.1%) of the household age were less than 20yrs; about 35(25.9%) lies between 21-25 years, about 46(34.1%) of the household age lies between 26 – 30 years, 13(9.6%) of the household age lies between 31- 35 years, about 11 (8.1%) of the household age lies between 36 - 40 years, and the remaining about 15 (11.1%) of the household age lies greater than 41 years. The largest age groups were between 26-30 years and generally in the study area most of the sample respondents were found at productive age category.

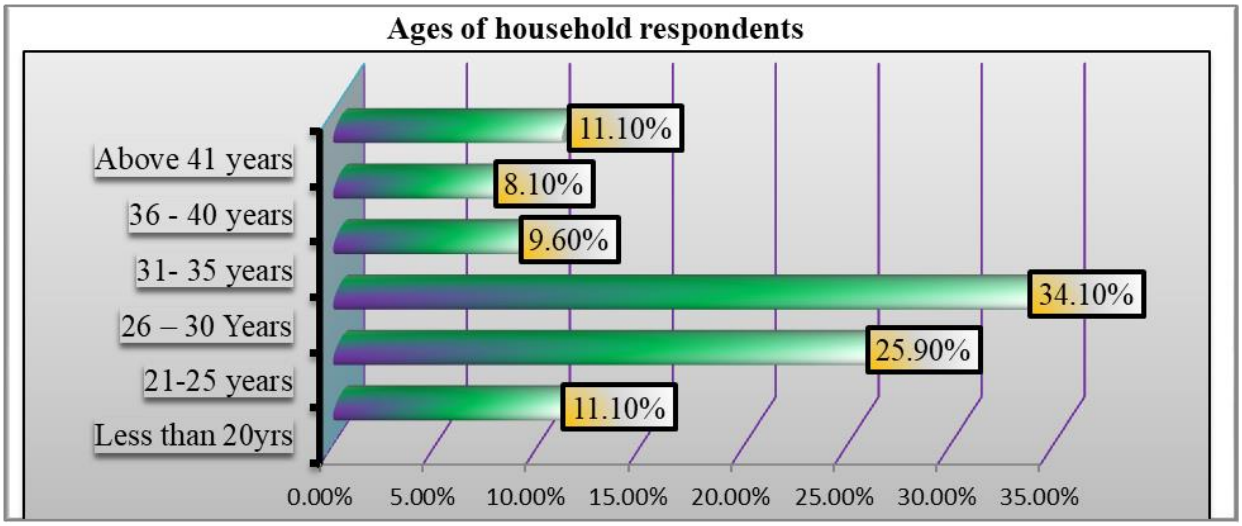

Figure 4. 1 Age Categories of Respondents
(Source: Primary data (2020)

4.2.3. Marital status

The figure 4.3 represents the marital status of the households. About 106 (78.5%) of households had got married, 15 (11.1%) of households were single, and 44 (10.4%) of households had divorce. Majority of the participants were got married.

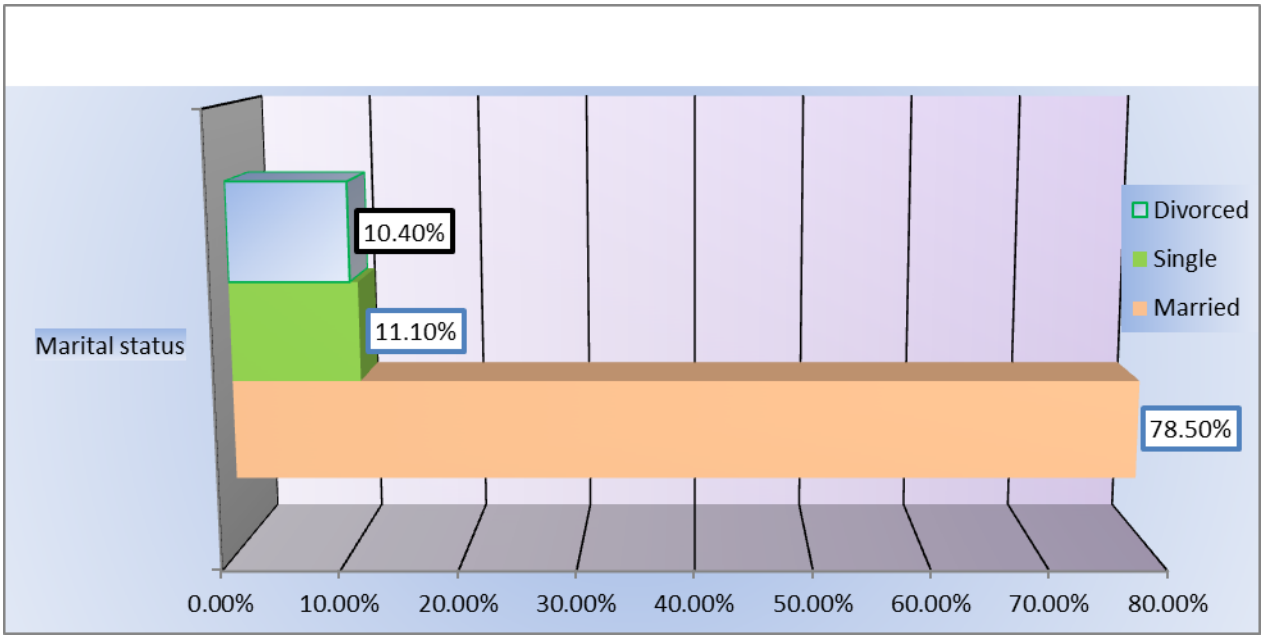

Figure 4. 2 Marital Status
Source: primary data (2020)

4.2.4. Education Status

Education is one of the socio-economic characteristics of household heads playing a significant role to ensure farmers awareness and appropriately use information to adopt challenges of population growth and land degradation. In the study area sample respondents were categorized in illiterate, elementary, high school, and diploma, and degree and above based on their educational back ground.

Consequently, from the total number of respondents, 25(18.5%) of the respondents have certificate, 36(26.7%) of them had diploma, 38(28.1%) of the respondents had a bachelor's degree, and 36(26.7%) of households had master's degree.

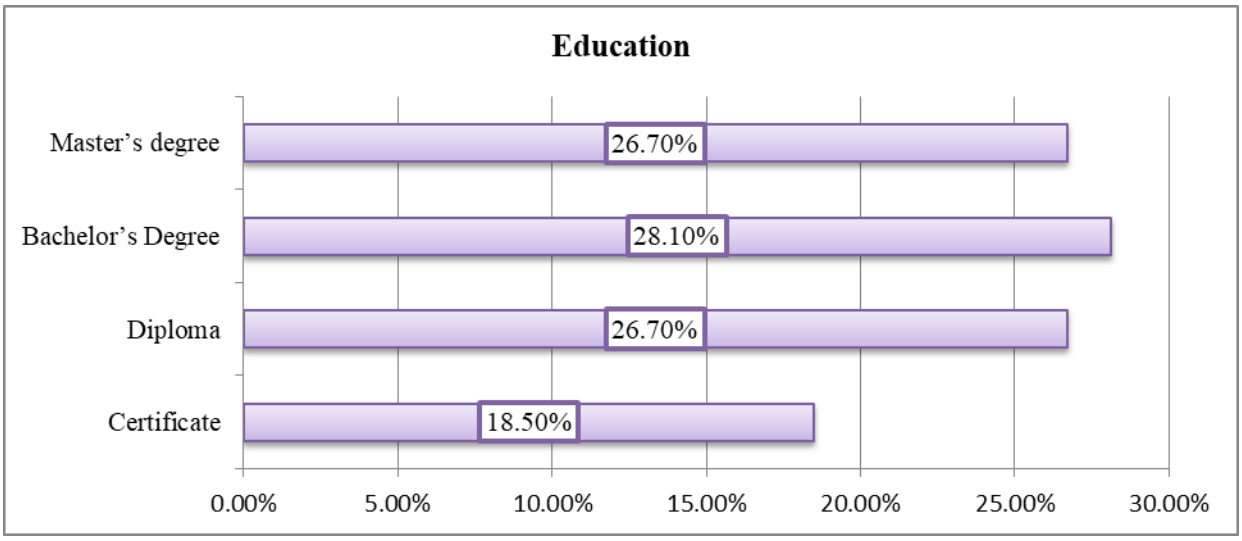

Figure 4. 3 Education Status
(Source: primary data (2020)

4.2.5. Residence

About 27(20.0%) of the participants lived for less than 5 years, about 31(23.0%) of the respondents agreed as they lived between 6-10 years, about 55(40.7%) of the confirmed that 11-15 years, and the remaining about 22(16.3%) of the participants over 16 years As shown in figure the majority of the respondents 55 (40.7%) were in the categories of 7-9 family members.

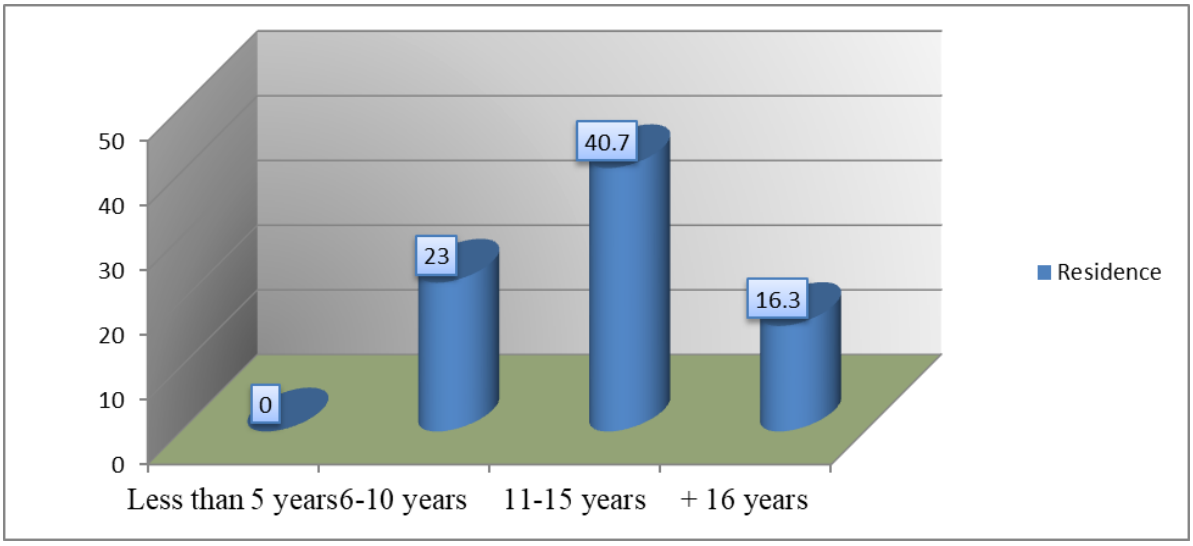

Figure 4. 4 Age of Respondents
(Source: Primary data (2020)

4.2.6. Monthly Income

About 16(11.9%) of the respondents monthly income were found less than 2000 ETB; about 24(17.8%) of the respondents monthly income were found 2000-4000 ETB; about 66(48.9%) of the participants monthly income were found 4000-6000 ETB; about and the remaining 29(21.5%) of the participants monthly income were found over 6000 ETB. The majority of respondents' monthly income lies between 4000-6000 ETB.

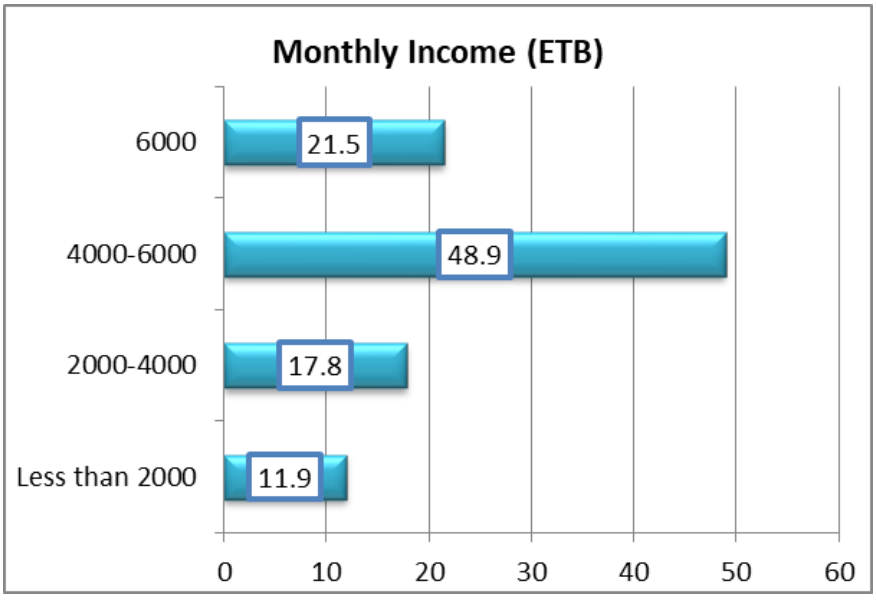

Figure 4. 5 Monthly Income
(Source: primary data, 2020)

4.3. Land use land cover Change of Lagatafo Lagadadi Town

4. 3.1. Image Classification

The sets of remotely sensed images namely LANDSAT 5" (1995), L7 ETM" (2000), "L7 ETM" (2011), LANDSAT 8" (2015) and LANDSAT 8" (2019) are used in this study to classify land use land cover classes in to deferent informational classes. Image classification is about classifying satellite imageries data of land use land cover classes in to categorical order (Weng, 2012).

Band combinations of 4–3–2 for the TMs images and 5–4–3 for the OLI image were used to produce false colour composite (FCC) imageries because it is the most effective technique for the classification of land use land cover maps (Jensen, 2004).

Based on the spectral responses of features on the Landsat images and field observation, Four LULCC was identified. The image classification was done by supervised image classification using the Maximum Likelihood (ML) classifier algorithm.

4.3.2. Accuracy Assessment

The remotely sensed data accuracy has to be checked after classification and it can be done using an error matrix (Seseman et al, 2002). The accuracy image can be affected by several variables, like methods of classification used, spatial and spectral resolution, processing statistics used, limits of detection of different surface materials, suitability of reference spectra used for image analysis training, the type and amount of ground truth data acquisition, and type of atmospheric correction algorithm applied to the imagery. In the study Error Matrix's has been used to assess the accuracy of classified image with the quality measures like user's and producer's accuracy; overall accuracy.

Accuracy assessment is about compering the ground realities with classified map. Higher quality ground representation can be obtained from collected data from the study area ground data, but this is difficult and expensive instead it better to use from goggle earth imageries or aerial photography having fine spatial resolution. To check the accuracy of classified map 30, 30, 40, 50, and 50 random points for the images of 1995, 2000, 2011, 2015 and 2019 is taken respectively. After that adding the geo-referenced map and after rearranging in KML file format and computed the truth GP points on the Google earth image and filling in the attribute table to get Error matrix.

The accuracy of classified Map can be calculated by dividing number of correctly classified site by total number of reference sites times hundred. Accordingly, the accuracy of the satellite imageries of the town 1995, 2000, 2011, 2015 and 2019 is computed.

Table 4. 1 Error Matrix of Classified Map of 1995

LULC	Reference					
	Truth 1	Truth 2	Truth 3	Truth 4	Total	User accuracy
Forestlands	7	1	0	0	8	87.5%
Agriculture	1	6	0	1	8	75%
Built-up	0	0	4	1	5	80%
Open space	0	0	2	7	9	77%
Total	8	7	6	9	30	
producer Accuracy	87.5%	85.7%	66.6%	77.7	Overall Accuracy=80%	

(Source: Organized by the author (2020)

Table 4.1 shows the accuracy for the Land cover map of the study area in 1995 was 80%. The accuracy value is obtained by dividing correctly classified sites which was Twenty Four (24) by the total number of reference site which was about thirty (30) and multiplied by Hundred (100).

Correctly classified sites: 7+6+4+7=24, Total number of reference site = 30

$$\text{Overall Accuracy} = \frac{\text{Correctly classified sites}}{\text{Total number of reference site}} = \frac{7+6+4+7}{30} * 100 = 80\%$$

$$\text{Overall Accuracy} = \frac{24}{30} * 100 = 80\%$$

Table 4. 2 Error Matrix of Classified Map of 2000

LULC	Reference					
	Truth 1	Truth 2	Truth 3	Truth 4	Total	User accuracy
Forestlands	6	2	1	0	9	66%
Agriculture	1	8	0	0	9	88.8%
Built-up	0	0	6	1	7	85.7%%
Open space	1	1	0	5	7	71.4%
Total	8	9	7	6	**30**	
producer Accuracy	75%	88.8%	85.7%	83%	83%= Overall Accuracy	

(Source: Organized by the author (2020)

Table 4. 2. Illustrate the accuracy for the Land cover map of the study area in 2000 was 83.3%. The accuracy value is obtained by dividing correctly classified sites which was twenty five (25) by the total number of reference site which was about thirty (30) and multiplied by Hundred (100).

Correctly classified sites: 6+8+6+5=25, Total number of reference site = 30

$$\text{Overall Accuracy} = \frac{\text{Correctly classified sites}}{\text{Total number of reference site}} = \frac{6+8+6+5}{30} * 100 = 83\%$$

Table 4. 3 Error Matrix of Classified Map of 2011

LULC	Reference					
	Truth	Truth	Truth	Truth	Total	User accuracy
Forestlands	7	1	0	0	8	87.5%
Agriculture	0	8	0	1	9	88.8%
Built-up	0	0	11	1	12	91.6%
Open space	1	0	1	9	11	81.8%
Total	8	9	12	11	40	
producer Accuracy	87.5%	88.8%	91.6%	81.8%	Overall Accuracy = 87.5%	

(Source: Organized by the author (2020)

As indicated in Table 4. 3, the accuracy for the Land cover map of the study area in 2011was 73.3%. The accuracy value is obtained by dividing correctly classified sites which was thirty five (35) by the total number of reference site which was about forty (40) and multiplied by Hundred (100).

$$\text{Overall Accuracy} = \frac{\text{Correctly classified sites}}{\text{Total number of reference site}} = \frac{7+8+11+9}{40} * 100 = 87.5\%$$

$$\text{Overall Accuracy} = \frac{35}{40} * 100 = 87.5\%$$

Table 4. 4 Error Matrix of Classified Map of 2015

LULC	Reference					
	Truth	Truth	Truth	Truth	Total	User accuracy
Forestlands	9	1	0	0	10	90%
Agriculture	0	9	1	1	11	81.8%
Built-up	0	0	14	1	15	93.3%
Open space	1	1	1	11	14	78.5%
Total	10	11	16	13	50	
producer Accuracy	90%	81.8%	87%	84.6	Overall Accuracy = 86%	

(Source: Organized by the author (2020)

The accuracy for the Land cover map of the study area in 2015 was 86%. The accuracy value is obtained by dividing correctly classified sites which was forty three (43) by the total number of reference site which was about Fifty (50) and multiplied by Hundred (100).

$$\text{Overall Accuracy} = \frac{\text{Correctly classified sites}}{\text{Total number of reference site}} = \frac{9+9+14+11}{50} * 100 = 86\%$$

$$\text{Overall Accuracy} = \frac{43}{50} * 100 = 86\%$$

Table 4. 5 Error Matrix of Classified Map of 2019

LULC	Reference					
	Truth	Truth	Truth	Truth	Total	User accuracy
Forestlands	7	0	0	2	9	77.7%
Agriculture	0	10	1	0	11	90.9%
Built-up	0	1	14	0	15	93%
Open space	1	0	1	13	14	78.5
Total	8	11	16	15	50	
producer Accuracy	87.5%	90.9%	87.5%	86.6%	Overall Accuracy = 88%	

(Source: Organized by the author (2020)

Table 4. 5 shows, the accuracy for the Land cover map of the study area in 2019 was 88%. The accuracy value is obtained by dividing correctly classified sites which was Forty four (44) by the total number of reference site which was about Fifty (50) and multiplied by Hundred (100).

$$\text{Overall Accuracy} = \frac{\text{Correctly classified sites}}{\text{Total number of reference site}} = \frac{7+10+14+13}{50} * 100 = 88\%$$

$$\text{Overall Accuracy} = \frac{44}{50} * 100 = 88\%$$

4.3.3. Overall accuracy

The overall accuracies for the Land cover map of the study area in 1995, 2000, 2011, 2015 and 2019 were 80%, 83, 87.5%, 86% and 88%, respectively. It is computed by dividing the total correctly classified number of random points to the total number of reference site.

