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Spatio-temporal analysis of urban area expansion in Zimbabwe between 1990 and 2020: The case of Gweru city

Mark Matsa, Oshneck Mupepi*, Tatenda Musasa

Department of Geography and Environmental Studies, Midlands State University, Zimbabwe

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ABSTRACT

Urbanization in Zimbabwe has become an unstoppable phenomenon since the 2000 decade. Before 2000, expansion of towns and cities in Zimbabwe was very slow and restricted by private land around them. In 2000 Zimbabwe embarked on a fast-track land reform program which changed both the rural and urban landscape in terms of land ownership as it freed most of the land that was in private hands. This triggered accelerated lateral expansion of most urban centers including Gweru. The study assessed Gweru city expansion between 1990 and 2020. The study adopted a mixed methods research design which allowed use of both quantitative and qualitative research techniques. Geographic information system and remote sensing, interviews and observations were used for data collection in this research. The study revealed that banks, building societies and some private land developers were major land development players who contributed to expansion of Gweru city between 1990 and 2020. The results of this study showed that rates of Gweru urban expansion were heterogeneous between 1990 and 2020. It was highlighted that the rates of Gweru urban expansion experienced an increasing trend from 1990 to 2020 with decade 2010 to 2020 experiencing highest rates of urban expansion followed by the 2000 to 2010 decade. The study results demonstrate that horizontal expansion of Gweru city took place at the expense of greenbelts and farmlands. Findings from this study showed that the land reform program and dollarization were the major drivers of Gweru urban expansion between 1990 and 2020. The study recommends that Gweru city council should take cognizance of the provisions of the environmental management act especially on protection of green spaces and wetland ecosystems when drawing its development plans to guard against deterioration of both green spaces and wetlands within the vicinity of Gweru urban. The study concludes that sustainable development of Gweru city can only be achieved if all developments take place according to the approved city council development plan.

1. Introduction

City development entails designed planning that employs social, economic, and environmental factors to direct development to undeveloped areas that possess necessary infrastructure (Ghorbani and Nowshad, 2008). According to Farzaneh et al. (2017) urban growth can be categorized into two forms which includes growth based on the development of inward regions and expanding growth. The shape or pattern of urban growth in different countries is very diverse but in general, the city's growth is a dual process of external expansion and rapid physical growth or internal growth and reorganization (Ghorbani and Nowshad, 2008; Song et al. 2020). Generally, cities are expanding at rates double their population growth rates and now cover approximately 0.5% of global land (Angel et al., 2011). According to Bay et al. (2017), 95% of urban expansion in coming decades will take place in cities of the developing world.

The increasing number of urban dwellers requires expansion of cities for the purpose of accommodating them (Ustaoglu and Williams, 2017; Güneralp et al., 2020; Egidi et al., 2020). Thus, population increase brings the need to plan and develop policies that determine trends of urban expansion commensurate with population needs. Fifty four percent (54%) of the world's population lives in cities compared to 30% in the 1950s (UN, 2008). The global urban population is anticipated to have increased by 2.5 billion urban dwellers by 2050 and almost 90% of the increase is projected to be concentrated in Asia and Africa (Todes et al., 2010; UN, 2015; Ahluwalia, 2019; Mahendra and Seto, 2019).By 2030, cities are expected to experience 20% population increase and urban land is anticipated to expand by 2.5 times (Schneider et al., 2009), with every new urban dweller transforming 500 m^2s of non-urban to urban land (Angel et al., 2005). However, Seto et al. (2011) asserts that high income countries experienced faster urban expansion as a function of income than middle income countries, an indication of economic situation as one of major determinants of urban development.

* Corresponding author.
E-mail address: omupepi@gmail.com (O. Mupepi).

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A study on global urban land expansion by Seto et al. (2011) indicated considerable variations in urban expansion across the globe between 1977 and 2000, with highest rates in China followed by south west Asia. Their study indicated that Europe, Oceania and North America experienced the lowest rates of urban expansion during the same period. A study by Ismael (2020) on Baghdad city expansion in Iraq between 1990 and 2013 indicated that the urban extent has increased by 0.9% whereas both open space and built-up area declined by 1.4%, which was mostly attributed to the preservation of the city's master plan over the study period. A study by Inotroza et al. (2013) on 10 Latin American city development between 1990 and 2010 indicated that all cities experienced an expansion during this 20-year period but the rates of expansion were varying. Brasilia, La Praz and Santa Cruz experienced an increase of 711%, 536%, and 356% respectively which were the highest rates in Latin America whereas the lowest expansion rates were experienced in Montevideo (44%) (Inotroza et al., 2013). The majority of cities did not experience much expansion as they were still filling open spaces within boundaries yet those which experienced salient expansion had filled their spaces earlier.

In Sudan, Khartoum city area increased by 7.3% between 1990 and 2013 and built-up area increased by 10.5% whereas open space increased by 3.2%. In Tunisia, Kairouan city expanded by only 0.5% between 1990 and 2020, which signifies the possibility of vertical expansion and infilling of urban spaces whilst in Algeria over the same period of time, Algiers city expanded by 4% (Ismael, 2020). In Egypt, Cairo's urban expansion rate was 8.5% between 1990 and 2013, the rate which was more than 3 times the rate of population growth (Ismael, 2020;). Between 1990 and 2000, in Ethiopia, Addis Ababa city area increased by 44.8%, in Zambia, Ndola expanded by 30.1%, in South Africa, Johannesburg increased by 13.9% and in Zimbabwe, Harare had increased by 47.7% (Angel et al.2013: Linard et al., 2013). These statistics confirm the idea that developing countries in Africa are dominating urban expansion since they still have the room for expansion compared to developed countries (Todes et al., 2010; UN, 2015; Ahluwalia, 2019; Mahendra and Seto, 2019).

