Analysing the influence of economic growth on land use changes in Agahenerezo and Karubanda Settlement Centres, Huye City.

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ABSTRACT: This study investigated challenges associated with the linkage between environment and economic growth in Huye city, Southern Rwanda with the purpose of identifying response for a synergized environment and economic growth improvement. A sample of 200 Heads of Households was selected from both Karubanda and Agahenerezo Villages in Huye City, following a multi-stage sampling procedure. Eight key qualitative data informants were also selected. With research questionnaire and interview questions, data were collected including the respondents' views on the linkage between affected land use patterns and economic growth as well as the existing alternative controls for managing environmental pressures. Collected data were analyzed using different computer-based tools including the ArcGIS and remote sensing and excel to present both spatial and non-spatial data. Findings showed that 71.97 SqKm of vegetation cover have been affected by economic growth associated influences like cutting trees and shrubs during agricultural activities or infrastructures and building development. It has also been indicated that the accelerated land use change is linked to not only economic growth but also other parameters including the absence of detailed physical settlement plans for any emerging settlement site, and the low level of community involvement in the land use Planning sessions and Programs. This study concluded that promoting environmental initiatives such as wastes management, bottom-up and participatory land use planning as well as capacity building can lead to a synergized environment and economic growth improvement.
KEYWORDS: Synergize, Environment pressures, Land use Change, Economic Growth.

I.   INTRODUCTION
Land and vegetation are some of natural Resources that Humankind rely on to meet most of their livelihood needs. However, the importance that these natural resources have to the economic growth of any community expose them to changes in both their quality and quantity. Forestry products for example contribute significantly to the economic output with the benefits often coupled with environmental degradation (Doreen Fedrigo-Fazio, et al., 2016)

Studies showed that the Urban Sprawl associated with Urban Population growth put Pressure on agricultural land resulted into Problems in Musanze District (Jean Marie Vianney KURADUSENGE &Abias MANIRAGABA, 2018)

In addition, studies showed that as long as cities prosper, they can simultaneously generate environmental and resource challenges (Government of Rwanda and GGGI, 2015)

In 2020, The increase of Huye City Population was expected to reach 103,654 population from 52,768 population in 2012 (+50,887 population), and the urbanization rate to 35% by 2024, from 16% in 2012(Huye DDS, 2018-2024)

The less Off-farm Employment rate (only 24%) and Unplanned settlement development accompanied with other environmental risk activities namely Soil; water; Mines and Plants exploitation for food & Infrastructures needs leads to High Urban Population Growth; Reliance on Agricultural activities; Low Understanding of Human Activities on Land; and Accelerated Land Consumption which are described as environmental and economic growth factors linked with land use changes in this study. The Main objective for this study is to understand challenges in the improvement of both the above introduced environmental and economic growth factors in Huye

City to ensure control on land use changes in Huye City by: (1) Exploring the linkage between land use change and economic growth, and (2) Analyzing the existing alternative controls for management of environmental pressures, (3) Assessing spatial changes in vegetation cover using GIS and remote sensing.

