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To Predict The Most Suitable Financial Factors For Urban Development Planning: A Case Study Of Kabeza Site Of Kicukiro District, Kigali City, Rwanda.

Jean Pierre Habiyaremye[1, 2*], Cush Ngonzo Luwesi[3, 4*], Ugwuoti Amos Iloabuchi[5, 6*]

1 Central Christian University Of Malawi, Department Head Of Land Surveying And Geo-Informatics. 2*Phd Candidate, Francophone Africa Campus, Université Privée Africaine Franco-Arabe, Curacao, The Netherlands. 3 Director Of Postgraduate Studies, Francophone Africa Campus, Ballsbridge University, Curacao, The Netherlands. 4*Full Professor, Environment And Economic Policy, Crrebac School Of Water, University Of Kinshasa, DR Congo. 5 Department Of Geoinformatics And Surveying, University Of Nigeria Nsukka. 6*PhD Hydrographic Surveying

Email address:
ccunmw@gmail.com

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Abstract

The land is required for the development of basic public infrastructure. Compensation for current rights holders on such land must be negotiated. Also, the resulting subdivisions will thus be smaller than the original portions of land, and the parcellation exercise will mean that households do not hold the same portion of land they held originally. All these aspects can lead to conflicts over land if not properly managed.

To reduce conflicts, data collected from the field and the topographic survey showed that the existing situation is not well planned according to the standard, which indicates that the new design is well planned compared to the existing one.

From the data analysis, there is no significant relationship between land reallocation and urban development planning. All new plots are 2168 plots, with 1873 plots for single-family residential in the residential extension; 295 plots remain as existing residential; and 14 plots of a total area of 4.22 ha will be totally affected by public utilities. The financial contribution on each plot will be 470,278Frw, with works done and public facilities calculated by the developed formula in this research.

However, there are still some serious concerns about the newly designed plan in this area. These should be viewed as recommendations to be considered by future research implementers and partners, particularly the local government units overseeing the research sites. The most important is the packaging of all infrastructure within the project. Thus, developers and state entities should work together to identify measures to minimize the negative impacts of interventions on the poor and women, as well as the negative impacts on the environment.

1. Introduction

According to the United Nations, 924 million people, or almost one out of three urban dwellers, were living in informal settlements in 2003 (Rwanda Land Management and Use Authority (RLMUA), 2021). Of these, 874 million live in low- and middle-income countries (RLMUA, 2021). The proportion of urban poverty is undoubtedly increasing: 43% of the population of developing cities is living in informal settlements, while 71% of sub-Saharan African cities are informal (RLMUA, 2021). In Rwanda, 61.7% of the population lives in informal settlements, although the urbanization rate stands at around 18.4% as per 2017 statistics (RLMUA, 2021). However, in many developing countries, urban conditions continue to be diffuse and disorganized. The lack of proper planning generates unsafe and dangerous conditions for everyday life and blocks access to jobs, educational opportunities, and cultural opportunities (Felipe Francisco De Souza et al., 2013).

The process of land reallocation involves the assembly of all properties belonging to different landowners in a certain area, followed by a new subdivision of land into parcels and redistribution of the land to the same landowners, based on the share (in terms of area and valuation) of each one's land as a percentage of the whole area (Sonnenberg, 2002). The urban upgrading component is integrated by an 'Urban Communities subcomponent' that promotes the use of community-driven development approaches. As such, it aims to support the strengthening of the legal framework governing community-based organizations and the formalization of their links with local governments, as well as building the capacity of community-based organizations for organization and management, self-regulation, and active participation in decision-making and service delivery (Community-Driven Development in Urban Upgrading, 2004).

The issues related to land reallocation have aroused special attention from economists and policymakers. Some of the existing literature focused on land reallocation policies associated with the land tenure system and the effects these policies have on land security (Liu, 1998; Brandt et al., 2002; Tan et al., 2006). Liu et al. (1998) use village-level data to analyze the frequency of land reallocation and its differences across villages. Brandt et al. (2002) concluded that land tenure security is influenced by land reallocation through its magnitude and frequency. Tan et al. (2006) use land reallocation as one sub-group of independent variables to find the determinants of land fragmentation.