According to Anderson et al, 2014, the accuracy for land use land cover classification is good if it is greater than or equal to 85%. Accordingly except 1995 and 2000 the other maps of 2011 to 2019s have greater than the accuracy value standards of Anderson et al, 2014 which is more than 85% accuracy value is good.

Table 4. 6 Summary of Error Matrix of Classified Map of 1995, 2000, 2011, 2015 and 2019 Producer Accuracy, User's Accuracy and Overall Accuracy

Land use land cover map of 1995				**Land use land cover map of 2000**		
LULC	Producer Accuracy	User's Accuracy	Overall Accuracy	Producer Accuracy	User's Accuracy	Overall Accuracy
Forestlands	87.5%	87.5%		75%	66%	
Agriculture	85.7%	75%		88.8%	88.8%	
Built-up	66.6%	80%	**80%**	85.7%	85.7%%	**83%**
Open space	77.7%	77%		83%	71.4%	
Land use land cover map of 2011				**Land use land cover map of 2015**		
LULC	Producer Accuracy	User's Accuracy	Overall Accuracy	Producer Accuracy	User's Accuracy	Overall Accuracy
Forestlands	87.5%	87.5%		90%	90%	
Agriculture	88.8%	88.8%	**87.5%**	81.8%	81.8%	**86%**
Built-up	91.6%	91.6%		87%	93.3%	
Open space	81.8%	81.8%		84.6	78.5%	
Land use land cover map of 2019						
LULC	Producer Accuracy	User's Accuracy	Overall Accuracy			
Forestlands	87.5%	77.7%				
Agriculture	90.9%	90.9%				
Built-up	87.5%	93%	**88%%**			
Open space	86.6%	78.5				

(Source: Organized by the author (2020)

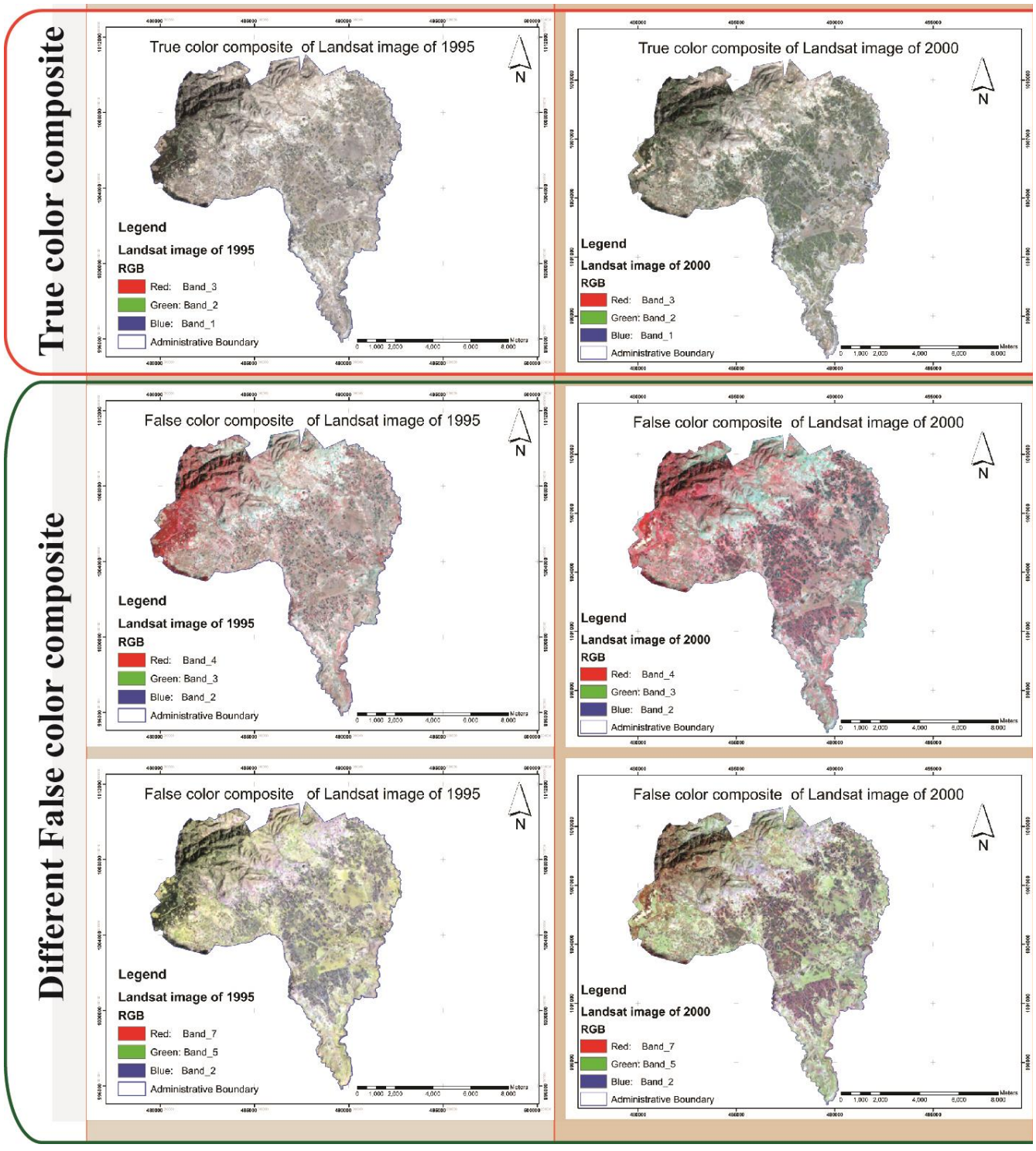

Figure 4. 6 Lagatafo Lagadadi Town True and False Colors Composites of Landsat Imageries of 1995 and 2000
(Source: Organized by the author (2020)

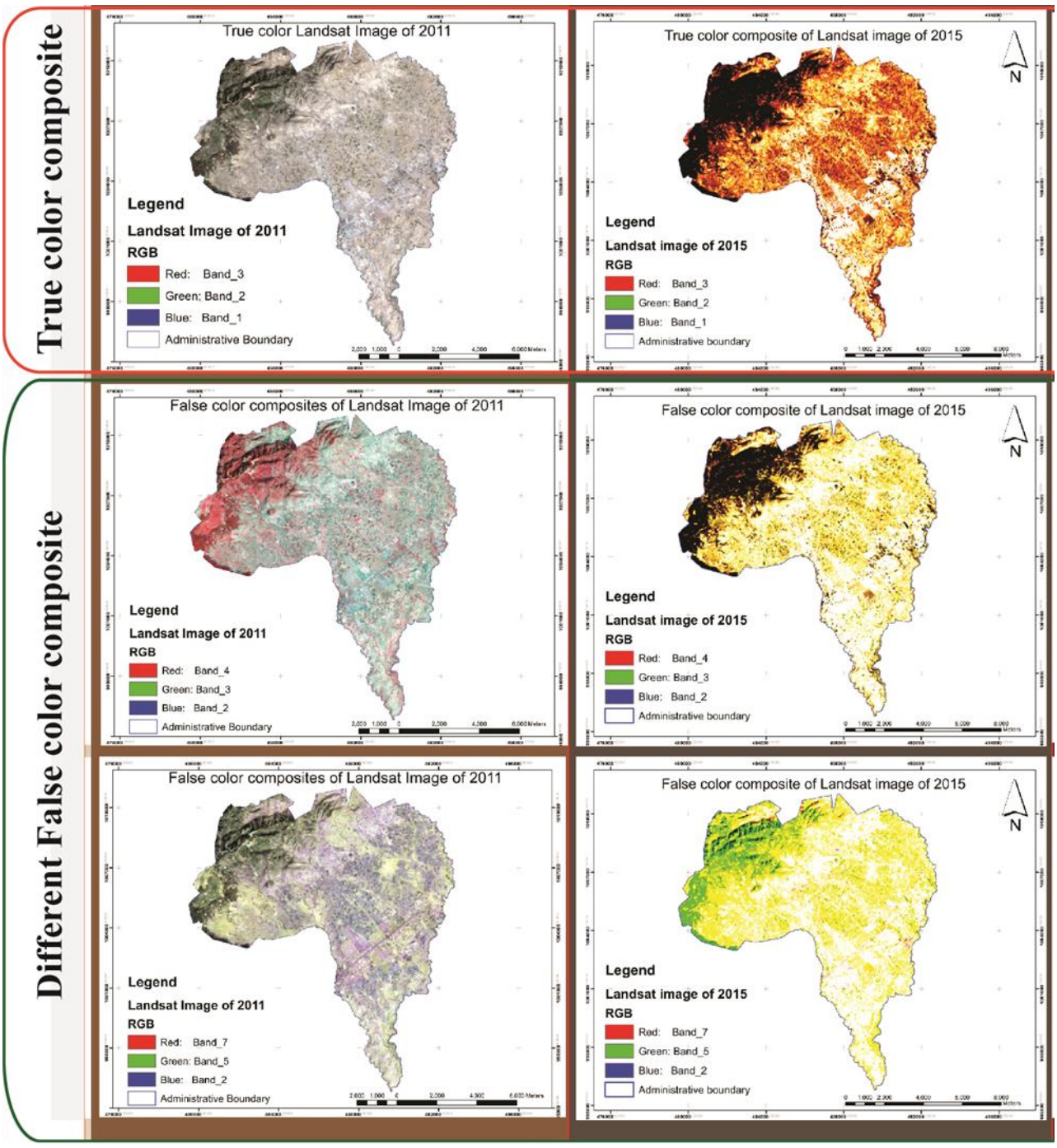

Figure 4. 7 Lagatafo Lagadadi Town True and False colors Composites of land sat imageries of 2011 and 2015
(Source: Organized By the Author (2020)

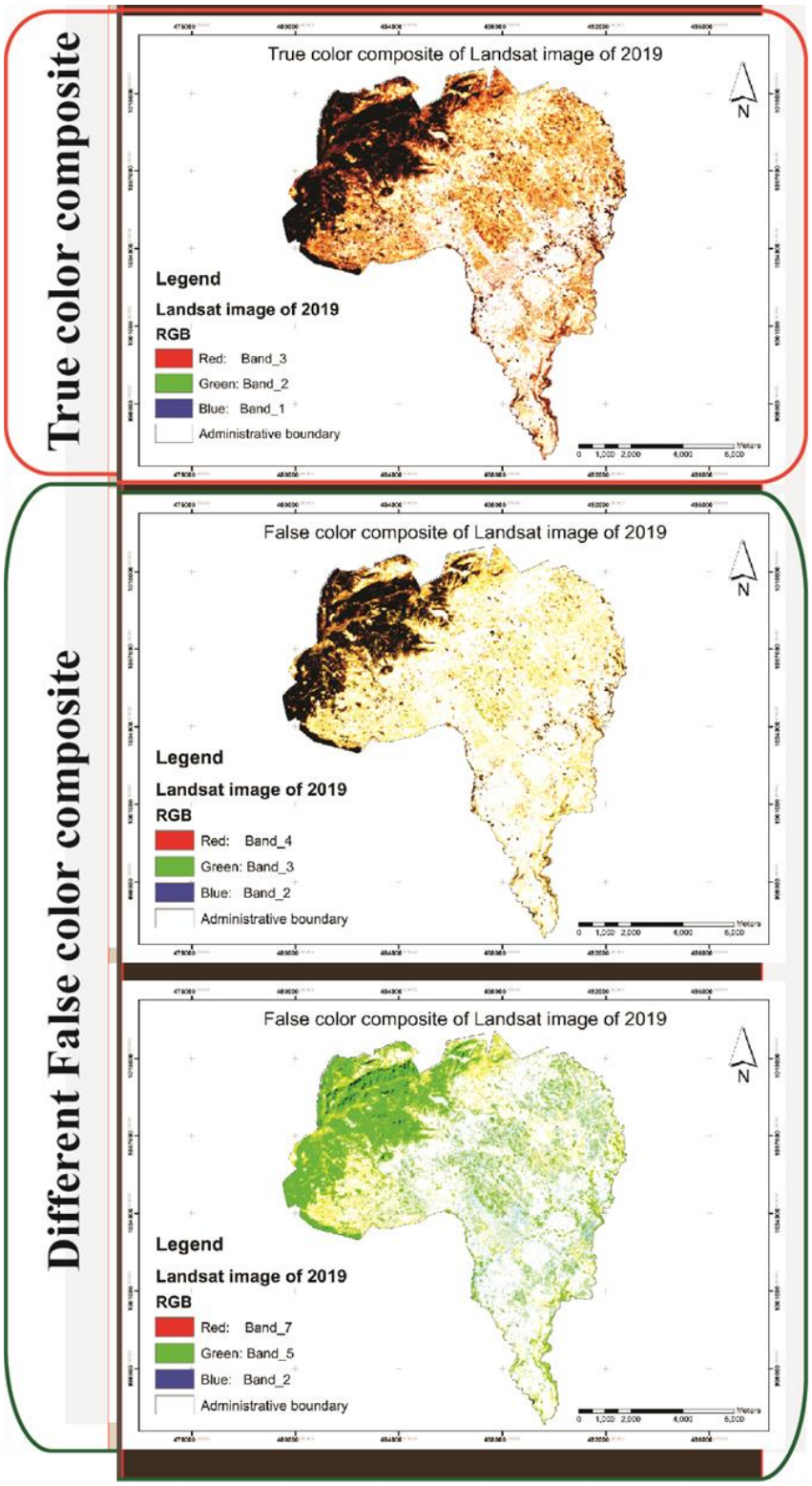

Figure 4. 8 Lagatafo Lagadadi Town True and False colors Composites of land sat imageries of 2019

(Source: Organized by the author (2020)

4.4 The Appearances of Lagatafo Lagadadi Town between Years of 1995 to 2019

Table 4.7 Land Use Land Cover of Lagatafo Lagadadi Town in the year of 1995

No	Land use land cover type	Area cover in square meter (m^2) in the year of 1995	Percentage of Land use land cover (%)
1	Forest	19,440,832	19.33
2	Agriculture	48878953	48.62
3	Built up	5,852,422	5.81
4	Open space	26,390,491	26.24
	Total	100,562,698	100

Source: Organized By the Author (2020)

As show the in table 4.7 the major land use land cover type of Lagatafo Lagadadi town in the year of 1995 includes forest, agriculture, built up, and open space. In terms of area cover and percentage in square meter land use land cover of Lagatafo Lagadadi town in the year of 1995 agriculture land use ranked the most dominated with about 48878953 m^2 (48.62%); while open space occupied the second largest land use with about 26,390,491 m2 (26.24%); similarly forestry land use ranked the third area land cover with about 19,440,832 m^2 (19.33%) and the remaining the least land use type were recorded built up space with about 5,852,422 m^2 (5.81%). From the data the area of urban land use land cover type (built up area) in the year of 1995 in Lagatafo Lagadadi town were the smallest compared to other land use types and agriculture was the highest.

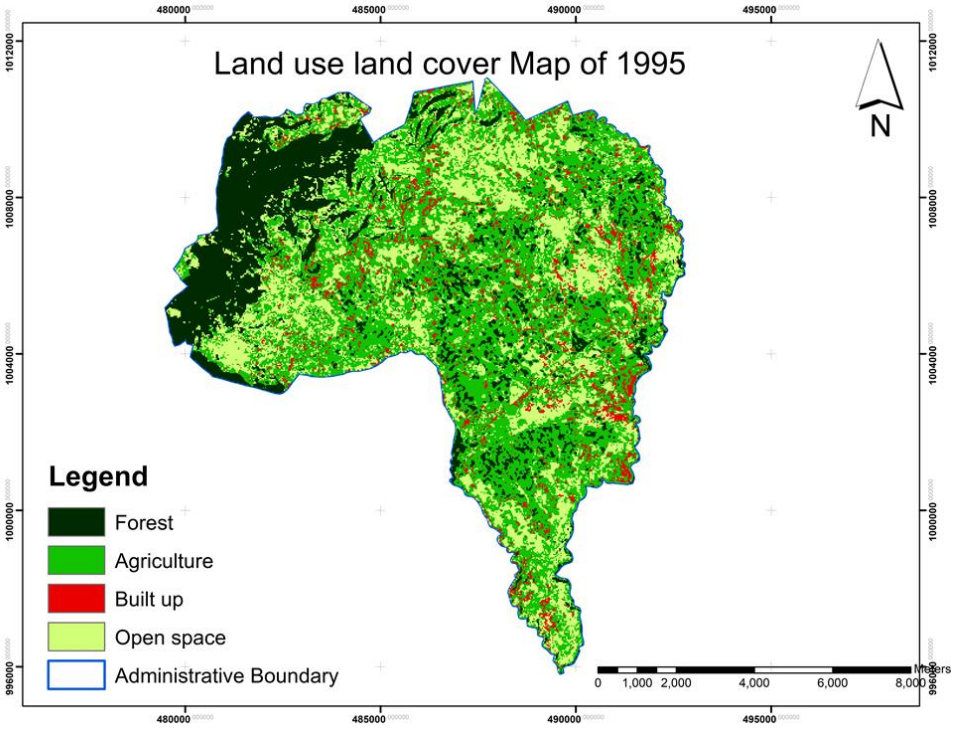

Figure 4. 9 Land Use Land Cover Map of Lagatafo Lagadadi Town in the year of 1995
(Source: Organized By the Author (2020)

The land cover maps generated GIS are presented in figure 4.9 above. The agricultural land was the most leading land cover class in the study area presented 48.62% in1995. And also the percentage of area cover in square meter for forest, built up, and open space were found 19.33 %, 5.81%, and 26.24% respectively.