II. ABOUT THE STUDY AREA
Huye City with 69.53 SqKm is in Southern Rwanda, as one of six Secondary Cities after Kigali, the Capital City of Rwanda (Huye SC MP, 2020-2050). The case study comprises two settlements sites, where the 1st is located inKarubanda Village(2.3SqKm) with an estimated 150 Households, Huye City and the 2nd one in Agahenerezo village with 250 Estimated Households in Agahenerezo Village(0.7SqKm), Huye City. The Karubanda Settlement site emerged in line with a detailed physical land use plan while the Agahenerezo Settlement site emerged on an unplanned land.
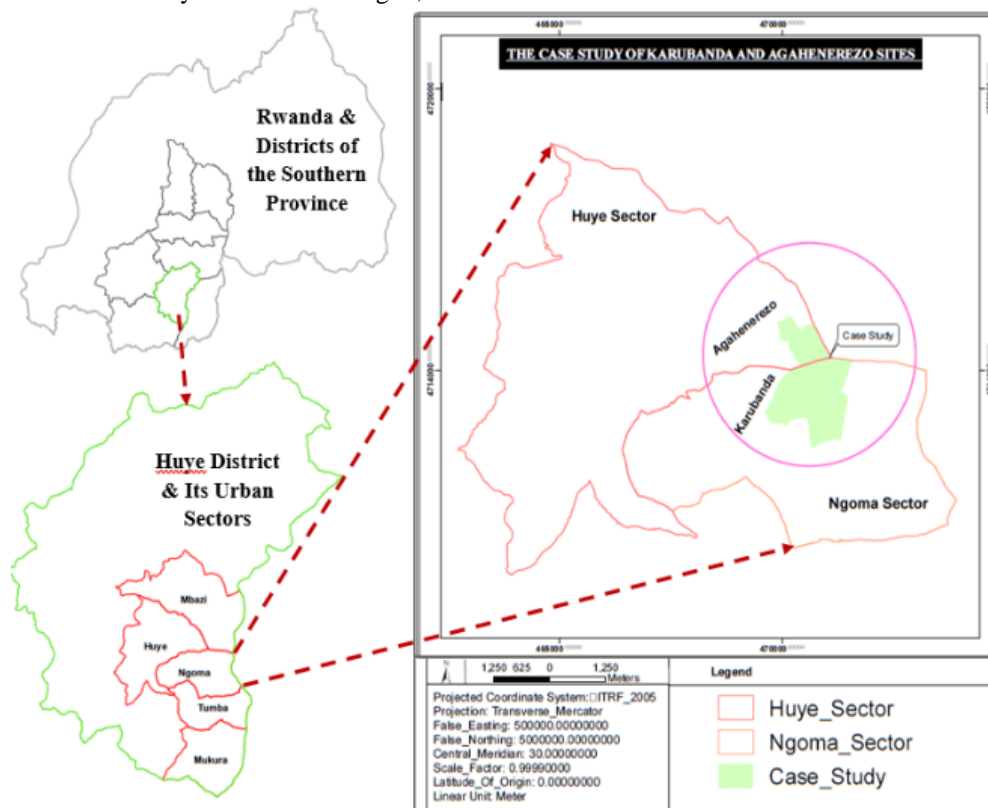

Figure 1. Karubanda and Agahenerezo Villages in Huye City

III. METHODOLOGY
In this study, the Main concepts of this research have been contextually defined and unpackaged into variables and measurable indicators.

Purposive Sampling, a deliberate choice of a participant due to His/her possessed qualities (Itikan, Ilker, 2016). Therefore, The research units in this study were composed by Heads of Households; urban investors and City officials in charge of land use implementation as target participants in our case study.

Hence, 8 Key Qualitative Informants were chosen from Urban Investors and District Officials and a sample size of 200 Heads of Households selected from the 400 Households located in the case study. To this sample size, the following Sampling procedure formulated by Yamane in 1967 and adopted by (AkinbodeWasiu Olalekan, et al., 2015) were used:

n=N/1+$N(e)$2

Where, n= anticipated total sample size; N= population size; e= acceptable error term (0.05).

In addition, a systematic sampling method were used to reach to each Household within the 200 Households that composed the sample size of this study.

The Landsat 8-9 OLI/TIRS C2 L2 from USGS Earth Explorer (Kristi, 2020) were used to calculate the Normalized difference Vegetation Index (NDVI) for the case study, for 2016 and 2021 year.

To calculate the NDVI, the following formula is

used:
NDVI= (NIR-Red)/(NIR+Red), where NIR stands for Near Infrared (Crippen,1990)
For our study, we used the Landsat 8-9 OLI/TIRS C2 L2, and the NDVI were calculated using its introduced formula as follows.
NDVI= (Band 5-Band 4)/ (Band 5+ Band 4)

IV. RESULTS AND DISCUSSIONS
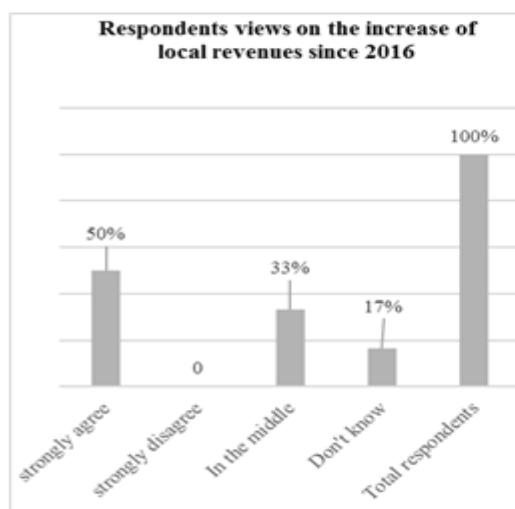This chapter examines the findings from this research trying to create a better understanding of this research questions and objectives. It consists of findings and their interpretation, the conclusion as well as the recommendations for the further researchers and Planners based on the collected and analyzed data from both Heads of Households in Karubanda settlement site and Agahenerezo centre as well as data from the urban investors and city officials in charge of land use plans implementation. This session focusses mainly on analyzing different views of the respondents regarding the objective of this research.

