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CONTENT

The COVID-19 crisis worsens with the occurrence of climate extremes and disasters

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Abstract: Climate change and the associated weather extreme events are a major threat to humanity as it affects agriculture and food security. Climate change disaster is on the increase as the global temperature keeps rising. Sub-Saharan Africa is one of the most vulnerable regions to climate change. The coronavirus (COVID-19) pandemic has been complicated by climate change and related extreme events especially with the imposed lockdown which has affected the global economy. The COVID-19 has killed over 4 million persons with the USA, Brazil and India being the worst affected nations. Thus, the multi-hazard scenario presented by extreme events like drought, flood and cyclones this period of the pandemic worsened its spread as it affected social distancing and personal hygiene as many people are crammed in camps and water become scarce for handwashing. It is suggested for countries to strengthen their emergency department by boosting the staff component, provide adequate technical support and develop detailed plans for multi-hazard preparedness.

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1. INTRODUCTION

Climate change and the associated climate extremes is a major threat to agriculture and food security. It has been opined that Sub-Saharan Africa is one of the most vulnerable regions to climate change [1] whereas there is also a steady change in the occurrence of climate extremes of which West Africa is one of the regions to suffer increasing droughts [2]. The change in the occurrences of the climate extremes is attributed to anthropogenic influences [2]. Weather extremes lead to a cyclic debt burden on the developing world [1]. The climate extremes and the disasters will weaken investment and the capacity to attain the 2030 agenda of the Sustainable Development Goals (SDGs).

The COVID-19 pandemic is a biological disaster [3] but also a natural disaster [4] that has dwarfed public reckoning with the climate crisis [5]; with the rising number of cases and casualties increasing daily. The number of cases globally is 191.08 million while the number of deaths is 4.10 million. It is a highly contagious disease and the World Health Organisation (WHO) declared it a global pandemic in March 2020. The worst-hit countries to date are the United States, India, Brazil [6]. The virus is spreading in many countries with high mortalities recorded daily while in some countries especially Oceania and Africa, it is reducing. The reduction might be due to increased use of vaccines and observance of the strict lockdown orders in several countries including a ban on international travel.

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It has been argued that those climate extremes and disasters do lead to a spike in COVID-19 cases recorded in some parts of the world. For instance, the resurgence of the COVID-19 in the eight contiguous hurricane coastal states of the USA in 2020 was associated with hurricanes like hurricane Hanna [3,7] This was because the evacuation of inhabitants from hurricane-prone areas increased the possibility of crowding people in camps or shelters that hardly observed the COVID-19 protocol of social distancing and regular washing of hands. The coastal states affected by the hurricane include Alabama, South Carolina, Florida, Georgia, Louisiana, Mississippi, North Carolina and Texas [7]. Unsurprisingly these states also provided the highest number of new cases in the summer of 2020.

Additionally, due to the strengthening of Cyclone Amphan around the Bay of Bengal, authorities evacuated about 2.2 m people in Bangladesh and 4.3 m in the West Bengal and Odisha states of India that were accommodated in over 15,000 shelters to maintain COVID-19 protocol [3,8]. The Cyclone Amphan which was accounted for one of the strongest storms claimed 80 lives due to prompt intervention and mitigation. The gain due to the prompt intervention and evacuation was lost by a spike in the new covid-19 cases in Kolkata India and other storm-affected areas. Thus, climate extremes have played a significant role in increasing the spread of COVID-19. Furthermore, it is also reported that flooding increases the risk of COVID-19 while hindering their ability to mitigate the dual impacts of flood and COVID-19 [9]. Flooding also exacerbated the management of the COVID-19 as authorities were struggling with how to maintain social distancing especially in informal settlements [5].

Also, due to droughts in several countries in Southern Africa including Zimbabwe, there was difficulty in assessing potable water last Autumn following severe droughts that ravaged that region of Africa [5]. With the absence of water to maintain personal hygiene, it became extremely difficult to contain the spread of COVID of which one of the mitigating actions is regular washing of hands. Droughts in the developing world cause malnutrition, impelled migration, conflicts and instability [10,11] and drought and flood occurrences are likely to increase in frequency due to climate change [5,12–14]. The compounded effects of the pandemic and droughts on agriculture and food supply have been emphasized [14].

This corroborates Phillips et al. [5] assertion that storms, flooding and droughts are among the clearest sources of displacement and disruption in the pandemic. About 70 countries were affected by flood in 2020 where many were displaced and put in camps where social distancing was rarely observed [5,13]. Such a situation would complicate the spread of the novel COVID-19 virus thereby, jeopardizing the effort to curtail its spread across the globe. Hence, its spread might accelerate under such circumstances. Therefore, the question is how do we manage the crisis of COVID-19 in the event of weather extremes? It is a difficult question to answer, however; efforts are required of every stakeholder to mitigate climate change which is the root cause of both the pandemic and extreme events especially its intensity and frequency of occurrence. Another critical quality to managing the crisis is building resilience [13] where resilience entails 4 Rs. These Rs are Robustness that entails the ability of a system to resist hazard-induced stresses, redundancy which is the ability of a system to provide uninterrupted services in the event of a disaster, the resource fulness that covers the utilization of resources or materials to establish, prioritise, and achieve goals and rapidity - the ability to return the system to its pre-hazard state as quickly as possible [13].

The assessment of resilience is quantitatively done using system dynamics simulation that has been enhanced by GIS. Thus, it has been asserted that resilience is a proactive means of disaster management [13] and so is the most desirable and effective means of disaster management as it minimizes loss to the barest minimum. The methodology has been used in infrastructure management affected by hurricanes and flooding [15] which can be extended to other extreme events and COVID-19 [13].

However, there is yet to be a full-scale implementation of these approaches in managing multi-hazards compounded by the COVID-19 pandemic while yet ensuring the maintenance of resilience across the board. The incidences of multi-hazards in the presence of the COVID-19 pandemic have revealed the hidden lapses in emergencies management and poor health systems of several countries across the globe. It has shown that poor developing nations or continents like Africa still has a long way to go in emergency management as its health system and education need more funding to meet world standard that can stand emergencies of similar magnitude in the future. Additionally, internet access should be boosted in order to

promote virtual learning across developing nations and funding made available to researchers to find a real cure for the coronavirus.

Thus, the study is divided into 5 subsections with an introduction as subsection one. Subsection two is the literature review, subsection three is the methodology, subsection four is the occurrence of COVID-19 and other disasters. Subsection five discusses management measures for the multi-hazards and finally, the last subsection is the conclusion.

2. LITERATURE REVIEW

The current rate of spread of COVID-19 is fast and threatens public health globally [16]. Yet, it is worsened by a simultaneous occurrence of natural disasters that may lead to an astronomical rise in casualties. Health systems have been overwhelmed in so many countries such that any concurrent incidence with natural hazards portend greater risks with many citizens requiring help, therebycreating a dangerous feedback loop [16,17]. Such concurrence has disrupted lockdown measures in several countries like Croatia in late march 2020, Bangladesh, Greece and others [16–18].

The pandemic has disproved or in part cast doubt on the current paradigm in disaster planning and management indicating that all hazards share commonalities which permits a certain level of generalization and can be studied under the framework of; 'All-Hazards Approach' (AHA) [19]. Thus, they suggest a different approach to managing the pandemic as it is a unique disaster. They recommend that a consolidated alternative framework that is known as the 'Top-Hazards Approach' (THA) arguing that inherently different events should be approached via different planning and mitigation tactics [19].

Thus, it has been suggested that national and international policies should address contingency plans that target improving prevention, preparedness, mitigation, response and rehabilitationto new emergency events [16]. However, Appleby-Arnold et al. [20] and van Bavel et al. [21] add that to enhance intervention and minimize casualties, there should be a development of 'a culture of preparedness' which will require a change of attitude and behaviour. Also, personal emergency plans should be set up with family and friends by discussing emergency contacts, meeting points using simple reminders like a picture on mobile phones, pasted on a fridge or in a purse [20].

In addition to behaviour, yet another dimension has been added to managing COVID-19 especially in the multi-hazard era and this is the psychological aspect [22,23]. For instance, they add that mask in itself makes no much sense if people do not wear them and worn in the proper and recommended way [22].

Finally, the incidence of multi-hazards in the presence of the COVID-19 pandemic was a double or multi-disaster scenario that affected the locations of occurrence. It challenged authorities and health workers and strained the health system beyond its carrying capacity and led to higher deaths in some locations [7,18]. Hence, it is uncertain the best approach or dimension to take in handling emergencies under multi-hazard incidence involving a pandemic like COVID-19. It beckons on scientists to work assiduously to develop a cure for the COVID-19 in addition to the already developed vaccines. Again social and behavioural scientists should develop the best management approach for such and related emergencies in the future. Also, health systems should be improved drastically especially in the developing world.

Regional incidences of COVID-19 and hydrometeorological hazards

The global recorded deaths due to the coronavirus pandemic stand at 4.10 million deaths [6]. The number of deaths and cases vary by region as shown in Figures 1 and 2 with Oceania having the lowest number of cases and deaths.

Europe

The scenario in Europe is dreadful as it spread like wildfire across the continent a few weeks after it was first reported in Italy. It is one of the worst-hit continents. Also, the occurrence of certain extreme weather events compounded the crisis in Europe. For instance, heatwaves during the winter made many people congregate at beaches during the 2020 summer which then led to a second wave of the pandemic as the number of cases soared. Also, there was flooding in January in Girona and Malaga Spain that led to about 13 deaths. In France, over 1,500 persons were evacuated in Eastern Pyrenees due to the rising level of the Agly river. There were also evacuations in Greater Manchester around the same time in England due

to flooding associated with storms Ciara and Dennis. In June 2020 in Ukraine, there were 3 deaths and over 1500 persons were evacuated to temporary accommodation due to flooding in the western region. The June flood also affected the eastern parts of Romania and Moldova [25]. Also,a flash flood hit Zagreb Croatia in July which killed a firefighter and disrupted public transport [26]. In October, another flood hit France's Saint Martin-Vesubie and Breil-sur-Roya killing 7 persons, 9 missing and over 2000 houses damaged [26]. Such scenarios of multi-hazards heightened the risk of COVID-19 transmission to others as the COVID-19 protocol could be breached under such conditions of resettling in temporary shelters due to hydrometeorological emergencies. In July 2021, 2 days' unprecedented rain hit Western Europe resulting in flooding that led to the death of over 120 persons in Belgium and Germany with over a thousand persons missing and property destroyed (Figure 3) [27]. It also affected Netherlands and Luxembourg due to heavy downpours of July 13th and 14th 2021. It has been alleged that it was disastrous due to people's inability to heed early warning signals [27]. This scenario has increased the tendency of cramming more people in temporary shelters that may increase the risk of higher COVID-19 transmission as the COVID-19 protocol of social distancing and frequent handwashing might be compromised. Europe has recorded 55,959,078 cases for which France and Russia have the highest.
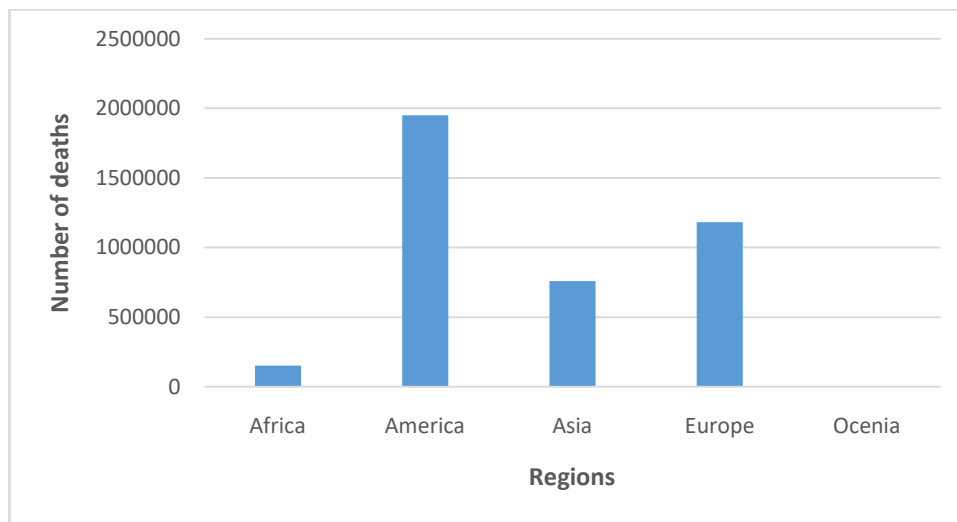
Figure 1. The COVID-19 number of deaths by regions
Source: ECDC [24]
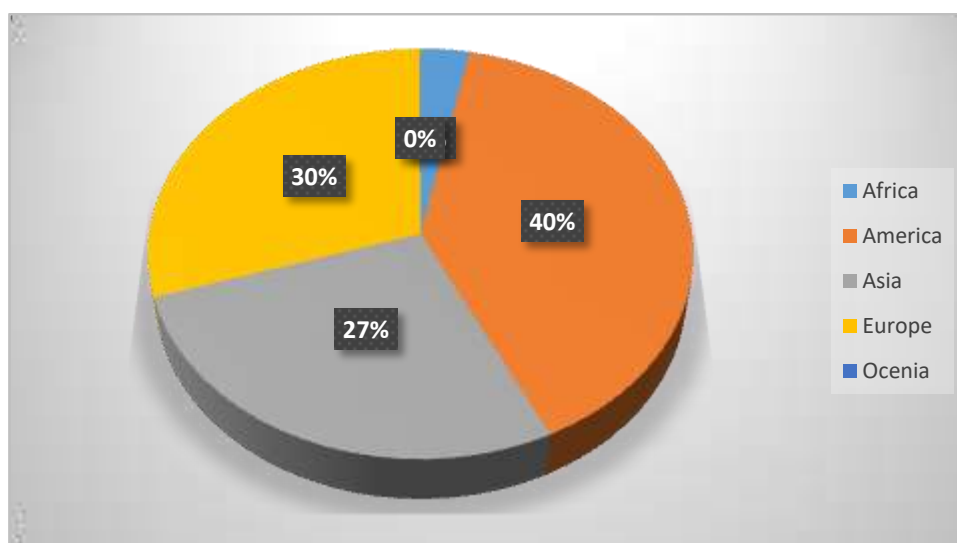
Figure 2. The COVID-19 percentage of cases by regions
Source: ECDC [24]

(a)

(b)

(c)

(d)

(e)

Figure 3. Devastating floods in Central and Western Europe (July 13-15, 2021) that affected rural and urban settlements: (**a**) Cars piled up by the floods at a roundabout in Verviers, Belgium; (**b**) Stansstad, Switzerland; (**c**) Devastating floods in the Rhineland-Palatinate region; (**d**) A regional train sits in the floodwaters at the local station in Kordel, Germany; (**e**) Erftstadt (Cologne): major damage after landslides caused by floods

Source: (a) Agence France-Presse; (b, c) HEPTA; (d) Daily Sabah; (e) Rhein-Erft-Kreis.

Oceania

The incidences of multi-hazards during the COVID-19 pandemic in Australia was devastating. By the summer of 2019/2020, there was a record-high increase in temperature in Australia that culminated in

heatwaves, drought and forest fires [27]. However, there was less likelihood for the disasters in the Winter which fortunately made the incidence of COVID-19 later in the year not coincide with the disasters. Damaging floods also affected Canterbury, New Zealand and New South Wales, Australia in March and May/June 2021 respectively [29,30]. Oceania has a total number of 90,540 cases for which Australia and French Polynesia have the highest number of cases.

Asia

Asia especially South Asia is one of the most densely populated regions of the world and are yet exposed to compound risks of COVID-19 and extreme climate events [28]. The nature of rainfall associated with the Monsoon season often leads to severe flooding in the region. For instance, about 1110 people died and nearly 14 million others were affected by the floods of June 2007 in Bangladesh [31]. Also, in 2020 several floods affected so many people in China, Pakistan and others which compromised the COVID-19 protocol as evacuees were crammed in camps and which exacerbated the daily recorded cases in those areas especially India [28,32–34,13,17,9]. Deadly floods in July 2021 swept across Asia killing so many people and displaced others. For instance, 6 were killed in Turkey, India, 2 were killed in South Korea, 10 in Nepal, 15 in Kyrgyzstan and Uzbekistan while several evacuees have been camped in temporary shelters in Indonesia, China and Japan due to floods [30].

However, it must also be stated that the increase in the number of cases is also worsened by the informal economy that dominates in most of the countries in this region that make social distancing a very difficult option to combating the pandemic [35]. Asia has recorded cases of about 51,198,820 for which India and Iran have the highest.

Africa

The spread of the COVID-19 pandemic in Africa has been low in many places except in South Africa and few north African States. Many African countries were lucky to have had a minimal number of cases and deaths due to the pandemic. The rising number of cases in many places were attributable to weather extremes like heatwaves that impelled many to congregate at beaches or unheeded lockdown orders in some places which skyrocketed the number of cases. Moreover, severe floods hit West and East African regions in 2020 that affected over 6 million persons. In July 2021, deadly floods hit Chad costing 5 lives, In May/June, floods in the Ashanti region of Ghana led to 4 deaths while several others were displaced in Kenya, Somalia, Senegal, South Africa, Congo DRC, Uganda and Burundi [30]. In May, Cyclone Jobo caused a flood that killed 22 people in Tanzania and affected 22,000 others [30]. In any case, the situation in Africa is worsened by the dominance of the informal economy characterised by a low-skilled labour force, poor or unavailable internet services among others nearly similar to what is obtained in India [35–37]. Africa currently has recorded 5,961,610 cases of which South Africa and Morocco have higher cases.

America

America especially the USA usually experience hydrometeorological disasters annually, especially during the boreal summer. There are cases of heatwaves that worsen pre-existing health conditions [28]. Towards or preceding the Fall every year are tornadoes and hurricanes that are associated with evacuations and resettlements. Such camps may compromise the COVID-19 protocols of regular handwashing and social distancing and thereby increase the risk of transmission to a much more number of new cases. This actually, happened with the event of hurricane Hanna and Isaias in 2020 which led to a high upsurge of new cases in the US due to breach in social distancing by evacuees [5,7,13]. In June/July 2021, a floodhit the Americas killing 2 persons in Texas USA while so many others were displaced in the USA, Colombia, Venezuela and Mexico [30]. America has recorded 74,299,121 cases which USA and Brazil havea higher number of cases.

3. METHODOLOGY

The paper is a review article. Thus, all materials were obtained from existing published articles related to the topic of discussion. A search at the Science Direct site returned a result of 62,902 while Google Scholar returned 421,000. However, when the search was further refined with 'COVID-19' and 'Natural disasters', 2,544 results were obtained from Science Direct that comprise 260 review articles, 1,645 research articles, 15 Encyclopedia and 153 book chapters. Google Scholar's refined search returned

77400 results. Out of these, a total of 42 articles that buttress on the topic under consideration were reviewed from Science Direct and 12 articles were selected from the Google Scholar search that meets the requirements for the current study.

A multi-hazard scenario is when there are concurrent hazard events where natural hazards either of weather extreme or geophysical origin intersect the occurrence of the COVID-19 pandemic in time and space [28]. It is critical to strengthen mitigation measures of COVID-19 to lessen transmission especially as it is projected to last till 2024 [38]. Natural hazards are known to have caused an estimated loss of about 60,000 lives annually worldwide [16,39]. Though the figure is decreasing in recent times [39], emergency management should do more this period of COVID-19 pandemic to reduce the impact of multi-hazards on the populace.

4. COVID-19 AND OTHER DISASTERS

4.1. COVID-19 and hydroclimate extremes

Climate extreme events refer to unexpected and severe weather events that originate from anomalous climate state that negatively and adversely affect a man's livelihood and his environment. It is the occurrence of a value of a weather phenomenon or climate variable far above or below the normal or threshold value within a range of observed values of the variable [2]. Such extreme events include heat waves, drought, cyclones and flooding. Climate change is increasing the intensity, frequency, duration, timing and spatial extent of weather extreme events [1,2]. Climate extremes do also result from natural climate variability such as the El Niño phenomenon.

It has been asserted that mortalities from climate extremes (flood and drought) are decreasing on average but that from cyclones and tornadoes are increasing [28,29]. This might be due to advances in technology, increased computing power and simulations including advances in geospatial techniques and software that permit the proactive measure to disaster management. However, despite such advances, fatalities are worsened in the COVID-19 pandemic era due to difficulty with relocating and resettling evacuees without circumventing the COVID-19 protocol of physical or social distancing [5,13]. The occurrences of hurricanes (tropical cyclones), tornadoes, heatwaves, droughts and floods led to the peaking of pandemic cases in many countries like the US, China, Pakistan, Bangladesh, India, Ethiopia among others [5,7,9,13,14,17,28,32–34,40–43]. Cyclones hit Solomon Island and Fiji in April 2020 which displaced over 159,000 people with 2 deaths. Camping the displaced led to breaking the COVID-19 protocol that could have affected the number of cases in that Pacific region [28].

4.2. COVID-19 and geophysical hazards

Geophysical hazards include Earthquakes, volcanic eruptions and tsunamis. They are very catastrophic events that cost several lives when they strike. The event of earthquakes and tsunamis increase the pressure for temporary accommodation for evacuees who may not observe the COVID-19 protocol of social distancing which do escalate the rate of infections [5,28]. For instance, a 5.3 magnitude earthquake occurred in Croatia, north of the Capital city of Zagreb though, a minor quake, affected the city of about 800,000 persons with nearly 60 persons needing temporary shelters [28]. Camping such people were accompanied by a temporary collapse of social distancing and thus was followed by an abrupt increase in COVID-19 transmission [28,44,45].

The eruption of the Krakatau Indonesia in April 2020 led to an increase in the COVID-19 pandemic on the islands of Java and Sumatra [28]. Also, the eruption of a volcano in Eastern Congo in 2021 led to the displacement of several persons which might have escalated the COVID-19 pandemic in the country. The 5.7 magnitude earthquake in Greece in 2020 compounded the emergencies [18]. The number of infected persons increased in most of the regions affected by the earthquake in addition to fatalities recorded due to the quake [18].

5. MANAGING COVID-19 PANDEMIC IN A MULTI-HAZARD SCENARIO

Immediate actions are required to curtail the spread of COVID-19 in a multi-hazard scenario especially given that the pandemic has peaked in many countries leading to overstressing the health

systems and health workers. The safety of health workers is critical in order to serve the general public better. For instance, it was reported that nearly 20% of the infected persons were health workers in Spain [16]. To minimize imminent natural disasters impact on human health while still limiting the risk of the virus transmission demands that national and international policies address contingency plans targeted at improving preparedness, prevention, mitigation, response and rehabilitation to new emergency events [16,28]. The contingency plans should include establishing safe work protocols and guides to avert new infections through strict intervention measures following international health regulations [46]. Also vital is the identification and analysis of worst-case scenarios via periodic risk assessments and re-design of emergency plans and interventions taking into account social distancing [16]. Pre-crisis planning and concerted efforts from all stakeholders including the authorities in coordinating the impending crisis with effective communication plans, public awareness, engagement and communitysupport [16,36,46].

Additionally, international cooperation is expedient in managing multi-hazards, especially when a highly transmissible disease like COVID-19 is involved. Donor agencies and other international organisations should aid the poor developing nations in managing a health challenge of this magnitude with every logistics necessary to forestall its spread. More so, the scientific community should do more to develop vaccines as they are currently doing and the eventual cure for the virus and also funds should be made available to research centres to pursue this lofty goal to save humanity from the threat of the virus. In addition to improving citizens' awareness of hazards, the role of culture should be integrated into hazard prevention [20]. The 'culture of prevention' they argue will enhance mitigation and resilience to multi-hazards as it increases social inclusion and mutual trust among the citizenry. Such a culture of prevention is vital as it enables and promotes total compliance of the people to measures put in place to reduce or counter the spread of COVID-19 and any other disaster. For instance, before the development of the vaccine, flatten the curve of infection depended solely on the compliance of the people to the imposed restriction of movement or lockdown order and wearing of masks with regular hand washing.

Thus it is asserted that those measures do not reduce or stop the spread by itself unless if implemented by the people [22]. And doing those things like wearing a mask is a 'behaviour' just like staying at home and others are part of the culture and if they are seen by the people as their culture, then they are bound to be obeyed effortlessly. In this way, the spread of the pandemic would be curtailed due to total compliance.

Furthermore, it has been shown that the poor are more likely to break the lockdown restriction than the most affluent [47]. Thus, the management of the COVID-19 can be approached from the role social inequalities play in society. Hence, if more green spaces are provided for recreation or economic palliatives provided to soothe the economic burden of people restricted from work and earning and fully equipped hospitals with sufficient bed spaces are made available and accessible to all and sundry, then the spread of the virus can be contained quickly. This also goes to decongesting many suburbs in developing countries that have high room density due to overcrowding of apartments by occupants. Should more houses be made available to the deprived regions, social distancing will be better adhered to.

Therefore, governments everywhere should endeavour to reduce social inequalities to the barest minimum by providing more infrastructure, better health systems and improve the economy, especially in the developing world. Also, the people should support the authority in crisis management by adopting the 'we' concept where collectivism is the watchword [22]. Thus, it is not about me, it is not all about you, it is about me too and so it is about we [22]. It is about we, if that sense of inclusiveness is assured. Effort should be devoted at improving the lives of the most vulnerable members of the society for the less vulnerable they become, the higher their chances of surviving during emergencies.