Table 4.8 Land Use Land Cover of Lagatafo Lagadadi Town in the year of 2000

No	Land use land cover type	Area cover in square meter in the year of 2000	Percentage of Land use land cover (%)
1	Forest	15,701,828	15.61
2	Agriculture	35,423,250	35.23
3	Built up	11228016	11.16
4	Open space	38,209,604	38.01
	Total	100,562,698	100%

Source: Organized By the Author (2020)

The table 4.8 represents the major land use land cover type of Lagatafo Lagadadi town in the year of 2000. The percentage of area cover in square meter varies across land use land cover type. From the total area boundaries in square meter in the year of 2000 forest land use land cover consists of 15,701,828 m^2 (15.61%); agriculture land use land cover was 35,423,250 m^2 (35.23%); built up land use land cover enlarged with about 11228016 m^2 (11.16%); and the remaining open space land use land cover 38,209,604 m^2(38.01%). From the data the area of built up in the year of 2000 in Lagatafo Lagadadi town were the smallest compared to other land use types and open space was with the highest coverage area.

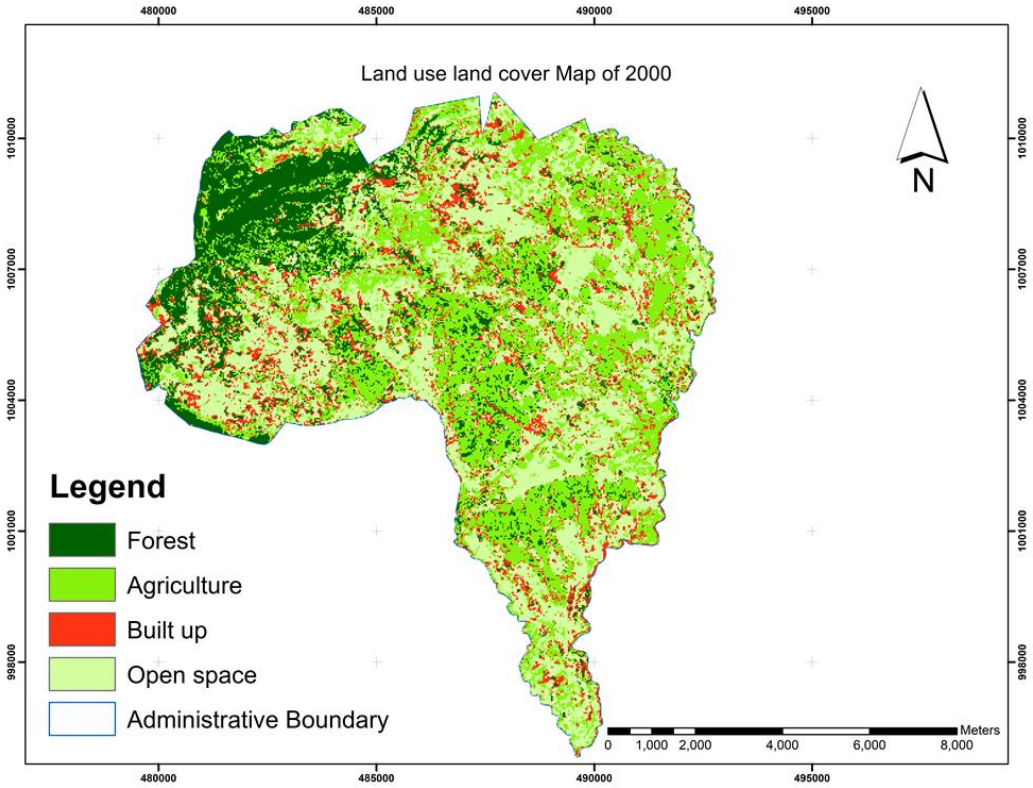

Figure 4. 10 Land Use Land Cover Map of Lagatafo Lagadadi Town in the year of 2000
(Source: Organized By the Author (2020)

The land cover maps of Lagatafo Lagadadi Town presented in the year of 2000 in figure 4.10 above. The open space land was the most dominant land cover class in the study area showed 38.01% in 2000. Similarly the percentage of area cover in square meter for forest, agriculture, and built up were found 15.61%, 35.23%, and 11.16% respectively.

Table 4.9 Land Use Land Cover Map of Lagatafo Lagadadi Town in the year of 2011

No	Land use land cover type	Area cover in square meter in the year of 2011	Percentage of Land use land cover (%)
1	Forest	14,176,298	14.1
2	Agriculture	34880000	34.68
3	Built up	15,638,150	15.55
4	Open space	35868250	35.67
	Total	100,562,698	100

Source: Organized By the Author (2020)

The Table 4.9 represents the major land use land cover type of Lagatafo Lagadadi town in the year of 2011. The percentage of area cover in square meter varies across land use land cover type. From the total area boundaries in square meter in the year of 2000 forest land use land cover consists of 15,701,828 m^2 (15.61%); agriculture land use land cover was 35,423,250 m^2 (35.23%); built up land use land cover enlarged with about 11228016 m^2 (11.16%); and the remaining open space land use land cover 38,209,604 m^2(38.01%). From the data the area of built up in the year of 2000 in Lagatafo Lagadadi town were the smallest compared to other land use types and open space was the major land cover class dominating the Town.

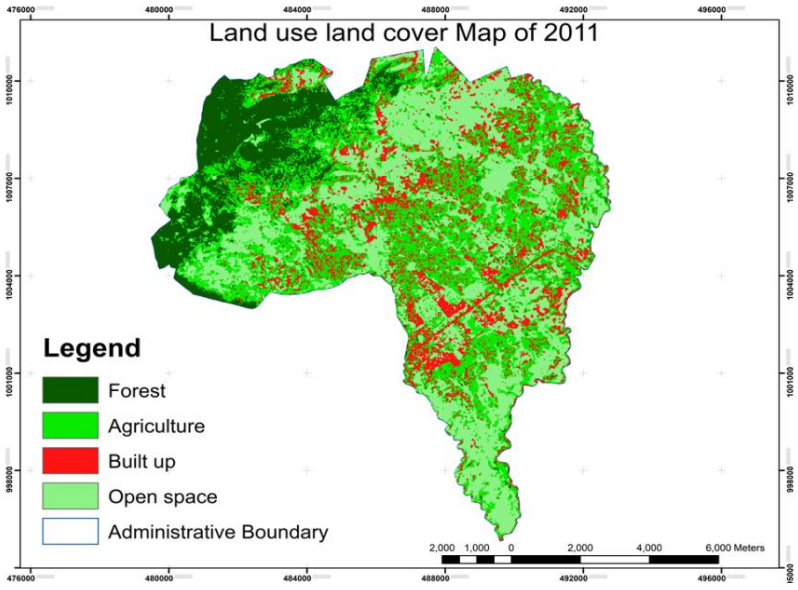

Figure 4. 11 Land Use Land Cover Map of Lagatafo Lagadadi Town in the year of 2011
(Source: Organized By the Author (2020)

The land cover maps of Lagatafo Lagadadi Town presented in the year of 2011 in figure 4.11 above. From the figure 4.11 above the open space land was the most dominant land cover class in the study area showed 35.67% in 2011. Similarly the percentage of area cover in square meter for forest, agriculture, and built up were found 14.1%, 34.68%, and 15.55% respectively.

Table 4.10 Land Use Land Cover Map of Lagatafo Lagadadi Town in the Year Of 2015

No	Land use land cover type	Area cover in square meter in the year of 2015	Percentage of Land use land cover (%)
1	Forest	13141841	13.07
2	Agriculture	30864188	30.69
3	Built up	26933621	26.78
4	Open space	29623048	29.46
	Total	100562698	100.00

Source: Organized By the Author (2020)

The Table 4.10 represents the major land use land cover type of Lagatafo Lagadadi Town in the year of 2015. The major land use types of the town categorized into four namely; forests, agriculture, built up, and open space. The area cover in square meter and the percentage of the total area of land use type about 13141841 m^2 (13.07%) were found forests; 30,864,188 m^2 (30.69%) were covered by agriculture; 26933621m^2 (26.78%) were covered by built up; and while the remaining about 29623048 m^2 (29.46%) were covered by open space.

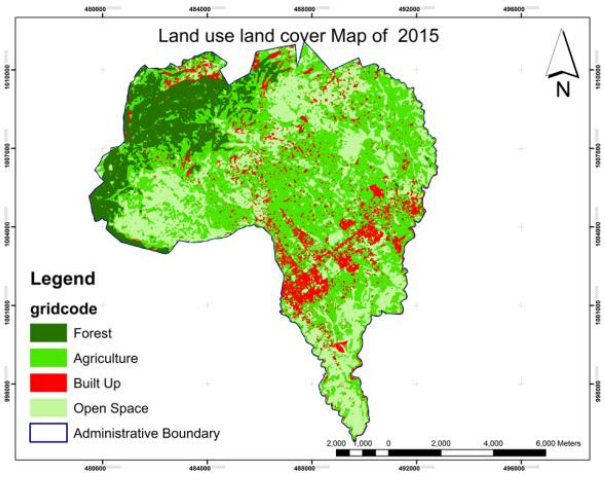

Figure 4. 12 Land Use Land Cover Map of Lagatafo Lagadadi Town in the Year Of 2015
Source: Organized By the Author (2020)

Similarly, figure 4. 12 represents land use land cover map of Lagatafo Lagadadi Town in the year of 2015. The map illustrates the percentage of total area land use land cover of Lagatafo Lagadadi Town in the year of 2015 was forests land use with about 13.07% of total area, agriculture land use has occupied with about 30.69% of total area; while about 26.78% of total area covered by built up, and the rest of open space land use land cover accounts about 29.46% of total area of Lagatafo Lagadadi Town. From the data agricultural land use accounts the larges area cover of land use class while open space and built up areas ranked the second and third large area cover. On the other hand the forest land use recorded as the lowest area cover of Lagatafo Lagadadi Town in the year of 2015.

Table 4.11 Land Use Land Cover Map of Lagatafo Lagadadi Town in the Year Of 2019

No	Land use land cover type	Area cover in square meter in the year of 2019	Percentage of Land use land cover (%)
1	Forest	7651991.973	7.61%
2	Agriculture	26651645.51	26.6%
3	Built up	46114324.33	45.86%
4	Open space	20144736.22	20.03%
	Total	100562698	100%

Source: Organized By the Author (2020)

The table 4.11 represents the major land use land cover type of Lagatafo Lagadadi town in the year of 2019. From the total area boundaries in square meter in the year of 2019 forest land use land cover consists of 7651991.973 m^2 (7.61); agriculture land use land cover was 26651645.51 m^2 (26.6); built up land use land cover enlarged with about 46114324.33 m^2 (45.86); and the remaining open space land use land cover 20144736.22m^2 (20.03). From the data the area of built up in the year of 2019 in Lagatafo Lagadadi town were with the largest portion of LULCC of the town compared to other land use types and forest was the smallest.

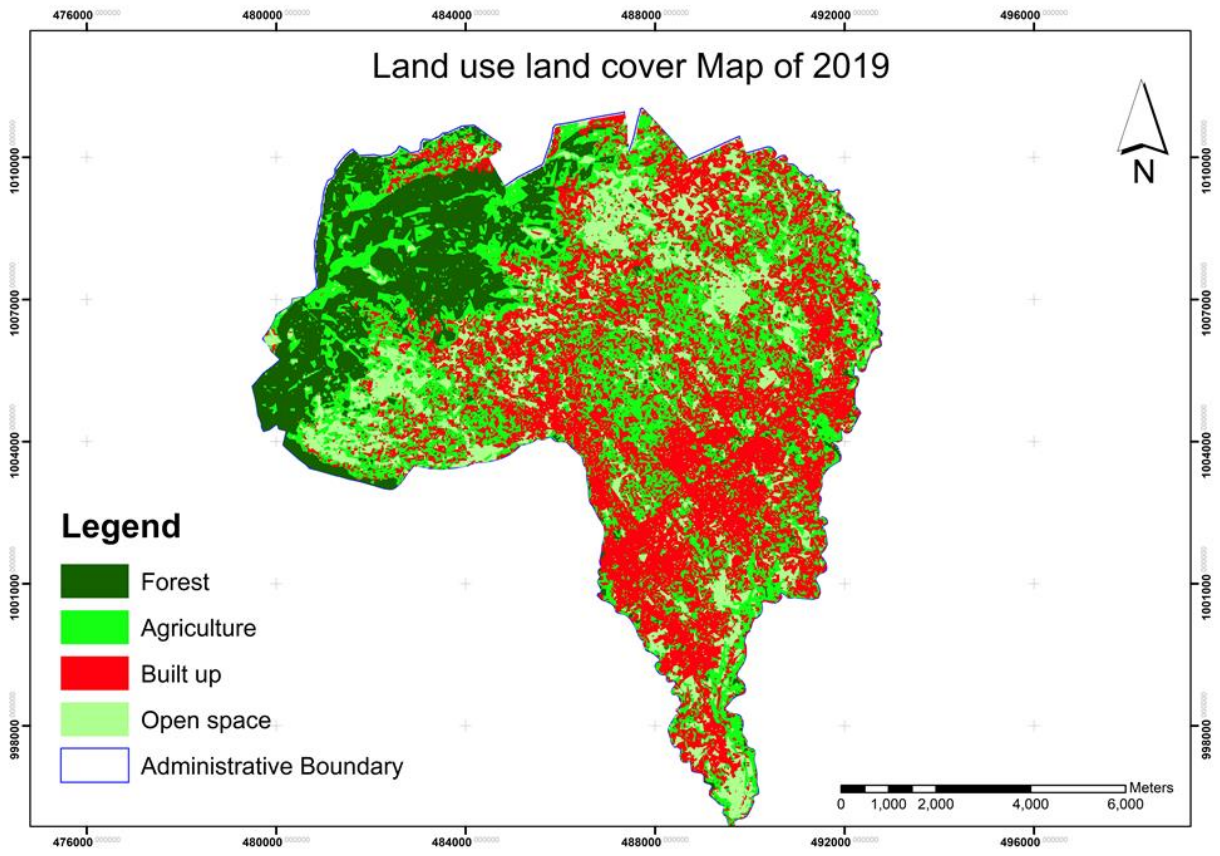

Figure 4. 13 Land Use Land Cover Map of Lagatafo Lagadadi Town in the Year Of 2019
(Source: Organized By the Author (2020)

The land cover maps of Lagatafo Lagadadi Town presented in the year of 2019 in figure 4.13. From the figure 4.13 the built up land was the most dominant land cover class in the study area showed 45.86% in 2019. Similarly the percentage of area cover in square meter for, agriculture, open space and forest were found 26.6%, 20.03%, and 7.61% respectively.

In 1995 the agricultural land was the most leading land cover class in the study area covering the largest percentage 48.62% comparing with other land use land cover class. In the year of 2000 agriculture area cover was 35,423,250 m^2 (35.23%). in 2011 it reduced to 34.68%. in 2015 agriculture land use was occupied with about 30.69% from total area of the town. In the final year of the study in 2019 it reduced to 26.6%.

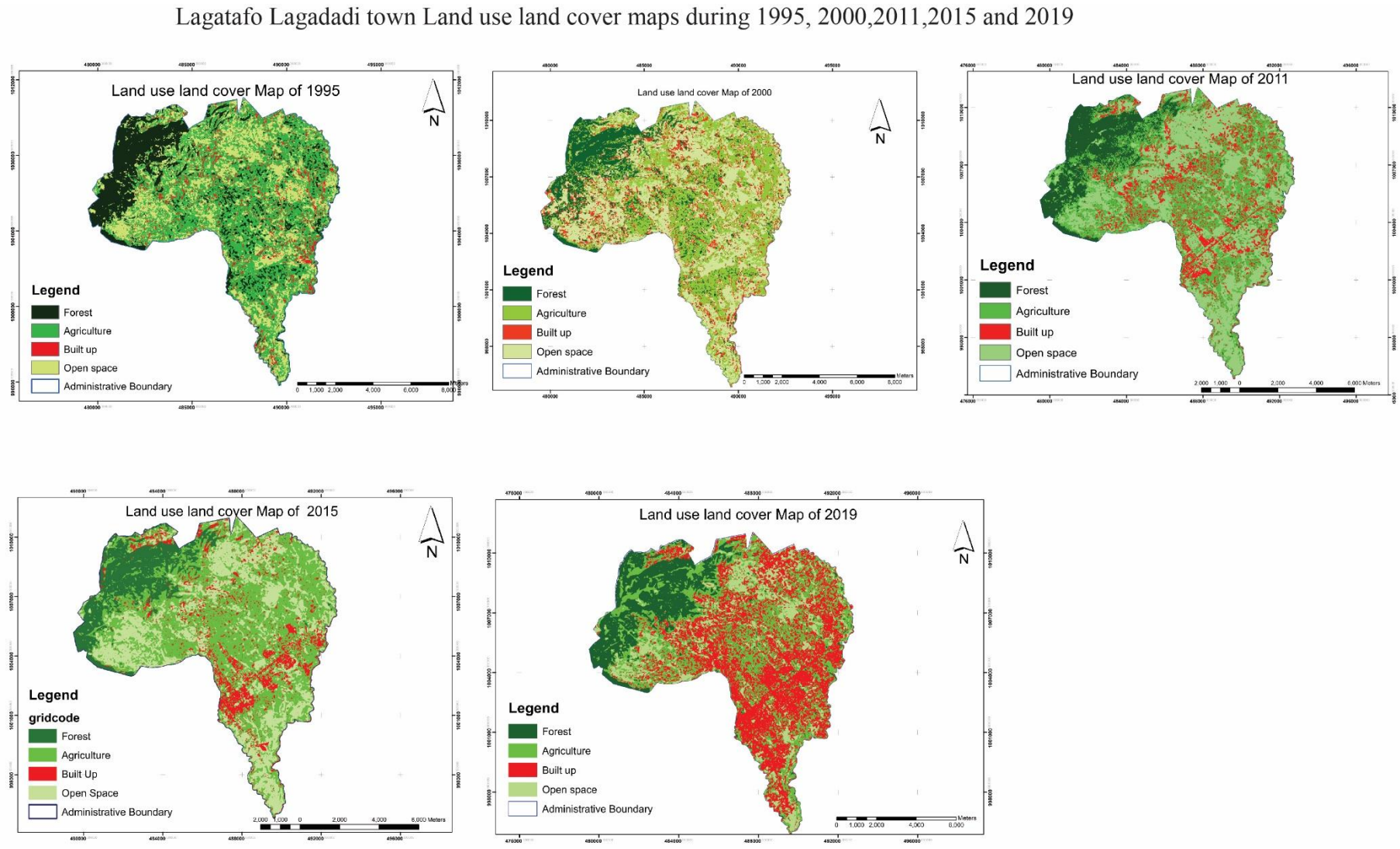

Figure 4. 14 Lagatafo Lagadadi Town in the year of 1995, 2000, 2011, 2015 & 2019
(Source: Organized By the Author (2020)

4.5 The Land use Land Cover Change Detection and Urban Expansion during 1995–2019

4.3.1. LULC Change Detection Analysis during 1995–2019

LULC change detection is undertaken to identify the degree of changes that have occurred in temporal periods and it helps to classify the LULCC to make appropriate decisions (Gashaw *et al.,* 2017; Ningal *et al.,* 2008). The current differences every classes of land use were calculated to show the trends of the change in LULCC differences between the periods. The change in LULC for the periods 2000–1995, 2011–2000, 2015–2011, and 2019–2015 was analyzed. The change detection method helps for the purpose of identifying LULC class's differences between specified period and to calculate the extent of LULCC conversion induced by the urban expansion. The change statistics for LULC maps of two time periods was calculated as following.