Rates of urban expansion in most developing countries are greatly affected by structural transformation of societies (Shin, 2017; Jia et al., 2020). Over the past decade, societies have witnessed changes that were unprecedented in recent history: the collapse of political and economic systems, new integration policies, globalization of the economy and the decline of the nation-state and social restructuring (Shin, 2017). Such changes result in shifts in land tenure systems which implies freedom or restrictions in the sale or development of land. Rural land reform in China during 1970s denied conversion of agricultural land to urban development which reduced rates of expansion (Zhang, 1997). However, during 1990s urban land reform resulted in allocation of stands to private owners in urban peripheries for urban development which saw increased rates of expansion in most cities (Mieszkowski and Mills, 1993). Since 2000, in China sprawling patterns of urban expansion have been observed which have been more prominent in small and medium sized cities due to shifts in policies to support stronger economic and population growth as well as real estate development (Jia et al.2020).

In Nigeria, land reform particularly after the nation's political independence in 1960, led to land ownership changes which saw peasant farmers losing their land to urban development for relatively small amounts of money which enhanced urban growth (Mabogunje, 2010). In Mexico, peri-urban growth has been necessitated by the land reform which saw corporatist system of government taking over land use control (Lombard, 2016). This resulted in sale of land to different developers in the peri-urban fringe owing to liberalization of urbanization (Lombard, 2016). Such political and social changes propelled urban expansion in most urban areas of developing countries as various developers jostled to acquire land for housing and industrial development. Following periods of economic challenges in most developing countries which impeded fast urban development, national development banks became key players for development through provision of long-term financing directly from their own funding sources, notably through the co-financing of urban housing and industrial development projects with other partners (Chin, 2014; UNCTAD, 2017). Examples of such Banks include the Banco Nacional de Desenvolvimento Economico e Social (BNDES) in Brazil, Industrial Development Bank of Turkey, Korean Development Bank (KDB) and the China Development Bank (CDB) among others (UNCTAD, 2017).

In Zimbabwe, the city of Gweru is among cities which have been and are still experiencing lateral urban growth due to existence of undeveloped land in the urban fringes. Some land which has been under agriculture and which was once green belt or protected has been transformed into urban development, a scenario which seem to have been exacerbated by changes in policies that govern land tenure or utilization systems as well as the economic situation in the country. However, no attempts have so far been made to capture the changes and document them as essential baseline information for developmental purposes. This study is significant to show how the economic situation and changes in policies that govern land tenure affects sustainability of urban development. It is against this background that this paper seeks to examine urban expansion in the context of Zimbabwe with special reference to Gweru. Thus, the specific objectives of the study are to: 1) identify land ownership players involved in the expansion of the city of Gweru; 2) map horizontal expansion of urban development in the city of Gweru between 1990 and 2020; and 3) analyze drivers of Gweru city expansion between 2000 and 2020. The year 1990 is taken as baseline to capturing the status quo of Gweru City development before the Fast-track land reform program of 2000 which brought milestone changes to land ownership and development in the whole country. This study considered studying urban expansion in different phases of development so as to compare implications of existing policies, land tenure systems and economic situations during these phases on rates of urban expansion.

2. Study area

The study was conducted in the city of Gweru which is the provincial capital for the Midlands Province of Zimbabwe. The city of Gweru is located between latitude 19° south of the equator and longitude 29° east of the Greenwich meridian (Fig. 1). The provincial capital for the Midlands Province is 168 km from Bulawayo and 280 km from Harare along the major Harare-Bulawayo road.

The city of Gweru lies on a watershed, which stretches from Rusape to Bulawayo supplying water resources to the surrounding communities. The Municipal area is dissected by numerous streams most of which drain into the Gweru River, a tributary of the Gwayi River. The region is mostly affected by northeast prevailing winds, which are dominant from August to November during which their mean speed is in the range of 8.0 to 9.3 knots. The city covers approximately 26,113 ha including Cambridgeshire and Clydesdale farms. The climate of Gweru is associated with warm and cool seasons hence it has been classified as warm and temperate (https://en.climate-data.org/africa/zimbabwe/midlands-province/gweru-3057/). The area is surrounded by non-gazetted forests; however, massive power cuts have resulted in deforestation in a bid to collect wood for fuel.

Human population has been growing in areas within the city of Gweru and the majority are poor and vulnerable. Gweru has a population of about 300 000 people (Zimbabwe National Statistics Agency 2012). As a result of increased population in the city there has been horizontal expansion so as to meet the increasing housing and other demands of the inhabitants. This therefore motivates this study to examine the spatio-temporal dynamics of urban area expansion in the city of Gweru.

Just like all other cities in Zimbabwe, Gweru is divided into high, medium and low-density residential areas (Fig. 1). During the colonial era, cities residential areas were segregated according to race with the black Africans living only in the high-density areas (Marambanyika et al., 2010). Coloureds (those of mixed heritage) lived in sep-