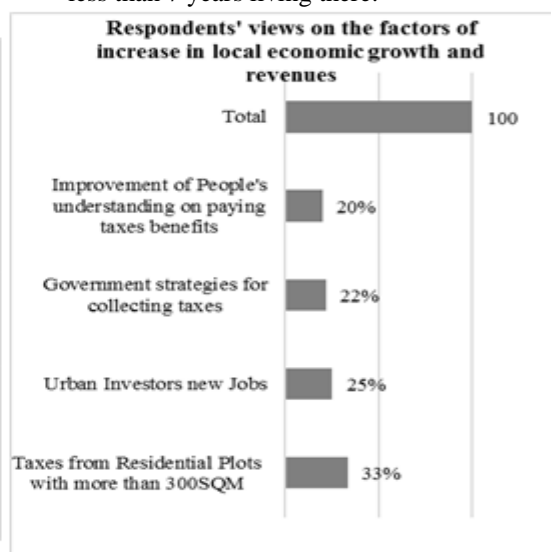| Responde nts	Particip ants	(%) of Respondent Ages			Gender in Percentage (%)		Number of years spent living in Huye City since 2012				
	Number	<30	30-60	Over 60	Male	Female	<1	1-2	2-4	4-6	>7
Heads of Household ds	200	12	76	12	65	35	5	10	25	40	20
Urban Investors	4	25	50	25	75	25	-	-	-	1	3
City officials in Charge of land use plans implemen tation	4	-	100	-	50	50	-	-	1	3	-

Source: Compiled data from survey questionnaire and interview by the Author, 2021

The Majority of respondents' ages were between 30 and 60 years old, and the 65% of them were Males. 20% of Heads of Households lived in Huye City for the period of more than 7 years. Among the 4 interviewed Urban Investors, only one of them lived in Huye City for the Period less than 7 Years, other 3 of them spent more than 7 years in this study area while all City officials in Charge of land use plans implementation had spent less than 7 years living there.

Respondents views on the increase of local revenues since 2016

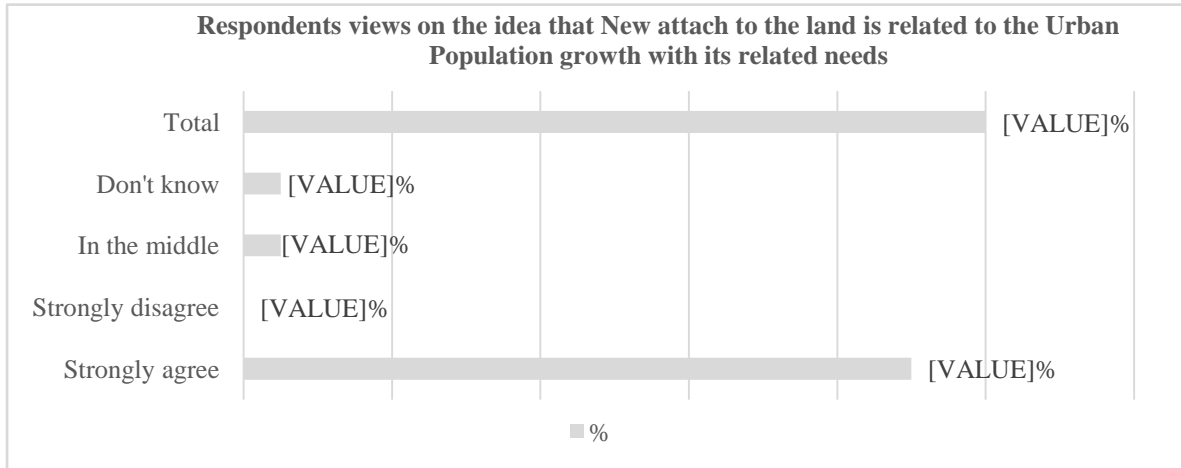Respondents' views on the factors of increase in local economic growth and revenues