After the upgrading, those who no longer have access to any land in the settlement may be unhappy. Conflicts related to the smaller land parcels than were held before and conflicts relating to the sharing of land from a former parcel to a new parcel held by another, even though shifting land between households is not voluntary at a household level, are a potential instrument to achieve an efficient allocation of land resources. This research is based on the following null hypothesis (Ho): "There is no significant relationship between land reallocation and urban development planning." This study aims to predict the most suitable financial factors taken care of by land reallocation in urban development planning at the Kabeza site to allocate each landholder a common share of the total area by ensuring that each former landholder acquires a parcel in the new plan.

2. State of the Art

Research about automating the land reallocation process began in the Netherlands at the end of the 1960s, a decade that was characterized by the establishment of large-scale computers, i.e., mainframes. In the early 1970s, a computer support system called LIN was introduced, focusing on supporting the administrative problem of land reallocation. In particular, LIN was a registration system able to store the original cadastral details before land consolidation, the intermediate design steps, and the final design. Therefore, LIN could not actually directly support the decision-making process of land reallocation (Rosman and Sonnenberg, 1998).

Despite these efforts, a survey commissioned by the Netherlands Cadastre in 1994 revealed that INOK was insufficient to support land consolidation planners. It was underutilized because it was mainly an information management system rather than a decision support system. The statement of Rosman and Sonnenberg (1998, p. 6) that "the development of an integrated design support system for land reallocation that comprises the three steps mentioned above is uncertain" shows how difficult a task it was, even thirty years after the first attempts at the end of the sixties! During that period, two studies were carried out at Delft University of Technology to modify and improve the existing models of INOK. The first one was that of Rosman and Sonnenberg (1998) on land distribution, and the second one was by Buis and Vingerhoeds (1996) and Buis (1999) on land

partitioning, both of which are discussed later in more detail.

The land reallocation process can be split into five main stages: data collection, preliminary calculations, preliminary land reallocation, definite land reallocation, and implementation (Demetris Demetriou, 2014).

The site committee, in collaboration with the consultant, must prepare a land consolidation and reallocation plan for the affected area, which shall, as far as possible.

Complementary principles are defined by two main sources: the legal expert advice provided by the government's legal services to the public institution having land surveying and urban planning in its attribution for a specific matter and advice notes issued throughout the implementation of land consolidation (Demetris Demetriou, 2014).

3. Materials and Methods

3.1. Research design

This study's methodological design encompasses one main objective and hypothesis, which were tested using a non-parametric prediction of the relationship between land reallocation and urban development planning technique, as portrayed in Table 1.

Table 1.Suggested methodology for the study

Objectives	Hypotheses	Methodology	Statistics
To predict the most suitable Financial factors for urban development planning at Kabeza Site	Ho: (Null hypothesis): There is no significant relationship between land reallocation and urban development planning.	Non Parametric prediction model (Logit, Probit or Tobit) of the relationship between land reallocation and urban development planning	Logistic regression model for urban development planning subject to land reallocation

3.2. Presentation of the Study Area

With an area estimated at 116.32 ha, Kabeza Site is located in Kicukiro District, Gahanga Sector, and Karembure Cell, covering around 75% of the total area of Kabeza Village and 26% of the total area of Mubuga Village within Kigali City. It is located at the point of the coordinates X = 509021.575m and Y = 4775632.714m as the coordinate system of ITRF_2005, at 2.40 km away from Nyanza Bus Parking and 1.5km away from Agakiriro of Gahanga, and also in the neighborhood of a school called G.S. Karembure at its north.

3.3. Sampling methods and techniques

The target population for this study included all residents of the site, with a total population of 550 residents (NISR, 2012). The study used a simple random sampling technique to select the participants for the study.