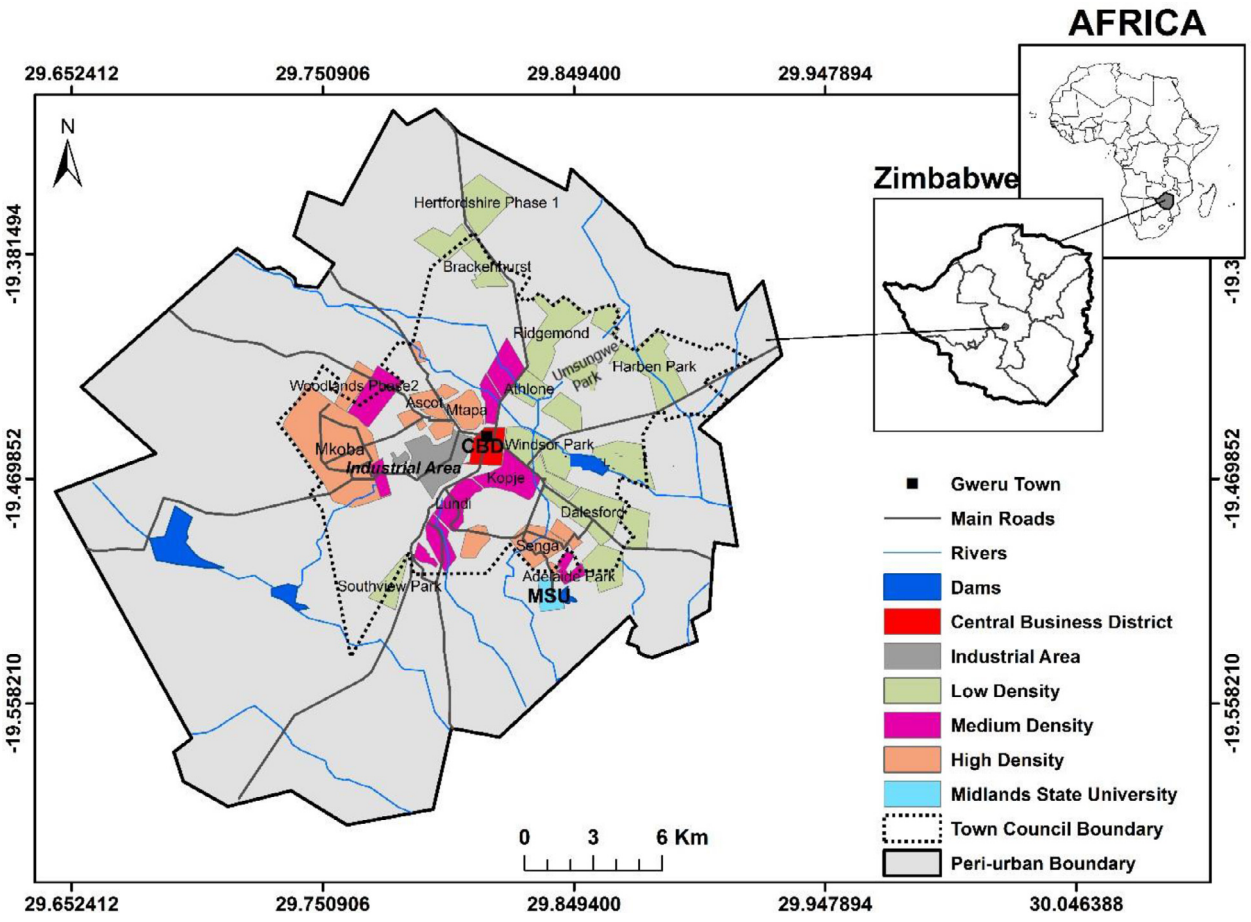

Fig. 1. Map of Gweru city.

arate medium-density areas, while the whites mainly occupied low-density areas. Although now racially integrated, the demarcation between low, medium and high density still remains noticeable (Madebwe and Madebwe 2011). The biggest original black suburb in Gweru is Mkoba which is divided into 21 sections (officially called villages) with the majority population being poor (Matsa 2012). Mkoba is the first suburban area to develop an extensive village which comprises of village 1 up to village 21. Mtapa, Senga, Nehosho, Mambo, Ascot are some of the high-density suburbs around Gweru. However, there has been emergence of new residential areas in high, medium and low residential area classes. Therefore, it is imperative to analyze the drivers of Gweru city expansion. Northlea, Mkoba 12, Ivene and Nashville are among the middle-class residential areas while Harben park, Kopje, Windsor Park, River Side, Athlone, Gweru East, Daylesford, Ridgemond, Hertfordshire, Umsungwe Park, Gweru Heights, South View, Mtausi Park, South Downs, Lundi Park constitute some of the low-density residential areas of Gweru. Some of these areas have emerged due to changes experienced in land ownership which stimulated city expansion.

A total of 65%–75% of households in Gweru fall within the low-income bracket of which the majority have no stable income (Marambanyika et al., 2010). Gweru city is supposed to be a center of economic development in Zimbabwe as it is endowed with several industries which include Zimbabwe Alloys, a chrome smelting plant, Bata Shoe Company and Zimbabwe Glass Company (Madebwe and Madebwe 2011). However, most of these and other industries are now either defunct or are operating at minimal capacity due to the poor state of the economy and the unattractive investment climate in the country.

3. Methodology

A mixed methods research design which allows data triangulation was adopted in this study. A combination of quantitative and qualitative data collection methods was employed so as to complement and expand research findings (Fetters et al. 2013). Qualitative data complimented quantitative data through explanations which improved the scientific rigor of the research than it would be using a mono-method approach (Creswell, 2013). The study adopted a two-pronged approach where data was collected from interviews followed by use of remote sensing techniques. The study required detection and quantification of urban build-up area expansion between 1990 and 2020 hence GIS and Remote sensing tools were adopted for a synoptic analysis as well as calculation of expansion rates. Remote sensing and GIS in this research were adopted due to their ability to provide a synoptic spatial and temporal visualization of phenomena.

The research targeted the Gweru city council town planning and urban development departments, and EMA Gweru. Gweru city council was targeted to provide information on drivers of Gweru urban development or expansion between 1990 and 2020 and land development players during this period. Gweru city council planning and development departments were important as providers of information of development patterns, updates on town plans, and provision of urban boundary dataset as well as information on land ownership dynamics between 1990 and 2020 in Gweru urban. Environmental Management Agency was targeted to determine information on land cover and development changes between 1990 and 2020. Prior to data collection, ethical issues were also observed. Permission to conduct interviews as well as conduct filed observations was sought from the relevant authorities. Face to face

Table 1
Satellite datasets used.

Year	Satellite	Spatial resolution (m)	Path/row	Date of acquisition	Cloud cover (10%)
1990	Landsat, TM	30	170/73	23/09/90	<10
2000	Landsat, TM	30	170/73	27/09/00	<10
2010	Landsat, TM	30	170/74	30/09/10	<10
2020	Landsat, OLI	30	170/74	20/09/20	<10

Source: Authors.

interviews were conducted with Gweru city council town planner, urban development officer and EMA community development officer. Audio recording was also used during interviews for collection of all reported information after seeking consent from the interviewees. Direct field observations were conducted to confirm remote sensing data as well as collection of ground truthing coordinates for image classification accuracy assessment. Researchers also targeted observing developed areas beyond Gweru urban boundary and GPS devices were used to confirm urban boundary so as to observe any developments beyond the boundary.

Landsat 4–5, 7 and 8 were acquired freely from USGS website for the mapping of urban development between 1990 and 2020. Landsat 4–5, 7 and 8 were downloaded for 1990, 2000, 2010 and 2020 respectively (Table 1).