The half of respondents have strongly agreed that the local revenues have increased since 2016 to 2021 while 17% of them had no information about the local revenues status. The remaining 33% of respondents remained in the middle to the idea that it has increased or reduced.
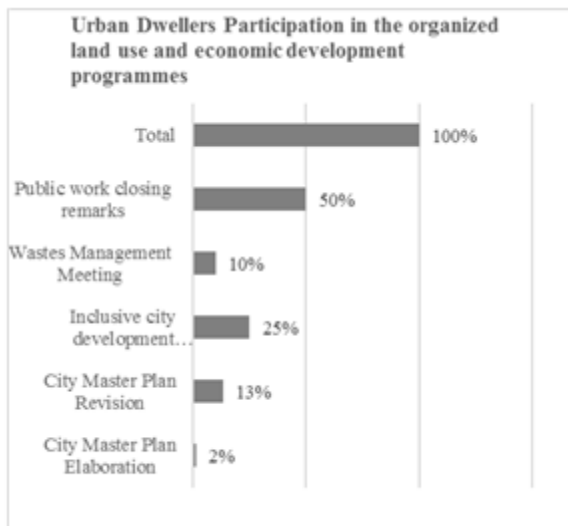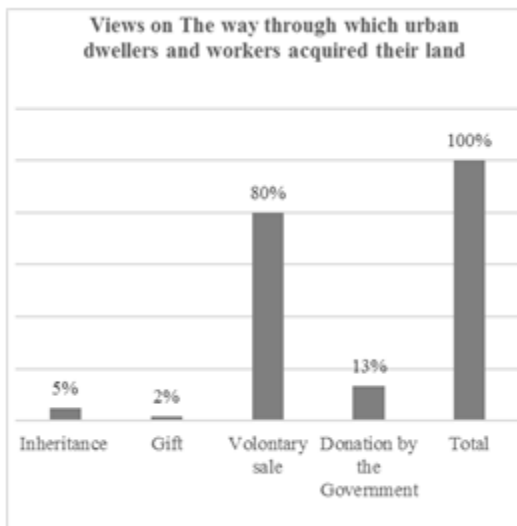
The Residential land Taxes and new jobs were recorded as the key factors for the local economic growth, supported by improvement into people's understanding on benefits from paying taxes and Government's strategies.

Respondents views on the idea that New attach to the land is related to the Urban Population growth with its related needs

Most respondents (90% of them) pointed the urban population growth as one of key factors for attaching and consuming new land in urban area, as the main source for their needs in terms of food and infrastructures. Only 5 % of respondents had no idea on the causes of the new attached land while other 5% were not sure whether it's linked with the growing urban population or not. This high number of People who see urban population growth as one of major factors behind the increase of in land demand and its attach by various developments for economic growth proves that Huye City needs to take control measures to limit land that would be affected by the projected increase in its urban population as it was introduced in this study background.

Views on The way through which urban dwellers and workers acquired their land

Urban Dwellers Participation in the organized land use and economic development programmes

The Majority of Urban dwellers in the study area (80%) said that they have received the land on which they live through voluntary sale process, while 5% of them inherited it from their parents.