The following Slovin's formula (Equation 1) for sample size calculation has been adopted in this study:

$$n = \frac{N}{1+N(e)^2}, \qquad \text{(Equation 1)}$$

Where n is the sample size, N is the population size and e is margin error,

$$n = \frac{550}{1+550(e)^2} = 521.327, \qquad \text{(Equation 2)}$$

Approximately 522 people were interviewed in this study out of a population of 550, using a margin of error of 0.01 or 1% at a 99% confidence level.

3.4. Data collection techniques and instruments

3.4.1. Types of data and techniques of data collection

Table 2. Field work technique and instruments

Activities	Techniques	Instruments
❖ Site reconnaissance ❖ Detailed topographic Survey ❖ Systematic boundary parcel resurvey	Trilateration	Differential Global Navigation Satellite System Receiver, Panger, Hammer, Total station
❖ Meetings with Land Owners	-	-

Source: Primary data, 2023

Topographic data has been collected from the field to enable an accurate understanding of the topography of the area. Ground point control (GPC) is conducted using a DGNSS receiver and a Total station. Interesting points revealed the existing natural occurrences and manmade features.

An unstructured interview has been conducted with an open-ended guide to help the researcher gather detailed information on the topic while doing field observation. Both observational information and an unstructured interview have been obtained during consultative meetings with landowners. However, the study also used the data from the Kigali City master plan and the Google Earth professional platform to get computerized data.

3.5. Data analysis techniques

Before starting land reallocation after developing a physical plan within the site, the contribution coefficient factor has been calculated in this study and helped in the land allocation, where each land owner must contribute at the same percentage as the contribution coefficient factor of the total area.

The financial contribution factor is a coefficient developed by the author to distribute this factor to all the parcels before making consolidation to know the land contribution of the individual. When this project starts the implementation period, each individual will need to pay for all the work done during the preparation of this site and implementation to make a successful land readjustment project using a participation approach after land consolidation.

The formula for the financial contribution factor developed by the author of this thesis is as follows:

$$FC = \left(\frac{TVP}{NPP} * CCF\right) + DAT, \qquad \text{(Equation 3)}$$

FC: Financial Contribution; TVP:**PP:** Total Number of the New Proposed Plot; **CCF** – Contribution Coefficient factor and **:T:** Distributed amount from Total Value to the New Proposed Plot.

During the data analysis for this project, the following software was employed:

- AutoCAD 2018 &CAVADIS17 for the production of topographic maps and maps of the existing features.
- ArcGIS Pro is for analyzing and demonstrating the site plans of different purpose requirements and also to upgrade urban development planning, replotting, land reallocation, layout planning, hydrology analysis, and flow accumulation within the study area.
- Excel was used in data management and reporting.
- Microsoft Word, in writing and combining the layouts from other software,
- Aerial photos.

4. Results and Discussion

4.1. Assessment of the existing land use and land cover at the Kabeza site

Most of the existing parcels in this area have no access to roads or other infrastructure. Some parcels are bigger than 300 m^2, and others are less than 300 m^2 refer to the land titles provided by the National Land Authority. This site has been planned as the low-density residential densification zone (R1A) in the Kigali master plan.

Figure 1 : Current image of the site with existing parcel (Primary data, 2023)

4.2. Making and replotting the new parcels within the Kabeza site

The replotting of the parcel happened when its lines were defined or when an existing parcel of land incorporated additional land into it without creating a new, independent parcel of land. Within the Kabeza site, parcels were upgraded and replotted by making the plots as shown in Figure 2.