Table 4.12 LULC Change Analysis During 1995–2019

	2000-1995		2011-2000		`2015-2011		2019-2015	
LULC class	Area (m2)	%	Area (m2)	%	Area (m2)	%	Area (m2)	%
Forest	-747801	-19.23	-138685	-9.72	-258614	-7.30	-1372462	-41.77
Agriculture	-2691141	-27.53	-49386.4	-1.53	-1003953	-11.51	-1053136	-13.65
Built up	1075119	91.85	400921.3	39.28	2823868	72.23	4795176	71.21
Open space	2363823	44.79	-212850	-6.13	-1561301	-17.41	-2369578	-32.00

Source: Organized By the Author (2020)

Land use land cover changes of forest shows decrement with meter square of 747801 m^2 (19.23%) between 1995-2000 years; similarly between years of 2000-2011 the areas of forest LLCC 138685m^2(9.72%); also it is determined about 258614 m^2 (7.30%) between 2015-2011 years and between the year of 2015- 2019 LLCC identified with about 1372462 m^2 (41.77%). The forest

With respect to agriculture land use land cover change analysis indicate continuous decrement thought 1995 to 2019 years. The results indicated that, an area of 2691141 m^2 (27.53%) between

1995-2000 years; about 49386.4 m^2 (1.53%) between 2000-2011 years; about 1003953 m^2 (11.51%) in the years between 2011-2015 and about 1053136 m^2 (13.65%) in the years between 2015-2019.

The urban / built-up areas land use land cover change analyses indicate increments throughout 1995 to 2019 years. The land use lands cover change in the years between 1995-2000 the land use land cover change of built-up areas was found about 1075119 m^2 (91.85%); in the years between 2000-2011 the land use land cover change of built-up areas was found about 400921.3 m^2 (39.28%); it was found about 2823868 m^2 (72.23%) in the years between 2011-2015; and in the years between 2015-2019 the land use land cover change of built-up areas was found about 4795176 m^2 (71.21%).

Regarding change in LULC open space areas, there is an increase between years of 1995-2000 with about 2363823 m^2 (44.79%); and the LULC of open space areas were decreased by 212850 m^2 (6.13%); 1561301 m^2 (17.41%); and 2369578 m^2 (32.00%); in the year between 1995–2000, 2011-2015, and 2015–2019 years respectively.

The interview with land management office head of Lagatafo Lagadadi town on what major shift in land use occurred in the locality in the last 24 years showed that there have been considerable land use/cover changes. The interview reported showed urban expansion resulted in invasion of surrounding landscape such as agricultural lands, open space; and forest. Urban expansion has posed serious threats to the farmers and the surrounding farmlands and nearby rural communities become part of the city's expansion zones. Also from the interviews report indicate the conversion of forests into agriculture in the marginal areas later changed to urban areas. To meet the demand on scarcity of land the people built houses on hillsides and on agricultural lands accelerating land cover changes. There were trend of urban increase and decline of cultivated land in the town. Also from interview increase in the urban/built-up areas resulted in deterioration of forest cover, as well as a decline in farmland.

4.3.2. Urban Expansion during 1995–2019

Urban land expansion and urban land use/land cover change has been one of the key subjects for study on dynamic changes of urban land use (Wu et al., 2006).

Table 4.13 Description of Urban Expansion

1995-2000		2000-2011		2011-2015		2015-2019			
Area (m2)	%	Area (m2)	%	Area (m2)	%	Area (m2)	%	Area (m2)	%
1075118.8	6.29	400921.2727	432.05	2823867.75	288.92	4795175.75	1.29	1677579.25	5.70

Source: Organized by the author (2020)

The yearly of change for 24 years of study period (1995-2000; 2000-2011, 2011-2015; and 2015-2019) indicated that the urban expansion increased 6.29% (1075118.8 m^2 $year^{-1}$), 432.05% (400921.27 ha year−1); 288.92% (2823867.75 m^2 $year^{-1}$), and, 1.29% (4795175.75 m^2 $year^{-1}$), respectively; with an average yearly increment of 5.70% (100 m^2 $year^{-1}$) for the whole study period, from 1995 to 2019 (Table 4.13). This indicates that yearly on average about 5.70% of non-urban land had been used for built-up purposes over the past 24 years. This indicated that in the past two decades, rapid urban expansion took place primarily at the expense of forest, agricultural lands and open space areas in the urban fringe.

4.6 The Forces Shaping Urban Expansion the Case of Lagatafo Lagadadi Town

The following sub topics briefly stated about the forces shaping urban expansion the case of Lagatafo Lagadadi town, thus, the respondents requested to give answer individually regarding to the drives of forces shaping urban expansion. The perception obtained using five point likert type items having a scale ranging from a low value of Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4, Strongly Agree (SA) =5. The range was aimed at capturing the intensity of respondents feeling for a given items. Analysis made using descriptive summery statics for individual variable such as mean score of the respondents. For the purpose of interpretation, the mean score were treated as 0.05-1.49 (very low), 1.5-2.49 (Low), 2.5-3.49 (Moderate), 3.5-4.49 (high) and 4.5 and above (very high). The results presented and analyzed in the following tables.

The mean was obtained by the summation of all responses as assigned to a rating scale in an item divided by the total number of responses: 4+3+2+1/4 = 2.50. The mean score of 2.50 and above was accepted, while those below 2.50 were rejected (Jamil Bin Ahmad; 2012). Mean scores were also calculated for certain responses. As a result, a mean value below 2.49 were rated as lower agreement in their level of application; mean values from 2.50 to 3.49 were rated as moderate and

mean value from 3.50 to 5.00 were labeled in the category of high agreements (Mohammed, et al.,, 2013).

4.6.1 The Economic Dimensions of Urban Expansion Driving force

Table 4. 14 the Economic Dimensions of Urban Expansion Driving force

No	I. Economic factors	Mean	SD
1.	The introduction of new industries in the town was driving force for urban expansion	3.43	1.443
2.	The affordable lands in the town are attracting the new immigrants.	3.35	1.329
3.	Low rental house attracted peoples towards Lagatafo Lagadadi town	3.22	1.297
4.	Agricultural lands are easily bought and sold and subdivided into residential lands.	2.76	1.341
5.	The housing market is a very important factor in urban expansion process in Lagatafo Lagadadi town	2.87	1.233
6.	Rigid demand, urban market and agglomeration capability frequently drives urban expansion	3.16	1.321
7.	Economic development through promoting urban land and construction demands frequently drives urban expansion	3.40	1.351
	Average	3.17	1.3307

Source: primary data, 2020

Table 4.14 illustrated the economic factors. Concerning item 1 of Table 4.14, respondents were asked if the introduction of new industries in the town was driving force for urban expansion. The results from that participants responses showed moderate agreement on as introduction of new industries in the town was driving force for urban expansion with mean value of 3.43 (SD=1.443). So, the introduction of new industries in the town was the economic dimensions of urban expansion of driving forces in Lagatafo Lagadadi Town.

With respect to item 2 on the same table, which says the affordable lands in the town are attracting the new immigrants. Hence, it was found that with mean values of 3.35 (SD=1.329) is rated moderate. From the data, it can be inferred that the affordable lands in the town are attracting the new immigrants the economic dimensions of the driving force of Urban Expansion in Lagatafo Lagadadi Town.

Regarding item 3 of Table 4.14, respondents were asked as low rental house attracted peoples towards Lagatafo Lagadadi Town as shown by the data, 3.22, SD=1.297) mean value. The results obtained showed that the low rental house attracted peoples towards the town had a moderate factor. Thus, the data revealed that the low rental house attracted peoples towards the town the economic dimensions of urban expansion driving forces in Lagatafo Lagadadi Town.

Pertaining to item 4 of Table 4.14, which asks the question that agricultural lands are easily bought and sold and subdivided into residential lands was rated moderate with a mean value of 2.76(SD1.341) from participants responses. Accordingly, thus, there is an agreement on the agricultural lands are easily bought and sold and subdivided into residential lands was the economic dimensions of urban expansion driving forces in Lagatafo Lagadadi Town.

As in the item 5 of Table 4.14, above, shows that the housing market is a very important factor in urban expansion process in Lagatafo Lagadadi town. The result found with mean values of 2.87(SD=1.233) from respondents response which indicate a moderate factor. This showed that the housing market was the economic dimensions of the driving force of Urban Expansion in Lagatafo Lagadadi Town.

As stated in the item 6 of Table 4.14, a rigid demand, urban market and agglomeration capability frequently drives urban expansion. The results indicated as a moderate factor with mean value of 3.16(SD=1.321) according to respondents agreement. Thus, result showed that rigid demand; urban market and agglomeration capability was the economic dimensions of the driving force of Urban Expansion in Lagatafo Lagadadi Town.

Response from item 7 of Table 4.14, economic development through promoting urban land and construction demands frequently drives urban expansion was rated by respondents with mean values of 3.40(SD=1.351) which indicate a moderate factor. Thus, from the data; it can be inferred that economic development through promoting urban land and construction demands frequently drives urban expansion.

During interview undertaken with Lagatafo Lagadadi Town Land Management Office on how economic factor related to urban expansion is recognized as it offers increased opportunities for employment, production, and goods and services. Such increased opportunities in urban areas further enhanced rural urban migration. According to interviews with land management heads of

Lagatafo Lagadadi Town suggested the superiority of economic factors such as introduction of industries, housing and agricultural market, job opportunities and the demands for low rental house attracted peoples towards Lagatafo Lagadadi Town.

4.6.2 The Infrastructure Dimensions of Urban Expansion Driving force

Table 4.15 the Infrastructure Dimensions of Urban Expansion Driving force

II. Infrastructure factors	Mean	SD
1. Availability of suitable roads and viable public transport service contribute for urban expansion,	2.70	1.306
2. The level of government investment in schools attracted many peoples in Lagatafo Lagadadi town	3.07	1.537
3. Existence of sufficient clean water supply for households has contributed for urban expansion	2.84	1.450
4. The availability of hospitals for health care has accelerated the extension of the town	3.23	1.215
5. The electricity power supply and telecom service has made the town to be attractive for the external investors	3.19	1.438
Average	3.006	1.389

Source: primary data, 2020

In the same way in the item 1 of Table 4.15, respondents were asked whether or not the availability of suitable roads and viable public transport service contribute for urban expansion. Hence, the mean values of with 2.70(SD=1.306) confirmed such practice is moderate. Thus, there is an agreement that availability of suitable roads and viable public transport service contribute for urban expansion.

With the same fashion in item 2, on the same table respondents were asked whether or not the level of government investment in schools attracted many peoples in Lagatafo Lagadadi town is rated moderate with mean values 3.07(SD=3.96) by participants of the study. This shows that the level of government investment in schools attracted many peoples had moderate Driving force of infrastructure dimensions of urban expansion measures.

In the item 3 of Table 4.15, regarding whether or not the existence of sufficient clean water supply for households has contributed for urban expansion. Then it was found out that the mean value 2.84 (SD=1.450) from participants of study town. This was rated moderate factor for urban expansion. This result shows that existence of sufficient clean water supply for households had moderate role in shaping urban expansion in infrastructure dimensions of urban expansion driving force measurement.

As it can be seen in item 4, from the same Table, the availability of hospitals for health care has accelerated the extension of the town. Therefore, the mean responses of respondents with a calculated mean value of 3.23 (SD=1.215) is indicating moderate influence from the data collected during the visit with the participants of Lagatafo Lagadadi town. From the result the availability of hospitals for health care had moderate driving force of infrastructure dimensions of urban expansion measures.

On the contrary in the item 5 of Table 4.15, respondents were asked whether or not the electricity power supply and telecom service has made the town to be attractive for the external investors it is found moderate with mean value 3.19 (SD=1.438) by participants of Lagatafo Lagadadi town. So, it is concluded that the electricity power supply and telecom service had moderate driving force of infrastructure dimensions of urban expansion measures.

Also from interview of Lagatafo Lagadadi Town Land Management Office government encourage of private investors for the construction of and communication networks in the open space place made important opportunities among the profitable economic agents coupled with an increase in the urban expansion on urban land and provided a context for rising of household incomes from sold land and housing market. An increased investment Lagatafo Lagadadi Town result, an increase in the demand for land along with the economic centrality of cities, escalates urban expansion.

4.6.3 The Proximity Factors Dimensions of Urban Expansion Driving Force

Table 4.16 the Proximity Factors Dimensions of Urban Expansion Driving Force

III. Proximity factors	Mean	SD
1. The closeness of the town to the capital city of the country Addis Ababa was major factor of urban expansion in Lagatafo Lagadadi Town	2.94	1.196
2. Due to nearness of Lagatafo Lagadadi Town to Addis Ababa many house newly built from people coming from other areas.	3.39	1.560
3. Proximity to one's place of work made preferences for new dwellers	2.84	1.326
4. There were preferences for proximity to amenities and actual lifestyles	3.53	1.510
5. Preferences for urbanism as a style of life gentrified neighborhoods in the Lagatafo Lagadadi Town	3.33	1.292
6. The demands for new housing and the accessibility of settlements	3.02	1.427
7. The closer regions to an administrative center characterize the higher probability of urban expansion.	3.12	1.466
8. Transportation accessibility distances to highway and national way characterize urban expansion	3.27	1.411
Average	3.18	1.3985

Source: primary data, 2020

Table 4.16 shows that the proximity dimensions of urban expansion driving force in Lagatafo Lagadadi Town. The response from item 1 Table 4.16 the closeness of the town to the capital city of the country Addis Ababa was major factor of urban expansion in Lagatafo Lagadadi Town were rated by respondents with mean values of 2.94 (SD=1.196) which indicate a moderate factor of urban expansion. Thus, from the data; one can infer that the closeness of the town to the capital city of the country had moderate driving force of proximity dimensions of urban expansion measures.

Regarding item 2 from Table 4.16, due to nearness of Lagatafo Lagadadi town to Addis Ababa many house newly built from people coming from other areas was rated as a moderate from the respondent's view with mean values of 3.39 (SD=1.560) indicating moderate agreement in forces

shaping urban expansion. Thus, statistical data revealed that nearness of Lagatafo Lagadadi Town to Addis Ababa had moderate factor of proximity dimensions of urban expansion measures.

Concerning item 3 from Table 4.16 the proximity to one's place of work made preferences for new dwellers the mean of respondents is 2.84 (SD=1.326). This means it is rated as moderate factor in urban expansion. Thus, there is an agreement proximity to one's place of work made preferences for new dwellers had moderate factor of proximity dimensions of urban expansion measures.

With respect to item 4 on the same table, which asks there were preferences for proximity to amenities and actual lifestyles in the town were rated with moderate with the mean values of 3.53 (SD=1.510). This showed that the preferences for proximity to amenities and actual lifestyles had moderate factor of proximity dimensions of urban expansion measures.

Concerning item 5 from Table 4.16, the preferences for urbanism as a way of life gentrified neighborhoods in the Lagatafo Lagadadi town was rated as a moderate from respondent's view with mean 3.33 (SD=1.292). This result shows that preferences for urbanism as a way of life gentrified neighborhoods had moderate factor of proximity dimensions of urban expansion measures.

In the item 6 of Table 4.16, participants view regarding the demands for new housing and the accessibility of settlements. The result obtained from the respondents mean values of 3.02 (SD=1.427) indicating moderate factor of urban expansion. So, it is concluded that, the demands for new housing and the accessibility of settlements had moderate factor of proximity dimensions of urban expansion measures.

The Table item 7, above represents respondents view if the closer regions to an administrative center characterize the higher probability of urban expansion. Then, it was found moderate factor with mean value of 3.12 (SD=1.466). Thus, from the data, one can infer that closer regions to an administrative center had moderate factor of proximity dimensions of urban expansion measures.

As it can be seen in item 8 of Table 4.16, describes the transportation accessibility distances to highway and national way characterize urban expansion. The respondents mean values of 3.27 (SD=1.411) were rated moderate factor. Thus, statistical data revealed that transportation accessibility distances to highway and national way had moderate factor of proximity dimensions of urban expansion measures.

4.6.4 The Neighborhood Dimensions of the Driving force of Urban Expansion

Table 4.17 the Neighborhood Dimensions of Urban Expansion Driving Force

IV. Neighborhood factors	Mean	SD
1. The locations nearer to urbanized settlements and urban infrastructures characterize the higher probability of urban expansion.	3.21	1.467
2. Neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs is a factor associated to urban expansion.	3.04	1.321
3. The tremendous rural-urban land conversion movement leads to urban expansion.	3.35	1.421
4. The actual lifestyles and dwellers preferences for proximity to open space, for single-family dwellings, or for home ownership attracting the new immigrants	3.19	1.198
5. Preferences for “flight from blight” or its converse, the appeal of gentrified neighborhoods in the inner city	3.26	1.371
Average	3.21	1.3556

Source: Primary Data, 2020

Table 4.17 shows that the neighborhood dimensions of urban expansion driving force in Lagatafo Lagadadi town. Concerning item 1, from table respondents were asked if the locations nearer to urbanized settlements and urban infrastructures characterize the higher probability of urban expansion. Then the result indicated that the mean of respondents is 3.21 (SD=1.467). This was rated as moderate factor linking urban expansion driving force in Lagatafo Lagadadi Town. Thus, it can be concluded that the closer locations to developed urban areas and urban infrastructures had moderate factor of neighborhood dimensions of urban expansion measures.