The half of respondents got information on land use plan and economic development programmes during public work closing remarks.
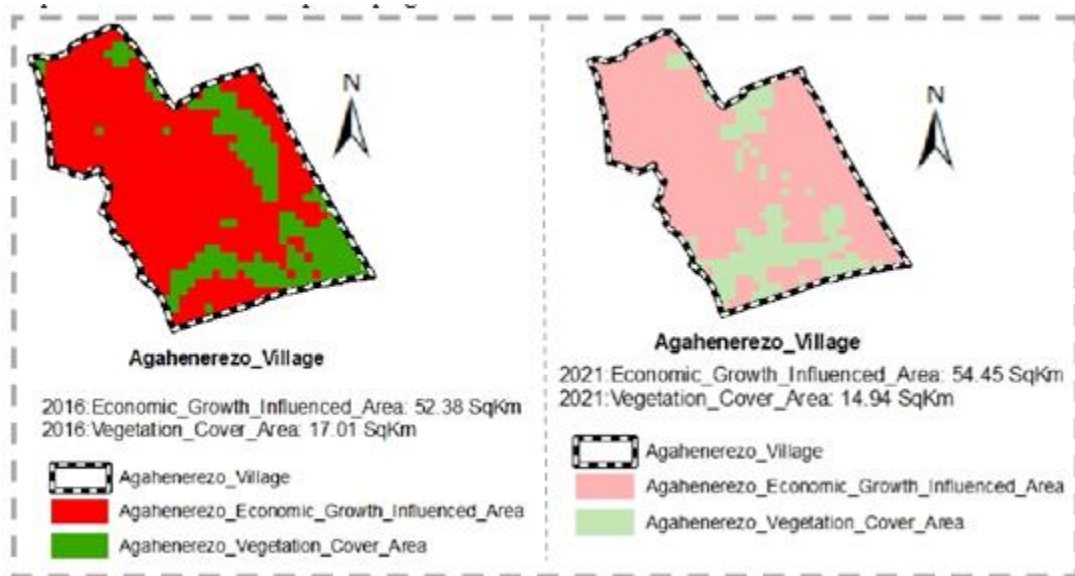
Area affected by economic growth influences of agricultural activities (cutting trees and vegetation) and infrastructures development such as roads and have increased from 52.38 SqKmin 2016 to 54.45 SqKm in 2021. This means that the area of vegetation cover that were not affected in any way have reduced from 17.01 SqKm in 2016 to 14.94 SqKm in 2021.
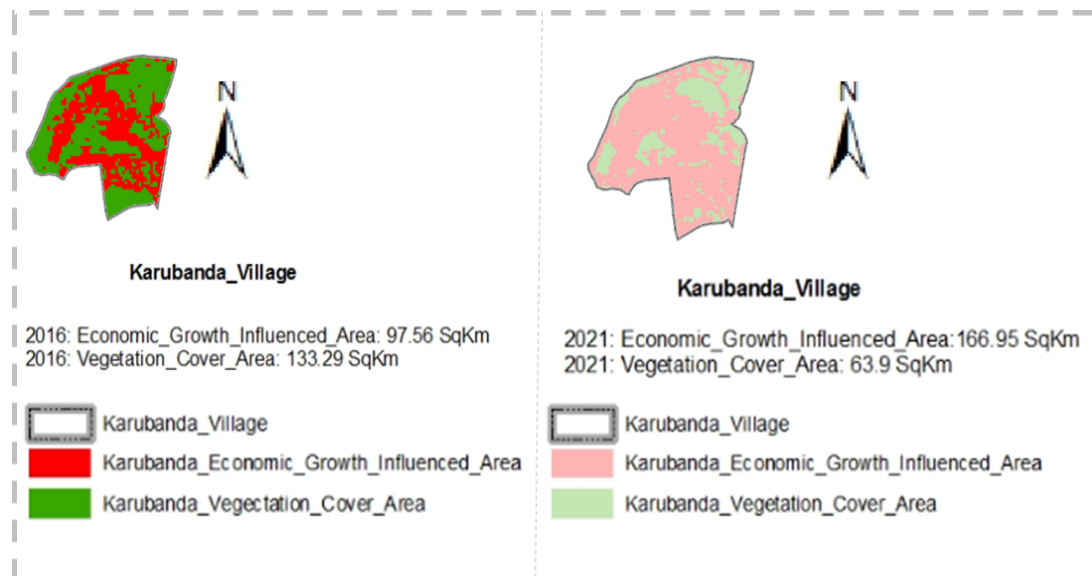
Area affected by economic growth influences of agricultural activities (cutting trees and vegetation) and infrastructures development such as roads and have increased from 97.56 SqKmin 2016 to 166.95 SqKm in 2021. This means that the area of vegetation cover that were not affected in any way have reduced from 133.29 SqKm in 2016 to 63.9 SqKm in 2021.
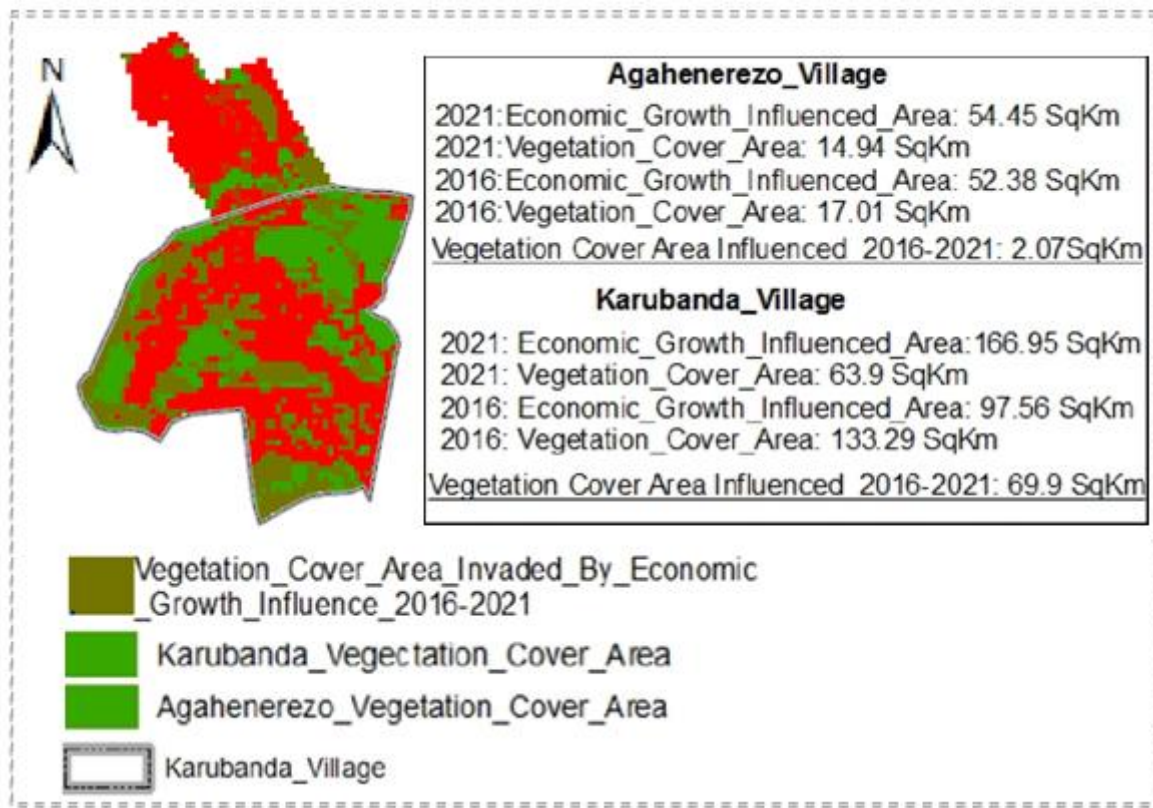
In Agahenerezo Village only, 2.07 SqKm of vegetation cover have been affected in one way or another by economic growth from 2016 to 2021, while in Karubanda Village, 69.9Sqkm of the same vegetation cover have been affected. This means that in both villages of our study area, 71.97 SqKm of vegetation cover have been affected by economic growth associated influences.