Images were from different mapping platforms because these platforms were operational during different time periods during the longitudinal stretch covered by the study (1990 to 2020). In this case Landsat 4–5 was operational during the first study decade and Landsat 8 was the best functional platform which was operational during the last study decade. However, Landsat 7 was adopted since it provided a better representation in terms of permissible amount of cloud cover (<10%) otherwise both Landsat 7 and 4–5 were operational during the middle study decade. The research used Landsat images throughout the study period to ensure comparison of images of same spatial resolution ($30m^2$). These images had same path and row of 170 and 73 respectively and all of them had cloud cover below 10% to ensure better classification accuracy. All images were acquired in September when cloud cover is absent or minimum and maximum insolation is experienced on target phenomena to ensure enhanced spectral signatures of phenomena under scrutiny.

Image pre-processing, processing analysis and map production were done using ArcMap 10.5 software. Image pre-processing included data cleaning through removal of no data value regions of each of the images, area of interest extraction/masking using Gweru urban boundary shapefile as well as correction of geometric and radiometric errors (Fig. 2).

Geometric errors were corrected by performing the re-projection process to ensure that the image and the Gweru urban shapefiles had the same map projection (Universal Mercator Projection) and radiometric errors were corrected by performing radiometric calibration. Image enhancement (improving image contrast and brightness using the image analysis function) as well as using the reflectance rescaling coefficients provided in the metadata files of the images were also done to overcome radiometric noise problems. The processing procedure included image classification using maximum likelihood classification algorithm. During this procedure training samples were established where regions of interests were picked to categorize all regions with similar spectral signature under one class. After image classification, accuracy assessment using the confusion matrix was done to confirm whether classified images agreed with ground truth. Attribute tables of classified images were exported to Microsoft excel package for statistical calculations.

ArcMap 10.5 was used to analyze quantitative remote sensing data on rate of Gweru urban expansion between 1990 and 2020. Land cover statistics were exported from ArcMap 10.5 software attribute table to Microsoft excel package for percentage calculation and production of graphical presentation of Gweru urban expansion trends. Four thematic maps showing Gweru urban development were produced in ArcMap 10.5 for visualization of Gweru urban built up area extent in 1990, 2000, 2010 and 2020. Qualitative information from interviews was analysed for relevancy and screened to ensure adoption of only relevant information which could be used to confirm or support quantitative data presented using graphs and thematic maps. Information gathered during field observations was also used as supporting information to quantitative data.

4. Results and discussion

4.1. Land ownership players involved in the expansion of the city of Gweru

As the case with other areas in Zimbabwe, the Land reform program and its associated land redistribution process resulted in changes in land ownership in Gweru urban and peri-urban areas. This saw some land adjacent to the city which was under commercial farmers being developed into urban under Gweru City Council. Vungu Rural District council owns the land beyond Gweru City Council's masterplan boundary which constitutes most of urban peripheries. According to the City planner, both Gweru City Council and Vungu Rural District Council were the major land owners who were and are still responsible for allocation or sale of land within their respective jurisdictions since the post-independence error. Therefore, the developments taking place within and beyond Gweru City council municipal boundary emanate from the directives of Gweru City Council and Vungu Rural District Council respectively. According to the City council's planner, the master plan of the Council which was adopted in 1997 couldn't be implemented due to changes that happened after its adoption hence development that is taking place is independent of the drawn masterplan by Gweru City Council.

The City planer postulated that, prior land reform program, development in Gweru urban was partly due to sponsorship from the United Nations and Central Africa Building Society (CABS), with CABS mainly participating in the development of low-density residential areas. During this time, the rate of development was reported by the Gweru City planner and EMA planning officer as sustainable since it was considerate of protection of private land and greenbelts. The City planner highlighted that banks and building societies played a major role in development of most residential areas in Gweru urban from 2000 to date as indicated by involvement of Commercial Bank of Zimbabwe (CBZ) in the development of Nehosho residential area, CABS in the development of residential areas in Senga among others and First Banking Corporation (FBC) in the development of some areas in Mkoba residential area. In addition, the Zimbabwe Banking Corporation (ZB bank) was involved in the development of Southdown residential among other residential areas to the south. Founders building society and Beverly building society were some of the players in as far as Gweru city expansion is concerned.

All these developments were significant in propelling the lateral expansion of the city of Gweru between 2000 and 2020. An interview with the housing development officer revealed that the City council sold 1095 stands in Nehosho to CBZ between 2012 and 2013. He further highlighted that 271 and 389 stands were sold to the ministry of National housing development and Tera Survey developer in the newly established Mkoba 21 suburb in 2014 which was an extension of the already existing Mkoba residential area. This shows that the City council is re-