More so, in line with the World Health Organisation's (WHO) recommendations outlining the following steps to manage multi-disasters: rapid assessment, prevention of infections, surveillance, control of disease outbreak, disaster management, evaluation in order to control disease spread [48]. Early Warning Systems (EWS) is also critical to managing multi-hazards [48] including communication and a culture of acceptance and implementation. It has been argued that EWS if available can save lots of lives from disasters, however, despite the United Nations (UN) call for the development of EWS following Indian Ocean Tsunamis and the Sendai Framework, only 81 countries have a national strategy for disaster risk reduction [49]. The UN advocate that EWS should comprise knowledge of the risk, its monitoring and

warning service, dissemination and communication, and response capability [48]. New Zealand has demonstrated the usefulness of EWS and her preparedness for disaster risk management in using alert level systems to manage earthquakes, volcanoes and the novel COVID-19 [49].

In addition, resilience is critical to successful disaster risk management such that the people should be resilient in terms of being flood-resilient, earthquake-resilient, pandemic-resilient and climate-resilient [44]. Resilience implies the capacity of a system, community, or society to adapt to potential hazards by resisting or evolving to maintain an acceptable level of functionality or structure [44,50]. However, the resilience and response capability of the community should be built into or integrated with the local adaptation capabilities and culture. Resilient critical infrastructure should be built to support the most vulnerable in times of crisis.

Finally, the concept of human security and dignity should be integrated into new policy for managing multi-hazards during the pandemic [40]. Provision should be made to support the most vulnerable populations and integrate disaster and climate resilience in their livelihood programmes to strengthen their ability to withstand additional stressors or shocks [33].

6. CONCLUSIONS

Climate change worsened by anthropogenic pressure on the earth's resources is impacting the earth severely. The impacts are numerous ranging from the novel coronavirus to extreme events like heat waves, drought, flooding, cyclones and other disasters like increased pollution. It has been pointed out that the earth's temperature is rising far above the pre-industrial revolution era and all efforts should be made to ensure it does not exceed 1.5^oC to 2^oC to avoid reaching the tipping point in the climate systems [51]. Climate change is already affecting the complexity and uncertainty of the present and future disaster management challenges [13]. With the recent events, scientists and other stakeholders should develop an effective approach to managing multi-hazards in time and space. This is crucial with the experience of the COVID-19 and climate extreme events which compounded management efforts, increased the number of cases and casualties.

According to the UN's Secretary-General, Africa might be the most vulnerable to the coronavirus pandemic just as it is to climate change and the associated extreme events[5]. As Simonovic et al. [11] add that if the uncertainty cannot be completely avoided or eliminated then, it should be communicated to provide a sound basis for planning and decision-making. Thus in this regard, proactive measures should always be advocated for and promoted in disaster and multi-hazard management. There should always be the political will to act on the part of the authority and the people's willingness to respond positively to the communicated early warning signals in order to minimize losses due to multi-hazards. Additionally, regionally cooperation is necessary to mobilise expertise and resources to establish multi-hazard early warning systems [3].

Therefore, governments everywhere, health agencies and disease control experts as well climate and environmental scientists should take immediate actions that will arrest the COVID-19 as well as limit the magnitude and frequency of the occurrences of climate-related disasters [5]. Proactive measures including pre-disaster preparedness and resilience approaches should be integrated into the disaster management of any nation. Additionally, emergency management and support staff should be boosted during the period of multi-hazard events as understaffing would likely exacerbate the disaster and increase the number of casualties due to a shortage of manpower at critical moments. Adequate technical support with funding is critical to ensure good results in disaster management [5]. Hence countries should develop detailed plans for multi-hazard preparedness taking into account regional differences to the vulnerability of climate change and the strength of existing health infrastructure [5]. Also, cooperation among the citizenry and the stakeholders is vital for with collective effort the battle with the pandemic will be won quickly.

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Nuclear energy in the context of climate change

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Abstract: Human society faces the great challenge of drastically reducing greenhouse gas emissions while providing increased amounts of energy. Although the share of renewable energy sources has increased in recent years, fossil fuels are still widely used and burning them makes large amounts of carbon dioxide enter the atmosphere. However, renewable energy sources may not be able to supply in time enough energy to replace fossil fuels. Under the circumstances, the question arises as to whether nuclear energy could play a significant role in mitigating climate change. Although there is still confidence and support for nuclear energy, it is unlikely that this energy source will make a greater contribution to combating climate change in the coming decades. This study analyzes the current state of nuclear energy, as well as the development prospects in the context of climate change and risks to the environment and human health.

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1. INTRODUCTION

The burning of fossil fuels generates greenhouse gases that cause global warming. The concentration of CO_2 in the atmosphere reached 410.5 ± 0.2 ppm in 2019, a considerable increase compared to the level of the mid-18th century (pre-industrial period), estimated at 278 ppm [1,2]. According to the Paris Agreement, in order to avoid the serious effects of climate change on the environment, the increase in global temperature must be kept well below 2°C compared to the pre-industrial period [3]. Thus, low-carbon energy sources, especially the renewable ones, need to replace fossil fuels, which continue to predominate in the final energy consumption, as soon as possible, although their share has gradually declined in recent decades, from 74% in 1980 to 67% in 2019 [4]. This conversion will be a major challenge because by 2050 an increase in global energy consumption of about 50% and final electricity consumption of 80% is expected [5].

Although renewable energy sources have increased at an average annual rate of 2% since 1990, in 2018, of the total energy supplied worldwide, only 13.5% came from these energy sources (biofuels, hydropower, municipal waste renewable energy, wind, solar, geothermal or tidal energy). If we refer only to power production, the share of renewable energy sources was over 25%, occupying the second position after coal [6]. Under the circumstances, the share of renewable energy in total energy consumption will have to increase significantly by 2050, reaching about two thirds [7]. However, this growth is not certain. According to U.S. Energy Information Administration (2019), although renewable energy sources will increase by more than 3% per year between 2018 and 2050, their share in global energy consumption will not exceed 28%.

At present, nuclear energy supplies about 10% of the world's power and is an important component of all low-carbon power production. According to the International Energy Agency (2019), the use of nuclear energy has prevented over 60 gigatons of CO_2 emissions in the last 50 years from entering the atmosphere. However, the March 2011 nuclear accident in Fukushima (Japan) called into question the safe operation of nuclear power plants, with some countries such as Germany and Switzerland announcing the early closure of the existing nuclear facilities [8].

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Thus, in the context of increasing global energy consumption and climate change concerns, the widespread use of low-emission energy sources is a must. The big challenge will be to produce enough energy from renewable sources to replace fossil fuels used in the production of electricity and heat or in transport, in the context of population growth, economic development, urbanization or the expansion of electric mobility.

2. LITERATURE REVIEW

The role of nuclear energy in the global energy system has been intensively analyzed over time, including in relation to climate change. Many studies have shown that nuclear fission technology is capable of providing large amounts of energy, safely and with low carbon emissions, which is essential for meeting the climate goals and the Paris Agreement. Consequently, nuclear energy must play a major role in the global energy system [9–14]. In this category, some authors believe that there are no insurmountable technical barriers to nuclear expansion, but this expansion must be carried out in accordance with very high safety standards [9]. Other argue that, in the long run, nuclear fission technology is the only source of energy capable of providing the large amounts of energy that modern industrial societies will need in a safe and sustainable way, both in terms of ecological view and in terms of the available resource base [10]. On the other hand, it is considered that the most serious problem facing humanity is that we only have a few decades to implement effective measures to stop global warming. In the long run, thorium and molten salt reactors could compete with uranium-based reactors. Nuclear expansion should be accompanied by effective international safety assurances, including a mandate to stop the construction of unsafe nuclear power plants [11].

There are still many uncertainties about the future evolution of nuclear energy, due to the fears about the potential risks to human health from possible nuclear accidents or radioactive waste [15–18]. There are authors who question the fact that nuclear energy is a low-carbon technology and therefore they advocate strictly for a non-nuclear future [19]. Other believe that the contribution of nuclear energy to climate change mitigation is and will be very limited. In addition, a substantial expansion of nuclear energy will not be possible due to technical barriers and limited resources [20].

3. METHODS AND DATA

The statistical data used were taken from the databases of the International Atomic Energy Agency, the International Energy Agency, U.S. Energy Information Administration, International Renewable Energy Agency or Our World in Data, which periodically collect and publish energy information. These data were represented graphically in order to track the dynamics over time of some indicators: global nuclear power production, the share of power from nuclear sources, reactors newly connected to the grid and reactors permanently shut down. The future evolution of nuclear energy is based on data published in 2020 by the International Atomic Energy Agency. The arguments for or against the role of nuclear energy in the global effort to combat climate change are based on a series of scientific articles published in various journals and other sources.

4. RESULTS

4.1. The current state of nuclear energy

At the beginning of 2020, 443 nuclear reactors were operational, with a total installed capacity of 393 GWe. In addition, 54 reactors, with a total capacity of 54.5 GWe, were under construction [21] (Table 1). Nuclear power plants generated 2,657 TWh of power, representing 10.4% of the global power production [22] (Figure 1). Although in 2019 there was an increase by 3.7% compared to 2018, the production of nuclear power was below the maximum value recorded previously, that is 2,791 TWh, reached in 2006 [23] (Figure 2). The United States, France, China, Russia and South Korea together generated 70% of the total nuclear energy in 2019; US and France accounted for 45% of the total [4].

After the first nuclear reactor was connected to the network (Obninsk, located about 100 km southwest of Moscow), in June 1954, followed a period of development that recorded two peak values: 26 network connections in 1974 and 33 connections to the network in 1984 (Figure 3). After the Chernobyl nuclear accident, a period of decline followed, and in 1989, for the first time in recent history, the number of permanently closed reactors exceeded that of the new reactors connected to the network. From 2012 (after the Fukushima nuclear accident) to the beginning of 2020, 55 new reactors were connected to the network, of which 34 in China alone [21, 24].

Table 1. Nuclear Power Reactors in the World.

Country	Operational (2020)		Under Construction (2020)		Nuclear Electricity Production in 2019	
	Number of units	Net capacity MWe	Number of units	Net capacity MWe	TWh	% of total
World	**443**	**393,068**	**52**	**54,515**	**2,657.2**	**10.4**
Argentina	3	1,641	1	25	7.9	5.9
Armenia	1	423	-	-	2.0	27.8
Bangladesh	-	-	2	2,160	-	-
Belarus	1	1,110	1	1,110	-	-
Belgium	7	5,930	-	-	41.3	47.6
Brazil	2	1,884	1	1,340	16.1	2.7
Bulgaria	2	2,006	-	-	16.5	37.5
Canada	19	13,554	-	-	95.4	14.9
China	50	47,518	14	13,175	348.3	4.9
Czechia	6	3,932	-	-	28.6	35.2
Finland	4	2,794	1	1,600	22.9	34.7
France	56	61,370	1	1,630	379.5	70.6
Germany	6	8,113	-	-	71.1	12.2
Hungary	4	1,902	-	-	15.4	49.2
India	23	6,885	6	4,194	40.7	3.2
Iran	1	915	1	974	5.9	1.8
Japan	33	31,679	2	2,653	65.6	7.5
Korea	24	23,150	4	5,360	138.6	26.2
Mexico	2	1,552	-	-	10.8	4.5
Netherlands	1	482	-	-	3.7	3.1
Pakistan	6	2,332	1	1,014	9.0	6.6
Romania	2	1,300	-	-	10.3	18.5
Russia	38	28,578	3	3,459	208.8	19.7
Slovakia	4	1,837	2	880	15.3	53.9
Slovenia	1	688	-	-	5.5	37.0
South Africa	2	1,860	-	-	13.6	6.7
Spain	7	7,121	-	-	55.8	21.4
Sweden	6	6,859	-	-	55.8	34.0
Switzerland	4	2,960	-	-	16.5	23.9
Turkey	-	-	3	3,342	-	-
Taiwan	4	3,844	-	-	31.1	13.4
Ukraine	15	13,107	2	2,070	83.0	53.9
United Arab Emirates	1	1,345	3	4,035	-	-
United Kingdom	15	8,923	2	3,260	51.0	15.6
United States of America	93	95,523	2	2,234	809.4	19.7

Source: IAEA/PRIS, 2021 [21]
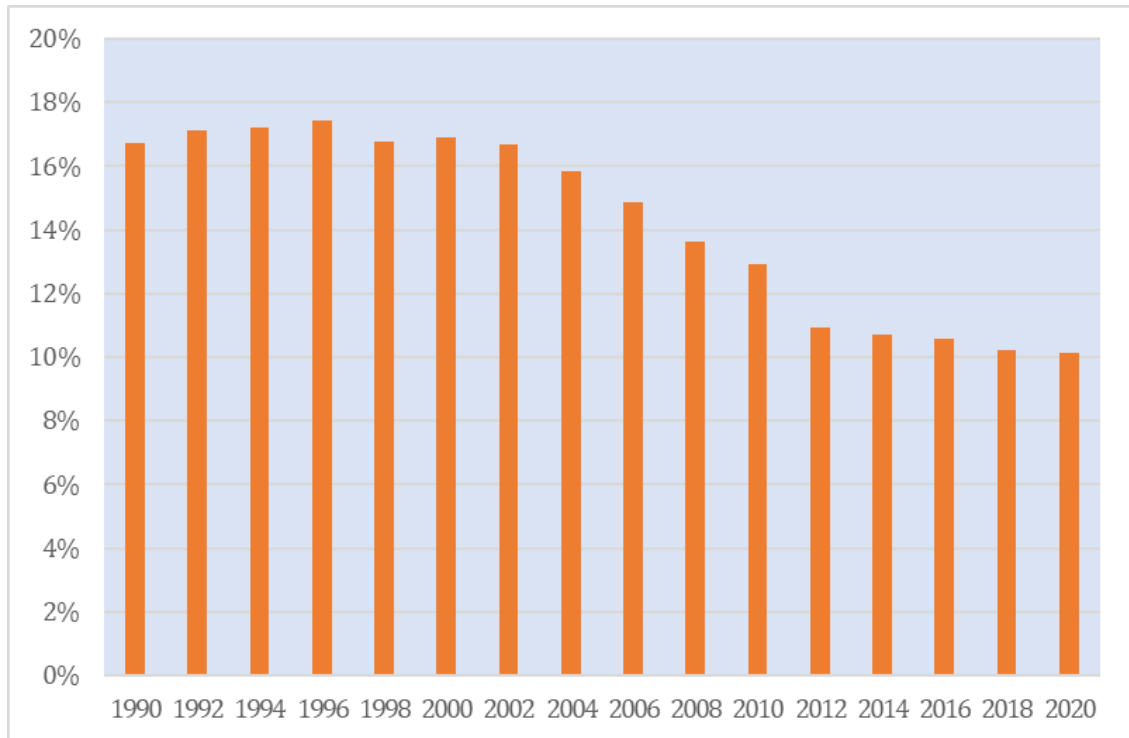
Figure 1. Share of nuclear power production.
Source: Our World in Data, 2021 [22]
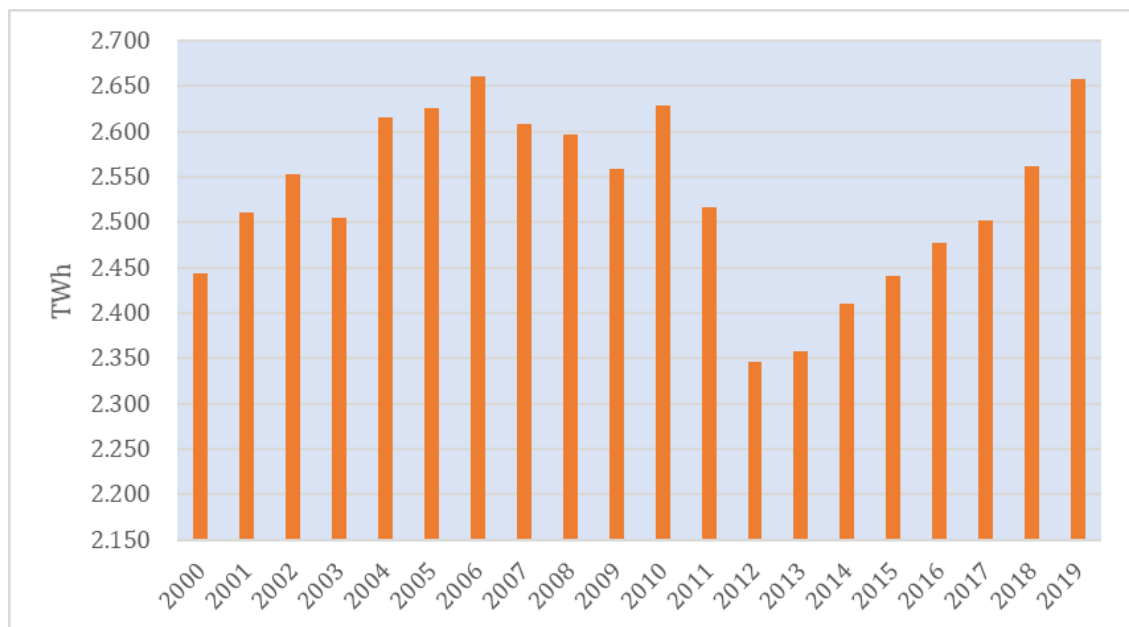
Figure 2. World nuclear power supplied.
Source: IAEA/PRIS, 2021 [23]
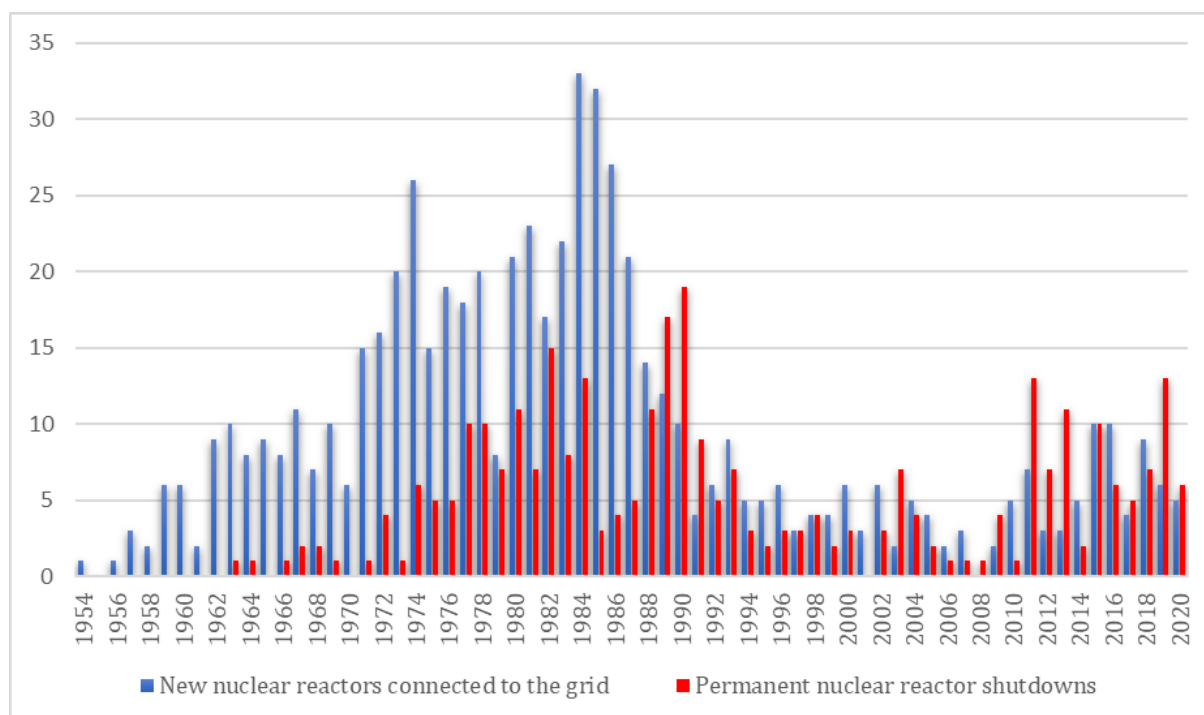
Figure 3. Comparison between reactors newly connected to the network and
reactors permanently shut down.
Source: IAEA/PRIS, 2021 [23]

In the absence of major construction programs, the average age of nuclear reactors operating in the world continued to rise, reaching 30.7 years by mid-2020. A total of 270 reactors, two-thirds of the world's total reactors in operation, have been in operation for more than 30 years, including 81 reactors (20% of the total) that have been in operation for more than 40 years [24].

4.2. Prospective evolution of nuclear energy

Currently, 52 nuclear reactors are under construction, of which 14 in China, with a net capacity of 54,515 MWe. Especially due to the high costs, many of these reactors have construction delays, in some cases the delays being very long. For instance, the construction on the Bushehr-2 reactor in Iran began in 1976, that is 45 years ago. Construction was suspended for about four decades and resumed in 2019 [24].

According to IAEA projections (2020), by 2050 the nuclear power generation capacity will be about 7% lower for the low variant and about 80% higher for the high variant (Table 2). In both cases, the share of nuclear energy in the total power generation capacity is expected to decrease. Regarding the power production of nuclear power plants, an increase between 10% (in the case of the low variant) and 100% (in the case of the high variant) is estimated by 2050.

Table 2. Perspective evolution of nuclear power generation and production capacity.

	2019	2030		2040		2050	
		Low	High	Low	High	Low	High
Nuclear Electrical Generating Capacity (GWe)	392	369	475	349	622	363	715
Nuclear as % of Electrical Capacity	5.3%	3.4%	4.4%	2.6%	4.7%	2.3%	4.5%
Nuclear Electrical Production (TWh)	2,657	2,872	3,682	2,774	4,933	2,929	5,762
Nuclear as % of Electricity Production	10.4%	8.2%	10.5%	6.4%	11.4%	5.7%	11.2%

Source: International Atomic Energy Agency, 2020 [4]

5. DISCUSSIONS

Discussions on nuclear energy must balance, on the one hand, its contribution to mitigating climate change and air pollution and, on the other hand, the risks to the environment and human health associated with nuclear accidents or radioactive waste. A first argument in favor of nuclear energy is its contribution to the decarbonisation of the atmosphere. However, as with the main renewable energy

sources (wind, solar), nuclear energy produces emissions indirectly. Taking into account the entire life cycle, from uranium mining and fuel fabrication to the construction of the nuclear power plant and the storage of spent fuel, nuclear energy releases certain amounts of greenhouse gases into the atmosphere, which vary, depending on various factors, between 2 tonnes of CO_2/GWh equivalent and 130 tonnes of CO_2/GWh equivalent [25]. Thus, the greenhouse gas emissions of nuclear power plants are among the lowest when it comes to power production (Table 3). Many other studies [26-28] confirmed that greenhouse gas emissions associated with nuclear energy are low.

Table 3. Lifecycle GHG emissions for the different power generation methods (tonnes CO_2e/GWh).

Electricity generation methods	Mean	Low	High
Lignite	1,054	790	1,372
Coal	888	756	1,310
Oil	733	547	935
Natural Gas	499	362	891
Solar PV	85	13	731
Biomass	45	10	101
Nuclear	29	2	130
Hydroelectric	26	2	237
Wind	26	6	124

Source: World Nuclear Association, 2011 [25]

At present, however, the contribution of nuclear energy to climate change mitigation is quite limited, reducing by only 2-3% the total global GHG emissions annually. According to the announced plans for new nuclear construction and lifetime extensions, this value would decline further in the coming decades [20].

Secondly, nuclear power plants can operate without interruption. Compared to some renewable energy sources (wind, solar or even hydropower), which provide electricity intermittently, depending on wind speed, cloudiness or water flow, nuclear power plants can operate uninterrupted for a long time. This feature makes nuclear energy a viable alternative to replacing coal-fired power plants or other fossil fuels. Another advantage over wind or solar power plants is the small space occupied. According to U.S. Department of Energy (quoted by EnergySage, 2021) [29], a typical nuclear facility that produces 1,000 MW of electricity occupies about 1km^2 of land while a solar farm that produces the same amount of energy requires an area 75 times larger, and a wind farm 360 times larger. This is a very important aspect, especially for agriculture, if the land is fertile.

On the other hand, the construction of nuclear power plants is extremely expensive, and costs have been rising in recent years. There are also high costs with waste management. The most recent estimates of overnight construction costs of nuclear reactors are between 3,000 and 6,000 USD/kW, being slightly lower in non-OECD countries [8]. Due to the very high costs, the construction of many reactors has been suspended or much delayed. Thus, the prospects for the expansion of nuclear energy remain low in many parts of the world.

The most worrying aspect of nuclear power plants is the risk of a nuclear accident, such as those at Three Mile Island (1979), Chernobyl (1986) and Fukushima (2011). Despite the safety measures applied to these nuclear power plants, various factors have led to nuclear accidents with a major impact on the population (deaths and mass evacuations), the economy and the natural environment. In the case of the Chernobyl nuclear accident, although the number of deaths directly attributed to radiation exposure was 31 people, those who lost their lives as a result of the long-term effects of radiation in the region could exceed 4,000 [30]. Also, the contaminated land area was estimated at about 150 thousand km^2, and the number of evacuees exceeded 200 thousand [31].