With respect to item 2, on the same table asks neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs is a factor associated to urban expansion were rated with moderate with the mean values of 3.04 (SD=1.321). This showed that the neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs had moderate factor of neighborhood dimensions of urban expansion measures.

Concerning item 3 of Table 4.17, asks the question that the tremendous rural-urban land conversion movement leads to urban expansion was rated as a moderate factor from the respondents with the mean values of 3.35 (SD=1.421). This result shows that rural-urban land conversion movement had moderate factor of neighborhood dimensions of urban expansion measures.

Relating to item 4 on Table 4.17, respondents were requested to give their views if the actual lifestyles and dwellers preferences for proximity to open space, for single-family dwellings, or for home ownership attracting the new immigrants. The mean values of 3.19 (SD=1.198) obtained from the respondents response shows a moderate factor urban expansion measures. Thus, it is concluded that, the preferences dwellers for actual lifestyles and proximity to open space, for single-family dwellings, or for home ownership had moderate factor of neighborhood dimensions of urban expansion measures.

Concerning Item 5, from the above table asks that the preference for “flight from blight” or its converse, the appeal of gentrified neighborhoods in the inner city. Then, response from participants showed mean values of 3.26 (SD=1.371). This indicates that the preferences for “flight from blight” or its converse, appeal of gentrified neighborhoods in the inner city is moderate. From the result it can be concluded that, preferences for “flight from blight” or its converse, the appeal of gentrified neighborhoods in the inner city had moderate factor of neighborhood dimensions of urban expansion measures.

From interview of Lagatafo Lagadadi Town Land Management Office land values were main factor of urban expansion due to rising demand of land and housing price in the urban service boundaries, weak legal enforcement at per periphery of town, scarcity and limitation of land in the center of town and availability of space at periphery of town for construction makes this factor as a key factor in urban expansion process.

4.6.5 The Physical Dimensions of the Driving force of Urban Expansion

Table 4.18 The Physical Dimensions of Urban Expansion Driving force

V. Physical Factors	Mean	SD
1. The suitability of topography preferred among new dwellers	3.27	1.537
2. The suitability flat slopes are contributed in direction towards urban expansion in the Lagatafo Lagadadi town.	3.56	1.336
3. The existing slopes as well as elevation are frequently characterized as suitability factors to urban expansion.	2.96	1.365
4. The increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area.	3.38	1.445
5. The increasing urban population causes increasing demand in the open spaces contained in the existing urban area.	3.59	1.265
6. Presence of river water resources opportunities that advantages development of urban in adjacent areas.	1.64	1.444
7. There were huge demands for land by households or firms who inhabit in the town from edges	3.89	1.348
Average	3.47	1.391

Source: primary data, 2020

Table 4.18 shows that the physical factors dimensions of urban expansion driving force in Lagatafo Lagadadi town. Concerning item 1 of Table 4.18, respondents were asked if the suitability of topography preferred among new dwellers. Thus, the responses showed that there moderate agreement on the idea with mean result of 3.27 (SD=1.537). So, the suitability of topography had moderate factor of physical factors dimensions of urban expansion measures.

With respect to item 2 on the same table, which says the suitability flat slopes are contributed in direction towards urban expansion in the Lagatafo Lagadadi town. Hence, it was found that with mean values of 3.56 (SD=1.326) by respondents rated high driving force shaping urban expansion. From the data, it can be inferred that physical dimensions of urban expansion driving force; the suitability flat slopes were major drives of urban expansion in Lagatafo Lagadadi Town.

Regarding item 3 of Table 4.18, respondents were asked as the existing slopes as well as elevation are characterized as suitability factors to urban expansion as shown by the data, mean value of 2.96 (SD=1.326). The results obtained showed that the existing slopes as well as elevation are characterized as suitability factors to urban expansion had moderate factor in urban expansion. Thus, the data revealed that the physical factor dimensions stating existing elevation and slope suitability was a moderate factor urban expansion in Lagatafo Lagadadi Town.

Pertaining to item 4 of Table 4.18, which asks the question that the increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area was rated high with a mean value of 3.38 (SD=1.445) in participants responses. Thus, there is an agreement physical factor were high driving factor of urban expansion as increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area in Lagatafo Lagadadi Town.

As in the item 5 of Table 4.18, above, shows that the increasing urban population causes increasing demand in the open spaces contained in the existing urban area. The result found with mean values of 3.59 (SD=1.265) is rated high. This showed that physical factor were high driving factor of urban expansion as respondents agreement on increasing urban population causes increasing demand in the open spaces contained in Lagatafo Lagadadi Town.

As stated in the item 6 of Table 4.18, a presence river water resources ware opportunities that advantages development of urban in adjacent areas. Thus, it was found low agreement with mean value of 1.64 (SD=1.444) by participants average response. Then, from the result showed that physical factor were not driving factor of urban expansion as respondents lower agreement as presence river water resources opportunities that advantages development of urban in Lagatafo Lagadadi Town.

Response from item 7 of Table 4.18, there were huge demands for land by households or firms who inhabit in the town from edges was rated by respondents with mean values of 3.89 (SD=1.348) which indicate high agreement on existence of huge demands for land by households from edges. Thus, from the data; it can be inferred that physical factor were a driving factor of urban expansion as respondents higher agreement as there were huge demands for land by households or firms who inhabit in the town from edges.

Also, from interview of Lagatafo Lagadadi Town Land Management Office there were rural to urban migration in favor of households' demand for more land and living in larger areas and instead of compact and crowd place in the center of the town was the factor of rapid urban expansion.

4.6.6 The Land Values Dimensions of Urban Expansion s Driving Forces

Table 4.19 The Land Values Dimensions of Urban Expansion Driving Force

VI. Land values	Mean	SD
1. Increased demand of land over time leads to conversion of former agricultural land for residential purposes	3.48	1.139
2. There were conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing.	3.16	1.367
3. The increasing urban population causes increasing demand on urban land.	3.56	1.402
4. The rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming.	3.87	1.379
5. Rise in price of land value contributed in direction towards urban expansion in the Lagatafo Lagadadi town.	2.94	1.232
Average	3.402	1.3038

Source: primary data, 2020

Table 4.19 shows that the land values factors dimensions of urban expansion driving force in Lagatafo Lagadadi town. As stated in the item 1 of Table 4.19, increased demand of land over time leads to conversion of former agricultural land for residential purposes. Thus, it was found moderate with mean value 3.48 (SD=1.139) by respondents average response. Then, from the finding it can be inferred that land value dimensions factors shaping urban expansion were increased demands of land over time leading to conversion agricultural land for residential purposes according to responses obtained from participants with moderate agreement

Response from item 2 of Table 4.19, there were conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing was rated with mean values of 3.16 (SD=1.367) is rated moderate on human intervention as factor of

land use change. Thus, from the data; it can be inferred that land value dimensions factors shaping urban expansion were a moderate factor due to conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing as responses obtained from participants.

Regarding item 3, of Table 4.19, the increasing urban population causes increasing demand on urban land was rated as a high factor from the respondents with mean values of 3.56 (SD=1.402) calculated from participants response involved in the study. The finding of the data revealed that the factors shaping urban expansion from land value dimensions in Lagatafo Lagadadi town were the increments of population demanding urban land according to participants moderate agreement involved in the study.

Concerning item 4, from the same table respondents were asked if the rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming. Then the result indicated that with a mean values of 3.87 (SD=1.379). This was rated as high agreement on the rising the price of the converted lands initiated residents to sell their land. Thus, it can be concluded that there were evidence on land value dimensions were the factors shaping urban expansion in Lagatafo Lagadadi town from participants higher agreement to the statements of rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming.

Regarding item 5, of Table 4.19, rise in price of land value contributed in direction towards urban expansion was rated as a moderate factor from the respondents response with mean values of 2.94 (SD=1.232). From the finding of the data it can be concluded that the factors of urban expansion from land value dimensions were rise in price of land value as respondent's moderate agreement in Lagatafo Lagadadi Town.

From interview of Lagatafo Lagadadi Town Land Management Office land values were main factor of urban expansion due to rising demand of land and housing price in the urban service boundaries, weak legal enforcement at per periphery of town, scarcity and limitation of land in the center of town and availability of space at periphery of town for construction makes this factor as a key factor in urban expansion process.

In line with the current finding Hosseini (2013), study on driving forces for urban sprawl at Mashhad city mainly associated with population growth, rural urban migration, the annexation of peripheral settlements, reducing of land price in suburbs, physical geography, urban plans, transportation, informal settlement.

4.6.7 Urban Planning and Land use policy Dimensions of the Driving force of Urban Expansion

Table 4.20 Urban Planning and Land use policy Dimensions of Urban Expansion Driving force

VII. Land use policy and urban planning	Mean	SD
1. The governments utilize policies of urban expansion by urban land lease cause new construction of buildings in the agriculture	3.53	1.455
2. The weak implementation of land use policy and urban planning resulted leaping over swaths of open space	2.96	1.419
3. The poor strictness and quality of enforcement in urban development controls has a share for urban expansion in Lagatafo Lagadadi Town	3.42	1.581
4. Informal settlement with people living at peripheries in built or rented housing occupations causes increasing urban expansion.	3.81	1.372
5. Formal urban sprawl invades the land of the farmers in Lagatafo Lagadadi Town.	3.93	1.345
Average	3.53	1.4344

Source: primary data, 2020

Table 4.20illustrated the land use policy and urban planning dimensions of urban expansion driving force. Concerning item 1 of Table 4.20, respondents were asked to rate if the governments utilize policies of urban expansion by urban land lease cause new construction of buildings in the agriculture. Thus, it was found that high agreement responses showed on the idea with mean result of 3.53 (SD=1.455) by respondents average response. So, it is concluded that, the land use policy and urban planning dimensions was driving force for urban expansion as governments utilize policies of urban expansion by urban land lease by construction of buildings in the agricultural land use according to participants higher agreement participated in the study.

With respect to item 2 on the same table, which says the weak implementation of land use policy and urban planning resulted leaping over swaths of open space. Hence, it was found with mean values of 2.96 (SD=1.419) is rated moderate. From the data, it can be inferred that the forces shaping urban expansion among dimensions of land use policy and urban planning was found the weak implementation of land use policy and urban planning resulted leaping over swaths of open space from the respondents moderate agreements participated in the study.

Regarding item 3 of Table 4.20, respondents were asked as the poor strictness and quality of enforcement in urban development controls has a share for urban expansion in Lagatafo Lagadadi Town as shown by the data, mean value of 3.42 (SD=1.581) indicate moderate agreement on the statement. Thus, the finding indicates the factors of urban expansion in Lagatafo Lagadadi Town from dimensions of land use policy and urban planning were identified the poor strictness and quality of enforcement in urban development controls as response obtained from participants moderate agreement.

Pertaining to item 4 of Table 4.20, which asks the question that informal settlement with people living at peripheries in built or rented housing occupations causes increasing urban expansion was rated high with a mean value of 3.81 (SD=1.372) in respondents responses. Thus, there is sufficient evidence that the drives of urban expansion from land use policy and urban planning dimensions were identified informal settlement of people living at peripheries in built or rented housing occupations with higher agreements among participants of the study.

As in the item 5 of Table 4.20, above, shows that formal urban sprawl invades the land of the farmers in Lagatafo Lagadadi Town. The result obtained from the participants revealed a mean values of 3.93 (SD=1.345) which is rated high agreement. Based on finding it could be concluded that the forces of urban expansion in Lagatafo Lagadadi town from dimensions of land use policy and urban planning were revealed formal urban sprawl invading the land of the farmers as respondents' high agreement during study.

4.6.8 The Mean Rank of the Forces Shaping Urban Expansion

Table 4.21 The Mean Rank of the Forces Shaping Urban Expansion

The driving forces of urban expansion in Lagatafo Lagadadi town	Mean	SD	Mean Rank
1. Economic factors	3.17	1.33	6th
2. Infrastructure factors	3.006	1.38	7th
3. Proximity factors	3.18	1.39	5th
4. Neighborhood factors	3.21	1.35	4th
5. Physical Factors	3.47	1.39	2nd
6. Land values	3.402	1.30	3rd
7. Land use policy and urban planning	3.53	1.43	1st

Source: Primary Data, 2020

As can be seen from the Table 4.21, the respondents' response on the item 1, 2, 3, 4, 5, 6 and 7 the mean scores were rated with average mean score by the respondents. These indicated that respondents asserted for higher agreement on driving forces of urban expansion variables in Lagatafo Lagadadi town. Accordingly, respondents average response for economic factors; infrastructure factors; proximity factors; neighborhood factors; physical factors; land values; and land use policy and urban planning were revealed with mean scores of 3.17(SD=1.33), 3.006(SD=1.38), 3.18(SD=1.39), 3.21(SD=1.35), 3.47(SD=1.39), 3.402(SD=1.30), and 3.53(SD=1.43) respectively. This implies that the variables such as economic; infrastructure; proximity; neighborhood; physical; land values; and land use policy and urban planning the factors were highly the forces driving expansions of Lagatafo Lagadadi town.

Table 4.21, shows the rank order of seven possible areas in which forces shaping urban expansion is currently most or least in Lagatafo Lagadadi town. As shown in Table, the mean rank revealed that, land use policy and urban planning was ranked first. It has been observed that, physical factors were ranked second. Similarly, from the results summarized the ranking order of participants

revealed that, land a value was third. Also from the mean rank of participants showed that, neighborhood factors was the fourth shaping forces of urban expansion; while proximity factors, economic factors and infrastructure factors were ranked from fifth to seventh, respectively. In general, the findings of this study imparted that the most driving factors for the expansion of Lagatafo Lagadadi Town was found land use policy and urban planning in the town. On the other hand, this study revealed that concerning infrastructure factors was the least forces driving urban expansion of Lagatafo Lagadadi Town.

From interview undertaken with heads of land management office of Lagatafo Lagadadi Town what factors do you think have contributed for urban expansion in this locality on rapid urban population growth combined with the economic development led to rapid and unplanned urban expansion. The gradual decline in agricultural and vegetation was as results of rapid built up on cultivated land. The rapid urban expansion was closely associated with combined huge investment of private and government on public infrastructure such schools, hospital and roads. Urban expansion is also associated with an increase in personal and public transportation.

4.7 Discussion of the Result

This study was conducted in the Oromia Special Zone Lagatafo Lagadadi Town. The study mainly aimed to analyze urban expansion and the forces shaping the case of Lagatafo Lagadadi Town. The study emphasized three major variables the appearances of Lagatafo Lagadadi Town; the land use/land cover change and urban expansion; the driving forces behind the expansion during the period of 1995 to 2019.

This study used descriptive research design to undertake study. For the purpose of this study, both quantitative and qualitative methods were employed. Both primary and secondary data source employed. To address the stated objectives; questionnaire, field observation, and key informant interview were used to get primary data. Secondary data sources from Landsat images regarding land use land and land cover changes and change detection help to investigate urban expansion.

The target population includes households, kebele leaders, land management agency higher professionals and leaders of Lagatafo Lagadadi town which is 12184. The total populations of households in Lagatafo Lagadadi town were 4181 Laga Tafo (01); 2947 Laga Dadi (02); 3455 Dambal (03); and 1601 Ekadalle (04) and totally 12184 households.

The sampling techniques employed for this study both probabilistic and non-probabilistic sampling techniques. Lagatafo Lagadadi town, selected based on purposive sampling technique and respondents were selected by using systematic random sampling technique. The sample size for collecting quantitative data were determined using Cochran's formula as indicated 99 households. In order to accomplish the objectives of this study, the data was collected through questionnaires; key informant interview; document analysis and field observations. Both open and close ended questionnaires were used. For this purposes semi-structured interview employed to answer the third basic research question regarding the forces shaping urban expansion the case of Lagatafo Lagadadi town. Data from document analysis remotely sensed images used and processed for identifying the extent of the town expansion land use/land cover change. The field observations also employed as data gathering tools using Global Positioning Systems (GPS).

Raw data was collected through questionnaires, interviews, document analysis and observations were carefully tallied, tabulated and organized manually. Both quantitative and qualitative approaches of data analysis were used. The qualitative methods were used to describe the findings qualitatively which were gathered through participatory assessment involving; key informant interviews, observations, secondary data obtained from the Landsat images from the earth explorer site.

The change in LULC for the periods 1995 to 2019 was analyzed using maximum likelihood classification method and using post-classification change detection technique in a GIS environment. This method allows to measure the sequential changes of the LULC types and to compute the extent of LULC conversion persuaded by the urban expansion. To calculate the urban expansion rate between 1995 to 2019 years in the study area, the total transformation of the built-up areas were taken into consideration. The urban expansion rate refers to the average annual urban area growth in the following years. Data which was gathered by questionnaire from household were analyzed using SPSS 24.0 to realize the force driving urban expansion in Lagatafo Lagadadi Town. The data collected by using semi-structured interview with municipal head of Lagatafo Lagadadi Town were analyzed thematically and in meaningful qualitatively ways.

The results of the study presented as follows. The information on the respondent's sex, age, work experiences, and educational background, data collected with an aim of providing an overall profile of the research participants. Most of the households were males. The largest age groups

were between 26-30 years and majority of the participants were got married. Education is one of the socio-economic characteristics of household heads playing a significant role to ensure farmers awareness and appropriately use information to adopt challenges of population growth and land degradation. In the study area sample respondents were categorized in illiterate, elementary, high school, and diploma, and degree and above based on their educational back ground. The majority of respondents had a bachelor's degree. The majority of the respondents have 7-9 family members. The majority of respondents' monthly income lies between 4000-6000 ETB.

The appearances of Lagatafo Lagadadi Town in the year of 1995 indicated the area of urban land use land cover type (built up area) in the year of 1995 in Lagatafo Lagadadi Town were the smallest compared to other land use types and agriculture was with the highest LULCC area coverage during the period. The agricultural land was the most dominant land cover class in the study area in the year of 1995. From the total area boundaries in square meter in the year of 2000 the area of built up were the smallest compared to other land use types and open space was the highest land use class. The land cover maps of Lagatafo Lagadadi Town presented in the year of 2011 was most dominated by open space land cover class in the study area showed 38.01% in 2011. From the data agricultural land use accounts the larges area cover of land use class while open space and built up areas ranked the second and third large area cover in the year of 2015. From the data the area of built up in the year of 2019 in Lagatafo Lagadadi Town were the leading LULCC compared to other land use types and forest was the smallest.

The land use land cover change of forest and agriculture land use shows decrement with meter square throughout the years between study periods. The built up areas shows dramatic increment indicating the conversion of other land use type to urban land use classes. The open space land use class shows an increment in the beginning study period between 1995- 2000 and reduced with increasing trend 2011-2019 years.