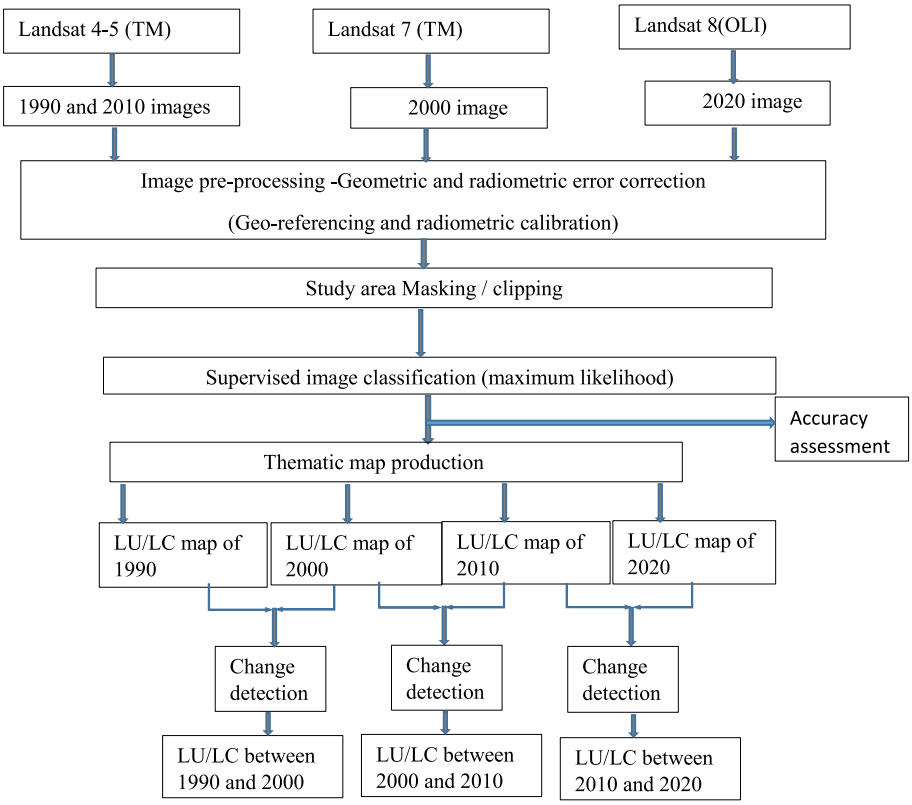

Fig. 2. Methodology flowchart (Source: Authors).

sponsible for sale of stands to various developers or it partners with other sponsors to initiate or propel urban development. It was also shown that an Extension of Mkoba 21 by the name Rosemond Park was developed by ZIET under youth empowerment program which was partly necessitated by the Housing delivery program and the ZANU PF election manifesto in 2013. The town planer and the housing development officer indicated that there are a number of private developers who contributed to the growth and development of Gweru city. For instance, Adelaide Park was developed by Wakdrive developers and Tatenda Park along Bulawayo road was developed by Strishens. These were developers independent of the City council according to the housing development officer. It was shown that most development taking place beyond the City council's master plan is under Vungu Rural District Council though the City council considers these areas as urban and requiring their services. Some of the examples of such developments include Umsungwe Park by David Kilpin to the north-eastern side of the CBD, Woodlands to the north-western side of the CBD and other extensions beyond the master plan boundary. All these development players contributed to lateral or horizontal urban expansion in Gweru city as confirmed through field observations. As confirmed also by the City planner, it was observed that Midlands's State University (MSU) and Fletcher High School developed beyond the City Councils master plan hence under Vungu RDC though considered by the City council for provisioning of services. These findings indicate that land development in Gweru urban after the Land reform program was driven by the City council in partnership with other private developers as well as by private developers who owned or bought land from the city council and from Vungu Rural District Council (in urban peripheries).

4.2. Gweru city expansion between 1990 and 2020

4.2.1. Gweru city expansion between 1990 and 2000

The findings of the study showed that in 1990, 10 years before the Land reform program, most of the land was covered by woodland (22,718.88 hectares) which signifies much protection of woodland under commercial farmers. During the same year, a considerable proportion of land cover was used for farming as shown by cultivated + bare land cover covering 18,995.22 hectares of land. Grassland was not extensive since the majority of protected lands were woodland whose canopy would cover much ground thus being more exposed than grassland. Developed land in 1990 was not large (2353.77 hectares) and all developed land was within the Gweru city council masterplan boundary, especially in the CBD and in Mkoba to the west of the CBD (Fig. 3). Water cover was very small, covering 30.69 hectares most of which was beyond the masterplan boundary of the city council.

In 2000 much forest had been cleared for development as well as extraction of wood by the increasing urban population. This resulted in forest cover declining by 6935.49 hectares which corresponds to 30.5% woodland loss. Most of open spaces and woodlands close to Gweru CBD have been developed into built up area which resulted in built up area increasing by 939.15 hectares which represents a 39.9% gain in area under urban development. Much area which was woodland and that which was under cultivation+ bare in the peri-urban and within the vicinity of Gweru CBD had been replaced by built up and grassland (Fig. 4). One of the examples is the area where Hertfordshire was developed, which had previously been used for horticulture but had been left unused after the Land reform. Also, some farms to the east of the city, including the area which is now Daylesford, among others in the urban peripheries were left unused and they developed into grassland. Therefore, grassland sharply increased by 12,298.41 hectares which is equivalent to 235.9% increase, cultivated + bare land decreased by 6287.4 hectares (−33%) and water has dropped by 14.67 hectares (−47.8%).

4.2.2. Gweru city expansion between 2000 and 2010

Between 2000 and 2010, developed land increased by 1930.5 hectares tantamount to a 58.6% gain owing to development of areas which were once virgin and farmlands. This development took place at the expense of some open grassland, bare areas, former croplands which have been used for urban agriculture and some portions of woodland within and slightly beyond the city council masterplan boundary