Another negative effect of nuclear energy is the radioactive waste it produces, which is hazardous to human health and the environment, and for which a long-term safe storage solution has not yet been identified. The waste is sealed in concrete containers and stored in the ground. The radioactivity of waste will decrease, but this process can take a long time. According to Corkhill and Hyatt [32], because nuclear fission generates a lot of energy from a very small amount of fuel, the volume of waste produced so far globally is relatively small. Radioactive waste, which is of several types depending on the degree of radioactivity (very low-level waste/VLLW, low-level/LLW, intermediate-level/ILV, high-level/HLW), includes both radioactive materials and contaminated ones (Table 4). The most radioactive waste (HLW), and consequently the most hazardous, represents less than 2% of the volume, but 95% of the total radioactivity of the waste [33].

Table 4. Nuclear waste inventory.

	Radioactive waste in storage (m³)		Total (m³)	Radioactive waste in disposal (m³)		Total (m³)
	Solid	Liquid		Solid	Liquid	
VLLW	2,356,000	-	2,356,000	7,906,000	-	7,906,000
LLW	3,479,000	53,332,000	56,811,000	20,451,000	39,584,000	60,035,000
ILW	460,000	6,253,000	6,713,000	107,000	8,628,000	8,735,000
HLW	22,000	2,786,000	2,808,000	0	68,000	68,000
Total (m³)	6,317,000	62,371,000	68,688,000	28,464,000	48,280,000	76,744,000

Source: International Atomic Energy Agency, 2018 [33]

As far as the uranium is concerned, in the last decade, uranium production was over 53,000 tonnes per year (Figure 4), with a maximum of 62,379 tonnes in 2016, with the largest producers being Kazakhstan, Canada, Australia and Namibia. Kazakhstan is the largest producer, supplying over 41% of global uranium production in 2019 [34].
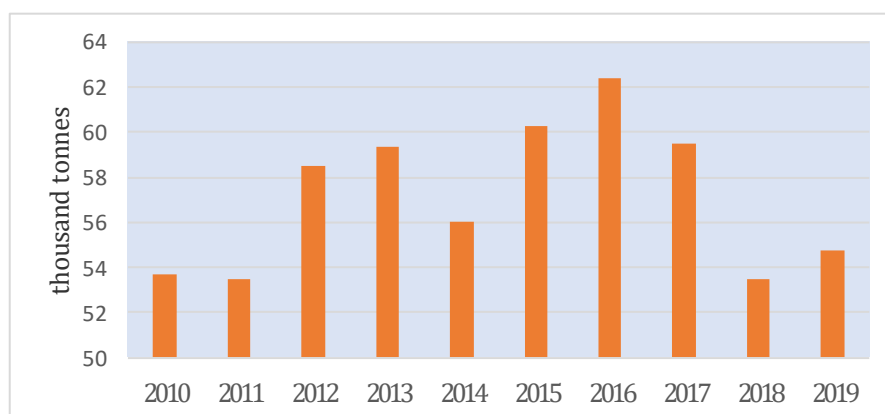
Figure 4. World uranium production in the period 2010-2019.
Source: World Nuclear Association (2020) [34]

Taking into account the estimates of uranium deposits (about 8 million tonnes), at current consumption, they would be available for more than 80 years. Any increase in installed nuclear capacity also means an increase in uranium ore mining to ensure the supply of fuel for nuclear power plants. In 2019, uranium production accounted for 81% of world demand [34].

In some cases, uranium mining may drag on due to public opposition. One such example is Greenland, where the government has announced that it is preparing a law that will ban uranium mining and stop the development of the Kvanefjeld mine, one of the largest rare earth deposits in the world [35].

6. CONCLUSIONS

The prospect of severe effects of climate change on the environment requires an urgent shift to a low-emission greenhouse gas economy. This goal can be achieved by replacing fossil fuels in energy production with other sources that do not have CO_2 emissions or which have reduced emissions. Because fossil fuels are a major component of energy systems in most countries of the world, such an approach could significantly affect electricity supply. Although the share of renewable energy has increased significantly in recent decades, the possibility of these energy sources, such as hydropower, wind or solar energy, replacing fossil fuels is not at all certain, especially in the context of increasing global electricity consumption, including by expanding electromobility.

As for the contribution of nuclear energy to climate change mitigation, at least in the short and medium term, it will not be significant. Current estimates show that in the next two decades, nuclear energy will not contribute more than 3% per year of total global greenhouse gas emissions. The long-term development of nuclear energy also depends on the supply of uranium deposits, which are a depletable resource, or the development of technologies based on another radioactive fuel. Thorium and molten salt reactors or other technologies are not viable solutions in the short term. Current nuclear reactors, no matter how safe, present a certain risk for serious accidents, with considerable emissions of radioactive materials. This is the case of the Fukushima nuclear accident.

Other restrictive factors in the development of nuclear energy are the very high costs of nuclear power plants, which the developing countries cannot bear, as well as the risks associated with radioactive

waste. In fact, from the earliest stages of development, nuclear energy has been viewed with concern by public opinion, and nuclear accidents have intensified these concerns. This is also the reason why in some countries such as Germany or Switzerland several nuclear power plants have been shut down.

As the risks to humanity due to climate change are very high, all energy sources with low greenhouse gas emissions should be considered. We must not exclude nuclear energy from this equation. In the long run, this source of energy could become very important if, as a result of research efforts, safe solutions are found for the production of energy (safe reactors) and the storage of radioactive waste.

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Critical appraisal of an example of best practice in urban sustainability

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Abstract: Urban centers are key to achieving the global goals of sustainability. Urban sustainability entails having thriving cities that fulfill their needs without impacting the long-term sustainability of the ecosystem. Achieving urban sustainability is, therefore, an important goal as sustainable urban centers portend numerous benefits to the ecosystem. This paper critically appraises Singapore as a best practice in Urban Sustainability. It reviews the literature on urban sustainability and discusses the high and low-performing sectors in Singapore. It finds a gap in contemporary urban sustainability metrics whereby most of the globally acclaimed Urban Sustainability Indicators do not measure universal design for inclusivity as an aspect of urban sustainability. This study, therefore, includes it as a measure and appraises it. High-performing areas highlighted in this study comprise education; universal design for inclusivity; transportation; people-centered approach; water and energy management; healthcare, safety and security; and food security. Areas for improvement comprise self-sufficiency in food production, urban heat island effect, and public participation and social welfare. The aim is to serve as a lesson to cities worldwide as they work towards achieving urban sustainability and provide key information to policymakers as they seek to improve the sustainability of their urban environment.

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1. INTRODUCTION

In the face of the rising climate and environmental crisis today, urban sustainability has emerged as a very important discourse. This is because urban centers are a major source of pollution that has contributed to the present-day climate and environmental crisis. Half of the global population currently live in urban areas with this number set to rise to 70% by 2050 [1]. Achieving overall global sustainability is, therefore, highly dependent on improving and achieving sustainability of the urban environment [2]. Urban sustainability entails having thriving cities that fulfill its need without impacting the long-term sustainability of the ecosystem. Many urban centers are striving to improve their sustainability while many others have also achieved remarkable improvements in urban sustainability. Notable among them are cities of previously underdeveloped countries like Singapore, the focus of this study, that is now a shining model of urban sustainability.

Singapore is a city-state with a population of 5.6 million people and a landmass of about 722 square kilometers currently (Figure 1), having increased its landmass from about 580 square kilometers at independence in 1965 through land reclamation efforts [3,4]. It was under British colonial occupation for 150 years [5]. Since its independence, it has witnessed a meteoric rise from being an underdeveloped third-world country to a first-world country. Today, Singapore is a gold standard in the sphere of urban

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development and sustainability [6–8], with a model that has become widely known as the 'Singapore model' [6].

Figure 1. Map of Singapore.
Source: Ontheworldmap.com

Even though some other places/cities have transformed over the years to emerge good examples of urban sustainability, for example, Seoul, Korea, which has also significantly improved its urban conditions and sustainability since its early days as an underdeveloped country in the 1960s [9,10]; Singapore stands out for reasons that will be discussed further in subsequent sections of this work. Also, Korea is not fully urbanized or metropolitan [11,12], like Singapore. Singapore's status as a fully urbanized city-state, therefore, gives it more capital as a more holistic urban model which contributes to its selection for study in this work, especially in the urban sustainability discourse. In this study, what makes Singapore a model and the areas that need improvement are highlighted. This will serve as a lesson for urban areas seeking to improve sustainability. Highlighting the low-performing areas in Singapore also provides important information to other nations that can enable them to avoid similar issues in the long run and to Singapore as well.

The following sections of this paper discuss the concept of sustainability and urban sustainability which then segues into the section on Urban Sustainability Indicators. The research method and best example selection criteria follow where I discuss/justify the reasoning behind the selection of Singapore. The next section discusses the best practice example of urban sustainability, the strengths of the Singapore model are discussed, and then the weaknesses/areas of improvement. The role of governance and urban planning in Singapore's success is discussed followed by the conclusion section that discusses the possibilities of the replicability of the Singapore model.

2. THE CONCEPT OF SUSTAINABILITY AND URBAN SUSTAINABILITY

Sustainability has emerged as an important discourse in the face of the many problems facing humanity. Even though it became a buzzing topic in the 70s [12], it is not a new concept. Indigenous cultures have always incorporated the tenets of sustainability in their ways of living and had a reverence for the earth treating it with much more respect than is done today [13,14]. There were norms practiced during hunting and agriculture to ensure stock remained for the next generations which is no longer the case today [15–17].

Development and unprecedented environmental pollution, which birthed the environmental movement of the 70s, brought more attention to environmental problems. While there are many definitions of sustainability [18], a common understanding is the need for the current generation to factor in the needs of the future generation in the consumption of resources for development and to protect and preserve the environment. Sustainability is a development goal with integrated social, economic, and environmental dimensions, which needs to be taken into account while meeting our current needs to ensure the ability of future generations to meet theirs is not compromised [19]. Humans face the growing challenge of managing the increased pressure on the environment on which they depend. Such pressures manifest in the form of pollution, resource depletion, mitigation, and adaptation to climate change, etc [20].

Urban sustainability is the concept of having vibrant cities that enhance the quality of life of residents while ensuring the availability of resources for future generations to fulfill their own needs [21]. It is the notion that a city can exist and be run with the least ecological footprint possible and the least impact on climate change. A sustainable city is characterized by compactness, dense mixed-use settlements that promote efficiency, greater innovation and production capacity, and minimal environmental impact [22–25]. In the literature, a sustainable city is characterized by healthy and secure urban space for people and nature to blossom, affordable housing, safety and security, good healthcare, education, jobs, use of clean energy, and a good public transportation system with dedicated cycling paths and active mobility.
Well-being, reduced environmental impact, and protection of ecosystems are the hallmarks of a sustainable city. Environmental and physical assets are preserved for future generations while the city's competitiveness is enhanced in a sustainable city. Good local governance and management are practiced to execute urban duties and there is room for citizen participation [26]. While cities are an agglomeration of people and activities and use up a lot of resources, they also produce a significant amount of waste which impacts significantly on the wider urban environment. Opportunities abound for economies of scale and more efficient use of natural resources in cities, for instance, compact settlements use less energy than dispersed ones.

The design and management of cities is the key to achieving urban sustainability and there is a wide consensus among various stakeholders on urban sustainability being central to achieving sustainable development in general [23,27–30]. In this study, I carry out an appraisal of Singapore highlighting the high and low-performance areas to provide an analysis that other cities as well the study city can learn from to improve their urban environment. The overall goal is to contribute to the knowledge needed to achieve global sustainable development and sustainability.

3. URBAN SUSTAINABILITY INDICATORS

Urban Sustainability Indicators (USIs) are tools for measuring or ascertaining the sustainability ranking or rating, status, and conditions of an urban area using a mix of factors [31,32]. USIs help in conducting appraisals of cities and provide an overview of areas of strength and improvement. They aim to improve and advance sustainability [33]. As sustainable development anchors on three interconnected pillars- social, economic, and environmental, it is common practice to have sustainability indicators focusing on these three main aspects of sustainability [34,35].

There are currently numerous USIs developed by organizations, universities, countries, and researchers based on various frameworks, principles, categories, indicators, etc [36,37]. Among these sustainability indicators, there is no common agreement on what makes up a category, index, or theme [38]. As the general interpretations of sustainability differ, so also do the features which form the basis of

the design of the various sustainability indicator tools in use today [39]. There have been also arguments that no one knows exactly what sustainable settlements resemble and that only a few places have incorporated the environmental, social, and economic aspects of sustainability in their entire societal fabric [40]. While there are many schools of thought on sustainability and sustainable development, most notably from the beginning of the environmental movement of the 60s and 70s [41,42], the three bottom lines of sustainability comprising the social, economic, and environmental as outlined in the Brundtland [19] report, is the understanding of sustainability that has gained the most traction and acceptance in the mainstream[43].

In brief, there is no single blueprint or outline as to what constitutes indicators of urban sustainability, but there is a wider consensus that there are different pathways to attaining urban sustainability according to the needs and priorities of a community [44–47]. This then implies a uniform USI will be inadequate to apply across all places [40]. Besides, indicators as a set of tools are constantly evolving and what may be relevant today may no longer be relevant tomorrow. In this work, therefore, I focus on the various sectors indicators set out to measure as opposed to using a set of USI to appraise the selected best practice.

4. RESEARCH METHOD AND BEST PRACTICE SELECTION CRITERIA

This work is an in-depth review that purposefully adopts Singapore as its best practice of urban sustainability based on its consistent positive ranking in various sustainability indexes and studies over the years [48–50]. Singapore was chosen because of its spectacular and noteworthy achievements in its development as a country, and the urban environment. Singapore's selection is aimed to serve as a practical example and inspiration to other countries as a model of what is achievable in terms of growth and urban sustainability, and the numerous improvement possibilities and paths especially as Singapore was not too long ago classed as a third-world country. Today, it has become a fully developed nation. Both developing and developed countries are drawing lessons from Singapore to improve their urban environment including its former colonizer, Britain [51–54].

Dizdaroglu [37] surmises that factors that guide and determine a sustainable urban form comprise sustainable transportation; design; renewable energy and waste management; environmental restoration and protection; economic development; healthy urban planning; and social equity and environmental justice. Ahvenniemi, Huovila [35] studied, refined, and built upon Neirotti, De Marco [55]'s work where various USIs were studied to find out their main focus areas. They subsequently came up with the following as core aspects of sustainable cities: Built Environment; Natural Environment; Water and Waste Management; Energy; Transport; Economy; Well-being, Health and Safety; Education; ICT; Governance and Citizen Engagement. In this work, I further condense Ahvenniemi, Huovila [35]'s core areas of urban sustainability and come up with these core areas which I appraise: education, universal design for inclusivity, transportation, people-centered approach, water, and energy management, healthcare, safety, and security, food security, urban heat island effect, public participation, and social welfare. However, Rebernik, Szajczyk [56] note that despite the myriad of urban sustainability indicators in use today, there are still gaps as measures for inclusion are missing. This key gap was observed and affirmed in this work after a review of 14 USIs where none measured or focused on Universal Design for Inclusivity (see appendix 1). Therefore, it is included as one of the aspects of urban sustainability appraised in this study of a best practice of urban sustainability.

Universal Design refers to the design of spaces and products that facilitate use by everyone to the fullest extent possible [57]. Universal design is aimed at fostering inclusivity. It entails factoring in the different needs of citizens in the design of the city, understanding different accessibility needs and challenges, and ensuring that there are space and opportunities for everyone to blossom, contribute to the city and achieve their potential. It is not just about designing for people living with disabilities [58,59], even as an estimated 15% of the global population live with a disability [60,61]. Incorporating Universal design enhances accessibility and is a practical affirmation that everyone belongs in the city. Accessibility is not limited to physical objects and promotes social participation in the city [62]. It is important to note that even people with no disabilities will have varying abilities as the years pass, therefore, universal

design is for the benefit of everyone [63]. The adoption of various USIs and growing attention to social sustainability is evidence of efforts in recent years to make the city more inclusive, but the lack of attention to Universal design in USIs indicates a shortcoming. Governance is viewed in this work, not as an index/sector but as the fabric that weaves together the different sectors and the most important enabling factor for urban sustainability.

5. BEST PRACTICE EXAMPLE OF URBAN SUSTAINABILITY

Addressing urban sustainability has become a global concern because of the need to support the rising global population while providing a safe, clean, and environmentally sustainable place for life to function [64]. In urban planning and economic development circles, a term known as the 'Singapore model' has emerged which is characterized by the efficient deployment of resources to achieve excellence, growth, and sustainability [6]. Singapore is a nation carefully planned from its birth for long-term sustainability with the understanding that how well a city and the living environment are planned and designed matters [65]. Sustainability was at the core of the country's design far back in the 1960s even before sustainability became a global concern [66]. Singapore just like other countries face urban challenges, but it has succeeded in turning these problems into opportunities and becoming a model of urban sustainability [67]. In this paper, the use of the term 'Singapore model' will refer to its relevance in urban planning and sustainability only.

5.1. Strengths of the Singapore model

All the hallmarks of what makes a sustainable place are present in the Singapore model [68]. Singapore as a model of urban sustainability has a lot of strengths but for this paper, we will be focusing on the key areas of education; universal design for inclusivity; transportation; people-centered approach; water and energy management; healthcare, safety and security; food security; urban heat island effect; public participation and social welfare.

5.1.1. Education

Singapore understands the centrality of education to its long-term sustainability and has backed this belief by concrete actions. It has a robust compulsory public education system in place with a high literacy rate of 97% [69,70]. The government aimed to have the best and brightest citizens and has invested substantially and intensively in the education sector over the years knowing that its lack of endowment in natural resources can be overcome by innovative citizens [71,72]. Education (both formal and informal) is key to teaching and ensuring sustainability and plays an important role in producing environmentally aware future generations. Sustainability and climate change education forms part of the school curriculum [73]. Singapore ranks among the global best performers in educational excellence and has had consistent high performance in examinations like Programme for International Student Assessment (PISA) over the years [74,75]. This excellence has been attributed to good school leadership, teacher quality, educational reforms, and system attributes [74,76]. Students at all levels are actively encouraged to participate in various forms of research which ingrains in them the spirit of citizen science, for example, the National Science Experiment, a joint initiative by the Ministry of Education, Science Centre Singapore, and National Research Foundation of Singapore was a research initiative in citizen science that involved students at all educational levels. Students designed experiments on sustainable urban features using wearable Internet of Things (IoT) devices that collected climate and environmental data to inform and improve spheres of urban living including physical activity and carbon emissions and transportation modes [77].

5.1.2. Universal Design for Inclusivity

At the core of the universal design is the understanding that there are special needs and generic needs, and this is factored in while designing and building to foster inclusiveness [78]. Residential town planning takes into account the architecture, physical layout, accessibility of public places like hospitals, schools, shops, parks, offices, etc. Since 2006, Singapore's built environment has been complying with the universal design and accessibility code which ensures accessibility for everyone. Even though buildings

constructed before 1990 are not bound by this code, the government has sought to make every building accessible through active consultations, engagements, and incentives of up to 80% of upgrade costs are offered to homeowners to ensure every house meets up to this standard enhancing accessibility for all (54). Smart technologies that encourage community access for the aged and people with disabilities are widely deployed in Singapore. For example, the Green Man+ initiative enables the companion of the old or people with disabilities to tap a concession card on a reader that gives them more time to cross the road at crosswalks [79]. Housing is affordable and available for all ranging from high-rise buildings to private properties and up to 80% of the population live in public housing. Public satisfaction with housing has remained high over the years at 90% [78]. Singapore understands that by 2050, the majority of its population will age and has factored that into physical planning to ensure the needs of everyone are met. Building code reviews and standards aimed at establishing suitable homes for all Singaporeans to thrive and age successfully while maintaining independence have been effected and backed by relevant legal instruments and policies [78]. Singapore's moniker is 'city in a garden'. There is ubiquitous lush greenery which can be found from rooftops to the streetscape to parks within 400 m of most homes. Parks are designed to enhance leisure and to be visually appealing. It is no gainsaying that efforts have been made to ensure the city is truly inclusive.

5.1.3. Transportation

The transportation sector is a big source of pollution emission that impacts urban sustainability. Achieving urban sustainability and improving liveability depends largely on an efficient public transportation system [80]. Singapore promotes public transport as the most effective and environmentally-friendly way to get around. It is a pioneer in integrated sustainable transport policy and a leader in mobility management [72].

Technology has been effectively deployed to solve traffic problems and provide travel information in real-time. Integrated land use and transportation planning with effective policies as well as a constant improvement over the years, ensured this good transport system. Bike-sharing services which are a zero-carbon means of transport are prevalent in Singapore [81]. Walking is also actively encouraged with its attendant positive environmental and health benefits [82]. Residents are favorably disposed towards active mobility and report satisfaction with the walking infrastructure in place [83]. Homes and amenities are built around major transport hubs to facilitate easier access without needing cars. It was expected by 2020 that the number of rail lines will double to maintain efficiency and cater to the increasing population as well as an increased number of public transit users [84]. As part of efforts to reduce congestion from the traffic flowing in and out of the city center which also has an environmental impact, regional centers were introduced to bring jobs closer to home Effective Government policies have reduced car dependency, encouraged public transportation, and reduced traffic congestion [85]. Globally, Singapore perhaps has the most technologically sophisticated and comprehensive urban Electronic Road Pricing system which is set to be replaced soon by an even more advanced satellite-based system which will make them one of the first countries to roll out the technology [86,87]. Singapore remains a pioneer in adopting new and innovative technologies to explore new frontiers in the transportation sector.

5.1.4. People-centered approach and conservation

To Singapore, sustainable development is not just about preserving the environment or building infrastructure. It is about putting the community first in every developmental decision, building a close-knit community, preserving a unique identity and local character by preserving and conserving the heritage. Citizen participation is enhanced by incorporating big data in urban design where the citizens willingly contribute to the data [77]. The country's ongoing 'Smart Nation' initiative' is people-centric as its success is dependent on citizen participation and also provides another chance for participatory and bottom-up governance [88].

Despite having lost up to 90% of its natural cover, Singapore is committed to biodiversity conservation and has several initiatives, for example, the Singapore Green Plan among others to conserve and sustain what is left of its natural landscape. Laws like the National Parks Act and Park and Trees Act protect nature reserves with the National Parks Board charged with management [50,89,90]. There are

protected nature reserves to conserve tropical rainforests and coastal mangroves despite the desperate need for land. Because Singapore's rapid growth and development mostly occurred at the detriment of natural habitats and loss of important historical buildings [4,91], conservation has been intensified and efforts like the Singapore conservation program have preserved at least 7,000 structures and buildings to date. Planners have often found creative ways of ensuring the viability and relevance of old buildings which is not an easy task with the people involved at every stage. The conservation efforts were not always the case as land was deemed more critical for development than conservation [92]. The shift in position is also a lesson on how unfavorable or poor situations can change in the face of evidence that says otherwise.

5.1.5. Water and Energy Management

Singapore's population to landmass ratio and limited natural water sources makes it a water-stressed country but yet, its water and wastewater management is one of the global best practices [93]. 30% of the country's water demand is met through the recycling of water. Today, it is a pioneer hydro hub, a status built off the success of its NEWater program [94]. The Active, Beautiful, Clean (ABC) Waters program launched in 2006 integrates reservoirs and waterways with the neighboring environment achieving multi-purposes of aesthetics, water quality improvement, and runoff management [95]. Rainwater is collected and stored because freshwater is a scarce resource. Water is recycled and seawater desalinated to provide for water needs. There is 100% recycling of water and wide public acceptance of reclaimed drinking water as well as positive household water conservation attitudes [96]. The country understands its vulnerability to the impact of climate change and has set out plans to improve water conservation, energy intensity, and recycling [97]. It has pledged to reduce greenhouse emissions by 16% by 2020. There are also measures to enhance drainage networks, promote resilience of the water supply system, coastal and natural biodiversity preservation. In its early days in far back 1979, building regulations were enacted to control external heat gain of air-conditioned buildings and regulate the overall thermal transfer value of new constructions. Existing buildings that do not meet the regulated values were surcharged but expenses incurred during retrofitting could be written off in taxes [98]. The country is very keen on using less carbon-intensive fossil fuels and improving energy efficiency. The government is also implementing a range of policies to achieve energy independence. Energy use is not subsidized and fuel and electricity prices are regulated by market forces. Stiff penalties apply for inefficient or excessive use of energy [99]. Singapore sees itself as a living lab and does not shy away from constantly seeking new ways to solve its problems.

5.1.6. Healthcare, Safety, and Security

Singapore ranked second in the 2017 and 2019 safe cities index [100,101]. The report studied the areas of health security, personal safety, digital security, and infrastructure safety. It ranked highest in personal safety which looked at how safe people are from violence and theft. However, there is still room for improvement in the area of safety and quality of the public environment as noted by Stauskis [102]. It also ranked first in the quality of its healthcare and accessibility for all. Digital technologies are infused in many aspects of life in Singapore with residents embracing digital technologies without fear of identity theft or privacy violations because of the security measures in place. The government adopts a holistic and proactive stance to cybersecurity, regularly reviewing and improving measures to improve the resiliency of the smart technologies in use [103]. Singapore has an excellent healthcare system that has been feted as the best in the world both in terms of service delivery and outcomes [104].