Similar to the current finding Barus (2009) compared the general appearance of land cover data from 1995 and 2007. These studies' results showed that the broad decline in forest cover from 17% (1995) to 14% (2007). Wetland also decreased, from 30% to 22% while the land area had increased the settlement area and dry land. Settlement area increased from 12% to 18%, and also dry land from 38% to 43%. The reductions of forest cover and agricultural land (productive paddy

field) have been threatening buffer zone (conservation areas) to maintain the balance of the ecosystem and threaten the occurrence of food insecurity.

The analysis of urban expansion between 2011-2019 years in the study area identified n average yearly increment of 5.70% for the whole study period. This indicates that yearly on average about 5.70 m2 of non-urban land had been used for built-up purposes over the past 24 years. This indicated that in the past two decades, rapid urban expansion took place primarily at the expense of forest, agricultural lands and open space areas in the urban fringe.

The economic dimensions was moderate factor for the force derived the expansion in Lagatafo Lagadadi Town with moderate agreement of participants as there were the situations of introduction of new industries; the affordable lands attracting the new immigrants; low rental house attracted peoples; agricultural lands are easily bought and sold and subdivided into residential lands; the housing market; rigid demand, urban market and agglomeration capability; economic development through promoting urban land and construction demands. The current finding is similar with the findings of Nedae Tousi and Bagheri (2017), the study on the sprawl phenomenon in metropolitan areas case study of shiraz metropolitan area revealed sprawl phenomenon in the city derived by the factors of economics of land and housing, land use, lifestyle, urban development policy, advances in information and communication technologies, the economic structure of cities, centrifugal forces, and physical geography.

The infrastructure dimensions was identified moderate force derived the expansion of the towns there were availability of suitable roads and viable public transport service; government investment in schools; clean water supply for households; availability of hospitals for health care; and electricity power supply and telecom service. Relating to the current finding Parsi and Farahani (2014) conducted analysis of the urban sprawl in the peripheral metropolitan areas of northern peripheral areas of Isfahan, Iran. The results indicated urban expansion was associated to the forces of industrialization, government housing assistance programs, transportation, rural urban migration, master plans, merging villages in urban service boundaries, land speculation, increasing of land and housing prices in the service area of cities, and political fragmentation.

The proximity dimensions was rated moderate as force derived the expansion in Lagatafo Lagadadi town due to the facts of closeness to the capital city of the country; due to many house newly built from people coming from other areas; place of work made preferences for new dwellers;

preferences for amenities and actual lifestyles; preferences for urbanism as a way of life gentrified neighborhoods; demands for new housing and the accessibility of settlements; closer regions to an administrative center; transportation accessibility distances to highway and national way.

The neighborhood dimensions was rated the moderate drives of urban expansion as respondents moderate agreement on the nearer to urbanized settlements and urban infrastructures; closer to accessibility to urban infrastructures; rural-urban land conversion; preferences for proximity to open space; and preferences for "flight from blight" or its converse, the appeal in the inner city.

There were high agreements of respondents regarding physical factors were the drives of urban expansions with respect to the suitability flat slopes for built up; the increasing urban population and huge demand of housing; and demands of households in the edges of town were major driving factor of urban expansion in the Lagatafo Lagadadi Town. Similarly, suitability of topography; existing elevation and slope; to the existing urban area; and presence river water resources were the moderate driving force for urban expansion.

With respect to the land values dimensions of urban expansion driving force the respondents rated moderately as land values were the driving forces of urban expansion as there is increased demand of land over time leads to conversion of former agricultural land for residential purposes; there were conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing; and there is rise in price of land value contributed in direction towards urban expansion in the Lagatafo Lagadadi Town. On the other hand the respondents highly agreed the increasing urban population causes increasing demand on urban land; and the rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming was the driving force for urban expansion. Similar to the current finding Tabibian, M., & Asadi, I. (2008) undertake study on examination and analysis of sprawl factors in spatial development of metropolitan regions. The finding showed the urban sprawl factors were related to land value in peripheral areas, inadequacy of the monitoring system for construction in the peripheral areas of cities, problems of the inner city, preferences of consumer and lifestyle, increasing motor vehicles ownership, transportation, and political fragmentation. Relating with the current result, Azizi & Yarmohammadi (2014), the study on the effects of a country's new divisions on urban sprawl in the case study of Bojnourd City of Iran

indicated, urban sprawl derived by factors of political policy and new political disintegrations, rural–urban migration, growing of land price and housing price,

With respect to the land use policy and urban planning dimensions of urban expansion driving the participants average response indicating very high relating to the governments utilize policies of urban expansion by urban land lease cause new construction of buildings in the agriculture; informal settlement with people living at peripheries in built or rented housing occupations causes increasing urban expansion; and formal urban sprawl invades the land of the farmers in Lagatafo Lagadadi Town. Similarly the participants moderately agreed the weak implementation of land use policy and urban planning resulted leaping over swaths of open space; and the poor strictness and quality of enforcement in urban development controls has a share for urban expansion in Lagatafo Lagadadi town. Also the current study confirms the study undertaken by Zebardast, E., & Habibi, S. (2009) on examining sprawl and its causes in Zanjan city. The study come up with the finding that, the causes of sprawl in Zanjan city were mainly associated with land and housing market, urban plans, and government policy.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

This chapter deals with the summary of major findings, the conclusion drawn from the findings and recommendations that the researcher suggests and assumes

5.2 Conclusion

Based on the findings of the study it is worth to draw the following conclusions related to the basic question of the study.

The major dominant land use of type in the year of 1995 were identified agriculture land use class, while in the 2000 years the dominant land use type found open space, also in the 2011 years the highest LULCC identified were open space land cover class, similarly in the 2015 years it was revealed agricultural land use, and built up area was the leading in 2019 land use land cover class of Lagatafo Lagadadi Town

The land use land cover change of forest and agriculture land use shows decrement with meter square throughout the years between study periods. While, the built up areas shows dramatic increment indicating the conversion of other land use type to urban land use classes. The open space land use class shows an increment in the beginning study period between 1995- 2000 and reduced with increasing trend 2011-2019 years.

Throughout the study period agricultural land use has declined constantly in the year of 1995 it was 48.62% then in 2000 it dropped to 35.23% in 2011 it reduced to 34.68%, in 2015 to 30.69% and in the final year of the study (2019) it declined to 26.6%.

The analysis of urban expansion in the study area identified that yearly on average about 5.70 m2 of non-urban land had been used for built-up purposes over the past 24 years between 2011-2019 years. This indicated that in the past two decades, rapid urban expansion took place primarily at the expense of forest, agricultural lands and open space areas in the urban fringe.

Ranking the average response of participants on variables shaping urban expansion most or least; the mean rank for land use policy and urban planning was ranked first; also it has been observed that, physical factors were ranked second. Similarly, land values were ranked the third from the results summarized rank order of participants' response. Also from the mean rank of participants showed that neighborhood factors was the fourth shaping forces of urban expansion; while

proximity factors, economic factors and infrastructure factors were ranked from fifth to seventh, respectively. In general, the findings of this study imparted that the land use policy and urban planning most driving forces of urban expansion while infrastructure factors was the least driving forces of urban expansion in Lagatafo Lagadadi Town.

5.2 Recommendations

On the basis of the major findings of the study, the following recommendations are forwarded for the sake of urban expansion and the forces shaping the case of Lagatafo Lagadadi Town.

1. The major dominant land use of type in the year of 1995 were identified agriculture land use class, while in the 2019 years built up area was the leading land use land cover class of Lagatafo Lagadadi Town. The except the areas of built-up land use land cover classes; the remaining land use such as forest, agriculture, and open space areas were showed the reduction in area converge. The current study recommends that the Lagatafo Lagadadi town municipality need to work on the conservation forest in order to enhance, proper land management approach is important to recover forests to get good air condition.
2. The built up areas shows dramatic increment indicating the conversion of other land use type to urban land use classes. For effective implementation of policies and strategies, the extent and rate of urban land use dynamics better to understand by Lagatafo Lagadadi Town municipality including planners, and policy makers.
3. In addition, the government authorities in Lagatafo Lagadadi need to enforce strict urban growth policies in coming days.
4. In the past two decades, rapid urban expansion took place primarily at the expense of forest, agricultural lands and open space areas in the urban fringe. Thus, proper urban planning is always needed to be emphasized by Lagatafo Lagadadi town.
5. To reduce the constant decrement of agricultural land covers the town the municipality, planners and responsible body's need to promote urban agriculture to create sustainable livelihoods , food security and for creation of employment opportunities for urban residents.
6. The driving forces of urban expansion in Lagatafo Lagadadi town were related to economic; infrastructure; proximity; neighborhood; physical; land values; and land use policy and urban planning the factors. It is, therefore, important for Lagatafo Lagadadi town municipality to

enforce timely and appropriate land use planning which considers the requirements of social, economic, and environmental sustainability.

7. Regular and up-to-date information on urban land use changes is required to visualize growth patterns and improve land use planning and management.
8. In controlling the urban encroachment of public land and preparation of better guidelines in terms of physical infrastructure development is highly essential to secure a sustainable urban future for Lagatafo Lagadadi town.
9. The urban expansion is expected to gain even more momentum in the foreseeable future in Lagatafo Lagadadi town.
10. Understanding the past spatial developments of physical urban structures and the driving-forces behind urban growth in Lagatafo Lagadadi town was prerequisite for framing sustainable coming planning policies and strategies.

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Annex

Annex 1: Article:

The Forces Shaping Urban Expansion: The Case Study of Lagatafo Lagadadi town, Oromia Special Zone, Ethiopia

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Abstract:

This study was conducted in the Oromia Special Zone Lagatafo Lagadadi town. The aim of the study was to identify the forces shaping urban expansion of Lagatafo Lagadadi town during the period of 1995 to 2019. The study emphasized on descriptive survey research design to undertake study. Both quantitative and qualitative methods were employed. Both primary and secondary data source employed. The target population includes households, and professionals. Both probabilistic and non-probabilistic sampling techniques employed. The participants of the study include 99 households; 43 employees and six key informants. Data was collected using questionnaires; and interview. Data was analyzed using SPSS 24. 0 The finding indicated the driving forces of urban expansion associated with economic, infrastructure, proximity, neighborhood, physical, land values, land use policy and urban planning. The findings of this study imparted land use policy and urban planning the most driving forces of urban expansion while infrastructure factors was the least driving forces of urban expansion in Lagatafo Lagadadi town in Lagatafo Lagadadi town. The study recommends the government authorities need to emphasize proper urban planning by understanding the past spatial and the driving forces of urban expansion in formulating sustainable future planning strategies and policies

Keywords: *Urban Expansion; Forces Shaping Urban Expansion*

1. INTRODUCTION

Urban expansion has become important concern all over the world. Urban growth, particularly the movement of residential and commercial land use to rural areas at the periphery of metropolitan areas, has

long been considered as a sign of regional economic vitality (Yuan et al, 2005). Urbanization has been rising from the time when World War II, and has not shown any sign of decrement and continued into the twenty-first century (Oğuz, 2004). According to United Nations Centre for Human Settlements Habitat (2001) the remarked changes in developing countries associated with the migration of rural people to cities for better opportunities.

Urban expansion in so many cases leads to expansion of urban areas. Haregewoin (2005) have shown that urban expansion in developing countries is largely a result of people's interest to move to the town in pursuit of better employment opportunity which leads to an escalation in size beyond the boundaries of the city. The studies by Araya and Cabral (2010) have noted that urban expansion was towards the periphery of urban areas due to the coalescence of a number of smaller settlements as well as through the consumption of agricultural land.

Urban expansion is due to various forces. Yeshaneh et al., (2013) reported rapid the forces resulted rapid extension of urbanization are due to the complex interaction of social, political, economic, technological and uniform human activity, such as increasing demand for agricultural land.

The researcher have noted through making a number of visits to the Lagatafo Lagadadi town and review of organization's annual reports as well as discussions made through informal way with Lagatafo Lagadadi municipality there were rapid urbanization which has a undesirable impact on infrastructure and the sustainability of cities. In most cases, sprawl results in an increase in the cost of public infrastructure and of residential and commercial development and transport. Moreover, rapid urbanization needs more energy, metal, asphalt and concrete than do compact cities because, homes, offices and utilities are set farther apart. Hence, the focus of this study was to the forces shaping urban expansion: the case study of Lagatafo Lagadadi town, Oromia special zone, Ethiopia.

1. RELATED LITERATURE REVIEW

Urban expansion is unintentional; undesirable spreading of urban development in to areas adjacent the ends of a city (Mekuriaw, &Gokcekus, 2019). Urbanization brings both environmental challenges and socioeconomic development opportunities. Urbanization lifts urban economic growth, industrial progression, population growth, and social development (Seto et al., 2010). Urbanization is also related with a number of adverse environmental impressions, including water and air pollution; greenhouse gas emissions; urban heat island effect (Pauchard, Aguayo, Pena, &Urrutia, 2006). Therefore, identifying the driving forces of urban expansion is still a fundamental challenge, but is essential for understanding the attributions and trends in urbanization, and for supporting related decision-making (Qu, Zhao, & Sun, 2014).

2.1 Driving Force of Urban Expansion

Urban expansion drives the transformation of landscapes and causes a massive of environmental and biological impacts. These impacts occur not only within the urban area itself but also well beyond the urban boundaries. Expansion of urban area is impressively endangered by socio-economic, geophysical, and institutional circumstances (Wu, 2003). There are five elements which are mostly recognized as driving forces of urban expansion, i.e., proximity, socioeconomic, accessibility, physical, and neighborhood factors (Li et al., 2018).

2.1.1 Socioeconomic Factors

The two socioeconomic factors, population and GDP, had positive effects on urban expansion for most regions and time periods. According to Salem (2015) showed the economic factor which influences the urban expansion process in the great Cairo metropolitan region. Economic development is sometimes actually defined as a process that shifts a nation's population from rural to urban. Transferring relatively less productive rural labor to the non-farm sector is one of the main engines of the development process (Beauchemin & Schoumaker, 2005). Based on UN (2014), urban living is often associated with higher levels of literacy and education, better health condition, greater access to social and economic services, and enhanced opportunities for cultural and political participation.

2.1.2 The Infrastructure Factors

Attempts have been made to investigate how infrastructure provision can affect urban expansion. Increased public expenditures in infrastructure are also related to urban expansion (Liu, 2005). Mahamud et al., (2016) found that the distance to public amenities, affordable housing, and the distance to the workplace are the most important factors of urbanization in the George Town conurbation in Malaysia. Demurger (2001) provides empirical evidence demonstrating the links between infrastructure investment and economic growth in China also related to urbanization urban expansion. Appiah et al., (2014) found two different factors as the most significant in Ghana: the increased demands for new housing in the city and the good accessibility of the settlements in the PUAs.

2.1.3 Physical Factors

There are four physical factors, slope, elevation, distance to a lake, and distance to a river. Elevation and slope are usually restrictive influences urban expansion. Urban expansion can be affected by the distance to river or a lake in two ways. First, urban enlargement is limited by the existence of a lake or a river. Second, a lake or river presents water resources advantages and waterborne ware opportunities advantages development of urban in adjacent areas (Luo & Wei, 2009).

Previous studies indicate a positive relationship between elevation and urban expansion. According to the study of Osman, Divigalpitiya, and Arima (2016), the accessibility was the main factor for urban expansion in the villages around the GCMR. Based on the results of Mohamed (2012) the regional topography was an

influencing factor which drove the urban expansion toward agricultural lands, particularly in the northern frontiers.

2.1.4 Proximity Factors

Proximity factors are measured by the distance to a city or country center. Hu & Lo (2007) found the two proximity factors, distances to a city or county center, were indicating higher likelihoods of urban expansion in areas closer to an administrative center in Eastern and Northeast China in later periods (2000–2010). In central and Western China, a significant positive effect from proximity factors was found, revealing a possible leapfrog urban development pattern in these regions, resulting from the construction of new towns and urban districts encouraged by government in these regions. The expansion will probably continue to take place in locations near developed areas due to the other factors which will lead to more informal areas. Osman et al., (2016), found that the proximity to urban centers was the most significant factor of the urban expansion in the PUA around Giza city in Egypt.

2.1.5 Neighborhood Factors

Neighborhood factors are determined by the localities nearer to urbanized settlements and urban infrastructures. Neighborhood nearer to developed urban areas has easier availability to urban infrastructures and requires lower costs for new urban development. The neighborhood factor always had a positive impact on urban expansion, revealing that urban expansion tended to occur close to existing urban areas (Sefidi, 2016). A typical urban development mode was via edge expansion, with urban expansion often in peri-urban areas (Shi, Sun, Zhu, Li, & Mei, 2012). The positive relation between urban development and the neighborhood factor was likely due to better accessibility to urban infrastructure in peri-urban areas and lower costs of urban development (Li et al., 2003).

2.1.6 The Land Value Factors

Almost all agricultural land is privately held, so agricultural lands are easily bought and sold and subdivided into residential lands. Moreover, no urban planning or land management carried out by government on agricultural land for these reasons, the speculation on lands for settlements is very common in these areas (World Bank, 2008).

Appiah et al., (2014) discussed two other factors in Ghana; the demands for new housing and the accessibility of land values for settlements is the most significant factor of the urban expansion. Based on Salem (2015) the land values factor became one of the main driving factors for urban expansion. The expansion process is very gainful, where the price of the converted lands (from agriculture to buildings) exceed between 8 to 12 times the prices of the same agricultural land.

2.1.7 The Land use Policy and Urban Planning Factor

Government, utilize policies to restrict and adjust urban expansion on agriculture lands. On the other hand, Nada (2014) explained the legal factor on periphery areas in which government doesn't reach to manage and control agricultural sites were prone for urban expansion in Egyptian cities.

3. MATERIALS AND METHODS

3.1 Description of the Study Area

This study is conducted in the Oromia Special Zone Lagatafo Lagadadi Town. Lagatafo Lagadadi Town is located in Oromia Regional State, at 21 km from Addis Ababa, the capital of Ethiopia. Geographically it is between 9°01'29"N - 9°06'0”N latitude and between 38°53'42"E - 38°55'30"E Longitude. It is located at altitude 2,316 to 2,500 masl Oromia Special Zone was established in 2008 by Oromia Regional State. Lagatafo Lagadadi Town Administration has four kebeles namely; Laga Tafo (01), Laga Dadi (02) Dambal(03), and Ekadalle (04) with in an area of 24,350 hectares (Lagatafo Lagadadi Town Municipality, 2020).