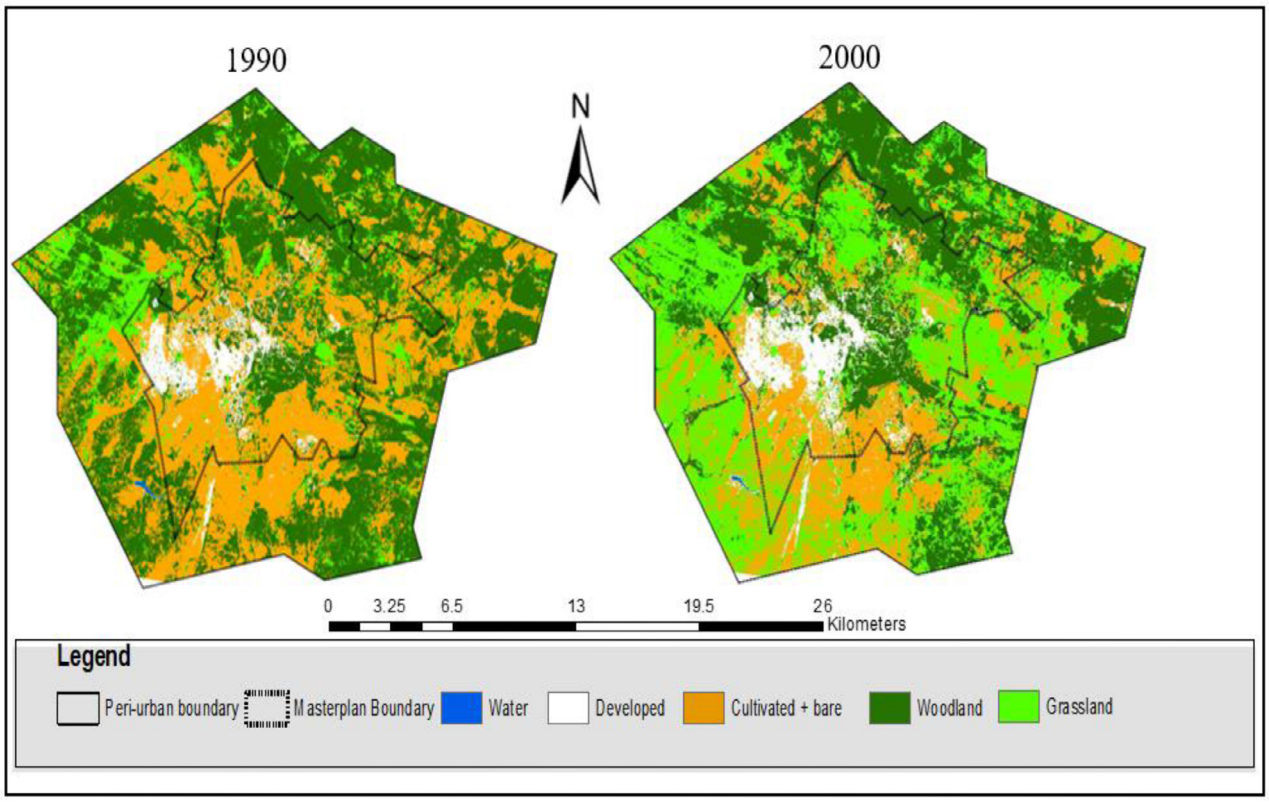

Fig. 3. Classified map of urban development between 1990 and 2000.
Source: Remote sensing data.

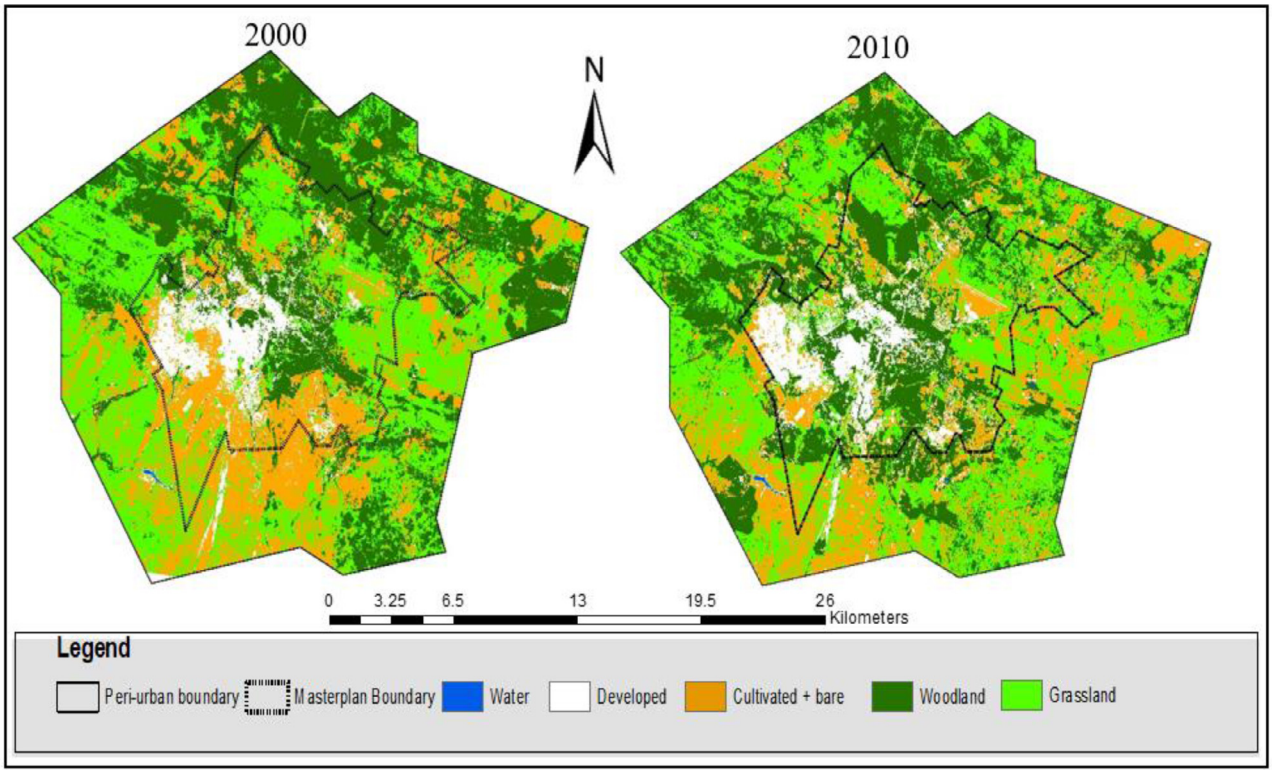

Fig. 4. Classified map of urban development between 2000 and 2010.
Source: Remote sensing data.