However, concerns over rising costs in recent years have led to new measures by the government geared at reducing individual out-of-pocket expenses, expanding coverage, and providing advice on necessary tests and procedures [104,105]. There is a high life expectancy of 83 years and low infant mortality of 2.4 per 1000 live births [106]. Singapore has a robust mix of public and private healthcare systems whereby private physicians handle up to 80% of primary care and 80% of in-patient care is provided by public hospitals which provide subsidized care [107]. Singapore understood the looming challenge posed by its aging population and put in place the 2020 healthcare Master Plan to improve all aspects of healthcare for its population [106]. Guidelines for healthcare professionals in line with the

latest clinical guidelines are provided and regularly updated on the Ministry of Health's website [106]. The health financing scheme is run efficiently with contributions from both the public and private healthcare sectors enabling excellent outcomes [104]. Tele-health services have further reduced the cost of healthcare promoting accessibility for all. Healthcare, safety, and security are areas Singapore performs excellently in.

5.1.7. Food Security

Even though Singapore imports about 90% of its food, it is ranked very highly in the global food security index because it has succeeded in using policies to become a food secure nation by making its food supply system robust [108]. Its strategies like the diversification of supply sources, the food fund, and enhancing food imports have earned it this top spot. However, it understands that its dependence on external sources is subject to forces it has no control over and is intensifying its urban food growing program to achieve self-reliance in food production [109]. To shore up food security, it has some international food production initiatives that allow for portions of produce to be shipped back to Singapore like the Jilin province China agri-food project [110]. A focus on technology-enabled, small-spaced urban farming supplies 10% of its food needs today with a plan to improve self-sufficiency to 30% by 2030 through its 'Singapore Food Story' program [111].

6. WEAKNESSES OF THE SINGAPORE MODEL

Despite the Singapore model's strengths, achievements, excellence, and high quality of life, there are still areas for improvement for more sustainable urban living and outcomes. These areas of weakness and improvement are discussed below.

6.1. Self-Sufficiency in Food Production/Food Security

Despite Singapore's high ranking in food security, a weakness exists because it is not yet self-sufficient in food production. The country's small landmass of 722 square kilometers with only about 600 hectares available for agriculture makes it hard to produce enough food to feed its people. 90% of food is imported from over 170 countries. Such dependence on foreign sources impacts its resiliency making it vulnerable in the key area of food security and raises sustainability concerns [112,113]. Global events further expose cracks in the system, for example, the post-2007 global food crisis and the Covid I9 pandemic [111,112,114]. To mitigate this problem of food production, urban farming is becoming more intensive with roof-top gardening taking off on bigger scales and agrotechnology parks being established to boost local food supply. Singapore's urbanization has also had opportunity costs that manifest in food production capacity decline. For instance, in 1965, farmlands occupied 25% of land resulting in partial self-sufficiency in food production but by 2014, farmlands made up only 1% of land due to urbanization [114]. Despite Singapore's commitment and deployment of innovative methods like vertical farming, insect farming, meat cultivation, etc, challenges still abound and widespread deployment and acceptance are yet to be achieved [114]. The success and long-term sustainability of these innovations are yet to be ascertained given the novelty of these technologies.

6.2. Urban Heat Island Effect

Urban Heat Island (UHI) is a phenomenon whereby built-up high-density urban areas have higher temperatures than surrounding less urbanized areas [115]. Due to Singapore's limited land size, arguments could be made that the city had no choice but to expand/grow upwards. It currently has the least intact original forest area in comparison to its neighboring countries [115]. Being a tropical country with a very dense urban form, the effects of climate change has led to an increased UHI effect [116]. UHI negatively impacts liveability and poses health concerns like heat stroke, cardiovascular stress, etc. More energy is consumed to maintain ambient temperature with attendant feedback climate impacts [116]. The temperature is set to rise more in the coming years as a result of climate change. This necessitates strong mitigation efforts. While the green roofs widely used in Singapore are helping to mitigate UHI impacts and

research endeavours like the 'cooling Singapore' is on-going, more work and action is still deemed necessary.

6.3. Public Participation and Social Welfare

Numerous studies have critiqued Singapore's mostly top-down management style [50], and labeled it semi-authoritarian [117]. There are also critiques of insufficient public engagement but a gradual change has been observed as the public is now more involved in issues like Environmental Impact Assessments where there is a window of 20 working days to make contributions [4]. Despite the general high satisfaction rate of the citizenry towards governance and high happiness levels and quality of life [118,119], a case could be made for a more participative and inclusive planning process as this has proven to yield even more satisfaction. The public expectation for more inclusive participation in governance is also on the rise [120]. There is a need to pay more attention in this area as urban sustainability also entails having engaged citizens. There are still pockets of poverty and inequality has risen [121–123]. The welfare system is not able to sufficiently meet the basic needs of the poor who still battle with feeding and getting adequate healthcare [124,125]. These gaps in the welfare system need to be addressed.

7. GOVERNANCE, THE BINDING AND SUCCESS FACTOR

Innovative and progressive urban planning and governance were wholly integral to the emergence of Singapore as a best practice of sustainability. The Urban Redevelopment Authority (URA) is the central body in charge of planning. It is a government institution that is 100% funded by the government. Their work is built on the foundations of integrated master planning and development. Integrated planning in Singapore entails planning for the very long term, at times as far as a century into the future while building in scalability. Concept Plans and Master Plans guide Singapore's urban planning. The in-built scalability ensures that the plans can be reviewed as needed because change is a constant. From the early days of the country's growth, these plans have been systematically reviewed to meet the changing needs while maintaining a balance between economic and social development (51). The government invests substantially to improve its urban form [126]. Planners in Singapore have almost total power to shape their urban development (6). They see their role as not just building a sustainable and functional urban environment but as bringing citizens together in time and space via urban redevelopment, smart city, and heritage [127]. There are ongoing plans to integrate within a few years, new Virtual Reality and Augmented Reality technologies like HoloLens in urban design and planning [77].

Good leadership is central to implementing urban planning policies and Singapore's leaders have proven dedicated and resolved to build on the legacy of their pioneers who built green Singapore and see it as their duty to ensure sustainability [128]. Planning policies and instruments are deployed as a tool to cater to the needs of the citizenry and foster integration among its different ethnic groups while strengthening the state's political legitimacy [129]. Singapore employs four sets of instruments in its planning: Planning controls, regulatory measures, public participation and awareness, and economic instruments [130]. Stringent regulations guide the management and protection of the city's environment. There are laws covering subjects ranging from clean air to livestock management and strict fines and monitoring to enforce these regulations which ensure compliance. The planning controls are laid out in the concept plan which covers spatial and environmental goals. Public awareness and participation are shaped through the education system, special campaigns, and the 'clean and green week'. There are channels to engage all sectors of the community in consultations on planning issues. The economic tools employed in environmental management include licensing fees especially to limit city traffic, user fees charged for wastewater treatment and collection, fiscal measures like lower prices for unleaded fuel to encourage its use and use of other cleaner technologies, and auction fees [130]. Good governance is thus the strongest factor that ensured Singapore's success as an urban model.

8. CONCLUSION

This work appraised Singapore, the chosen model for urban sustainability, to provide an insight into urban sustainability. Singapore is viewed as a good model as it satisfies most of the criteria assessed by

urban sustainability indicators. As there are many USIs developed by different organizations, countries, and researchers based on different frameworks, principles, and indicators, etc., there is no common agreement on what makes up a category, index, or theme. Indicators as a set of tools are constantly evolving and in this paper, the focus is on the various sectors indicators set out to measure as opposed to using a set of USI to appraise the selected best practice.

There is a gap in the majority of the USIs in use today whereby the universal design for inclusivity is not measured and thus, which this work fills by including and appraising it as a sustainability indicator in this study. Universal design needs to be recognized as a key USI if it is to be believed that the city is indeed, a place for all. It is key to emphasize that the selection of Singapore as a best practice in urban sustainability does not imply it is a utopia or perfect by any means but we focus on urban sustainability, as an aspect where it is a strong performer. Its favorable appraisal in a particular sector does not also imply perfection, for example, in the area of universal design which is appraised positively in this work.

Singapore's excellence is acknowledged and imported by many other cities and countries in both the developed and developing world. The city-state is also constantly seeking to improve its urban environment in line with the tenets of sustainability. When a good understanding of the concept of sustainability forms the backbone of planning, cities will be a step closer to achieving sustainability. Sustainability pervades all aspects of living and cuts across sectors like healthcare, transportation, inclusivity, universal design, food security, ecological footprint to mention but a few. The Singapore example can be replicated by incorporating the main indices of sustainability into the planning framework of a city just like Singapore did. Singapore's success story can be studied and analyzed as a framework that can be tailored to suit other environments. The gaps and weaknesses identified in this study could also guide Singapore in the improvement of its urban form. Critical appraisals of this nature contribute to knowledge and provide important lessons for other countries to learn from.

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Appendix

Table 1. List of Urban Sustainability Indicators Reviewed

S/N	Urban Sustainability Indicator	Developed By
1	China Urban Sustainability Index	China
2	City Blueprint	Waternet Amsterdam; KWR Water Cycle Research Institute
3	Urban Environment and Social Inclusion Index(UESI)	Yale-Data Driven
4	Urban Ecosystem Europe-Informed Cities	International Council for Local Environmental Initiative(ICLEI) Ambiente Italia
5	Urban Audit City Statistics	Eurostat
6	Urban Sustainability Indicators	European Foundation for the Improvement of Living and Working Conditions
7	Reference Framework For Sustainable Cities	RFSC
8	Star Community Rating System	Sustainable Tools For Assessing and Rating Communities
9	Indicators For Sustainability	Sustainable Cities International
10	Global City Indicators Programme	Global City Indicators Facility
11	European Green Leaf Award	European Union
12	European Green city Tool	European Union
13	EEA Urban Metabolism Framework	European Environmental Agency
14	European Green City Index	Economist Intelligence Unit; Siemens

Peculiarities of local elections in pre-war Romania. The chrono-spatial distribution of key electoral variables (1864-1914)

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Abstract: The article analyzes the chrono-spatial distribution of some electoral variables – the turnout, the political preferences of the voters and the political representation in the local councils (county and / or communal) – in pre-war Romania (1864-1914). Regarding the voters turnout, there is a downward trend, favored by some legislative measures (declaring the winner of the list submitted by a party, if it is the only one registered). The political preferences of the electorate were directed, predominantly, towards the big pre-war parties – Liberal or Conservative – with a modest presence of other formations, while only representatives of the two mentioned formations entered the local councils. The results of the local elections are very similar to the legislative ones (for the Assembly of Deputies and / or the Senate).

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1. INTRODUCTION

We intend to analyze the chrono-spatial distribution of some political-electoral variables in the local elections in pre-war Romania, this approach being part of the broader process of studying the particularities of the Romanian elections in the last two centuries.

Even if these local elections are the first of this type about which we have significant information (far from being, however, complete), these were not the first electoral consultations in Romanian space. The elective process of dignitaries, at different political levels, has a long tradition in this space. Without too many details, but also without exhausting the subject, we mention, first of all, the designation, by elections of *Sfatul Bătrânilor = the Council of Elders*, as the leading institution of the peasant communities, a tradition that appeared under the influence of Greek polis in Thracian-Dacian and continued by Romanians, after the Romanization of our ancestors, until the dawn of the modern era. Also, by elections, the *Concilium trium daciarum*, the provincial assembly of Roman Dacia (II-III centuries), was designed by the Daco-Roman citizens with the right to vote, for more than a century. From the Middle Ages, we mention the election of voivodes by *adunări cneziale = princely assemblies*, as happened frequently, for example, in the Maramureș voivodeship (before 1400, an element present in the extra-Carpathian space, for example, by choosing as ruler of Moldavia, by *adunarea țării = the assembly of the country* (representing all social strata), of Stephen the Great, in the place named *câmpul de la Direptate* (1457). In the same medieval epoch, *sfaturile orășenești = the towns councils* was designed by elections too[†]. This tradition was strengthened, in the Danube Principalities, after 1831, by including, in Regulamentul

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Organic = the Organic Regulation, of the provision of the election of dignitaries at the head of any city following the citizen vote.

After the Union of the Principalities (1859), within the numerous reforms initiated by the prince Alexandru Ioan Cuza, it was counted the legislation of the elections for the county councils and the generalization of the designation by vote of all local councils, including those in rural areas (1864). Thus, starting from the dawn of the existence of the young Romanian state, a preserved electoral system was developed, with all the difficulties that affected it (especially in the periods of authoritarian and / or dictatorial regime, from 1938-1989), until today[‡].

The Romanian principalities - Moldavia and Wallachia - were, since the Middle Ages, in the situation of vassal states of the Ottoman Empire, which, since the early eighteenth century, no longer trusting the Romanian rulers, had introduced the leadership of the two Christian rulers from the Greek quarter Fanar of Constantinople, therefore called Phanariots. At the beginning of the 19th century, in 1821, the Revolution led by Tudor Vladimirescu took place. One of the revolutionary demands, related to the reintroduction of the local leaders, instead of the Phanariots, was satisfied, starting with 1822. After a few years, a new Russian-Turkish conflict broke out, related to the Greek War of Independence, a conflict concluded with the Peace of in Adrianople (1829). It provided for the return to Wallachia of the Danube rayas (Turnu, Giurgiu and Brăila), the freedom of trade and navigation on the river of ships from the Principality and some political-electoral provisions, contained in a regulation similar to a Constitution, called *Regulament Organic = Organic Regulation*. Such an Organic Regulation was elaborated for each Principality, under the careful coordination of the Russian general Pave Kiseleff and, after the tsar's approval, these texts entered into force: on July 1, 1831, in Wallachia and on January 1, 1832 – in Moldova. These constitutional establishments provided for both the election of deputies from *Adunări Obşteşti = General Assemblies* (instead of the system of appointing dignitaries in the old *Sfaturi Domneşti = Prince Councils*) and the election of local authorities, but only for urban centers, voters having the right to vote, based on the cense. These elections took place until the adoption, in 1864, of new legislation for local elections, promulgated by Prince Alexandru Ioan Cuza. Also, the Organic Regulation provided for the election of the ruler by an *Extraordinary General Assembly*, consisting of both boyars and craftsmen, merchants and intellectuals from the cities. This provision was observed only once, at the election of Gheorghe Bibescu as prince in Wallachia, in December 1842. Otherwise, the rulers were proposed by the Porte, with the consent of the tsar.

Following the Revolution of 1848, also held in the Romanian Principalities, the *Balta-Liman Convention* eliminated the elective system of General Assemblies, replaced by the appointment, by the ruler of the deputies from Bucharest and Iasi. These so-called legislative assemblies functioned until 1852, when the Crimean War broke out the following year, pitting Russia against the Ottoman Empire (supported by a Franco-British alliance). In 1856, Russia lost the confrontation, convening a Peace Conference in Paris. Within it, it was decided that the southern part of Bessarabia (Cahul, Ismail and Bolgrad counties) be returned to Moldavia (from which Bessarabia had been annexed by the Tsarist Empire in 1812).

This assembly of European powers - comprising the British Empire, the French Empire, the Kingdom of Prussia, the Kingdom of Piedmont, the Habsburg Empire, the Tsarist Empire and the Ottoman Empire – also called into question the international status of the Romanian Principalities. Thus, in order to test the desire to unite the Romanians, in 1857 elections were convened for *the ad-hoc Assemblies*. In Moldova, those held in July were largely falsified by the administration of the Principality, coordinated by the caimacam Vogoride, who wanted the majority of elected deputies to be among those who opposed the Union with Wallachia. Among those dissatisfied with these frauds was the Colonel Alexandru Ioan Cuza, who resigned from the leadership of the Covurlui (Galaţi) administration, making the electoral forgeries public. The great powers demanded the repetition of the elections: the new election, held in September, simultaneously with the one in Wallachia, gave a clear majority to the unionist forces. Both Assemblies – from Iasi and Bucharest – adopted almost identical resolutions, in which they demanded the Union of the Principalities under a ruler from a European dynasty.

The Great Powers, however, were divided on this subject. The Ottoman and Habsburg empires did not want the Union at all. The Court in Vienna had millions of Romanians in Transylvania and Bucovina, and the emergence of a united Romanian state would have become a "magnet" for them. The Ottomans

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[‡] The presence of Local Councils was continuous until today and the County Councils was replaced, in the years 1938-1940, by the District Councils (at the level of the 10 big *ţinuturi = districts*), and, from 1950 to 1968, by the Regional Councils (in the period of Soviet influence). From the 1969 Local elections, the communist regime returned at the County Councils (named Popular County Councils). We noted, in the other hand, the absence of Local elections between 1914 and 1926, and between 1938 and 1950.

knew, on the other hand, that a unified Romanian state, still under the suzerainty of the Porte, would have sought to break this yoke and become independent. The British initially supported the Union, but later rejected the idea in order to "keep the European balance". Following negotiations with France, an "Osborne compromise" was reached, following which *the Paris Convention* (1858), a new constitutional establishment of the Principalities, which replaced *the Organic Regulation*, specified the new political-administrative framework of the Principalities. The new state was to be called the United Principalities of Moldova and Wallachia, but with separate administrations, capitals, parliaments and different rulers. A single unifying political body became the Central Commission of Focsani, consisting of 4 Moldovans and 4 Wallachians, with the role of ensuring the unity of the legislation of both Principalities.

A provision in the Paris Convention allowed any elected official to be able to vote in both Principalities. As *the Electoral Assemblies* (Parliaments of Iasi and Bucharest) elected the ruler, both voted Alexandru Ioan Cuza, in January 1859. After 3 years (December 1861), the ruler obtained the sultan's approval for the unification of the administration of the Principalities, so that since January 1862, both the ruler and the government and Parliament have established their sole headquarters in Bucharest. Subsequently, in the following years, Cuza initiated a series of reforms, including in the electoral plan. Thus, since 1864, the communal elections took place in all localities, including in rural areas (by *Law no. 394 of March 31 / April 12, 1864 for urban and rural communes*), and at county level, the first elections for the Councils took place. County (based on *the Law for the establishment of county councils no. 396 of March 31 / April 12, 1864*). Among the first 3 county councilors, the ruler appointed one senator, for each county, the other half of the Senate being also proposed by the ruler. Thus, Romania benefited, from this moment, from a bicameral Parliament, the Senate, named at that time a Corp Ponderator = Pondered Body, having the purpose of "tempering" the excesses of the Assembly.But internally, dissensions between the ruler and some political forces – radical liberals (dissatisfied with reforms being too slow) and conservatives (bothered with reforms) – led to Cuza's abdication in February 1866. After a plebiscite, held in April, Carol I of the Hohenzollern-Siegmaringen family was appointed ruler. The new prince was related to the Prussian royal family and also had the approval of the Emperor of France, Napoleon III. Although dissatisfied with the perpetuation of the Union of Principalities under the new ruler, both the Habsburg and Ottoman empires accepted the fact. After the promulgation of the first *Constitution* of the Romanian state, both the first legislative elections – for the Assembly of Deputies and the Senate – and the first local elections took place. In the case of the Senate, its elected members were voted in two colleges. The county councilors were to be elected by the same electoral body convened for the Assembly of Deputies, in 4 electoral colleges, based on the census paid. Instead, local councilors were elected in two urban colleges, in the case of county residences and in single colleges – or all other settlements.

After about a decade, taking advantage of the unrest in the Balkan part of the Ottoman Empire, Tsarist Russia negotiated with the Principality of Romania a transit agreement for Russian troops through Romanian territory (1876). Although Romania was not yet involved in the conflict the following spring, after Russian troops crossed the country, Ottoman artillery began bombarding the Romanian bank of the Danube, with Ottoman soldiers making raids north of the river. The reaction was not delayed: at the end of April, the cannons from Calafat bombed Vidin, and on May 9/21, the Assembly of Deputies adopted the Declaration of Independence of Romania against the High Porte, the next day being voted in the Senate and sanctioned by Prince Carol I.

On the Balkan front, the situation of Russian troops worsened in front of Pleven. In this context, towards the end of the summer, following the Russian requests, the Romanian Army crossed the Danube, thus entering into war with the Ottoman troops. Hostilities, mainly in the northern part of Bulgaria, ended in January 1878, when the Ottomans demanded peace. Initially, a treaty was concluded in San Stefano, but because he was dissatisfied the great powers, a Peace Congress was convened in Berlin. For Romania, it recognized the Independence proclaimed a year earlier, but, at the insistence of the Russians, southern Bessarabia was reoccupied by tsarists (in September). Romania received, in return, northern Dobrogea (Tulcea and Constanța counties), where the Romanian administration settled in November 1878. If for the election of deputies and senators, Dobrogea waited until 1912, the first local elections in this region took place even in December 1878, a few weeks after the integration of this region. Based on *the Law on the organization of Dobrogea, of March 9/21, 1880*, the legislation from the rest of the country was extended from this point of view, with the difference that, in all the settlements of the region, the communal elections took place in single colleges.

In the following years, several reforms took place, which changed both the country's status and electoral legislation. Thus, in 1881, Romania proclaimed itself a Kingdom, and in 1883, the Parliament, convened as a Constituent Assembly, voted to change the electoral system. These changes mainly affected the Assembly of Deputies, in which case, the 4 electoral colleges were reduced to 3 (the same colleges, with exactly the same voters, also voted in the election of the County Councils). Also, those that finalised a

school received the right to vote (in the third college for the Assembly), increasing the number of voters who already had this right, based on the cense paid. Until the First World War, electoral legislation remained broadly the same, undergoing only a few minor changes (for example, *the Communal Law of May 7, 1887*, on the basis of which the mayor was elected by communal councilors, *the Law on the Organization of Rural Communes and the administration of plăși = districts of May 31, 1904*, by which the county became a legal entity, *the Law of December 15/28, 1912*, by which, where only one list was submitted, that was declared the winner, without voting, etc.).

The years 1912-1913 were distinguished by the development of the two Balkan wars. In the first of these, the Balkan states – Serbia, Montenegro, Greece, Bulgaria – formed a coalition against the Ottoman Empire, which managed to abduct much of the Balkan territories. Later, however, Bulgaria refused to divide Macedonia with the Greeks and Serbs, sparking a second Balkan conflagration. Because Bulgaria was to incorporate territories inhabited by Balkan Romanians (Aromanians, Megleno-Romanians), which Romania could not annex to its territory, and the Bulgarian state also had an aggressive attitude towards its northern neighbor, considering that Romanian Dobrogea should attached to the Bulgarian state), the authorities in Bucharest intervened in the conflict. Thus, in July 1913, Bulgaria demanded peace. The treaty was signed the following month, in Bucharest: Bulgaria ceded to Romania the southern part of Dobrogea (the Quadrilater), as a compensation for the annexation to the Bulgarian state of some territories inhabited by Romanians. Although, by *the Law for the organization of New Dobrogea* (March 31 / April 13, 1914), local elections were provided in this region, they did not take place until the interwar period: first came the outbreak of World War I (in the summer the same year), then the death of King Carol I (October) and the period of mourning (6 months) postponed, indefinitely, these elections.

The period around and after the proclamation of the country's Independence was the one in which the first Romanian political parties emerged. Thus, if until the Union and, a few years later (following the consolidation of the unified Romanian state), one cannot speak of a too clear political differentiation – intellectuals and the bourgeoisie generally having liberal views, and boyars being often conservatives – after the promulgation of the Constitution of 1866, the pre-war political forces began to be structured. In 1875 the National Liberal Party was founded, followed in 1881 by the Conservative Party. Economic development – including industry, trade, transport, etc. – also led to the structuring of a social democratic movement, culminating in the establishment of the Social Democratic Party of Workers in Romania (1893). It disappeared, however, towards the end of the 19th century, only to reappear, after a decade, as a Social Democratic Party. On the other hand, after 1910, there is both an extreme right-wing party – the Nationalist Party, and an important dissidence, detached from the Conservative Party – the Conservative-Democratic Party. Also, at the level of pre-war and local legislative elections, independent candidates often registered and obtained mandates. We noted, at the local level, even a coalition of minorities (Turks, Serbs, Bulgarians), who supported a common candidate in the 1894 municipal elections in Tulcea. In general, however, the representatives of minorities (especially in Bessarabia, before 1878, and in Dobrogea – after this year) ran and were frequently elected on the lists of the mentioned parties (especially liberal or conservative), a practice also encountered in the interwar period.

The number of eligible voters has seen an upward trend, both in terms of county and communal elections. Thus, in 1864, over 3200 voters were registered on the lists for the county elections. Their number increased to over 43 thousand in 1874, to almost 64 thousand – in 1888-1889, to 96.1 thousand – in 1899, exceeded 102 thousand in 1905 and approached 128 thousand in 1914. Related to the communal elections, the values are slightly lower, first of all, because we have not found data, so far, except for urban communes (cities), and in some cases, even for this type of settlements, no data have been published for the same number of localities. Thus, in 1864, over 20.8 thousand voters were listed, in 1874 – 23 thousand, in 1888-1889 – almost 36 thousand, in 1899 – almost 42.8 thousand, in 1905 – over 43 thousand , and in 1914 – over 62.2 thousand voters. However, despite this numerical increase – at least a few times in half a century – the Romanian electorate represents a modest share of the country's total population, the main cause being the restrictive censitary voting system, applied to legislative elections too.