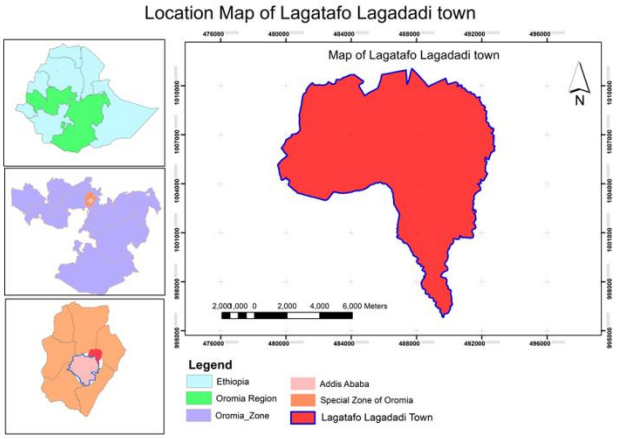

Figure 3. 3 Location Map of Lagatafo Lagadadi Town

3.2. Methods

The study emphasized on descriptive survey research design, and explanatory research design to undertake study. For the purpose, both quantitative and qualitative methods were employed. Both primary and secondary data source employed. The target population includes households, kebele leaders, land management agency higher professionals and leaders of Lagatafo Lagadadi town which is 12184. The total populations of households in Lagatafo Lagadadi town were 4181 LagaTafo (01); 2947 LagaDadi (02); 3455 Dambal (03); and 1601 Ekadalle (04) and totally 12184 households. The sampling techniques employed for this study both probabilistic and non-probabilistic sampling techniques. Lagatafo Lagadadi town, selected based on purposive sampling technique and respondents were selected by using systematic random sampling technique. The sample size for collecting quantitative data were determined using Cochran’s formula as indicated 99 households. In order to accomplish the objectives of this study, the data was collected through questionnaires; and key informant interview. Raw data was collected through questionnaires, interviews, document analysis and observations were carefully tallied, tabulated and organized manually. Both quantitative and qualitative approaches of data analysis were used. The qualitative methods were used to describe the findings qualitatively which were gathered through

participatory assessment involving; and key informant interviews. The data collected by using semi-structured interview with municipal head of Lagatafo Lagadadi town were analyzed thematically and in meaningful qualitatively ways. Data which was gathered by questionnaire from household were analyzed using statistical package for social science version 24.0 to determine the driving forces of urban expansion in Lagatafo Lagadadi town.

3.2 Methods of Analyzing the Driving Forces of Urban Expansion

From the literature there were many factors drives of urban expansion, however the current study emphasized weather economic factors; infrastructure; proximity; neighborhood; physical; land values; and land use policy and urban planning were the drives of urban expansion in the study area. Accordingly, questionnaires were prepared and distributed for sample of randomly selected households in Lagatafo Lagadadi town. In this study quantitative data which was gathered by questionnaire from household were analyzed using software Statistical Package for Social Science (SPSS 24). The results presented in descriptive statistics such as mean/ average values and percentage. The results of mean values help to determine if or not the factors were the driving forces of urban expansion in Lagatafo Lagadadi town.

4 RESULTS AND DISCUSSIONS

4.1 The Forces Shaping Urban Expansion the Case of Lagatafo Lagadadi Town

The topics briefly stated about the forces shaping urban expansion the case of Lagatafo Lagadadi town, thus, the respondents requested to give answer individually regarding the driving forces shaping urban expansion. The perception obtained using five point likert type items having a scale ranging from a low value of Strongly Disagree (SD) =1, Disagree (D) =2, Neutral (N) =3, Agree (A) =4, Strongly Agree (SA) =5. The range was aimed at capturing the intensity of respondents feeling for a given items. Analysis made using descriptive summery statics for individual variable such as mean score of the respondents. For the purpose of interpretation, the mean score were treated as 0.05-1.49 (very low), 1.5-2.49 (Low), 2.5-3.49 (Moderate), 3.5-4.49 (high) and 4.5 and above (very high). The results presented and analyzed in the following tables.

4.1.1 The Economic Dimensions of Urban Expansion Driving force

Table 4.1 The Economic Dimensions of Urban Expansion Driving force

No	I. Economic factors	Mean	SD
1.	The introduction of new industries in the town	3.43	1.443
2.	The affordable lands in the town are attracting the new immigrants.	3.35	1.329
3.	Low rental house attracted peoples towards Lagatafo Lagadadi town	3.22	1.297
4.	Agricultural lands are easily bought and sold and subdivided into residential lands.	2.76	1.341
5.	The housing market is a very important	2.87	1.233
6.	Rigid demand, urban market and agglomeration capability	3.16	1.321

7.	Economic development through promoting urban land and construction demands	3.40	1.351
	Average	3.17	1.3307

Source: primary data, 2020

Table 4.1 illustrated the economic factors. Concerning item 1 of Table 4.1, respondents were asked if the introduction of new industries in the town was driving force for urban expansion. The results from that participants responses showed moderate agreement on as introduction of new industries in the town was driving force for urban expansion with mean value of 3.43 (SD=1.443). So, the introduction of new industries in the town was the economic dimensions of urban expansion of driving forces in Lagatafo Lagadadi town.

With respect to item 2 on the same table, which says the affordable lands in the town are attracting the new immigrants. Hence, it was found that with mean values of 3.35 (SD=1.329) is rated moderate. From the data, it can be inferred that the affordable lands in the town are attracting the new immigrants the economic dimensions of urban expansion Driving forces in Lagatafo Lagadadi town.

Regarding item 3 of Table 4.1, respondents were asked as low rental house attracted peoples towards Lagatafo Lagadadi town as shown by the data, 3.22, SD=1.297) mean value. The results obtained showed that the low rental house attracted peoples towards the town had a moderate factor. Thus, the data revealed that the low rental house attracted peoples towards the town the economic dimensions of urban expansion driving forces in Lagatafo Lagadadi town.

Pertaining to item 4 of Table 4.1, which asks the question that agricultural lands are easily bought and sold and subdivided into residential lands was rated moderate with a mean value of 2.76(SD1.341) from participants responses. Accordingly, thus, there is an agreement on the agricultural lands are easily bought and sold and subdivided into residential lands was the economic dimensions of urban expansion Driving forces in Lagatafo Lagadadi town.

As in the item 5 of Table 4.2, above, shows that the housing market is a very important factor in urban expansion process in Lagatafo Lagadadi town. The result found with mean values of 2.87(SD=1.233) from respondents response which indicate a moderate factor. This showed that the housing market was the economic dimensions of urban expansion Driving forces in Lagatafo Lagadadi town.

As stated in the item 6 of Table 4.1, a rigid demand, urban market and agglomeration capability frequently drives urban expansion. The results indicated as a moderate factor with mean value of 3.16(SD=1.321) according to respondents agreement. Thus, result showed that rigid demand; urban market and agglomeration capability was the economic dimensions of urban expansion Driving forces in Lagatafo Lagadadi town.

Response from item 7 of Table 4.1, economic development through promoting urban land and construction demands frequently drives urban expansion was rated by respondents with mean values of 3.40(SD=1.351) which indicate a moderate factor. Thus, from the data; it can be inferred that economic development through promoting urban land and construction demands frequently drives urban expansion. During interview undertaken with Lagatafo Lagadadi town land management office on how economic factor related to urban expansion is recognized as it offers increased opportunities for employment, production, and goods and services. Such increased opportunities in urban areas further enhanced rural urban migration. According to interviews with land management heads of Lagatafo Lagadadi town suggested the superiority of economic factors such as introduction of industries, housing and agricultural market, job opportunities and the demands for low rental house attracted peoples towards Lagatafo Lagadadi town.

4.1.2 The Infrastructure Dimensions of Urban Expansion Driving force

Table 4.2 the Infrastructure Dimensions of Urban Expansion Driving force

II. Infrastructure factors	Mean	SD
1. Availability of suitable roads and viable public transport service	2.70	1.306
2. The level of government investment in schools attracted many peoples	3.07	1.537
3. Existence of sufficient clean water supply for households	2.84	1.450
4. The availability of hospitals for health care	3.23	1.215
5. The electricity power supply and telecom service	3.19	1.438
Average	3.006	1.389

Source: primary data, 2020

In the same way in the item 1 of Table 4.2, respondents were asked whether or not the availability of suitable roads and viable public transport service contribute for urban expansion. Hence, the mean values of with 2.70(SD=1.306) confirmed such practice is moderate. Thus, there is an agreement that availability of suitable roads and viable public transport service contribute for urban expansion.

With the same fashion in item 2, on the same table respondents were asked whether or not the level of government investment in schools attracted many peoples in Lagatafo Lagadadi town is rated moderate with mean values 3.07(SD=3.96) by participants of the study. This shows that the level of government investment in schools attracted many peoples had moderate Driving force of infrastructure dimensions of urban expansion measures.

In the item 3 of Table 4.2, regarding whether or not the existence of sufficient clean water supply for households has contributed for urban expansion. Then it was found out that the mean value 2.84 (SD=1.450) from participants of study town. This was rated moderate factor for urban expansion. This result shows that

existence of sufficient clean water supply for households had moderate role in shaping urban expansion in infrastructure dimensions of urban expansion Driving force measurement.

As it can be seen in item 4, from the same Table, the availability of hospitals for health care has accelerated the extension of the town. Therefore, the mean responses of respondents with a calculated mean value of 3.23 (SD=1.215) is indicating moderate influence from the data collected during the visit with the participants of Lagatafo Lagadadi town. From the result the availability of hospitals for health care had moderate Driving force of infrastructure dimensions of urban expansion measures.

On the contrary in the item 5 of Table 4.2, respondents were asked whether or not the electricity power supply and telecom service has made the town to be attractive for the external investors it is found moderate with mean value 3.19 (SD=1.438) by participants of Lagatafo Lagadadi town. So, it is concluded that the electricity power supply and telecom service had moderate Driving force of infrastructure dimensions of urban expansion measures.

Also from interview of Lagatafo Lagadadi town land management office government encourage of private investors for the construction of and communication networks in the open space place made important opportunities among the profitable economic agents coupled with an increase in the urban expansion on urban land and provided a context for rising of household incomes from sold land and housing market. An increased investment Lagatafo Lagadadi town result, an increase in the demand for land along with the economic centrality of cities, escalates urban expansion.

4.1.3 The Proximity Factors Dimensions of Urban Expansion Driving Force

Table 4.3 the Proximity Factors Dimensions of Urban Expansion Driving Force

III. Proximity factors	Mean	SD
1. The closeness of the town to the capital city of the country	2.94	1.196
2. Due to nearness of Lagatafo Lagadadi town to Addis Ababa many house newly built from people coming from other areas.	3.39	1.560
3. Proximity to one's place of work made preferences for new dwellers	2.84	1.326
4. There were preferences for proximity to amenities and actual lifestyles in the town	3.53	1.510
5. Preferences for urbanism as a way of life gentrified neighborhoods in the Lagatafo Lagadadi town	3.33	1.292
6. The demands for new housing and the accessibility of settlements	3.02	1.427
7. The closer regions to an administrative center characterize the higher probability of urban expansion.	3.12	1.466
8. Transportation accessibility distances to highway and national way characterize urban expansion	3.27	1.411
Average	3.18	1.3985

Source: primary data, 2020

Table 4.3 shows that the proximity dimensions of urban expansion driving force in Lagatafo Lagadadi town. The response from item 1 Table 4.3 the closeness of the town to the capital city of the country Addis Ababa was major factor of urban expansion in Lagatafo Lagadadi town were rated by respondents with mean values of 2.94 (SD=1.196) which indicate a moderate factor of urban expansion. Thus, from the data; one can infer that the closeness of the town to the capital city of the country had moderate driving force of proximity dimensions of urban expansion measures.

Regarding item 2 from Table 4.3, due to nearness of Lagatafo Lagadadi town to Addis Ababa many house newly built from people coming from other areas was rated as a moderate from the respondent's view with mean values of 3.39 (SD=1.560) indicating moderate agreement in forces shaping urban expansion. Thus, statistical data revealed that nearness of Lagatafo Lagadadi town to Addis Ababa had moderate factor of proximity dimensions of urban expansion measures.

Concerning item 3 from Table 4.3 the proximity to one's place of work made preferences for new dwellers the mean of respondents is 2.84 (SD=1.326). This means it is rated as moderate factor in urban expansion. Thus, there is an agreement proximity to one's place of work made preferences for new dwellers had moderate factor of proximity dimensions of urban expansion measures.

With respect to item 4 on the same table, which asks there were preferences for proximity to amenities and actual lifestyles in the town were rated with moderate with the mean values of 3.53 (SD=1.510). This showed that the preferences for proximity to amenities and actual lifestyles had moderate factor of proximity dimensions of urban expansion measures.

Concerning item 5 from Table 4.3, the preferences for urbanism as a way of life gentrified neighborhoods in the Lagatafo Lagadadi town was rated as a moderate from respondent's view with mean 3.33 (SD=1.292). This result shows that preferences for urbanism as a way of life gentrified neighborhoods had moderate factor of proximity dimensions of urban expansion measures.

In the item 6 of Table 4.3, participants view regarding the demands for new housing and the accessibility of settlements. The result obtained from the respondents mean values of 3.02 (SD=1.427) indicating moderate factor of urban expansion. So, it is concluded that, the demands for new housing and the accessibility of settlements had moderate factor of proximity dimensions of urban expansion measures.

The Table item 7, above represents respondents view if the closer regions to an administrative center characterize the higher probability of urban expansion. Then, it was found moderate factor with mean value of 3.12 (SD=1.466). Thus, from the data, one can infer that closer regions to an administrative center had moderate factor of proximity dimensions of urban expansion measures.

As it can be seen in item 8 of Table 4.3, describes the transportation accessibility distances to highway and national way characterize urban expansion. The respondents mean values of 3.27 (SD=1.411) were

rated moderate factor. Thus, statistical data revealed that transportation accessibility distances to highway and national way had moderate factor of proximity dimensions of urban expansion measures.

4.1.4 The Neighborhood Dimensions of Urban Expansion Driving force

Table 4.4 The Neighborhood Dimensions of Urban Expansion Driving Force

IV. Neighborhood factors	Mean	SD
1. The locations nearer to urbanized settlements and urban infrastructures	3.21	1.467
2. Neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs is a factor associated to urban expansion.	3.04	1.321
3. The tremendous rural-urban land conversion movement leads to urban expansion.	3.35	1.421
4. The actual lifestyles and dwellers preferences for proximity to open space, for single-family dwellings, or for home ownership attracting the new immigrants	3.19	1.198
5. Preferences for “flight from blight” or its converse, the appeal of gentrified neighborhoods in the inner city	3.26	1.371
Average	3.21	1.3556

Source: Primary Data, 2020

Table 4.4 shows that the neighborhood dimensions of urban expansion driving force in Lagatafo Lagadadi town. Concerning item 1, from table respondents were asked if the locations nearer to urbanized settlements and urban infrastructures characterize the higher probability of urban expansion. Then the result indicated that the mean of respondents is 3.21 (SD=1.467). This was rated as moderate factor linking urban expansion driving force in Lagatafo Lagadadi town. Thus, it can be concluded that the closer locations to developed urban areas and urban infrastructures had moderate factor of neighborhood dimensions of urban expansion measures.

With respect to item 2, on the same table asks neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs is a factor associated to urban expansion were rated with moderate with the mean values of 3.04 (SD=1.321). This showed that the neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs had moderate factor of neighborhood dimensions of urban expansion measures.

Concerning item 3 of Table 4.4, asks the question that the tremendous rural-urban land conversion movement leads to urban expansion was rated as a moderate factor from the respondents with the mean values of 3.35 (SD=1.421). This result shows that rural-urban land conversion movement had moderate factor of neighborhood dimensions of urban expansion measures.

Relating to item 4 on Table 4.4, respondents were requested to give their views if the actual lifestyles and dwellers preferences for proximity to open space, for single-family dwellings, or for home ownership attracting the new immigrants. The mean values of 3.19 (SD=1.198) obtained from the respondents response shows a moderate factor urban expansion measures. Thus, it is concluded that, the preferences

dwellers for actual lifestyles and proximity to open space, for single-family dwellings, or for home ownership had moderate factor of neighborhood dimensions of urban expansion measures.

Concerning Item 5, from the above table asks that the preference for "flight from blight" or its converse, the appeal of gentrified neighborhoods in the inner city. Then, response from participants showed mean values of 3.26 (SD=1.371). This indicates that the preferences for "flight from blight" or its converse, appeal of gentrified neighborhoods in the inner city is moderate. From the result it can be concluded that, preferences for "flight from blight" or its converse, the appeal of gentrified neighborhoods in the inner city had moderate factor of neighborhood dimensions of urban expansion measures.

From interview of Lagatafo Lagadadi town land management office land values were main factor of urban expansion due to rising demand of land and housing price in the urban service boundaries, weak legal enforcement at per periphery of town, scarcity and limitation of land in the center of town and availability of space at periphery of town for construction makes this factor as a key factor in urban expansion process.

4.1.5 The Physical Dimensions of Urban Expansion Driving force

Table 4.22 The Physical Dimensions of Urban Expansion Driving force

V. Physical Factors	Mean	SD
1. The suitability of topography preferred among new dwellers	3.27	1.537
2. The suitability flat slopes are contributed in direction towards urban expansion in the Lagatafo Lagadadi town.	3.56	1.336
3. The existing slopes as well as elevation are frequently characterized as suitability factors to urban expansion.	2.96	1.365
4. The increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area.	3.38	1.445
5. The increasing urban population causes increasing demand in the open spaces contained in the existing urban area.	3.59	1.265
6. Presence of river water resources ware opportunities that advantages development of urban in adjacent areas	1.64	1.444
7. There were huge demands for land by households or firms who inhabit in the town from edges	3.89	1.348
Average	3.47	1.391

Source: primary data, 2020

Table 4.5 shows that the physical factors dimensions of urban expansion driving force in Lagatafo Lagadadi town. Concerning item 1 of Table 4.5, respondents were asked if the suitability of topography preferred among new dwellers. Thus, the responses showed that there moderate agreement on the idea with mean result of 3.27 (SD=1.537). So, the suitability of topography had moderate factor of physical factors dimensions of urban expansion measures.

With respect to item 2 on the same table, which says the suitability flat slopes are contributed in direction towards urban expansion in the Lagatafo Lagadadi town. Hence, it was found that with mean values of 3.56

(SD=1.326) by respondents rated high driving force shaping urban expansion. From the data, it can be inferred that physical dimensions of urban expansion driving force; the suitability flat slopes were major drives of urban expansion in Lagatafo Lagadadi town.

Regarding item 3 of Table 4.5, respondents were asked as the existing slopes as well as elevation are frequently characterized as suitability factors to urban expansion as shown by the data, mean value of 2.96 (SD=1.326). The results obtained showed that the existing slopes as well as elevation are frequently characterized as suitability factors to urban expansion had moderate factor in urban expansion. Thus, the data revealed that the physical factor dimensions stating existing elevation and slope suitability was a moderate factor urban expansion in Lagatafo Lagadadi town.

Pertaining to item 4 of Table 4.5, which asks the question that the increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area was rated high with a mean value of 3.38 (SD=1.445) in participants responses. Thus, there is an agreement physical factor were high driving factor of urban expansion as increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area in Lagatafo Lagadadi town.