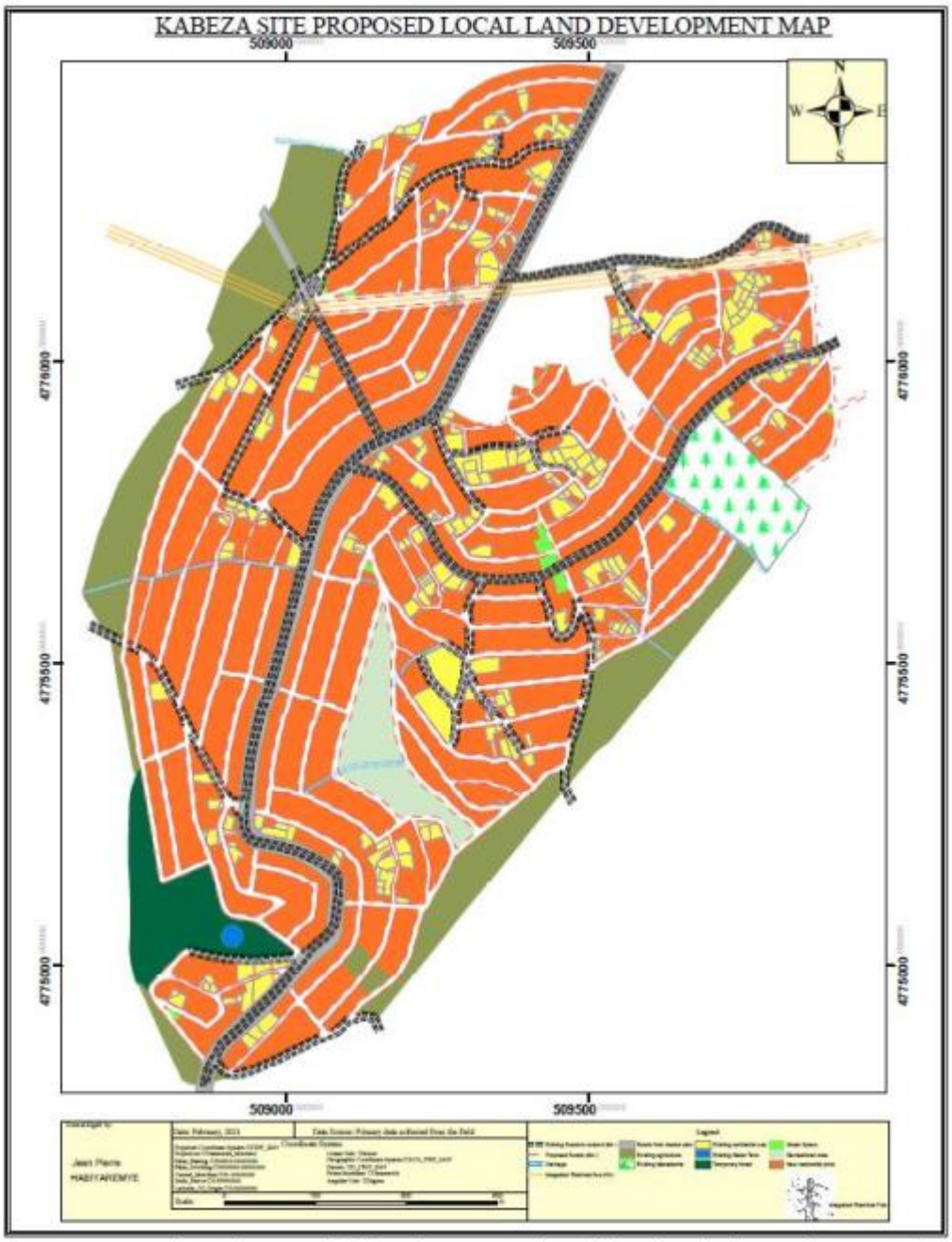

Figure 2 : Local Land upgraded development Plan of the Site (Primary data, 2023)

Regarding the zoning requirements from the Kigali City masterplan, this project has been made at 116.32 ha, with the plots having a width of 15m and a length of 20 m (15m*20m) Because of the shape and some obstacles of the existing buildings, all the planned plots have not been fitted with 300 Sq.m as required. The following table shows the adjustments to the urban development plan.