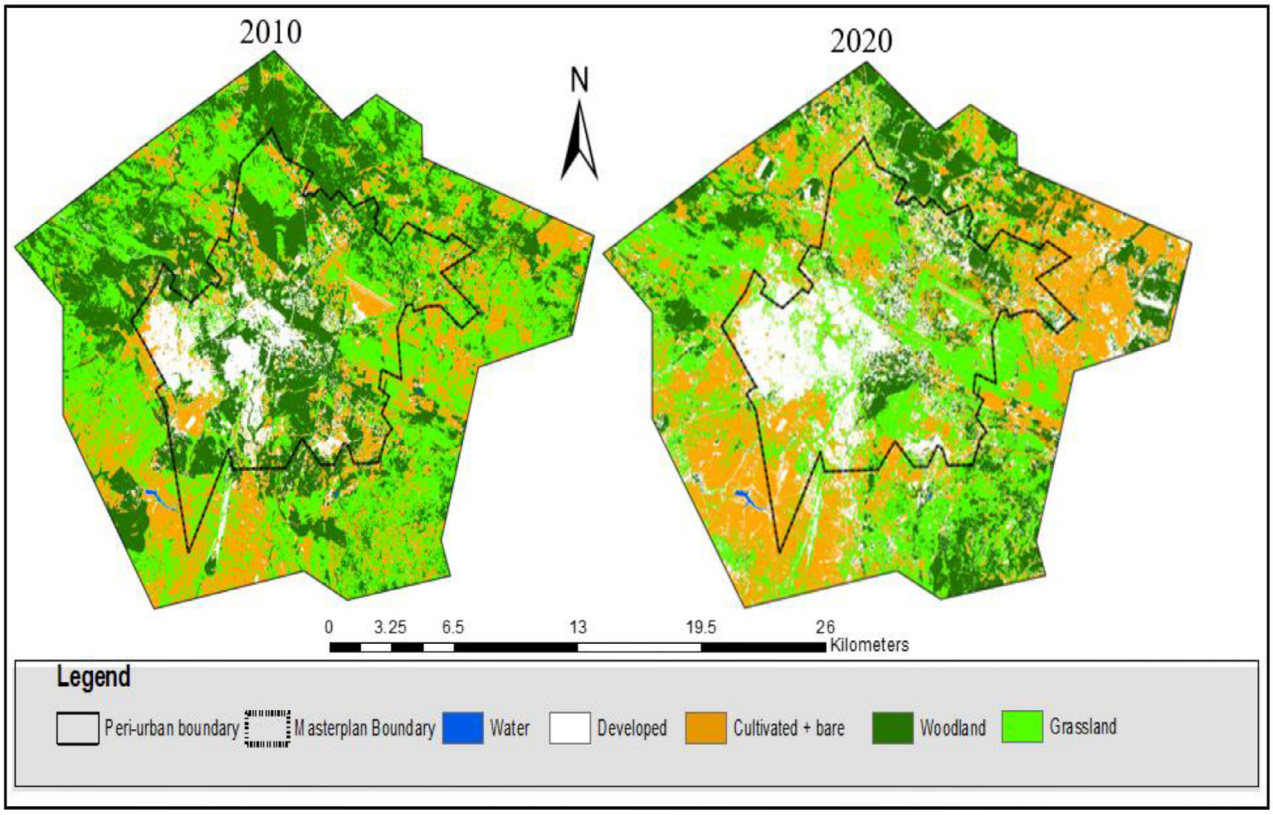

Fig. 5. Classified map of urban development between 2010 and 2020.
Source: Remote sensing data.

(Fig. 5). As a result, cultivated+ bare and woodland declined by 7941.78 hectares and 7373.79 hectares respectively. Due to former farmlands lying fallow and the continued cutting down of trees to clear land for development and extraction of wood for selling and domestic use (Zimbabwe had an acute national power problem during this period), grassland experienced an increase of 12,842.46 hectares which is equivalent to 73.3% increase. This was mainly because some former farmlands were now covered by grass and removal of woodland exposed grassland which was beneath woodland canopy especially areas to the south beyond Senga residential area, to the west beyond Mkoba residential area and areas beyond Antelope park and Thornhill air base. During this decade, water cover increased by 2.61 hectares most probably due to good rains received during this decade. A study by Bagan and Yamagata (2014) on dynamics of 50 global cities between 1985 and 2010 indicated that more than 32% of studied global cities experienced expansion rates of 30% and above attributed to increased housing and other urban development. This corresponds with increased Gweru urban expansion rates between 1990 and 2010 as a result of residential area development.

4.2.3. Gweru city expansion between 2010 and 2020

Between 2010 and 2020, developed area increased by 4890.15 hectares which corresponds to 114.1% gain in developed land. Much area within Gweru City Council master plan boundary and close to the CBD has been developed and some residential areas had been built beyond the city council master plan boundary in almost all directions from the CBD (Figure 4.3). This corresponds with the postulation by the Gweru city town planner who highlighted that built up area in Gweru urban doubled between 2010 and 2016 compared to the 2000 to 2010 decade. This resulted in woodland declining by 6098.76 hectares which indicates a 39.7% loss in woodland cover. Grassland declined by 3096.18 (−17%) as much of its area had been used for development.

Most open spaces within the CBD were developed, for example, ZOU Provincial Offices and Midlands Private Hospital had occupied spaces which were open and privately owned before, as confirmed by EMA planning officer and the housing development officer. The City planner estimated that over 20 portions which were reserved and private have been incorporated into urban development. During the same time, cultivated + bare land increased by 4883.49 which signifies a 44.2% increase in cultivated + bare land. This increase emanated from clearing of land both for housing development and increase in urban agriculture, especially in the urban peripheries. Some space which had been under commercial farmers before the Land reform program was converted to residential areas. Water cover had increased by 8.28 hectares (24.9%).

Findings from this study concur with the findings by Mansour et al. (2020) in their study on urban development in Nizwa city in Oman which indicated accelerated rates of urban expansion (418.5%) between 2008 and 2018 which took place at the expense of protected urban green spaces. Faster development of Gweru urban, especially during the 2010 to 2020 decade confirms the postulation by Haregeweyn et al. (2012) that expansion of unplanned urban areas of developing countries is faster than in the developed countries. This may be the case in Gweru city since the City planner highlighted that development in the city could not follow the masterplan of the City council which led to unplanned lateral expansion. Conversion of farmlands to urban development in Gweru urban peripheries mimic the findings by Haregeweyn et al. (2012) in urban expansion of Bahir Dar in Ethiopia. In their study it was shown that urban expansion took place at the expense of some farmlands in the peripheries of Bahir Dar.