As in the item 5 of Table 4.5, above, shows that the increasing urban population causes increasing demand in the open spaces contained in the existing urban area. The result found with mean values of 3.59 (SD=1.265) is rated high. This showed that physical factor were high driving factor of urban expansion as respondents agreement on increasing urban population causes increasing demand in the open spaces contained in Lagatafo Lagadadi town.

As stated in the item 6 of Table 4.5, a presence of river water resources ware opportunities that advantages development of urban in adjacent areas. Thus, it was found low agreement with mean value of 1.64 (SD=1.444) by participants average response. Then, from the result showed that physical factor were not driving factor of urban expansion as respondents lower agreement as presence river water resources advantages possibilities that benefit urban development in Lagatafo Lagadadi town.

Response from item 7 of Table 4.5, there were huge demands for land by households or firms who inhabit in the town from edges was rated by respondents with mean values of 3.89 (SD=1.348) which indicate high agreement on existence of huge demands for land by households from edges. Thus, from the data; it can be inferred that physical factor were a driving factor of urban expansion as respondents higher agreement as there were huge demands for land by households or firms who inhabit in the town from edges. Also, from interview of Lagatafo Lagadadi town land management office there were rural to urban migration in favor of households' demand for more land and living in larger areas and instead of compact and crowd place in the center of the town was the factor of rapid urban expansion.

4.1.6 The Land Values Dimensions of Urban Expansion Driving Force

Table 4.6 The Land Values dimensions of Urban Expansion Driving force

VI. Land values	Mean	SD
1. Increased demand of land over time leads to conversion of former agricultural land for residential purposes	3.48	1.139
2. There were conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing.	3.16	1.367
3. The increasing urban population causes increasing demand on urban land.	3.56	1.402
4. The rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming.	3.87	1.379
5. Rise in price of land value contributed in direction towards urban expansion in the Lagatafo Lagadadi town.	2.94	1.232
Average	3.402	1.3038

Source: primary data, 2020

Table 4.6 shows that the land values factors dimensions of urban expansion driving force in Lagatafo Lagadadi town. As stated in the item 1 of Table 4.6, increased demand of land over time leads to conversion of former agricultural land for residential purposes. Thus, it was found moderate with mean value 3.48 (SD=1.139) by respondents average response. Then, from the finding it can be inferred that land value dimensions factors shaping urban expansion were increased demands of land over time leading to conversion agricultural land for residential purposes according to responses obtained from participants with moderate agreement

Response from item 2 of Table 4.6, there were conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing was rated with mean values of 3.16 (SD=1.367) is rated moderate on human intervention as factor of land use change. Thus, from the data; it can be inferred that land value dimensions factors shaping urban expansion were a moderate factor due to conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing as responses obtained from participants.

Regarding item 3, of Table 4.6, the increasing urban population causes increasing demand on urban land was rated as a high factor from the respondents with mean values of 3.56 (SD=1.402) calculated from participants response involved in the study. The finding of the data revealed that the factors shaping urban expansion fromland value dimensions in Lagatafo Lagadadi town were the increments of population demanding urban land according to participants moderate agreement involved in the study.

Concerning item 4, from the same table respondents were asked if the rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming. Then the result indicated that with a mean values of 3.87 (SD=1.379). This was rated as high agreement on the rising the price of the converted lands initiated residents to sell their land. Thus, it can be concluded that there were evidence on land value dimensions were the factors shaping urban expansion in Lagatafo Lagadadi town

from participants higher agreement to the statements of rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming.

Regarding item 5, of Table 4.6, rise in price of land value contributed in direction towards urban expansion was rated as a moderate factor from the respondents response with mean values of 2.94 (SD=1.232). From the finding of the data it can be concluded that the factors of urban expansion from land value dimensions were rise in price of land value as respondent's moderate agreement in Lagatafo Lagadadi town.

From interview of Lagatafo Lagadadi town land management office land values were main factor of urban expansion due to rising demand of land and housing price in the urban service boundaries, weak legal enforcement at per periphery of town, scarcity and limitation of land in the center of town and availability of space at periphery of town for construction makes this factor as a key factor in urban expansion process.

In line with the current finding Hosseini (2013), study on driving forces for urban sprawl at Mashhad city mainly associated with population growth, rural urban migration, the annexation of peripheral settlements, reducing of land price in suburbs, physical geography, urban plans, transportation, informal settlement.

4.1.7 The Land use Policy and Urban Planning Dimensions of Urban Expansion Driving force

Table 4.7 The Land use Policy and Urban Planning Dimensions of Urban Expansion Driving force

VII. Land use policy and urban planning	Mean	SD
1. The governments utilize policies of urban expansion by urban land lease cause new construction of buildings in the agriculture	3.53	1.455
2. The weak implementation of land use policy and urban planning resulted leaping over swaths of open space	2.96	1.419
3. The poor strictness and quality of enforcement in urban development controls has a share for urban expansion in Lagatafo Lagadadi town	3.42	1.581
4. Informal settlement with people living at peripheries in built or rented housing occupations causes increasing urban expansion.	3.81	1.372
5. Formal urban sprawl invades the land of the farmers in Lagatafo Lagadadi town.	3.93	1.345
Average	3.53	1.4344

Source: primary data, 2020

Table 4.7 illustrated the land use policy and urban planning dimensions of urban expansion driving force. Concerning item 1 of Table 4.7, respondents were asked to rate if the governments utilize policies of urban expansion by urban land lease cause new construction of buildings in the agriculture. Thus, it was found that high agreement responses showed on the idea with mean result of 3.53 (SD=1.455) by respondents average response. So, it is concluded that, the land use policy and urban planning dimensions was driving force for urban expansion as governments utilize policies of urban expansion by urban land lease by construction of buildings in the agricultural land use according to participants higher agreement participated in the study.

With respect to item 2 on the same table, which says the weak implementation of land use policy and urban planning resulted leaping over swaths of open space. Hence, it was found with mean values of 2.96 (SD=1.419) is rated moderate. From the data, it can be inferred that the forces shaping urban expansion among dimensions of land use policy and urban planning was found the weak implementation of land use policy and urban planning resulted leaping over swaths of open space from the respondents moderate agreements participated in the study.

Regarding item 3 of Table 4.7, respondents were asked as the poor strictness and quality of enforcement in urban development controls has a share for urban expansion in Lagatafo Lagadadi town as shown by the data, mean value of 3.42 (SD=1.581) indicate moderate agreement on the statement. Thus, the finding indicates the factors of urban expansion in Lagatafo Lagadadi town from dimensions of land use policy and urban planning were identified the poor strictness and quality of enforcement in urban development controls as response obtained from participants moderate agreement.

Pertaining to item 4 of Table 4.7, which asks the question that informal settlement with people living at peripheries in built or rented housing occupations causes increasing urban expansion was rated high with a mean value of 3.81 (SD=1.372) in respondents responses. Thus, there is sufficient evidence that the drives of urban expansion from land use policy and urban planning dimensions were identified informal settlement of people living at peripheries in built or rented housing occupations with higher agreements among participants of the study.

As in the item 5 of Table 4.7, above, shows that formal urban sprawl invades the land of the farmers in Lagatafo Lagadadi town. The result obtained from the participants revealed a mean values of 3.93 (SD=1.345) which is rated high agreement. Based on finding it could be concluded that the forces of urban expansion in Lagatafo Lagadadi town from dimensions of land use policy and urban planning were revealed formal urban sprawl invading the land of the farmers as respondents' high agreement during study.

4.1.8 The Mean Rank of Forces Shaping Urban Expansion

Table 4.8 The Mean Rank of Forces Shaping Urban Expansion

The driving forces of urban expansion in Lagatafo Lagadadi town	Mean	SD	Mean Rank
1. Economic factors	3.17	1.33	6th
2. Infrastructure factors	3.006	1.38	7th
3. Proximity factors	3.18	1.39	5th
4. Neighborhood factors	3.21	1.35	4th
5. Physical Factors	3.47	1.39	2nd
6. Land values	3.402	1.30	3rd
7. Land use policy and urban planning	3.53	1.43	1st

Source: primary data, 2020

As can be seen from the Table 4.8, the respondents' response on the item 1, 2, 3, 4, 5, 6 and 7 the mean scores were rated with average mean score by the respondents. These indicated that respondents asserted

for higher agreement on driving forces of urban expansion variables in Lagatafo Lagadadi town. Accordingly, respondents average response for economic factors; infrastructure factors; proximity factors; neighborhood factors; physical factors; land values; and land use policy and urban planning were revealed with mean scores of 3.17(SD=1.33), 3.006(SD=1.38), 3.18(SD=1.39), 3.21(SD=1.35), 3.47(SD=1.39), 3.402(SD=1.30), and 3.53(SD=1.43) respectively. This implies that the variables such as economic; infrastructure; proximity; neighborhood; physical; land values; and land use policy and urban planning the factors were highly driving forces of urban expansion in Lagatafo Lagadadi town.

Table 4.8, shows the rank order of seven possible areas in which forces shaping urban expansion is currently most or least in Lagatafo Lagadadi town. As shown in Table, the mean rank revealed that, land use policy and urban planning was ranked first. It has been observed that, physical factors were ranked second. Similarly, from the results summarized the ranking order of participants revealed that, land a value was third. Also from the mean rank of participants showed that, neighborhood factors was the fourth shaping forces of urban expansion; while proximity factors, economic factors and infrastructure factors were ranked from fifth to seventh, respectively. In general, the findings of this study imparted that the most driving forces of urban expansion in Lagatafo Lagadadi town was found land use policy and urban planning in the town. On the other hand, this study revealed that concerning infrastructure factors was the least driving forces of urban expansion in Lagatafo Lagadadi town.

From interview undertaken with heads of land management office of Lagatafo Lagadadi town what factors do you think have contributed for urban expansion in this locality on rapid urban population growth combined with the economic development led to rapid and unplanned urban expansion. The gradual decline in agricultural and vegetation was as results of rapid built up on cultivated land. The rapid urban expansion was closely associated with combined huge investment of private and government on public infrastructure such schools, hospital and roads. Urban expansion is also associated with an increase in personal and public transportation.

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusions

The findings of this study imparted that the most driving forces of urban expansion while infrastructure factors was the least driving forces of urban expansion in Lagatafo Lagadadi town in Lagatafo Lagadadi Town. Based on the findings of the study it is worth to draw the following conclusions related to the basic question of the study.

Ranking the average response of participants on variables shaping urban expansion most or least; the mean rank for land use policy and urban planning was ranked first; also it has been observed that, physical factors were ranked second. Similarly, land values were ranked the third from the results summarized rank order of participants' response. Also from the mean rank of participants showed that neighborhood factors was the fourth shaping forces of urban expansion; while proximity factors, economic factors and

infrastructure factors were ranked from fifth to seventh, respectively. In general, the findings of this study imparted that the most driving forces of urban expansion while infrastructure factors was the least driving forces of urban expansion in Lagatafo Lagadadi town in Lagatafo Lagadadi town.

5.2 Recommendations

On the basis of the major findings of the study, the following recommendations are forwarded for the sake of urban expansion and the forces shaping the case of Lagatafo Lagadadi town. The driving forces of urban expansion in Lagatafo Lagadadi town were related to economic; infrastructure; proximity; neighborhood; physical; land values; and land use policy and urban planning the factors. It is, therefore, important for Lagatafo Lagadadi town municipality to enforce timely and appropriate land use planning which considers the requirements of social, economic, and environmental sustainability.

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Annex 2: Survey Questions

ADDIS ABABA UNIVESSITY

ETHIOPIAN INSTITUTE OF ARCHITECTURE, BUILDING CONSTRUCTION AND CITY DEVELOPMENT

Survey Questions for Households and Employees of Lagatafo Lagadadi Town Land Management Office

Dear Respondents,

My name is Hundesa Kassahun Genemo M.Sc. student in Urban Planning at Addis Ababa University Ethiopian Institute of Architecture, Building Construction and City Development. Currently, I am conducting research that aims "Analysis of Urban Expansion and the Forces Shaping the Case of Lagatafo Lagadadi Town".

I would like to invite you to take part in my study as participants by completing the following survey questionnaire Thus, I kindly request you to give the required information provided and please save some time to complete and return it to me as soon as you can. Your contribution is highly important for the success of this study. The researcher would like to assure you that all the responses you give will be kept confidential and used only for the research purpose. As a further assurance, you don't need to write your name.

Thank you in advance for your co-operation.

PART 1: Personal Information

Direction 1: Please give information about **yourself** for each of the categories below. Put a tick (√) mark in the appropriate box where necessary.

1. Name of the kebele _____

2. Age a) 20-29 ☐ b) 30-39 ☐ c) 40-49 ☐ d) 50 and above

3. Sex a) Male ☐ b) Female ☐

4. Qualification:

a) No formal education ☐ b) primary school 1-8 ☐ c) secondary school and certificate ☐

d) Diploma ☐ e) BA ☐ f) MA ☐ g) PhD ☐ h) other (specify) _____

6. How long you live in Lagatafo Lagadadi Town: a) five and less than five years ☐

b) 6-10 years ☐ c) 11-20 years ☐ d) more than 20 years ☐

2. The following questions are about the forces shaping urban expansion the case of "Lagatafo Lagadadi Town". Please you are requested to read each statement carefully and indicate your level of agreement or disagreement for each item under the scales that represents your opinion by ticking in one of the boxes of the option given. Keys: Strongly agree=5 Agree=4, Undecided=3, Disagree=2 Strongly Disagree=1

No.	**Statement**					
I	**Economic Factors**	**1**	**2**	**3**	**4**	**5**
1. .	The introduction of new industries in the town was driving force for urban expansion					
2. .	The affordable lands in the town are attracting the new immigrants.					
3. .	Low rental house attracted peoples towards Lagatafo Lagadadi Town					
4. .	Agricultural lands are easily bought and sold and subdivided into residential lands.					
5.	the housing market is a very important factor in urban expansion process in Lagatafo Lagadadi Town					
6.	Rigid demand, urban market and agglomeration capability frequently drives urban expansion					
7.	Economic development through promoting urban land and construction demands frequently drives urban expansion					
II	**Infrastructure Factors**					
8. 1.	Availability of suitable roads and viable public transport service contribute for urban expansion,					
9. 2.	The level of government investment in schools attracted many peoples in Lagatafo Lagadadi Town					
10. 3.	Existence of sufficient clean water supply for households has contributed for urban expansion					
11. 4.	The availability of hospitals for health care has accelerated the extension of the town					
12. 5.	The electricity supply and telecom service has made the town to be attractive for the external investors					

III	**Proximity Factors**					
13. 1.	The closeness of the town to the capital city of the country Addis Ababa was major factor of urban expansion in Lagatafo Lagadadi Town					
14. 2.	Due to nearness of Lagatafo Lagadadi Town to Addis Ababa many house newly built from people coming from other areas.					
15. 3.	Proximity to one's place of work made preferences for new dwellers					
16. 4.	There were preferences for proximity to amenities and actual lifestyles in the town					
17. 5.	preferences for urbanism as a way of life gentrified neighborhoods in the Lagatafo Lagadadi Town					
18. 6	the demands for new housing and the accessibility of settlements					
19. 7	The closer a region to an administrative center characterize the higher probability of urban expansion.					
20. 8	Transportation accessibility distances to highway and national way characterize urban expansion					
IV	**Neighborhood Factors**					
21. 1	The locations nearer to urbanized settlements and urban infrastructures characterize the higher probability of urban expansion.					
22. 2	Neighborhood nearer to urbanized settlements and easier accessibility to urban infrastructures at lower costs is a factor associated to urban expansion.					
23. 3	The tremendous rural-urban land conversion movement leads to urban expansion.					
24. 4	The actual lifestyles and dwellers preferences for proximity to open space, for single-family dwellings, or for home ownership attracting the new immigrants					
25. 5	Preferences for "flight from blight" or its converse, the appeal of gentrified neighborhoods in the inner city					
V	**Physical Factors**					

26. 1	The suitability of topography preferred among new dwellers					
27. 2	The suitability flat slopes are contributed in direction towards urban expansion in the Lagatafo Lagadadi Town.					
28. 3	The existing slopes as well as elevation are characterized as suitability factors to urban expansion.					
29. 4	The increasing concentration due to rapid population growth resulted new development in contiguous clusters immediately adjacent to the existing urban area.					
30. 5	The increasing urban population causes increasing demand in the open spaces contained in the existing urban area.					
31. 6	Presence of river water resources ware opportunities that advantages development of urban in adjacent areas.					
32. 7	There were huge demands for land by households or firms who inhabit in the town from edges					
VI	**Land Values Factors**					
33. 1	Increased demand of land over time leads to conversion of former agricultural land for residential purposes					
34. 2	There were conversion of agricultural land use due to human intervention for purposes, such as, settlement, transportation, infrastructure and manufacturing.					
35. 3	The increasing urban population causes increasing demand on urban land.					
36. 4	The rising the price of the converted lands (from agriculture to buildings) initiated residents to sell their land rather than farming.					
37. 5	Rise in price of land value contributed in direction towards urban expansion in the Lagatafo Lagadadi Town.					
VII	**Land use policy and Urban Planning Factors**					
38. 1	The governments utilize policies of urban expansion by urban land lease cause new construction of buildings in the agriculture					
39. 2	The weak implementation of land use policy and urban planning resulted leaping over swaths of open space					

40. 3	The poor strictness and quality of enforcement in urban development controls has a share for urban expansion in Lagatafo Lagadadi Town					
41. 4	Informal settlement with people living at peripheries in built or rented housing occupations causes increasing urban expansion.					
42. 5	Formal urban sprawl invades the land of the farmers in Lagatafo Lagadadi town.					

Annex 3: Interview

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Semi-Structured Interview for Kebele Leaders and Heads of Lagatafo Lagadadi Town Land Management Office

Data collected with semi-structured interview will answer the research question a study on the forces shaping urban expansion the case of "Lagatafo Lagadadi Town". The following open-ended questions are presented to the Kebele Leaders respondents of the research

1. What factors do you think have contributed for urban expansion in this locality?
2. What major shift in land use occurred in your locality in the last 24 years? (provide qualitative description; +, - & No change)
3. How do you think about economic factors contribute to urban expansion in Lagatafo Lagadadi town
4. How do you think about land use policy and urban planning contribute to urban expansion in Lagatafo Lagadadi town
5. How do you think about land values contribute to urban expansion in Lagatafo Lagadadi town
6. How do you think about Physical Factors contribute to urban expansion in Lagatafo Lagadadi town
7. How do you think about Neighborhood factors contribute to urban expansion in Lagatafo Lagadadi town
8. How do you think about Infrastructure factors contribute to urban expansion in Lagatafo Lagadadi town