Table 3: Adjustment of upgraded urban development plan

UPGRADED LAND USE	Area (ha)	%
Existing upgraded residential plot	13.44	11.56
New residential plot	56.18	48.25
Agriculture	11.82	10.16
Forest	2.83	2.48
Open space	0.37	0.32
Sport and Leisure	2.48	2.13
Water tank	0.098	0.08
Upgraded Transportation	8.7	7.48
New Transportation	20.402	17.54
Total	**116.32**	**100%**

Source: Primary data, 2023

4.3. Estimate of a contribution coefficient factor

The land distribution has been made according to the contribution coefficient factor on each parcel using the data shown in the following table:

Variables	Values
TEP	100.844ha
TNP	87.88ha
TPP	56.12ha
PD	3.63%

Source: Primary data, 2023

Then, $CCF = \left(\frac{100.844-87.88}{56.12} * 100\right) + 3.63\% = 26.73\%$ Says, 27%. Now Contribution Coefficient Factor is 27% which must be subtracted from each parcel, including public interest and land compensation of the destroyed parcel in the newly designed plan.

4.4. Predicting the most suitable financial contribution for urban development planning at Kabeza Site

There is a financial contribution from each plot to make a successful land readjustment project using the participation approach after land consolidation by considering the total amount of the project. Table 4 explains in detail by identifying the needed cost of the project before and during implementation.

Table 4: Summary of costs and priority projects

Project	Description	Cost		
		Quantity	Unity Price (Frw) /Parcel	Total
Road and Ravine	Road tracement and Ravine study and demarcation on ground	30.09 Km	84,000	182,120,000
Electricity and Water	Water supply system at each plot and electricity distribution	15.045Km	300,000/1km	4,513,500
Deed plan	Making deed plan of each plot	2168 Plots	30,000	65,040,000
Physical plan development	Data collection, Making layout plan, physical check on the site, setting out new proposed road, topographic report	2168 Plots	100,000	216,800,000
Beaconing	Buy beacons, transport and Stake out	6504	10000	65,040,000
Sub total				**533,513,500**
Contingency (30%)				**160,054,050**
Total				**693,567,550**
Say Six hundred ninety three millions five hundred sixty seven thousand and Five hundred fifty Rwandan francs (693,567,550 Frw) Distributed amount from Total value to new proposed plot is 320,298frw				

Source: Primary data, 2023

Regarding the zoning guidelines from Kigali Masterplan2020, the plots must have a maximum area of 300 Square meters for residential plots.

The financial contribution coefficient that will be needed on each plot to make the success of this project has calculated using the data provided in the following table:

Variables	Values
TVP	693,567,550Frw
NPP	1873
CCF	27%
DAT	320,298

Source: Primary data, 2023

Then, FC= $\left(\frac{693,567,550}{1873} * 27\%\right) + 320,298$ = 470,278 Frw by considering all works done in the site and public facilities.

The probit model for analyzing the relationship between land reallocation and urban development planning has used, and finding shows that the Significance level is 0.0294 and is less than P, which is 0.9. Thus, the study fails to reject the Null hypothesis

(Ho), stating that "there is no significant relationship between land reallocation and urban development planning".

Table 5. The general outcome of the study hypothesis testing

Objectives	Hypotheses	Result	Comments
To predict the most suitable Financial Contribution for urban development planning at Kabeza Site	Ho: (Null hypothesis): There is no significant relationship between land reallocation and urban development planning.	**FC**= $\left(\frac{TVP}{NPP} * CCF\right) + DAT$, **CF** is 470,278Frw	Null hypothesis is not rejected

Source: Primary data, 2023

4.4. Discussion of the Study Results

There shall be a financial contribution from each plot to make a successful land readjustment project using a participation approach after land consolidation by considering the total amount of the project. Compensation for the plot within the site will act from shared land found from the distribution coefficient calculated on each parcel. If the residents do not agree to the land as compensation, they will get compensation in terms of money on a generic market price. That price will define by a Certified Valuer on-site service and will be updated yearly.