4.3. Drivers of Gweru city expansion between 1990 and 2020

The economic liberalization of 1990 and the Land reform program which followed a decade after it transformed existing land tenure sys-

tems which gave Gweru City Council and Vungu RDC powers to sell stands for business and housing development. The Land reform program resulted in change in land ownership mainly from commercial farmers to Gweru City Council and Vungu Rural District Council. According to the Gweru city town planner, the United Nations and CABS started financing housing development before the land reform program during which time the rate of development was sustainable. Changes in land ownership resulted in declined farming as new land owners in the form of Gweru City Council and Vungu Rural District Council prioritized sale of land for urban development. Therefore, during 2000s, land which used to be farmed was abandoned as some areas within and outside the city council boundary were earmarked for development. This saw most of farmlands developing into grassland as former land owners (commercial farmers) who used the land for farming were replaced by other developers whose plans were to develop the land into residential and business stands.

Between 2000 and 2010, the rate of urban development was comparatively higher to that experienced between 1990 and 2000. This was attributed to involvement of various land developers who bought land from the City Council and from Vungu Rural District Council for the purpose of developing residential areas following land ownership changes due to the fast Track Land Reform Program. Some land owners unaffected by the land reform program but with land adjacent to the city also started developing their land for urban use for fear of appropriation which actually increased the rates of urban development between 2000 and 2010. Decade 2010–2020 experienced expansion rates higher than decades 1990–2000 and 2000–2010 mostly because the dollarization of the economy adopted in February 2009 increased the capacity of land developers to buy stands for development. Economic situation before 2010 was characterized by high inflation associated with devaluation of the local currency (Zimbabwean dollar) which made it difficult for developers to purchase land. More so, even those who got land during the resettlement period emanating from land reform program between 2000 and 2009 could not develop their land due to financial constraints. However, the adoption and use of foreign currency under the so called dollarization which ushered in a multi-currency system (US$, South African Rand, Botswana Pula, British Pound, Euro, Chinese Yuan), resulted in faster increase in built-up areas between 2010 and 2020 than during previous decades when the economic situation and restricted land tenure systems crippled development.

The City council planner highlighted that the council partnered with banks like CABS and CBZ who sponsored development of high-density residential areas south of the CBD. For example, during the 2000s, CABS sponsored the development of residential stands in Senga whereas CBZ developed some stands in Nehosho high density suburbs. Lateral expansion of Gweru city became so visible during this period, with some of the development approaching the Gweru city council master plan boundary both to the north and northwest, Ascot extension and Mtapa Garikayi area, as well as to the west, Mkoba expansion and south of the CBD around Senga residential suburb. Some of these residential areas have grown and were extending beyond the city council master plan boundary. According to the City planner and EMA planning officer, less development took place at the onset of the fast track land reform program in 2000 compared to post 2000s era because of the economic hardships and associated inflation and devaluation of the Zimbabwean dollar. This implies that land was redistributed but the new owners were not in a position to develop it due to financial constraints associated with the time, but after dollarization in 2009, development gained marked momentum. This saw the city council partnering with developers like FBC and CBZ among others to develop residential areas.

According to the City planner, housing development between 2010 and 2020 was also accelerated by the Housing delivery program and ZANU PF election manifesto of 2013 which advocated for allocation of more land for housing development. This resulted in the accelerated development of Hertfordshire, Umsungwe Park, Northgate Heights and Woodlands among other residential areas which were developed at the edge and beyond the Gweru city masterplan. More so, the adoption of multi-currency system augmented the expansion of Harben Park, Ridgemond and Mkoba residential areas and development of Woodlands Phase 2 among other residential areas. The adoption of the United States Dollar made it cheaper to acquire stands in reserved open spaces. Most of the woodland within the city council masterplan boundary had been cleared and replaced by built up areas and some portions of grassland. According to a research by Murayama et al. (2015), Bankok in Thailand, Bijin in China and Dhaka in Bangladesh are experiencing enhanced urban expansion which is mainly attributed to increasing population and associated increasing need for residential areas. This conforms to the expansion of Gweru city which is mainly due to housing development. Another study by Song et al., al.(2020) on expansion of 290 Chinese cities showed that most cities expanded laterally whereby green spaces in urban fringes were converted to built-up areas. In this study it was indicated that sale of land in the urban peripheries accelerated this form of urban expansion. A study by Jia et al. (2020) on expansion of 265 cities in China showed that sprawling patterns of urban expansion, which have been more prominent in small and medium sized cities since 2000, were associated with shifts in policies to support stronger economic and population growth as well as real estate development. This conforms to the findings from this study as urban expansion rates were accelerated by land reform and dollarization which were part of the government's thrust towards enhancing economic and social development.

5. Conclusion

The study assessed Gweru city expansion between 1990 and 2020. The findings from this study revealed that major land ownership players who were responsible for the development of Gweru city were the City council under sponsorship from the United Nations and banks like CABS, ZB, CBZ, and FBC among others. The findings from this study showed that Gweru city experienced steady expansion rates between 1990 and 2000. From the year 2000 to 2010 the rate of Gweru urban expansion accelerated followed by further acceleration between 2010 and 2020. An analysis of this expansion indicated that urban development took place at the expense of naturally vegetated land in the form of grassland and woodland. It was also shown that some farmlands and green belts were converted to build up areas. The study revealed that the land reform program of 2000 and dollarization which took place around 2009 and 2010 were the major drivers of horizontal expansion of Gweru city between 2000 and 2020. The study indicated that the land reform program resulted in change of land ownership and use which resulted in some land being converted from farmlands and greenbelts to urban built-up areas. The dollarization further accelerated changes in land use as well as land development rates as it increased the purchasing power of some land developers who became able to develop Gweru city residential areas unlike during the 1990 - 2000 decade.

6. Policy implications

In light of the findings from this study, the following recommendations are suggested:

- Ø Expansion of cities in developing countries like Zimbabwe should be strictly monitored to ensure planned development that preserves natural vegetation which is essential in improving air quality and esthetic aspects of urban areas.
- Ø City authorities especially in developing countries should take cognizance of the provisions of environmental management laws during their development plans to ensure protection of green spaces and wetland ecosystems within and in the vicinity of developing cities .
- Ø To promote preservation of nature in urban areas, urban planners should consider vertical development to avoid quick horizontal expansion which end up affecting green belts and natural vegetation in the outskirts of developing cities.

Declaration of Competing Interest

None.

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