V. CONCLUSION

This research investigated the intervention of various driving forces and actors including the urban population and economic growth, Government with its partners and stakeholders in promoting both environment and economic growth improvements through different programmes on Land use planning and development such as the City Master Plan elaboration, Inclusive city development campaigns and trainings.

It has been found that where a detailed physical plan as well as other land use densification strategies such as Incremental housing development are provided to guide the urban dwellers' settlements as it's the case for Karubanda Village, the Economic growth effects over land use can be limited and controlled as the rate of new attach of economic growth activities to the natural land /vegetation cover will not be that higher as to areas where people occupy land without a such detailed physical plan or strategies to guide their settlement.

This has there so far revealed that if no further environmental management controls are taken to synergize both environment and economic growth improvement, more natural land/sensitive land will continue to disappear with the only ambition to accumulate wealth without considering the environmental losses. The environmental management initiatives such as solid wastes managements, bottom-up and participatory land use planning, Training of trainers and other initiatives took and carried out by the Government of Rwanda with its partners can lead to a synergized environment and economic growth improvement.

SOME OF THE RECOMMENDATIONS FROM THIS STUDY ARE AS FOLLOWS:
a) Assessing strategies for encouraging densification of developments in Agahenerezo and Karubanda Settlement Centres
b) Ensuring access to information related to land use developmentplans by everyone living in Agahenerezo and Karubanda settlement Centres

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