The Financial Contribution of previous construction projects must calculate using the following formula:

$$FCPC = \left(\frac{TVP-(FC*NPP)}{PPC}\right), \quad \text{(Equation 4)}$$

where PPC is total number of the plot previously permitted for constructions projects or integrated plots previously constructed and FCPC- Financial Contribution of previously permitted construction projects and integrated plots previously constructed that have been upgraded. Author carried out all technical details and prepared the map, analysis, and results discussion.

5. Conclusions and Recommendations

The main objective of this project is to predict the most suitable financial factors for urban development planning at the Kabeza site in Kigali City, Kicukiro District, Gahanga Sector, and Karembure Cell. The data collected from the field and the topographic survey showed that the existing situation is not well planned according to the standard, which indicates that the new design is well planned compared to the existing one.

From the data analysis, there is no significant relationship between land reallocation and urban development planning. All new plots are 2168 plots, with 1873 plots for single-family residential in the residential extension; 295 plots remain as existing residential; and 14 plots of a total area of 4.22 ha will be totally affected by public utilities. The financial contribution on each plot will be 470,278Frw with work done and public facilities.

Based on these results, several recommendations have been formulated. For an adequate consideration of urban and rural design during the physical planning and design process, the following recommendations are proposed:

- The project implementers and partners, particularly the local government units overseeing the project sites, should pay particular attention to the growing income disparity and the exclusion of the poorest of the poor from the development process since this may lead to social disparities.
- institute the necessary processes to allow the inclusion of all the poor in community consultations and also their participation in

community organizations and urban development.

- Promote a regulatory environment for competitive transport services.
- Identify measures to minimize the interventions' negative impacts on the poor and women.
- Identify measures to minimize negative impacts on the environment.
- Building design will be the responsibility of the individual land owner and must follow the Kigali City Master Plan guideline zone.
- To make a detailed feasibility study of the road, water drainage, ravine, and sewage system within the site
- To follow the implementation of land reallocation by the site committee in collaboration with the government authority, especially the local government.

The following are considerations for the design of future similar projects:

1. The design, implementation, and maintenance of infrastructure should be integral to the project design and operations; infrastructure users, particularly the households that hold most of the benefits (i.e., transport operators), should be required to bear a larger share of facility maintenance and upkeep.

2. The packaging of all infrastructure within the project should be supported by interventions that ensure the inclusion of the poor and help enhance their capacities and capabilities. Some of these interventions are: provision of credit, microenterprise development services, agricultural technology transfer, social capital formation, and gender integration.

3. The conventional approach must be adopted to solve the problem with many conflicting criteria and constraints by applying basic calculations and decision-making.

In the end, the researcher developed a contribution coefficient factor as the amount of land that will be shared from every plot of land and a financial contribution used by the plot to make this project successful and encourage other researchers to continue further research in a different region using the provided formula.

List of References

1. Abhas K. Jha, Jennifer Duyne Barenstein, Priscilla M. Phelps, Daniel Pittet, Stephen Sena (2010). A Handbook for Reconstructing after Natural Disaster, The International Bank for Reconstruction and Development/ The World Bank, Washington DC 204333.
2. Achamyeleh Gashu Adam (2014). Urbanization and the Struggle for Land in the Peri-Urban Areas of Ethiopia, Bahir Dar University, Ethiopia.
3. Barbara C. Colley& P.E (2005), Practical Manual of Land Development (Fourth Edition), McGraw-Hill
4. Christian Lund, Rie Odgaard, Espen Sjaastad (2006). Land Rights and Land Conflicts in Africa: A review of issues and experiences, Danish Institute for International Studies, Denmark
5. City of Kigali (2020), Guidelines for elaboration and implementation of local land development plans, Kigali.
6. David Saithwaithe (2000). Roundtable on Urban Upgrading, Johannesburg, South Africa.
7. http://www.tcpghana.gov.gh/doc/structureplan.pdf
8. https://documents1.worldbank.org/curated/en/909671468270272353/pdf/Agricultural-land-redistribution-and-land-administration-in-Sub-Saharan-Africa-case-studies-of-recent-reforms.pdf
9. https://europa.eu/capacity4dev/topics/urban-development
10. https://masterplan2020.kigalicity.gov.rw
11. https://openknowledge.worldbank.org/bitstream/handle/10986/2653/488960pub0replacement0file09780821376270.pdf?sequence=1
12. https://pdf4pro.com/view/district-development-plan-2013-2018-kicukiro-gov-rw-428bed.html
13. https://www.jica.go.jp/jica-ri/publication/booksandreports/l75nbg00000ltoak-att/LAND_READJUSTMENT_web.pdf
14. https://www.researchgate.net/publication/221899396_The_impact_of_land_reallocation_on_technical_efficiency_Evidence_from_China
15. https://www.researchgate.net/publication/238693052_A_GISBASED_LAND_READJUSTMENT_SYSTEM_FOR_URBAN_DEVELOPMENT