2. LITERATURE REVIEW

There are published works on the Romanian local elections that deal with this type of elections starting with the interwar period, as is the case of those published by **Gh. I. Ioniță** (1965), *Succesele forțelor democratice din România în alegerile comunale și județene din anii 1936-1937 / The successes of the democratic forces in Romania in the communal and county elections of 1936-1937*, in Studii, volume 18, no. 4, Bucharest, pp. 785-805 [1], or by **Sorin Radu** (2004), *Administrația și procesul electoral din România în anii democrației parlamentare (1919-1937) / Administration and the electoral process in Romania during*

the years of parliamentary democracy (1919-1937), in Annales Universitatis Apulensis. Series Historica, year 8, Alba Iulia [2]. Instead, the way in which the pre-war local elections took place is treated, rather, tangentially, in some works with a more general theme, such as those written by **Tudor Drăganu** (1991), *Începuturile și dezvoltarea regimului parlamentar în România până în anul 1916 / The beginnings and development of the parliamentary regime in Romania until 1916* [3], or **Ioan Silviu Nistor** (2000), *Comuna și județul. Evoluția istorică / Commune and county. The historical evolution* [4], both works being published at the Dacia Publishing House in Cluj. Important mentions was made in the work *Rumânii fericiți. Vot și putere de la 1831 până în prezent / Happy Rumanians. Vote and power from 1831 to present* [5], by **Cristian Preda**, issued at Polirom Publishing House, in Iași (2011). Another work with references of the historical, economical and politcal context of this period are that realised by **Gheorghe Iacob** and **Luminița Iacob**, *Modernizare-Europenism. România de la Cuza Vodă la Carol al II-lea.* Vol. 1: *Ritmul și strategia modernizării / Modernization-Europeanism. Romania from Cuza Vodă to Carol II.* I[st] vol: *The rhytm and strategy of modernization* [6], issued at the Publishing House of the "Alexandru Ioan Cuza" University of Iași. From another point of view, historian **Bogdan Murgescu** studied, by comparison with another peripheric spaces of Europe (Serbia, Denmark, Ireland), the evolution of the Romanian Space in the last 5 centuries, in the book *România și Europa. Acumularea decalajelor economice (1500-2010) / Romania and Europe. The accumulation of economic gaps* [7], at the Polirom Publishing House in Iași (2011). References, quite brief, were also made in the book *Geografie electorală / Electoral Geography*, published in 2013 at the Publishing House of the "Alexandru Ioan Cuza" University of Iași [8]. Therefore, we considered that a broad, if not exhaustive, presentation of this type of election is not only necessary, but also useful, covering a gap in this type of research in Romania.

3. METHODS AND DATA

In carrying out this scientific approach we ran into several problems. Thus, with all our efforts so far, we have managed to inventory only a part of the electoral data related to the local elections and neither do they refer only to cities[§] (*comune urbane = urban communes*, as they were called at that time). The data already obtained do not refer to all urban settlements, but, in general, to the county residences and, more frequently, to a part of the other urban localities, but not always the same, from one election to another. Overall, we managed to inventory 13 county and communal elections, out of the 18 (county, respectively communal) held at national level, in the exact 50 years of pre-war local elections (1864-1914). The evolution of local elections in pre-war Romania is highlighted in the following table. The data regarding the county elections from 1866, 1870, 1876, 1878, 1883, respectively those from the communal elections from 1868, 1870, 1876, 1878, 1880 are missing. In all cases, the first time is from the "old style" calendar and the second after the "/" sign is "new style". Starting with the communal elections of 1905, both the information related to the dissolution of the rural communal councils and the date on which the next local elections were to be held for the designation of the new communal councils were published in *Monitorul Oficial = the Official Gazette*. Our intention, for the future, is to "cover" the statistical "gaps", as much as possible, for all local pre-war elections, through access, in more detail, to the press of the time, which was, many years before the Official Gazette, the main (the only) source of electoral documentation.

Table 1. Local elections in pre-war Romania (1864-1914).

Year	Local elections (county)	Electoral legislation (county elections)	Local elections (communes)	Electoral legislation (communal elections)
1864	October 18/30, 1864	*Law for the establishment of county councils no. 396 of March 31 / April 12, 1864*	July 26/August 7-August 15/27, 1864	*Law no. 394 of March 31 / April 12, 1864 for urban and rural communes*
1866	May 1/13, 1866	*Constitution of 1866*		*Constitution of 1866*

[§] In one case, we discovered, in the press, not in *Monitorul Oficial = the Official Gazette*, information, incomplete, related to voting at local elections in rural areas.

1868			November 12/24, 1868-January 15/27, 1869	
1870	April 16/28-May 3/15, 1870		February1/13, 1870-February 3/15, 1871	
1874	May 2-14-8/20, 1874		June 13/25-July 16/28, 1874	
1876	July 8/20-14/26,1876		July 1/13-July 22/August 3, 1876	
1878	January 26/February 7-August 30/September 11, 1878 (plus December 17/29 – only in Dobrogea)		July 15/27-December 5/17, 1878 (plus December 17/29 – for the communes of Dobrogea)	
1880	June 4/16-November 22/December 4, 1880		November 2/14-4/16, 1880	
1883	May 7/19-13/25,1883			
1884	October 14/26-18/30, 1884	*Constitution revised in 1883*	November 4/16-6/18, 1884	*Constitution revised in 1883*
1888	May 7/19, 1888-January 20/February 1, 1889		April 30/May12, 1888-January 15/27, 1889	*Communal Law of May 7, 1887*
1890			November 4/16-6/18, 1890	
1891	May 5/17-7/19, 1891			
1894			September 4/16-6/18, 1894	
1895	May 7/19-11/23, 1895		March 21/April 2, 1895-December 30, 1895/January 11, 1896	
1899	May 2/14, 1899-January 6/18, 1900		June 4/16-August 15/27, 1899	
1901			March 16/29-November 4/17,1901	
1903	May 4/17-8/21, 1903			

1905	January 31/ February 13- September 28/ October 11, 1905	*Law on the Organization of Rural Communes and the administration of plăși = districts of May 31 / June 13, 1904*	January 22/February 4, 1905-December 29, 1905/January 11, 1906 (January 15/28, 1905-January 8/21, 1906 – rural communes)	*Law on the Organization of Rural Communes and the administration of plăși = districts of May 31 / June 13, 1904*
1907	June 10/23, 1907-December 20,1907/ January 2, 1908		April 5/18, 1907-December 22, 1907/January 4, 1908 (January 28/February 10, 1907-January 27/February 9, 1908 – rural communes)	
1911	January 20/February 2-October 6/19, 1911		January 5/18-October 18/November 1, 1911 (January 15/28, 1911-January 8/12, 1912 – rural communes)	
1914	23 February/8 March, 1914-18/31 January, 1915	*Law of December 15/28, 1912*	March 1/14-May 4/17, 1914 (February 23/March 8, 1914-January 25/February 7, 1915 – rural communes)	*Law of December 15/28, 1912*

Source: Monitorul Oficial, 1864-1915.

Taking into account the differences related to the number of urban settlements whose data were accessible to us, but also to have the comparability of these data, both with the information related to county elections and with similar local elections in the following periods (especially with the interwar and post-communist too), we aggregated the data from the communal elections at the level of the interwar counties. Also, taking into account the application, also at the level of local elections, of the censitary vote, on colleges, we summed the data, at the level of localities[**] and, then, by counties, both for the urban colleges of the county residences and for the colleges at the level at which the county elections took place.

[**] At the level of urban communes, the voters with the right to vote in county residences voted in two colleges (the first comprising the bourgeois elite – owners of workshops, factories, commercial spaces, etc., and the second – especially workers, employees), while all the other cities – in a single college (as well – the electorate from the county residences of Dobrogea, Constanța and Tulcea). At the county level, the electorate was the same one that voted for the Assembly of Deputies, divided into 4 colleges (until 1883), then into 3 (after 1884). We note that, although at the level of the Parliament (Assembly of Deputies and Senate), Dobrogea voters received the right to vote only in 1912, for communal and county councils they could vote immediately after the incorporation of regions within the Romanian state (November 1878), i.e., in December 1878, subsequently participating in all local pre-war elections. We also add the fact that, in this case, in 1878, both the voters from the south of Basarabia (until the summer of the mentioned year!) And those from Dobrogea (in December) voted in the Romanian local elections. Also, the Tsarist Empire maintained, in southern Basarabia, until 1917, the electoral-administrative legislation implemented here by the Romanian authorities during 1856-1878 period.

Another problem is related to the variability of administrative boundaries, in which case, if there are no significant changes in intra-county boundaries, which would influence the aggregation, by county, of electoral data, in connection with the external borders of the Romanian state, important changes have taken place. Thus, in 1878, following the Peace Congress in Berlin, Romania was forced to cede to the Tsarist Empire the counties in southern Basarabia (Cahul, Bolgrad and Ismail), receiving Dobrogea (divided into Tulcea and Constanța counties). Thus, we had to deal with the electoral variables (turnout, distribution of votes and/or mandates by political parties/orientations) over two intervals: 1864-1878 (really, 1864-1874), respectively 1880-1914. In the case of the second interval, we should have separated another one that would also take into account the annexation, following the Peace of Bucharest, in August 1913, of southern Dobrogea (the Quadrilater). It was later planned to hold local elections in the new counties of Dobrici/Caliacra and Silistra/Durostor, but first the outbreak of the first world conflagration, then the period of mourning in the fall of 1914, decreed following the death of King Carol I (who lasted 6 months) and, finally, the entry of Romania itself in this conflagration (in the summer of 1916) made this election no longer take place[††].

Also related to the intra-county boundaries, taking into account the fact that, since 1864, since the first modern local elections, a single county council has been appointed for Bolgrad and Ismail counties and because the aggregate boundaries of these two counties overlap, to a large extent, over those of the interwar county Ismail, we treated together the electoral data regarding these South Bessarabian counties, including for their comparability with the similar ones from the interwar period.

Regarding **the research methods**, they fall into two categories: **documentation methods** (sources) and **analysis and interpretation methods**. In the first category – of *documentary sources* – there are, besides *Monitorul Oficial = the Official Gazette* [9], even more, more frequently than the official newspaper of the country, various titles of the pre-war press: *Adevărul* [10]*, Lupta* [11]*, România Liberă* [12]*, Telegraful* [13]*, Voința Națională* [14]. Beyond the partisan character, at least of some of these publications, we took into account, as a priority, exclusively, the statistical data, presented objectively and, often, in great detail[‡‡].

This statistical information was entered into the computer and statistically processed in a Microsoft Excel document, being standardized for mapping. As **methods of analysis and interpretation** we used *the cartographic method* (using the ascending hierarchical classification) and *the geographical method*. The maps made with the help of the *Philcarto* program, made, updated and provided by the geographer and computer scientist **Philippe Waniez**, were processed and finalized in Adobe Illustrator. For each interval – 1864-1874 and 1880-1914 – we represented, together, both the data from the county elections and those from the communal elections. Also, in order not to overload the cartographic representations obtained with graphic elements (which would have made it difficult to read these graphic elements), we also divided the interval 1880-1914 into two: 1880-1899 and 1901-1914. Thus, if for the voter turnout we used only two intervals – 1864-1874 and 1880-1914, for the chrono-spatial distribution of the votes, respectively of the councilor mandates (county and/or communal) we made 3 maps, for the intervals of 1864 -1874, 1880-1899 and 1901-1914.

4. CHRONO-SPATIAL DISTRIBUTION OF ELECTORAL VARIABLES AT THE LOCAL ELECTIONS IN PRE-WAR ROMANIA

Voter turnout began with high values – 87.1% in the 1864 county election – but later dropped to 50-60%, sometimes – even less, as in the county election in 1905 – when only 40.7% was recorded or in 1914 – when the turnout reached only 36.4%[§§].

[††] We specify that, in the case of the maps for the period 1880-1914, we included between the (pre-war) borders of Romania, besides the Quadrilater, and Basarabia (which joined the Country on March 27/April 9, 1918). As the last local elections took place in 1914, the mandate of the local elected officials should have expired in 1918 and local elections should have taken place, as in the middle of the same year (May/June 1918) parliamentary elections took place.

[‡‡] In fact, even the fact that the press of the time, as well as the political meetings, had a pronounced critical character towards the authorities in office at that time, is an expression of the democratic political life in pre-war Romania, this character being largely preserved between the two world wars.

[§§] In 1905, in many counties, the Liberals did not submit lists, so that with only one (Conservative) list, voters' interest in voting declined considerably. Instead, the low turnout since the last pre-war county election is explained by the effects of a law of December 1912, according to which, in the constituency where only one list was submitted, it was declared the winner, without elections. Although this measure was adopted by a Conservative government, its real winners (and the only ones, by the way) were... the Liberals, who thus won many county and communal councils. The measure was applied, even longer (several decades), to the elections held in dualist Hungary (hence, in Transylvania),

Figure 1. Chrono-spatial repartition of voter turnout at the county and communal elections in Romanian Principalities/Romania (1864-1874). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

The turnout in the communal elections had lower fluctuations: if in 1874 there was a percentage of 73.3% of voters present at the polls, before 1914, the share of turnout was generally between 50 and 60%, with a minimum, also at the last communal election, in 1914, when only 46.1% of the voters registered on the lists voted[***].

Such values are lower than in the parliamentary elections – which also had shares of over 80% in the first legislative elections and were generally close to 70% or even above this value, in all years, until 1914, inclusive. The only legislative election with modest weights was in 1918, when, because electors of Oltenia and Muntenia voted among the Austro-German bayonets, many refused to go to the polls, in protest of maintaining the occupation of the Central Powers even after Romania signed the shameful "peace" in Buftea-Bucharest, but, even then, the turnout exceeded 51% in the election for the Assembly of Deputies and 46% in the senatorial elections.

If we refer to the delimited intervals, we will notice, first, that the first – 1864-1874 – had, rather, an amalgamated distribution of percentage values. Thus, on a general background of some weights of over 70% (except for the communal election of 1864, with only 58.2%), percentages higher than the national average were recorded in several counties in Moldova, in the southern Basarabian ones, several administrative units in the north and southwest of Muntenia and in Vâlcea. Ilfov County, along with Bucharest, has had an oscillating evolution. If at the first local election there were few voters present at the polls, at the next turnout it was even above average, while at the county elections it was close to the national average. In contrast, in several counties in central, eastern and western Moldova, eastern and northern Muntenia and most of Oltenia, the turnout rates were continuously below the national average (Figure 1).

The next analyzed interval – longer and with (almost) complete records, shows a different situation. Thus, Gorj and several counties in the central-northern part of Moldova are detached, with influxes at the polls higher, in general, than the national average. Other counties – Iaşi, Tecuci, Râmnicul Sărat, Prahova, Vlaşca, Teleorman, Vâlcea – were noted for oscillations, being generally above average, before 1901, then with values lower than it in 1903-1907 and returns to weights over the national value, at the last two pre-war elections (1911-1914). Several Danube counties, from the south of Moldova (Covurlui), Dobrogea, the south of Muntenia and Oltenia, but also Buzău, were distinguished, in the whole range, by values located, generally, below the national average (Figure 2). Among them was a class, quite close in terms of electoral behavior, rather not involved in the act of voting, but which, however, also had situations, rare, above the national average (in 1907 and 1911). It is represented by counties such as Dorohoi, Vaslui, Bacău, Putna, Brăila, Dâmboviţa, Argeş and Mehedinţi.

Probably, this behavior, quite differentiated, both at county level and from one year and from one type of election to another, was also influenced by the electoral stake or – as we have seen, in the elections of 1905 or 1914 – even in the absence of such a stake. Although it is not the subject of our analysis, we can refer, comparatively, to the situation in the other two democratic intervals, for which we have even more complete data (and for a larger Romanian territory): the interwar and the post-communist too. Thus, in the local interwar elections (1926-1937), values of turnout were recorded even higher than in the pre-war period – reaching, in 1930, even 80%, but with a downward trend, synchronous with the values of the elections after 1931 (in 1936-37 only 62-65% went to the polls) – while the post-communist period (1992-2020) shows values rather similar to the pre-war period (initially, in 1992, a turnout of 67.5% was recorded, which subsequently dropped to around 50%). Thus, by comparison with the legislative elections of each period, the pre-war one is distinguished by the modest values of turnout at the polls, rather by disinterest of the electorate (compared to the interest shown in the legislative elections), while the next two periods – the interwar, respectively the post-communist one – shows a greater mobilization of the electorate in the local elections, by comparison with the legislative ones (however, with values generally lower after 1989, than in the interwar period).

If we consider the values, in absolute data (sometimes incomplete, as is the case of communal elections) of the total number of eligible voters, as in the case of legislative elections, the rigors of the censitary vote show a modest number, in the order of tens of thousands of citizens with the right to vote. Thus, in 1864, just over 3200 voters were registered, a total that increased to tens of thousands after the adoption of the Constitution of 1866 (almost 43.8 thousand voters in 1874) and to almost 128 thousand before the First World War II (1914). Apparently surprising, in Cuza's time, the number of voters in urban centers was higher – 20.8 thousand eligible voters in 1864, a number that also increased to almost 40 thousand (1894) and over 62 thousand at the last pre-war communal election (1914). It is possible that the limitation, by census, of the right to vote will explain, at least in part, the lower turnout of voters at the polls, in local elections. One (possible) argument in this regard is given by the large number of voters present at the interwar local elections (with weights of over 75%, before 1930), during which time the right to vote was extended to all male adults (and, since 1929, including literate women).
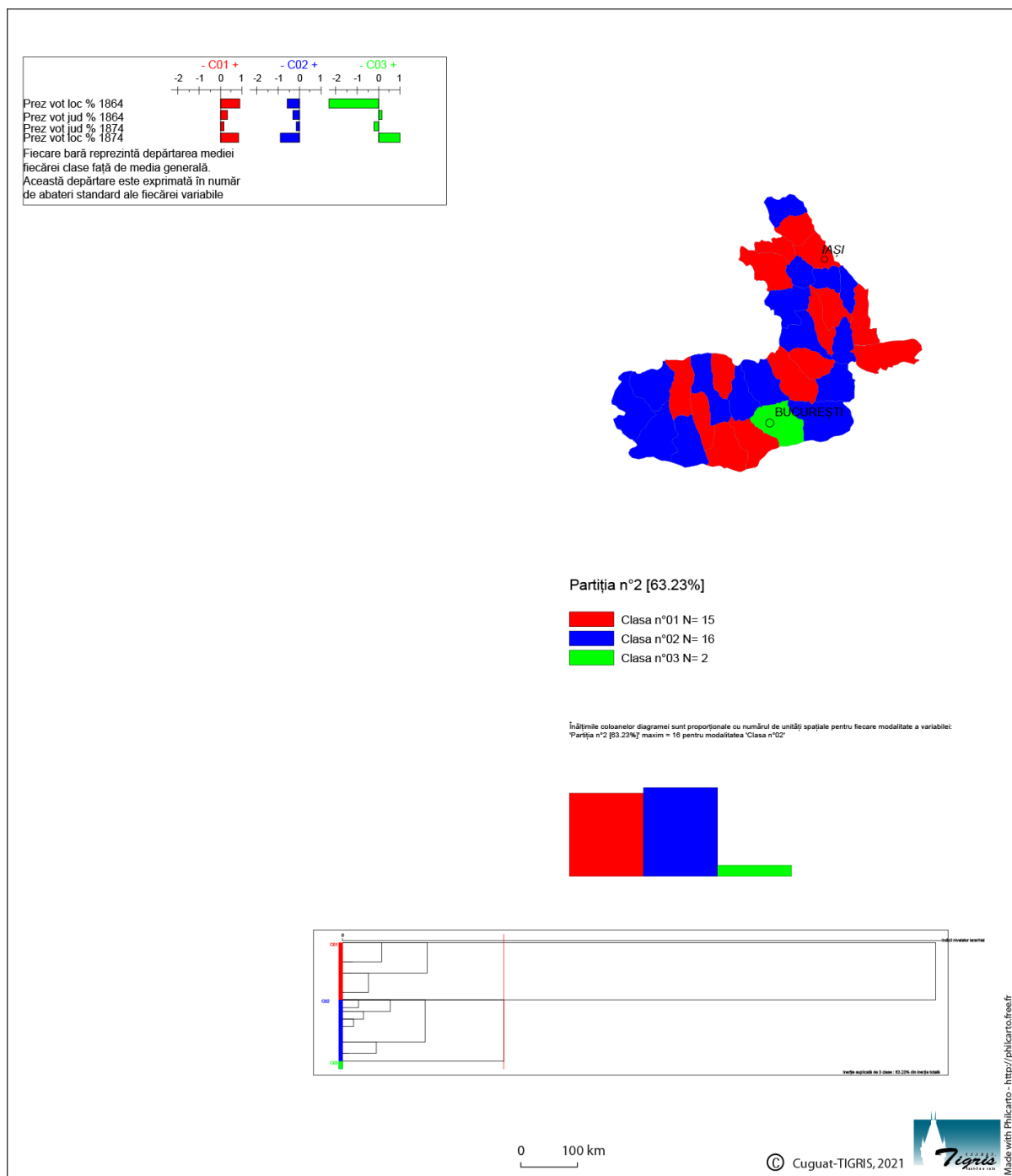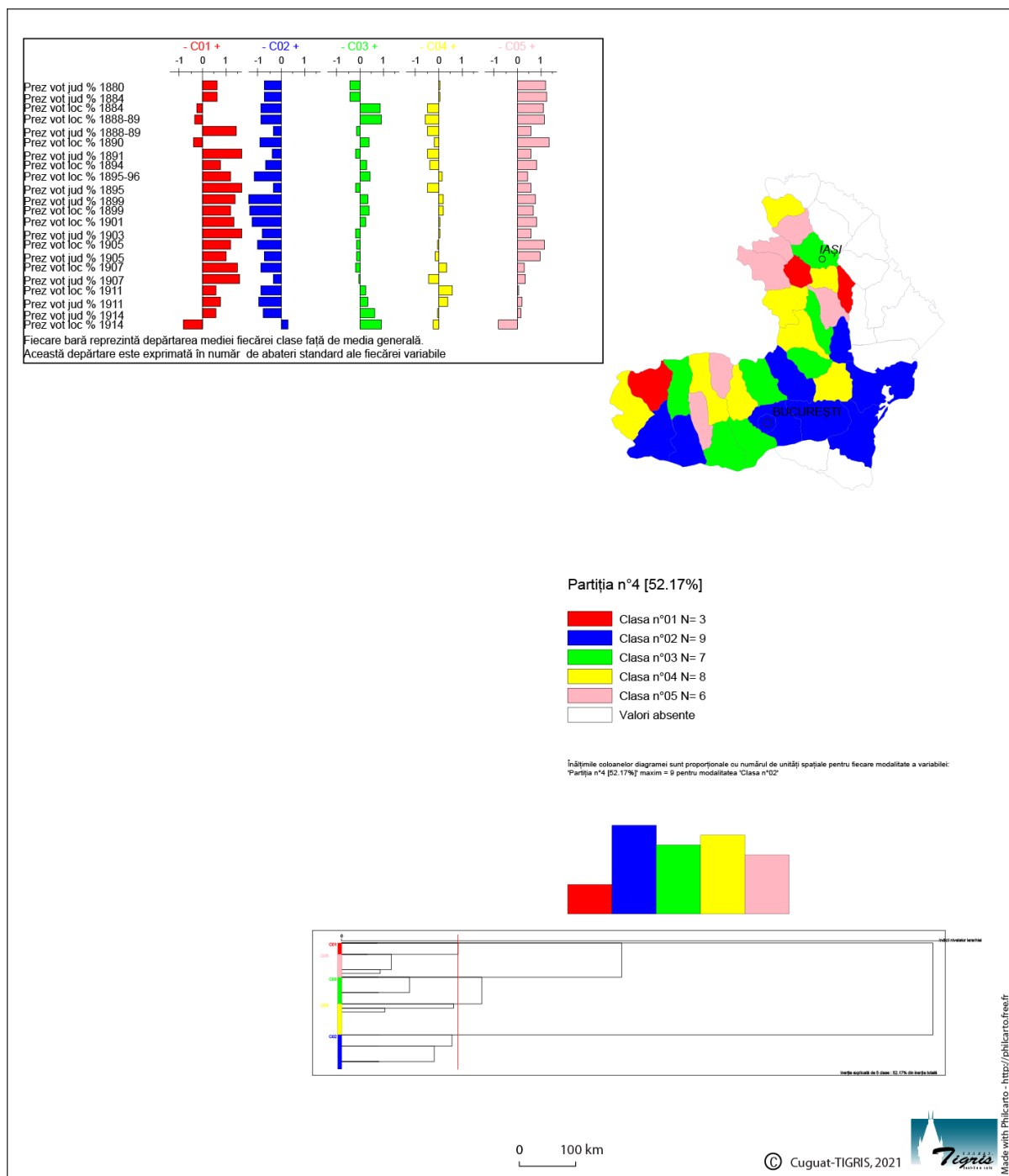
Figure 2. Chrono-spatial repartition of voter turnout at the county and communal elections in Romania (1880-1914). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

Figure 3. Chrono-spatial repartition of votes by political formations at the county and communal elections in Romanian Principalities/Romania (1864-1874). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

If we refer to *the chrono-spatial distribution of the votes for the different political formations (orientations)*, we must specify, from the beginning, that the majority of the pre-war votes, in the local elections, went, as in the case of the legislative ones, alternatively, towards Liberals or Conservatives. In the first interval – 1864-1874 – the two great pre-war Romanian parties were just being formed[†††]. If

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[†††] Thus, the National Liberal Party was founded in 1875 (being the oldest party in Romania, but not the oldest Romanian party – this title belongs to the Romanian National Party, founded in Transylvania, in 1869). A few years later, in 1881, the Conservative Party appeared. After a few more years – after the founding of several social-democratic circles - the Social-Democratic Party of Workers in Romania was founded in 1893 – which, later, after

counties like Dorohoi, Neamț, Tutova, Ialomița and Dâmbovița show, in this first interval, a predominance of votes for Liberals, in Suceava[‡‡‡], Iași, Fălciu, Tecuci, Ismail-Bolgrad, Muscel, Olt, Teleorman and Vlașca there is a Liberal-Conservative alternation (Figure 3). Most counties show, however, a presence of preferences towards Conservatives, better highlighted by the elections of 1864, the other election framing this majority of administrative units (19 out of 33) in the general national trend[§§§].

After a first period of Conservative domination (1871-1875) and a long presence of the Liberals in government (1876-1888), the well-known *rotativa guvernamentală = governmental rotation* was established in the pre-war period, which allowed, practically, the governments alternation of the two great Romanian parties. Thus, the Conservatives were in power in the years 1888-1895, 1899-1901, 1905-1907, 1911-1914 and a few months in the second half of 1918, while the Liberals ruled Romania between 1895-1899, 1901-1905, 1907-1911 and 1914-1918. It is observed that, if the Liberals controlled the country for an entire legislature, for 4 years, the Conservatives was, after 1895, in power for only 2-3 years or even less (a few months, in 1918).

This alternation of Liberal-Conservative government also had a significant impact on local elections. Thus, the county elections of 1880, 1884, 1895, 1903, 1907 and 1914 were won by the Liberals, and those of 1888, 1891, 1899, 1905 and 1911 - by the Conservatives. The communal elections were similarly awarded: in 1884, 1895, 1901, 1907 and 1914 – by Liberals and in 1888, 1890, 1894, 1899, 1905 and 1911 – by Conservatives. In fact, starting with 1880, the local elections took place, as a rule, in "electoral" years (in which there was also an alternation in government, legislative elections being scheduled), the only exceptions being the local elections of 1894 and the county elections of 1890 and 1903, the last ones – scheduled on time, after the end of the 4-year mandates of the previous county councils.

Between 1880 and 1899, some Moldovan counties (Tutova, Bacău) and northern Muntenia (Prahova) stood out, rather, through their electoral support for Liberals. A slightly Liberal trend was registered in counties such as Brăila, Buzău, Dâmbovița and Vlașca, but also in Iași, Roman, Vaslui, Tecuci, Constanța, Ialomița, Teleorman, Olt and Romanați. This spatial distribution would show, without absolutizing this trend, the presence of a rather liberal area in the central part of Moldova, in a large part of Muntenia and, partially, in the south of Dobrogea and Oltenia. Instead, in the north and west of Moldova, isolated in Muntenia and Oltenia (in counties such as Dorohoi, Neamț, Putna, Râmnicul Sărat, Ilfov, Vâlcea, etc.) there was, rather, a Liberal-Conservative alternation. On the other hand, in Botoșani, Covurlui, Tulcea, Muscel, Argeş and most of Oltenia, Conservatives more frequently had weights above the national average (Figure 4). We also add that, when they submitted candidacies (in the years 1888-1894), the Social-Democrats obtained more votes in Iași, Roman and Ilfov.

The situation changed somewhat at the beginning of the twentieth century (1901-1914). Thus, in Suceava, Neamț, Roman, Putna, Covurlui, Brăila, Dâmbovița and Vâlcea, the Liberals obtained above average votes in the majority of elections, most of the times, these being won by the Liberals and in the legislative elections. A similar fact was recorded in administrative units such as Botoșani, Iași, Tutova, Bacău, Râmnicul Sărat, Buzău and Gorj (Figure 5). Instead, in other areas, the electoral competition was tight, the Liberals and Conservatives winning an equal number of electoral competitions (in the counties of Vaslui, Fălciu, Tecuci, Prahova and Romanați). On the contrary, the south-east of the country (from Constanța to Vlașca) stood out with a slight advantage for the Conservatives, who often obtained votes above the national average in the years when the party also won the legislative elections. Finally, in Dorohoi, Tulcea, Muscel, Argeş, Olt, Teleorman, Dolj and Mehedinți, the Conservatives won the majority of local elections in this period.

1895, disappeared, temporarily, to reappear as a Social-Democratic Party, after 1910. In the last pre-war years, the first Romanian far-right party emerged – the Democratic Nationalist Party, present at the local elections in 1911 and 1914. The two major parties – the Liberals and the Conservatives – also experienced various splits, however, at the level of electoral data, both in terms of voters' electoral preferences and the mandates of county and/or communal councilors, we summed up the data by political orientation (these, however, generally overlap by parties, almost the whole pre-war period).

[‡‡‡] This county represents a remnant of the old homonymous district, "broken" in two by the occupation of a large part (including the residence, Suceava) by the Habsburgs, at the annexation of the future Bucovina. The pre-war county was renamed, from the interwar period, initially *Fălticeni* and, later, *Baia*, until the abolition of the interwar counties by the communist regime, in 1950.

[§§§] In 1874, local elections were won by the Conservatives, who were in power.

Figure 4. Chrono-spatial repartition of votes by political formations at the county and communal elections in Romania (1880-1899). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevĕrul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.
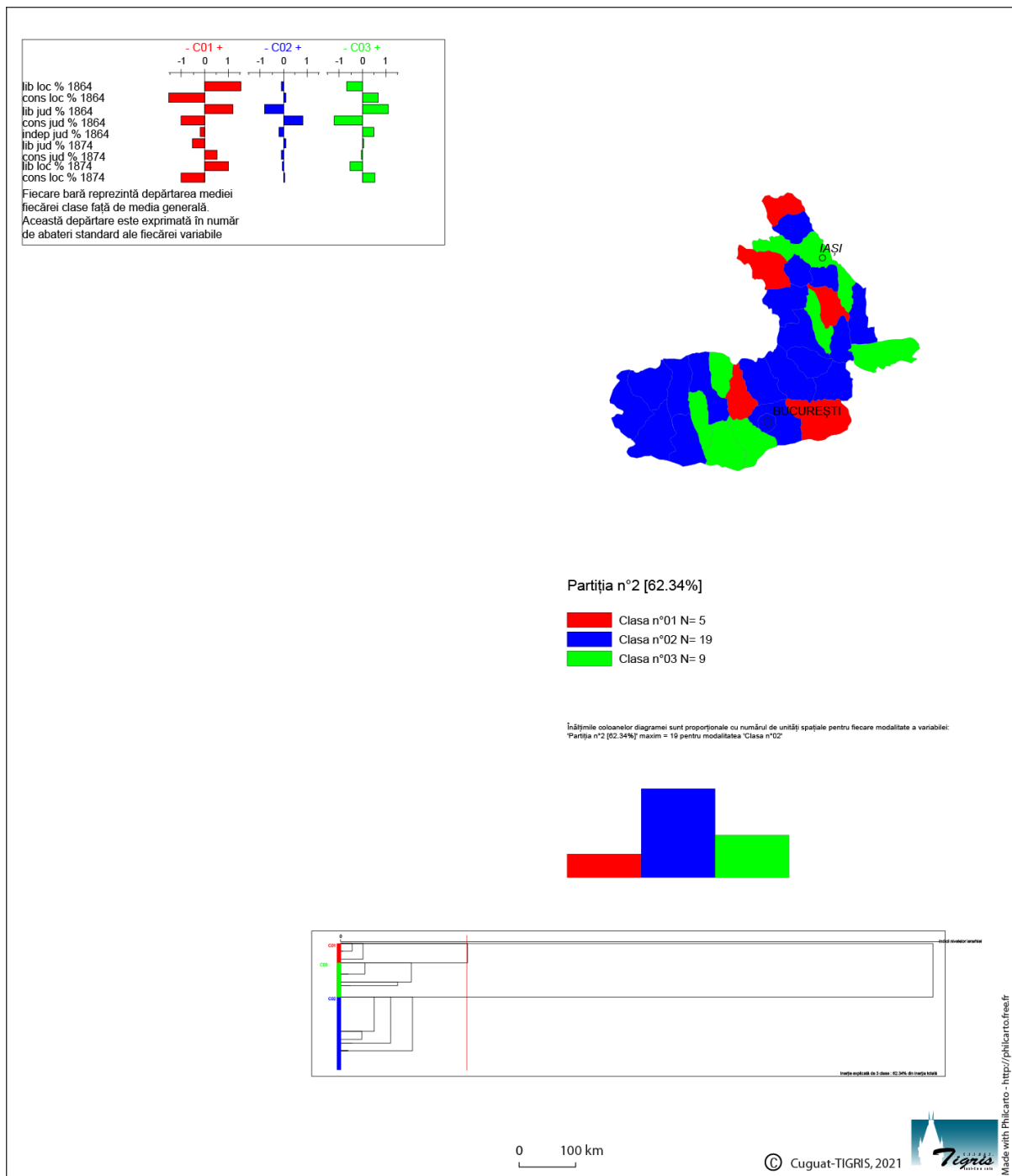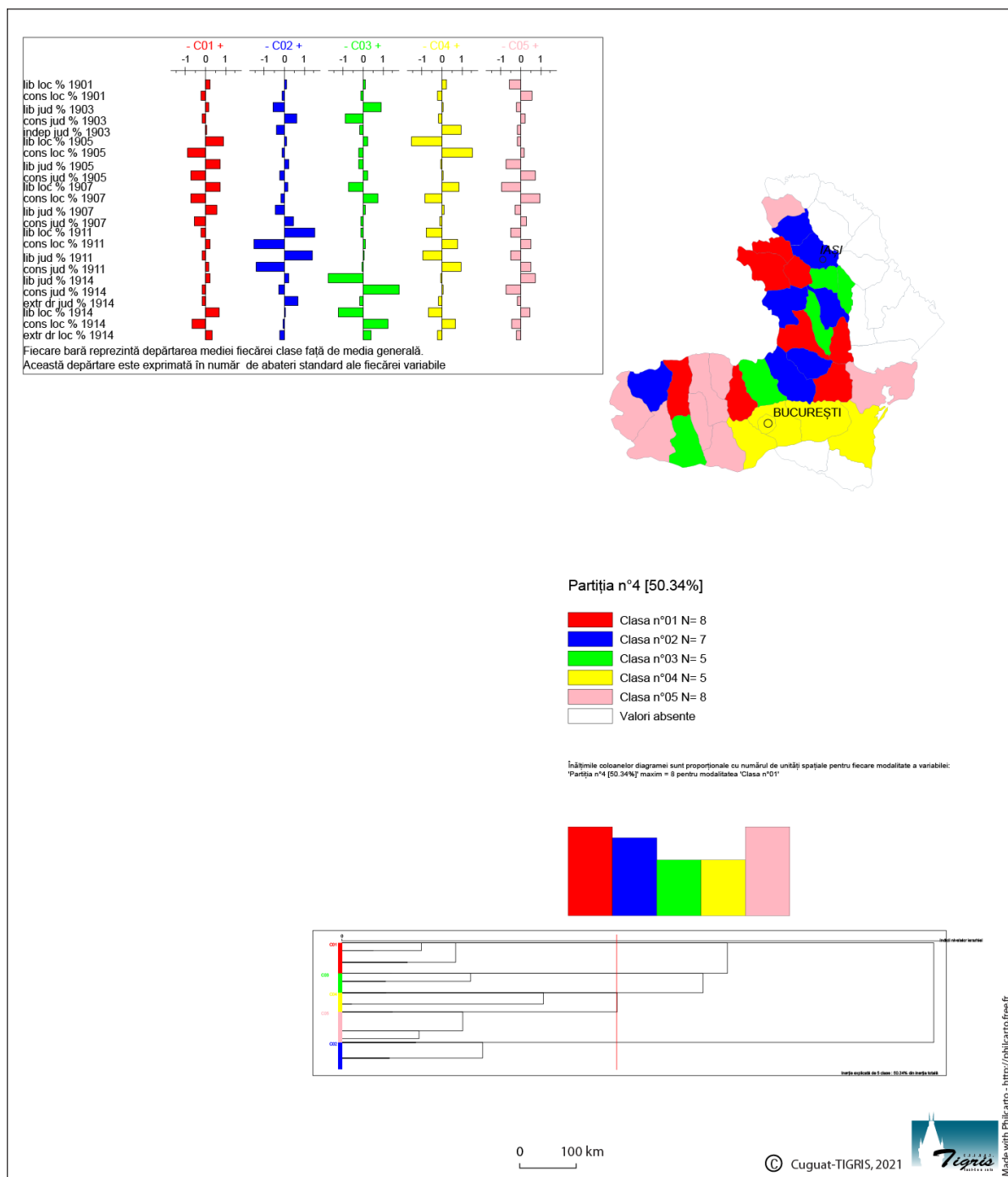
Figure 5. Chrono-spatial repartition of votes by political formations at the county and communal elections in Romania (1901-1914). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

If we refer to the chrono-spatial distribution of the mandates of county and/or communal councilors on political formations, in the interval 1864-1874 there is a very great similarity with the distribution of votes (Figure 6). We attribute this reality to the fact that, in these years, the Romanian political system was at the beginning, being established.

Figure 6. Chrono-spatial repartition of mandates by political formations at the county and communal elections in Romanian Principalities/Romania (1864-1874). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

The last two decades of the nineteenth century were characterized, also at the level of councilors' mandates, by their adjudication by Liberals or Conservatives. If at the level of votes and – for other types of elections (legislative ones) – and of mandates, there were other formations that also obtained mandates (Social-Democrats, Nationalists), throughout the period 1880-1914 they could become county and/or communal councilors only some Independent and Conservative-Democrats (only in 1911 or 1914).
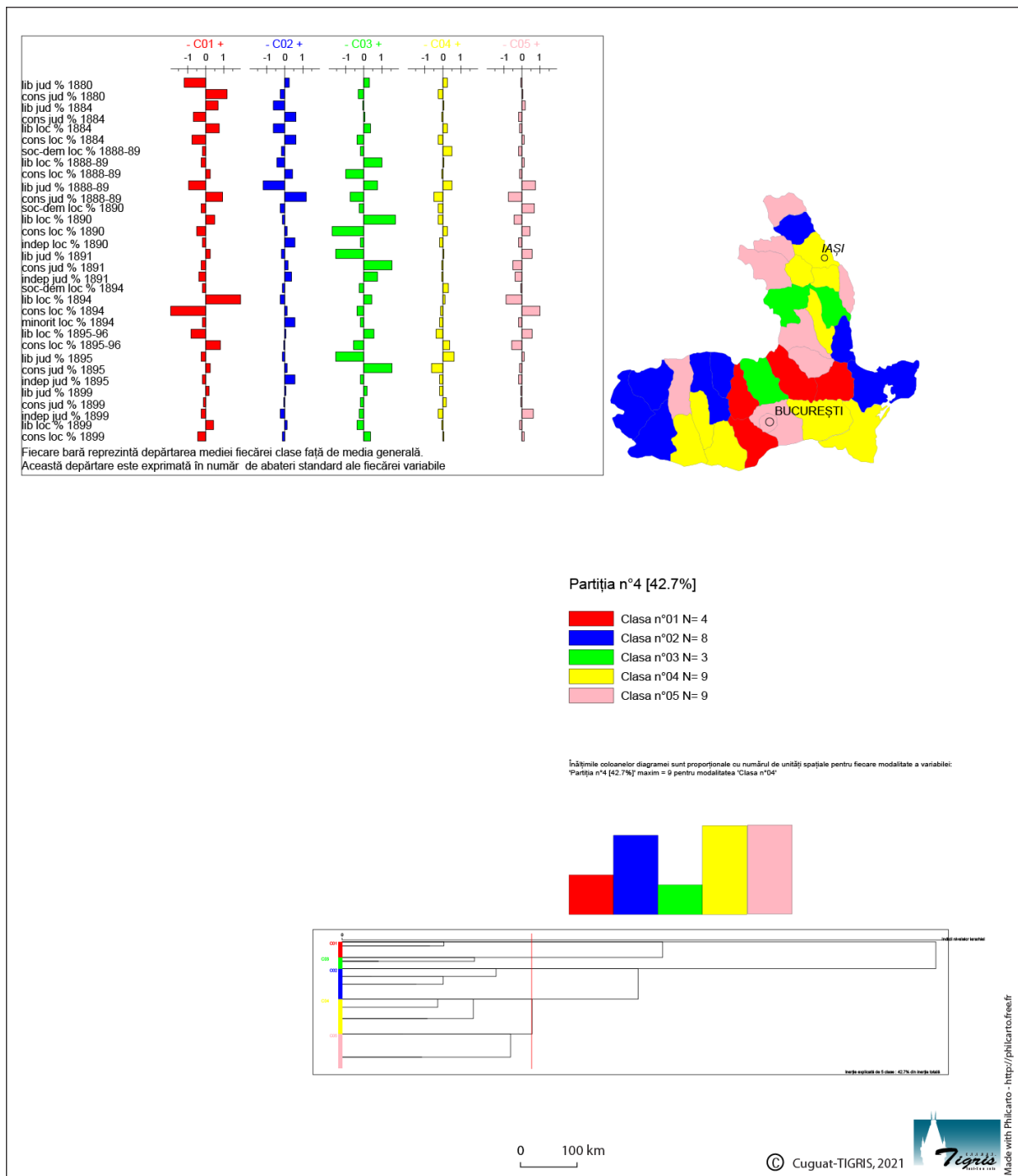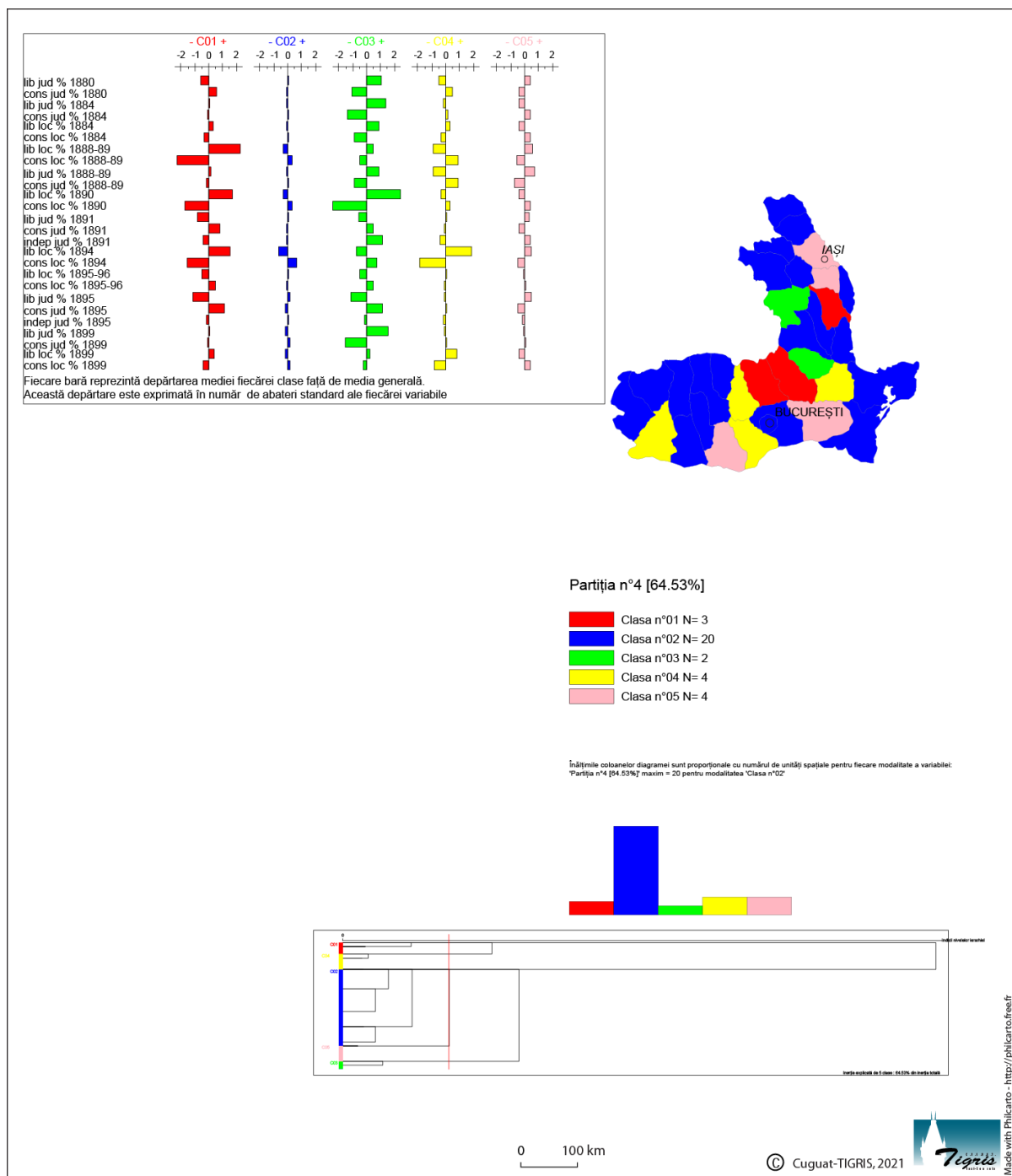
Figure 7. Chrono-spatial repartition of mandates by political formations at the county and communal elections in Romania (1880-1899). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