16. JF Chriqui, E Thrun, A Sanghera (2018).Components of Local Land Development and Related Zoning Policies, Associated with Increased Walking: A Primer for Public Health Practitioners, Chicago
17. Kigali City (2018). Local Land Development plan Guidelines, Kigali
18. Kigali City (2020), Kigali city zoning Regulations (2020 edition), Kigali.
19. Mevlut Uyan, Vahit Tongur, Ela Ertunc (2020). Comparison of different optimization based land reallocation models, Computers and Electronics in Agriculture, Elsevier.
20. Musa AVCI (1998). A New Approach Oriented to New Reallotment Model Based on Block: Priority Method in Land Consolidation, Ege Üniversitesi Ziraat Fakültesi, Tarımsal Yapılarve Sulama Bölümü, Bornova, İzmir-Turkey.
21. Pr. M. ESSADIKI, Pr. M. ETTARID, Pr. P. ROBERT (2003). New Approach for Land Reallocation using a geographic information system, 2nd Regional Conference of the FIG, Marrakech
22. Prof. Mohammed ESSADIKI, Prof. Mohamed ETTARID & Prof. Pierre ROBERT (2003). Optimisation of Technical Steps of Rural Land Consolidation Project Using a GIS: Land Reallocation Step, FIG Working week 2003, Paris.
23. Republic of Rwanda (2015). Ministerial order n°04/cab.m/015 of 18/05/2015 determining urban planning and building regulations, Kigali
24. Republic of Rwanda (2021), Law N°27/2021 of 10/06/2021 Governing Land, Official Gazette n° Special of 10/06/2021, Kigali
25. Republic of Rwanda (2021). National Land Use & Development Master Plan (NLUDMP 2020-2050), Official Gazette n° 15 bis of 26/04/2021, Kigali.
26. Republic of Rwanda (2021). Presidential Order N° 058/01 of 23/04/2021 Establishing the National Land Use and Development Master Plan, Kigali
27. Rwanda Housing Authority (2010). Affordable Housing Development project in Rwanda, Kigali
28. Rwanda Land Management and Use Authority (2021). A Practical guide for conducting participatory land readjustment in Rwanda (First Edition), Kigali.
29. Serife Tulin Akkaya Aslan, Muge Kirmikil, Kemal Sulhi Gündoğdu & Ismet Arici (2017). Reallocation model for land consolidation based on landowners' requests, Turkey
30. Sumila Gulyani, Genevieve Connors (2002). Urban Upgrading in Africa: a summary of rapid assessments in ten countries, The World Bank.
31. United Nations (1987), The Rio Declaration on Environment and Development
32. United Nations (2000), The World Commission on Environment and Development.
33. United Nations (2005). Land Administration in THE UNECE REGION Development trends and main principles, New York and Geneva.
34. Wisconsin Department of Administration Division of Intergovernmental Relations, Wisconsin State Cartographer's Office (2017).Final Report: Statewide Parcel Map Database Project ran from January 2016 to October 2017 (Version 3), United States.
35. Xiaobin Zhang &Yanmei Ye (2016). Land Reallocation in Land Consolidation: a Chinese Mode and Its Future Direction (8069), FIG Working Week, Christchurch.