For the interval we are referring to, Bacău and Râmnicul Sărat counties were characterized by numerous mandates won by Liberals (Figure 7), often in the years when the mentioned party also won the parliamentary elections. Tutova, Buzău and Prahova counties behaved somewhat similarly. Instead, the counties of Iași, Vaslui, Ialomița and Teleorman were characterized by mandates won somewhat on par by both major parties, while in Brăila, Dâmbovița, Vlașca and Dolj, the Conservatives won mandates slightly more frequently than at national level. The same Conservatives prevailed, more frequently, in the rest of the country, that is, in the north and south of Moldova, in Dobrogea, the south and west of Muntenia and in most of Oltenia.
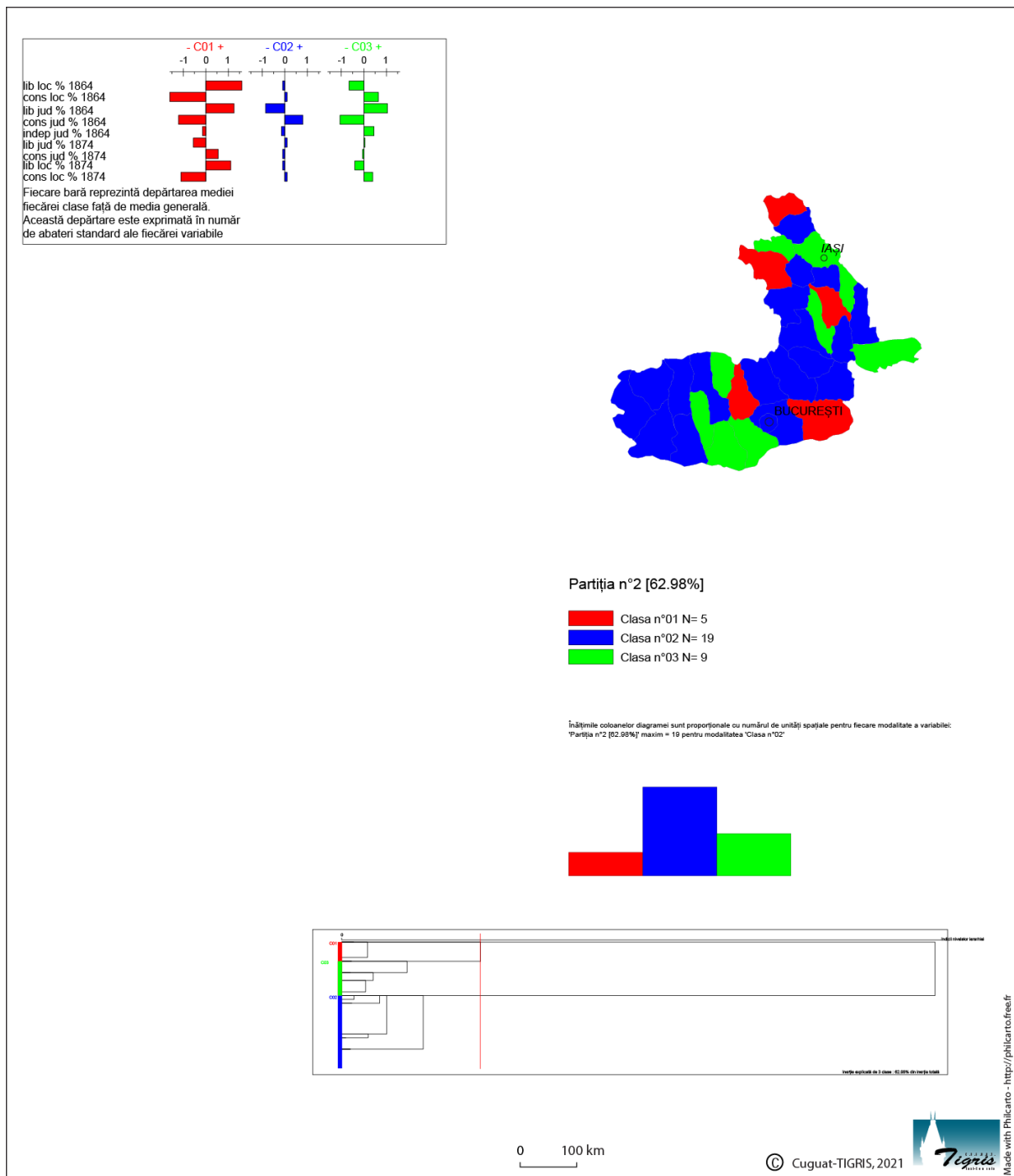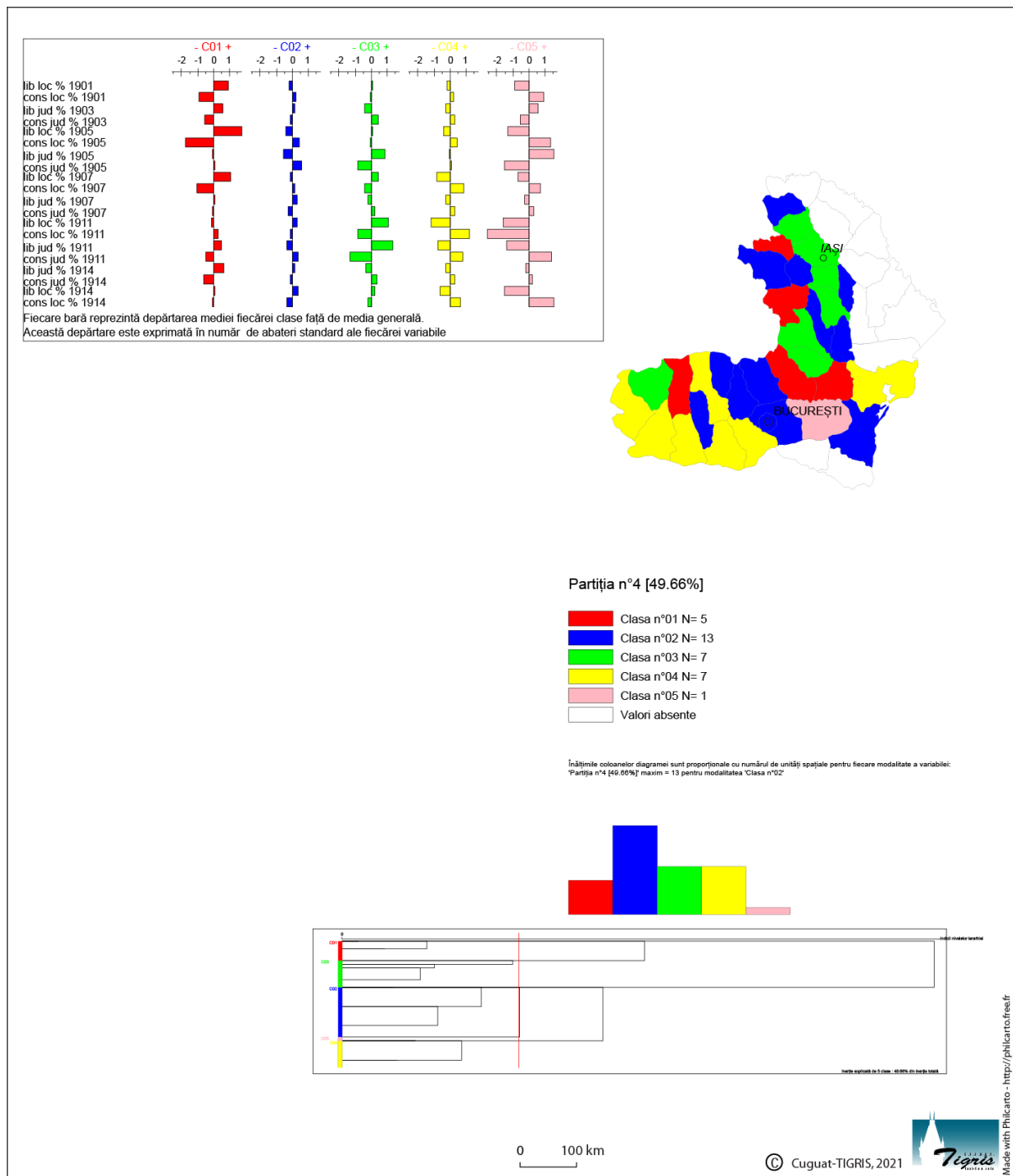
Figure 8. Chrono-spatial repartition of mandates by political formations at the county and communal elections in Romania (1901-1914). Hierarchical ascendent classification.
Source: *Monitorul Oficial*, 1864-1915, *Adevărul*, 1890-1914, *Lupta,* 1891-1894, *România Liberă,* 1880-1888, *Telegraful*, 1888, *Voința Națională*, 1888-1905.

In the local elections at the beginning of the twentieth century (1901-1914), in the counties of Suceava, Bacău, Brăila, Buzău and Vâlcea, the Liberals frequently won mandates above average, often – in the years when the same party obtained the government too. A similar situation was recorded in the counties of Botoşani, Iaşi, Vaslui, Tutova, Putna, Râmnicul Sărat and Gorj. Another group of administrative units stood out, rather, through a paritys between Liberals and Conservatives (each party often winning in the years when it came to power): Dorohoi, Neamț, Roman, Fălciu, Tecuci, Covurlui, Constanța, Ilfov, Prahova, Dâmbovița, Muscel and Olt (Figure 8). Finally, if in Ialomița we recorded, mainly, Conservative

victories, the last group of counties stood out by winning, by the mentioned party, all the local elections in this interval: it is about the counties of Tulcea, Argeş, Vlaşca, Teleorman, Romanaţi, Dolj and Mehedinţi.

5. DISCUSSION

Throughout the pre-war period (1864-1914) there are certain areas in which the Liberals were, mainly, winners, represented by the counties: Neamţ, Roman, Bacău, Vaslui, Tutova, Putna, Râmnicul Sărat, Constanţa, Prahova, Teleorman, Olt, Vâlcea and Dolj. The Conservatives obtained the first place, most frequently, in Dorohoi, Botoşani, Tecuci, Covurlui, Tulcea, Ialomiţa, Ilfov, Vlaşca, Muscel, Romanaţi, Gorj and Mehedinţi. If the Dobrogea counties have a different situation, for the first analyzed years (1864-1874), the South Basarabian counties were also noted for the preponderance of support for Conservatives. In the other administrative units, no political formation was clearly evident during the whole analyzed period.

As we noted earlier – in the case of the elections for the Assembly of Deputies and for the Senate – the distribution of the mandates of county and/or communal councilors has a repartition very similar to that of the votes. The only notable difference is that only Liberals, Conservatives and, less frequently, Independents obtained mandates as councilors, the other political orientations not being represented.

We can analyze the electoral variables at the level of all types of elections from the pre-war period. Thus, in terms of turnout, in the first interval (1864-1877), it is noted by a high turnout in southern Basarabia and Moldova, followed by Ilfov (with Bucharest). The second interval (1879-1899) shows a Moldova very interested in the electoral processes, followed by Muntenia, this time, the same regions being noticed after 1900 (between 1901-1914).

Regarding the electoral preferences of the voters, the first interval (1864-1877) is highlighted by the preferences above average for liberals of Oltenia and Ilfov (with Bucharest), while southern Basarabia, Moldova and the rest of Muntenia were rather, conservative. Independent candidates were voted especially in southern Basarabia, but also in Muntenia and Oltenia. The second interval (1879-1899) already brings a diversification of the pre-war Romanian political spectrum. Thus, the Social Democratic candidates were often supported in Moldova, but also in the Capital. The Capital (within Ilfov) also voted, above average, in general, with the Liberals, as well as the rest of Muntenia and Oltenia, while Dobrogea and Moldova preferred, rather, Conservative candidates. We note, in the case of Dobrogea, the vote for minorities (even if it was singular, in the communal elections of 1894). Finally, Oltenia, Muntenia and Moldova frequently supported independent candidates.

In the last pre-war period (1901-1914) was distinguished by the presence of a wider political spectrum, with the difference that, instead of minority candidates, the Far Right appeared. The Social Democrats were supported, this time, especially in Muntenia, after which Moldova was highlighted again. The Liberals received support especially in Oltenia, while the Conservatives were voted especially in Muntenia (with Ilfov and Bucharest). The Far Right is starting to stand out especially in Moldova, being present in Muntenia (even if, in both regions, the share of votes was modest). Independent candidates were supported especially in Moldova and Ilfov, receiving many votes in Muntenia as well. Dobrogea had a special situation: the support for Liberals or Conservatives was relatively evenly distributed, in the elections in which voters between the Danube and the Sea participated, noting that in Constanţa the Liberals were preferred, and in Tulcea – he Conservatives.

6. CONCLUSIONS

Given that the turnout was declining (and for the reasons already mentioned), there were certain territorial concentrations that generally remained above average throughout the half-century. Such a group stands out in the north of Moldova, being constituted by the counties of Botoşani, Iaşi, Suceava, Neamţ, to which, after 1880, Romanul also joined. In the southern half of the region, only Tutova and Tecuci stand out, to which Fălciu was added, after 1880. In the south of the country, Râmnicul Sărat, Vlaşca, Teleorman, Olt, Muscel – all from Muntenia and only Vâlcea – from Oltenia stand out continuously. After 1880, Prahova and Gorj joined, but Buzău left this group. We also note that, for the first part of the analyzed period (1864-1874), the Basarabian counties were distinguished by notable influxes at the polls, which did not characterize, since 1880, the Dobrogea counties, as well as the other administrative units which were not mentioned. Thus, there are two areas with significant turnout – northern Moldova and southwestern Muntenia (plus southern Basarabia, before 1878), separated by other areas, larger, with low shares: southern Moldova, northern Muntenia and most of Oltenia, extended, since 1880 and in Dobrogea.

Regarding the electoral preferences, there is differences, both in terms of spatial distribution and related to the specifics of each interval. Thus, in the first interval (1864-1874), the Liberals were supported, in general, above average, in Dorohoi, Neamţ, Bacău, Tutova, Ialomiţa, Teleorman, Muscel, Dolj,

while the Conservatives won, mainly, in Fălciu, Cahul, Ismail, Putna, Tecuci, Covurlui, Râmnicul Sărat, Brăila, Buzău, Ilfov, Olt, Romanaţi, Vâlcea, Gorj, Mehedinţi. The other counties did not stand out with a clear winner.

The interval 1880-1899 was characterized by a diversification of the political spectrum, being voted also representatives of the Social-Democrats and Minorities, in addition to the Independents who had appeared, isolated, earlier (in Ismail). The counties of Neamţ, Roman, Tutova, Putna, Buzău, Prahova, Teleorman, Olt, Mehedinţi were rather Liberal, and predominantly Conservative – Dorohoi, Botoşani, Iaşi, Bacău, Fălciu, Covurlui, Tulcea, Ialomiţa, Ilfov, Musf Vâlcea, Gorj. There was no clear winner in the other counties. We note the presence, quite modest, of the electoral support for the Social-Democrats in Iaşi, Roman, Covurlui, Brăila and Ilfov, for Independents – in several counties and for Minorities – in Tulcea county (at the communal elections of 1894).

Finally, in the last analyzed period – 1901-1914 – we noticed, in addition to Liberals and Conservatives, votes given to the Nationalist extreme right and, again, to the Independents. The Liberals were the most frequent winners in Dorohoi, Botoşani, Iaşi, Roman, Neamţ, Bacău, Vaslui, Putna, Tutova, Covurlui, Brăila, Constanţa, Râmnicul Sărat, Buzău, Prahova, Vâlcea, Gorj, and the Conservatives – in Fălciu Tulcea, Ialomiţa, Ilfov, Vlaşca, Olt, Romanaţi, Mehedinţi. The extreme right was highlighted, by modest weights, in Iaşi, Covurlui and Prahova, and the Independents – in Brăila, Ialomiţa, Ilfov, Argeş, Muscel and Romanaţi.

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Exploring unbalanced urban spatial expansion in sprawling cities. Case study of Kimara Matangini, Kibululu and Dovya settlements in Dar es Salaam City, Tanzania

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Abstract: Unbalanced urban expansion characterize urban growth in rapidly urbanizing cities in the global south. This pattern of growth has resulted into difficulties in provision of services which leads to challenges of livability within settlements. Services such as education, health, water supply and road network are not easily accessible because of unbalanced growth. Balanced urban growth is concerned with three key themes: place, people and planning. The aim of this study is to help policy makers, local governments, developers, planners and service providers to analyze and visualize different options and scenarios to achieve balanced urban expansion. The overall goal of balanced urban spatial expansion is to achieve livable, sustainable, resilient and affordable cities. This paper adopted both qualitative and quantitative approaches of data collection and subsequent analysis and captured empirical evidence from primary and secondary data sources. The key methods included; literature review, interviews and observations. The research was conducted in three settlements with a sub-ward status namely; Kimara Matangini, Kibululu and Dovya. Findings indicate that the drivers of urban spatial growth are related to economic and social factors, people's choice and satisfaction of residential areas, modalities in land acquisition, provision or non-provision of services, mobility, proximity to services and proximity to the city centre. Yet the emerging development pattern pose some challenges to residents settling in these areas because of unavailability or longer distances to basic services. This pattern of growth has culminated into unbalanced urban growth. This study recommends that the government in collaboration with key stakeholders should strengthen development control even in unplanned settlements so as to monitor development and potential service requirements, acquire parcels of land for future service provision, strengthen regularization activities to provide for land reserves for infrastructure and conduct a city wide analysis on the unbalance pattern, especially in rapidly urbanizing peri-urban areas.

Key words: unbalanced spatial growth, service availability, accessibility, livability, density

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1. INTRODUCTION

Urban spatial change is the process of growth and decline of the spatial extent of land use agglomerations. The spatial pattern of cities and their evolution, has been found to be a result of economic and social change factors. Similarly, the size and pattern of urban forms results from the patterns of urbanization and at times influenced by planning interventions [1]. Urban growth exhibits many patterns that reshape the urban spatial structure, which also contribute to changes on housing density and transportation systems. Urban areas are in their nature dynamic, complex and are continuously changing. These changes are catalyzed by many drivers and underlying factors. Among these, transport is

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considered one of the main factors of urban growth. Advances in the transport system have reduced the cost of commuting within urban areas and encouraged urban scattering. Equally, transport infrastructure expansion has stimulated urban growth and land use changes.

Urban spatial growth has been strongly influenced by population growth that catalyze land use change as a source of livelihood. However, in most of the cities in the global south, unplanned urban growth has culminated into informality of both housing and livelihood activities. Where informality has emerged in some difficult or hazardous lands, it has led to the occurrence of disasters in the context of climate change. Consolidation and expansion of informally developed settlements have aggravated the unbalanced nature of urban expansion especially the issue of access to basic services. Infrastructure services and community facilities are problematic to the extent that services provided are not sufficient, due to fact that unplanned settlement agglomerations do not provide room for the provision of these services [2].

Dar es Salaam is a rapidly growing city that has been experiencing substantial changes in its spatial pattern and land development. These spatial changes have been driven by a number of factors which include; transport and communication, internal migration, high natural growth rates of population, public policies and agglomeration economies. Urban expansion has taken the form of 'peripherization' that is characterized by large sections of peri-urban areas with the informal pattern of land use developments. Most of these settlements are deficient in terms of infrastructure services, public facilities and often accompanied by inadequate provision of access roads and public transport. Spatial forms that emerge are largely driven by individual efforts to secure land to construct a shelter that is affordable by respective households [3]. The unplanned spatial expansion of Dar es Salaam leads to unbalanced or difficulties in services provision as per urban planning guidelines. The consequences of this pattern of growth has been manifested in increased inaccessibility to services such as schools and health facilities within and outside the vicinity of the neighbourhoods when densities reach the highest levels. This paper seeks to explore the drivers that contribute to urban spatial growth in Dar es Salaam City and examine accessibility thresholds resulting from this pattern of settlement growth. The main purpose being to contribute to the existing body of knowledge on unbalanced urban expansion and its effects on livability. This paper is expected to find readership among policy makers, practicing planners as well as academicians.

2. CONCEPTUALIZING BALANCED URBAN EXPANSION

Many authors have discussed the concept of balanced urban expansion pointing out that it relates to broader concepts of sustainable development and livable cities [4]. They argue that while the concept symbolizes the big visionary ideas for urban planning and balanced development its implementation can encounter a host of conflicts due to a range of interests and stakeholders involved [4].
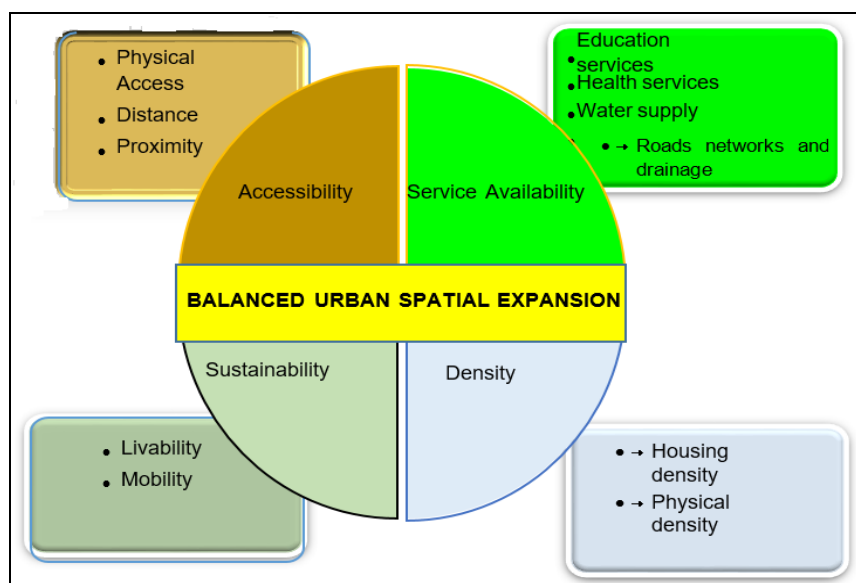

Figure 1. Conceptual framework.
Source; own construct.

In this paper, four key variables have been considered to characterize balanced urban expansion namely; accessibility, service availability, sustainability and density (Figure 1). While the aim of balanced urban expansion or development is to help urban stakeholders to develop various planning tools and models that help to analyze and visualize different options and scenarios, the overall goal of balanced urban expansion is to deliver livable, sustainable, affordable and accessible cities. Accessibility refers to the ability and easiness by which people can reach the desired activities, places or areas. It refers to the potential of opportunities for interaction [5]. An accessible area or environment is an area which allows the freedom of movement and use in total safety, regardless of age and gender [6]. Related to balanced spatial expansion, the concept of accessibility is important because it helps to show how city expansion should accommodate the services needed. Many urban dwellers face accessibility challenges, they are unable to access services because of distance and congestion when urban areas expand without following urban guidelines. Therefore, the concept of accessibility is an important component in urban spatial expansion analysis because it helps to show how urban expansion should be designed to accommodate facilities needed by all users. In this paper a focus is paid on physical accessibility, distance and proximity analysis in analyzing access to facilities by users.

While sustainable development as a concept has been widely discussed from various perspectives namely spatial, environmental, economic, social, cultural and political [7], in this paper, this concept is being viewed from livability and mobility points of view. Livability as a conceptual variable depict changing interpretation due to a range of factors in time and space. What is livable now and in one specific area may not be so in future and in another locality [4]. This points out to discussing livability in context based on locality data or information. The same authors [4] argue that it will be important to regularly collect data that will assess livability, community health, well-being and a range of factors that contribute to a better quality of life in a given urban area or context. Other authors argue that the common goal of livability is to ensure that we direct our actions, planning and designs that will make a place enjoyable to live in [8,9]. The idea of a livable city is to bring the community together for healthy living, enhanced their interaction among themselves and the surrounding environment and promote their productivity and wellbeing in a sustainable way. Livability is often related to the values and preferences of local community places for amenity, wellbeing aspect and sense of place or belonging.

Another perspective on livability as a concept is the social infrastructure and community interactions and their impact on access to quality services. These may include; health, educational, social, cultural, business and recreational facilities in the area and how these facilities promote social interactions, a sense of community place and belonging. The future livable cities must also have climate change adaptation and risk management strategies, particularly taking care of natural disasters, such as flooding and wildfire in their agenda.

Mobility in this discussion refers to the easiness of movement from one destination to another with the help of a transport network and services available within the two destinations. Mobility between original and destination is measured as the distance travelled by people in person miles travelled [10]. In the same vein, accessibility is discussed with the view to the extent to which goods, services, places and information are accessible with minimum time and efforts [5]. It is classified as access to other people, access to human activities, access to services, access to material resources, access to the natural environment and access to information [5]. Accessibility in this paper has been viewed in the context of physical accessibly, distance and proximity.

While distance has been viewed as a key geographical concept especially as part of the theoretical and quantitative revolution, its perceived advantage of distance over other key geographical concepts was that distance connotes an objective physical property [11]. It could easily be measured, quantified, and deployed in comparative work. Impliedly, urban growth or expansion can be determined by the relationship between the service available and the extent of distance perceived in a settlement. This sub variable is closely related to proximity. Proximity is associated with member value. Some authors argue that proximity helps consumer co-operatives understand and serve their members' needs through their closeness to the members' daily social activities (locale) [12]. The sustainable consumption literature highlights the role of proximity as a contextual factor which constrains and shapes consumer preferences [13]. Therefore spatial proximity, is a widely used dimension to analyze geographical closeness of two agents or localities [14]. In this paper, the operational measure of spatial distance is the actor's perception of the geographical distance.

Service availability makes reference to the physical presence of services. In this paper, service availability did not include more complex dimensions such as geographical barriers, travel time and user behaviour, which require more complex input data. Service availability is simply described by the presence of services as responded by respondents. In this context, two major items were put into focus namely; education (schools) and health facilities (dispensaries and health centres).

Density is a concept also draws in varied meanings and interpretations. While physical density (sometimes referred to as objective density) has been examined as land use ratios, from a housing perspective, density has been measured in terms of floor area ratios, plot coverage and dwelling units per specified area [15,16]. Floor Area Ratio (FAR) refers to floor space in relation to plot or land area, plot coverage refers to the proportion of built-up areas to that of plot area expressed in percentage. Floor Area Ratio largely expresses the verticality of buildings while coverage expresses the horizontal coverage of built spaces [15, 16]. In common practice, density has often been referred to as a degree or intensity of development or of occupancy. The focus of this paper is on a number of houses in a given geographical space that is primarily aimed at tracking variations across settlements and as a dimension of balanced urban expansion.

3. METHODOLOGY

Dar es Salaam city was selected as a case study primarily because it is a primate city with a rapid urbanization rate. The unguided nature of city expansion has rendered many of the peri-urban settlements to develop informally. The rate and spatial character of these settlements depict a varied situation in terms of service availability and accessibility, physical accessibility and physical densities. Therefore, having listed five settlements that could be selected, and elimination method was used based on four established criteria to select a few cases for detailed interviews. The selected settlements were Kimara Matangini and Kibululu in Ubungo Municipality, and Dovya (Bunju) in Kinondoni Municipality (Table 1).

Table1. Case selection criteria.

S/N	Settlement	Service availability	Sustainability of the area	Accessibility	Population density	Total score
1	Kimara Matangini	X	X	X	⊕	3
2	Kibamba	⊕	X	⊕	⊕	1
3	Kisarawe	⊕	X	⊕	⊕	1
4	Kibululu	X	X	X	⊕	3
5	Dovya	⊕	X	X	⊕	2

NB: X stands for not well served and ⊕ for a well-served area

The sample size for household interviews was established based on sub-ward population statistics for each settlement. Using a statistical model [17], the sample sizes for household interviews was 68 households for Kimara Matangini, 64 households for Kibululu and 60 households for Dovya. Mapping was used to analyze spatial data especially on the emerging city spatial pattern and location of services. The same methods was employed to analyze proximity and accessibility to services within case study settlements. Quantitative data was analyzed using tables and spatial data (proximity analysis) was analyzed using Geographical Information System Software (GIS).

4. RESULTS

4.1. Urban spatial expansion of Dar es Salaam

Dar es Salaam is the largest city and commercial capital of Tanzania. With a total population of 4.4 million in 2012, it is one of the rapidly growing cities in sub-Saharan Africa [18]. Dar es Salaam's population grew at an average annual rate of 5.6 percent between 2002 and 2012. Despite the rapid

population growth, population densities remain quite low in most parts of the city [19]. The city has a jurisdictional area of 147,557 hectares and its built up area is estimated to be 115,372 hectares. The built up area is equivalent to 71 percent of the jurisdictional area [20]. By 1892, the spatial extent of Dar es Salaam was limited to only 2 kilometre radius from the city centre. This coverage increased to 6 kilometres in 1963, 17 kilometres in 2002 and 30 Kilometres in 2012. The spatial expansion of Dar es Salaam in the 1970s and 1980s followed a star-shaped pattern along major roads of Bagamoyo, Morogoro, Pugu and Kilwa [20]. Presently, the city has grown up to 30 kilometres northwards along Bagamoyo Road, 28 kilometres westwards along Morogoro Road, some 32 kilometres southward westwards and south eastwards along Pugu and Somanga Roads (Figures 2 and 3).

(a)   **(b)**
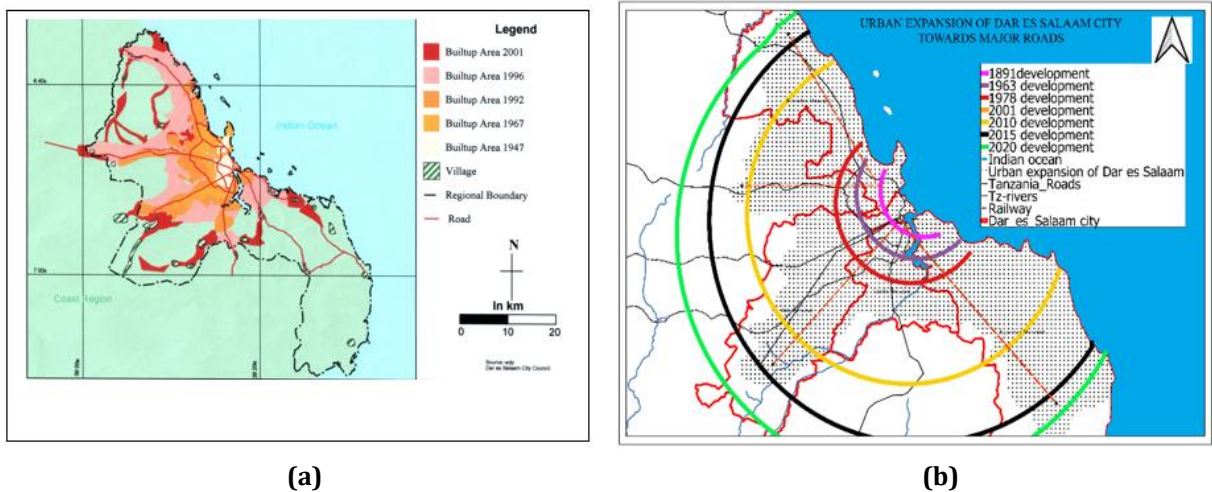
Figure 2. (a) Dar es Salaam city spatial expansion (1947-2001); **(b)** Dar es Salaam city spatial extent (2020).
Source: [15, 22, 23, 24]

(a)   **(b)**
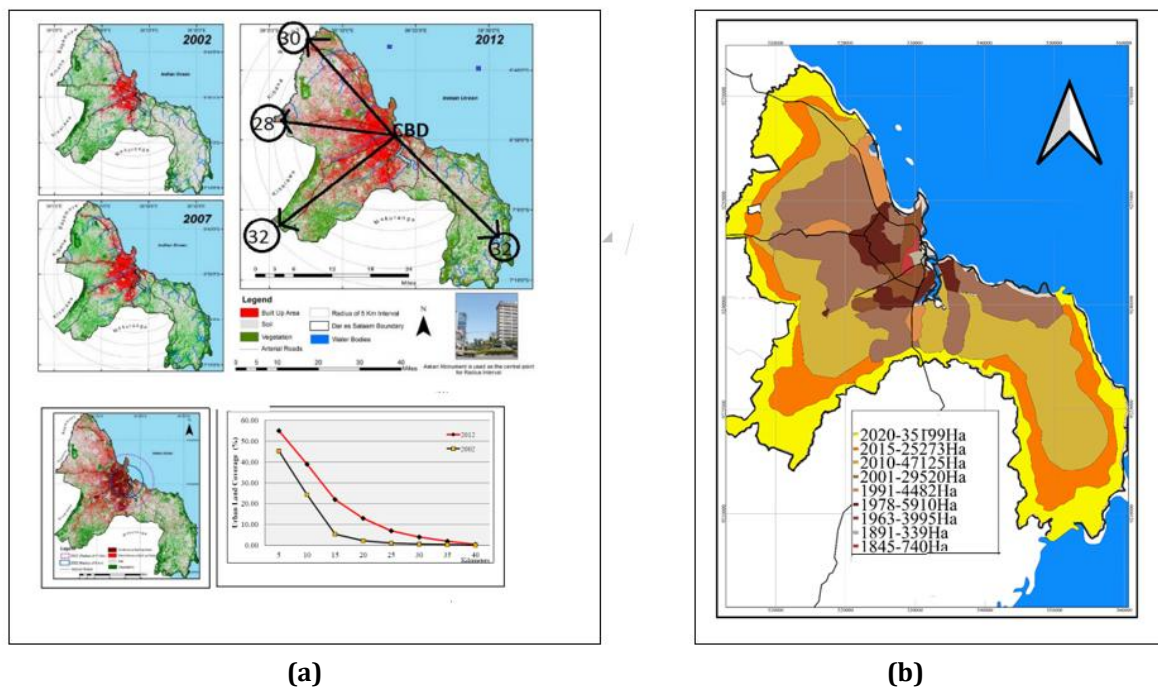
Figure 3. Spatial growth trends and extent of Dar es Salaam City. **(a)** City spatial growth trends and extent (2002-2012) and density gradient with distance from the city centre; **(b).** City development extent and built up areas in hectares (1845-2020).
Source; [19, 20, 22, 23]

Provision of infrastructure services has not kept pace with the demographic and spatial growth of the city. Road density for Dar es Salaam has been diminishing over time. For example, while urban growth for Dar es Salaam stood at 13 square kilometres in 1947, the road length by then was 107 kilometres. This resulted into a road density of 8.3 kilometres per square kilometre. In 1967, when urban growth had

reached 51 square kilometres and a corresponding road length of 190 kilometres, road density diminished to 3.7 kilometres. In the year 2012, road length had increased to 941 kilometres within a spatial growth extent of 927 kilometres resulting into road density of 1.0 kilometre per square kilometre [25]. The diminishing road density has been taking place amidst a rapid increase (estimated at 5.6 percent per annum) of Dar es Salaam population. While in 1948 Dar es Salaam population stood at 50,765, this figure increased to 93,363 people in 1957, then to 272,821 in 1967, further increased to 843,090 in 1978 and in 1988 the population for Dar es Salaam had reached 1,377,201. The population census of 2002 recorded a population of Dar es Salaam to be 2,487,288 and the latest census that was conducted in 2012 recorded a population of 4,364,541 [25]. While 85 percent of the population in Dar es Salaam can access potable water supply, only 10 percent have access to sewerage connection services. Informal settlements have also grown in terms of size, population, spatial extent and density. The reasons for informal growth are largely attributed to the limited capacities of urban local government authorities to timely acquire, plan and make serviced land available to developers, increasing land acquisition costs, ineffective urban development control and rapid population increase resulting from in-migration and natural growth.

The city spatial expansion has continued undeterred despite escalating problems in the mobility system of the city. Dar es Salaam has a mono-centric structure, where most of the functions and employment centres are located in the central business district. Mobility system is characterized by highly inadequate road networks, insufficient public transport and severe congestion problems [26]. The ongoing transformations of the central areas into high-rise commercial buildings along with increasing rates of car ownership has further increased pressure on the urban mobility system [27]. Urban expansion is happening largely informally and unguided by the city planning authorities. In total, an estimated 80 percent of Dar es Salaam's territory is informal [28].

4.2. Description of case study areas

The three case study areas are Kimara Matangini, Kibululu and Dovya (Figure 4).
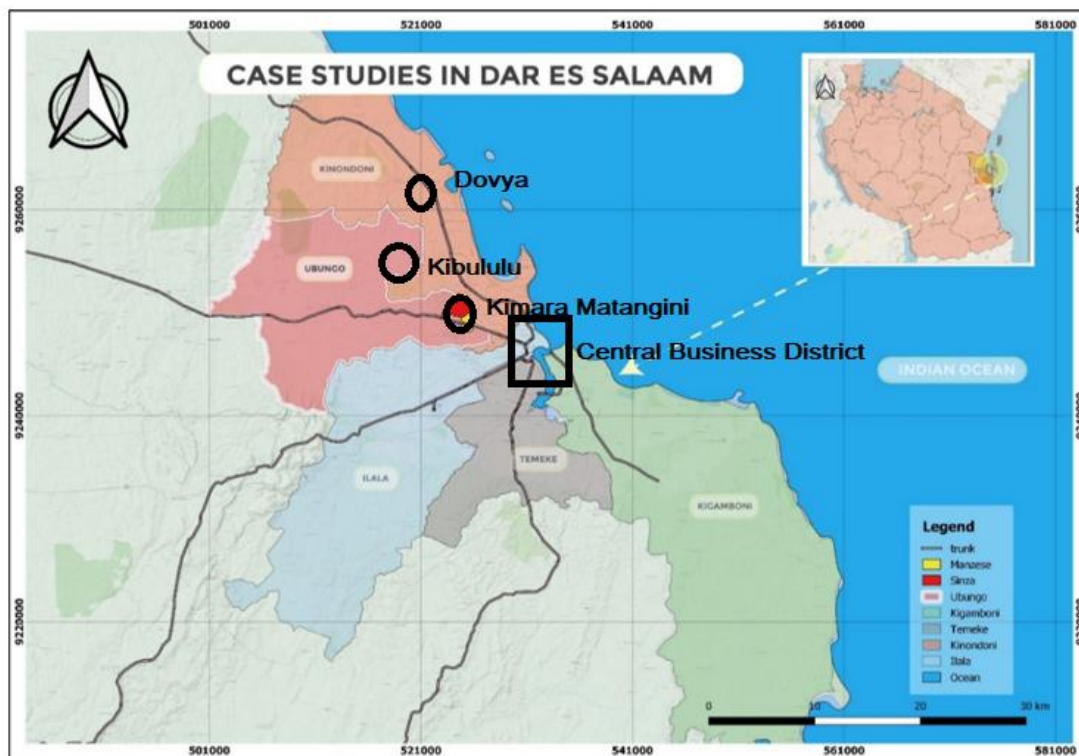
Figure 4. Location of case study areas.
Source: [23] modified by author

Kimara Matangini is a sub-ward in Kimara ward in Ubungo Municipality. It occupies a total area of 277 hectares. It has a total population of 11,000 people and an average population density of 40 persons per hectare. It is located along Morogoro Road. It has developed informally with limited or planned services to serve the entire population and the consolidating settlement. Kibululu sub-ward is located in Goba award in Kinondoni Municipality. Kibululu covers a total area of 592 hectares with a total population of 15,940 people. It has a gross population density of 27 persons per hectare. This is a settlement where informal housing construction is going on. Dovya is a sub-ward located in Bunju ward in Kinondoni Municipality. It covers a total area of 944 hectares and an estimated population of 13,000 people. These two variables give an average population density of 14 persons per hectare. It is a settlement where informal housing development is also on-going (Figures 4, 5, 6 and 7).
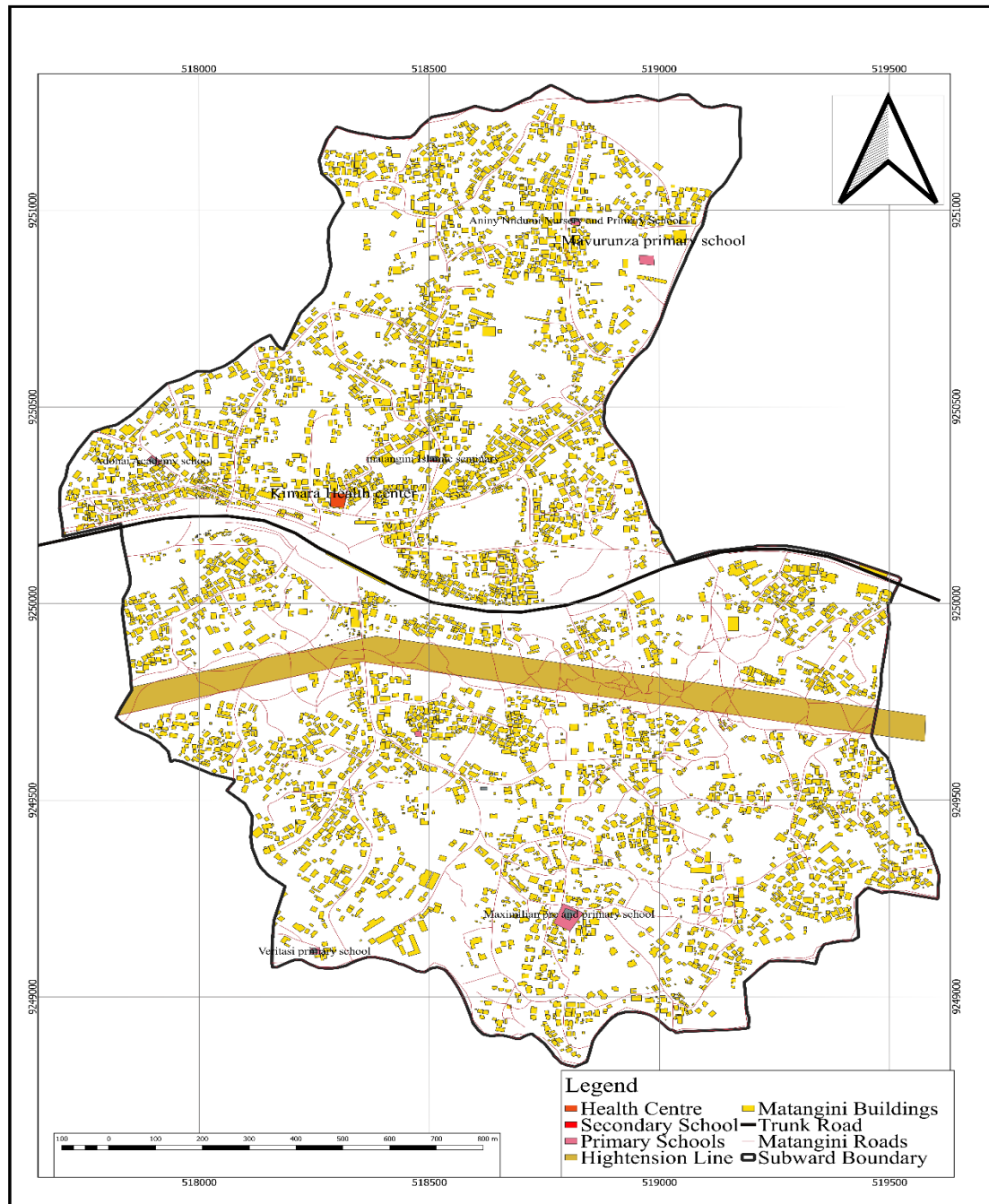
Figure 5. Locational characteristics of Kimara Matangini settlement.
Source: [29]
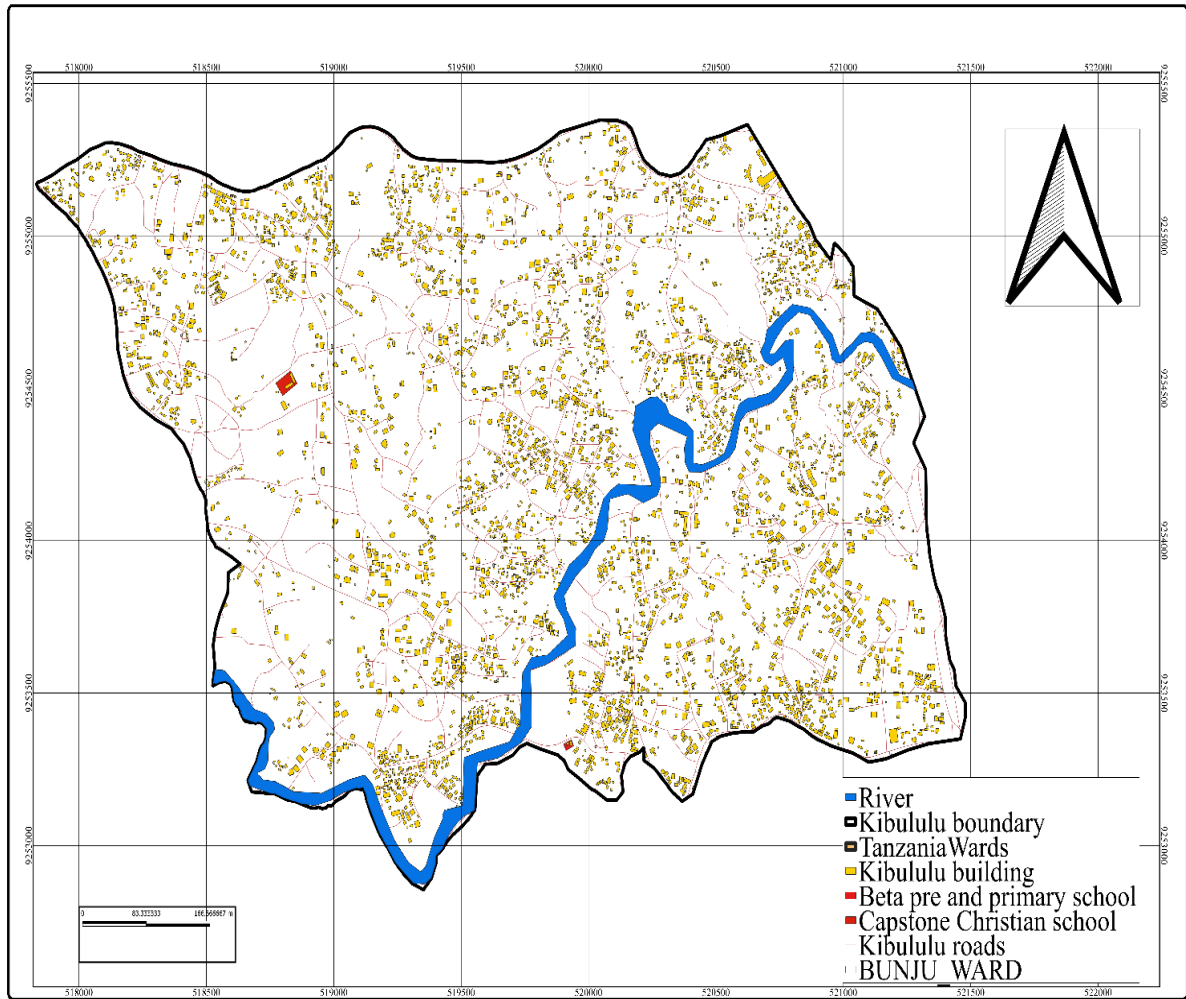
Figure 6. Locational characteristics of Kibululu settlement.
Source: [29]
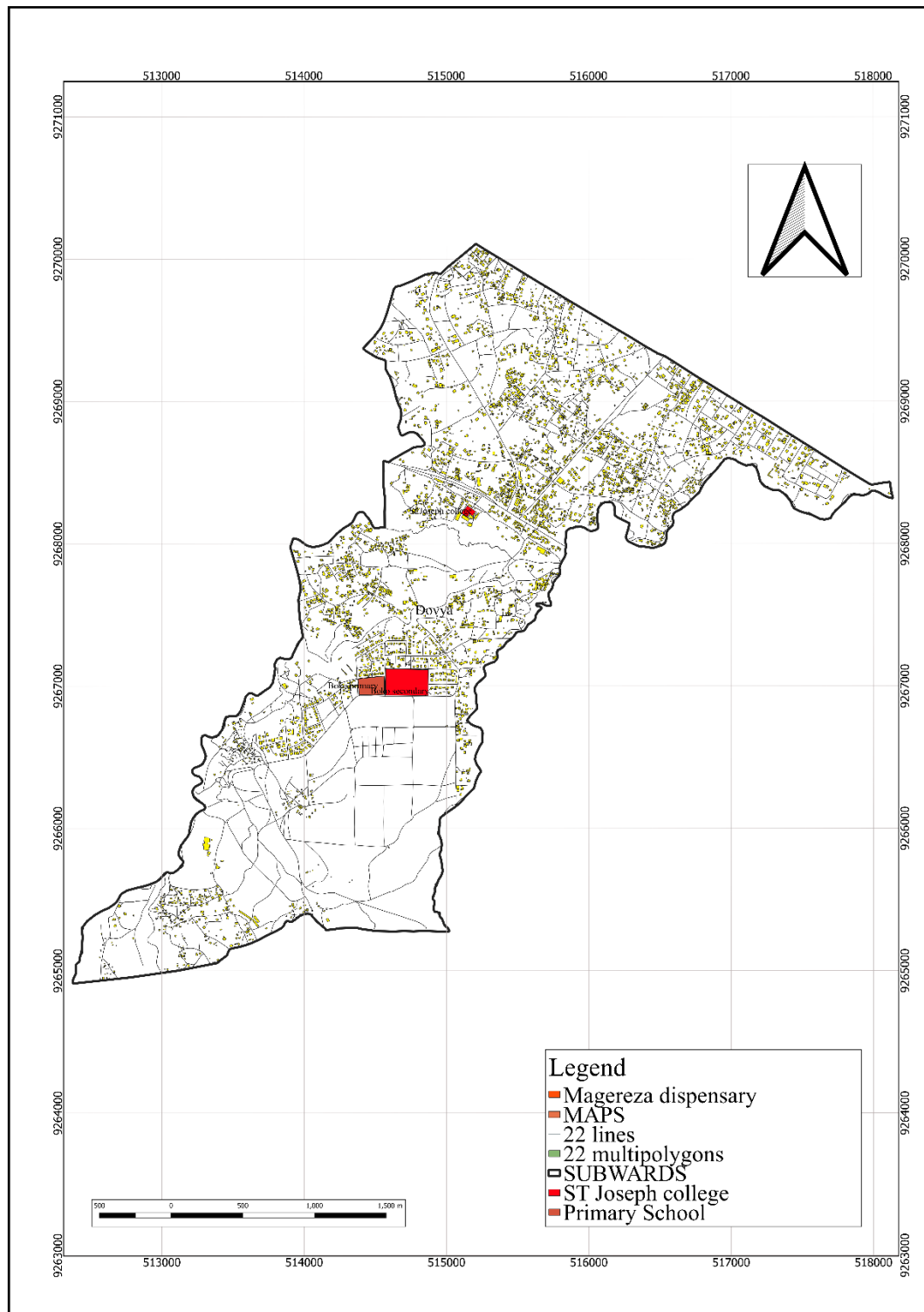
Figure 7. Locational characteristics of Dovya settlement.
Source: [29]

4.2.1. Household characteristics

From the three case study areas there was variation in number of household members who lived in one house. While in Kimara Matangini the highest number of household members living in one house was 4, the same was for Kibululu where the established figure was 4 household members. In Dovya settlement, the highest values were recorded for 3, 4 and 5 household members per house (Table 2). This size

corresponds to the Tanzania average of 4.6 as reported by the National Household Budget Survey Report of 2020 [30].

Table 2. Household characteristics.

Total number of household members	Settlement		
	Kimara Matangini	Kibululu	Dovya
1	3	2	2
2	7	3	4
3	5	7	13
4	14	15	13
5	12	13	13
6	10	13	8
7	3	6	3
8	1	1	2
9	0	0	0
10	0	0	0
Total	68	64	60

Source: Household interviews, June, 2021

Employment status

Employment status determines the pattern of movement of people from one location to another. About 50 percent of the respondents said that they were employed in the government, private sector and self-employed. Employed respondents in Kimara accounted for 68 percent, 89 percent in Kibululu and 63 percent in Dovya (Table 3).

Table 3. Employment status.

	Kimara Matangini	Percent	Kibululu	Percent	Dovya	Percent
Yes	46	68	57	89	38	63
No	22	32	7	11	22	37
Total	68	100	64	100	60	100

Source: Household interview June, 2021

These data are not far from the national average of 78 percent employment as per Integrated Labour Force Survey of 2014 [31]. They also indicate that the majority of the people from these settlements earn their livelihood based on employment. In terms of employment by sector, the collected data indicate a high percentage of respondents from all three case study settlements to work as self-employed, followed by government and private sector. In Kimara, for example, 44 percent were self-employed, 43 percent were employed in the government sectors and 13 percent were employed in the private sector. In Kibululu settlement 60 percent were self-employed, 30 percent employed in the government sectors and 10 percent were self-employed. In Dovya settlement, 63 percent were self-employed, 32 percent were employed in the government sectors and has and 5 percent were employed in the private sector. These data implies that the majority of the people are currently self-employed in various economic activities (Table 4).

Table 4. Employment by category of respondents.

	Kimara Matangini	Percent	Kibululu	Percent	Dovya	Percent
Government	29	43	21	30	19	32
Private sector	9	13	7	10	3	5
Self employed	30	44	36	60	38	63
Total	68	100	64	100	60	100

Source: Household interview June, 2021

Modality of land acquisition

One of the factors contributing to city sprawl is the modality of land acquisition. Free entry to land acquisition without controls from urban authorities promotes informal land transactions and subsequent development. From the case study settlements, there were two main modalities of acquiring land which included purchase and inheritance or gift. There were neither cases of granted right of occupancy not customary land ownership. In Kimara Matangini purchase of land accounted for 44 percent, 61 percent for Kibululu and 43 percent for Dovya. There were more cases of inheritance and gift in Dovya (57 percent) followed by Kimara (56 percent and Kibululu (39 percent) (Table 5).

Table 5. Modalities of acquiring land.

Modality	Kimara Matangini	Percent	Kibululu	Percent	Dovya	Percent
Purchase	30	44	39	61	26	43
Inheritance and gift	38	56	25	39	34	57
Total	68	100	64	100	60	100

Source: household interview June, 2021

This pattern of land acquisition indicates that increasingly, people who purchase land are more or less equal to those who inherited land. This implies that people purchasing land are usually outsiders from the original settlers of these areas and contribute to sprawling city and further consolidation of houses in these settlements.

Plot sizes

According to the Urban Planning Space Standards, high density plots have the area range of (301-600) square metres, medium density (601-800) square metres and low density (801-1,200) square metres [32]. Observation studies in the three settlements recorded that most of the plots constituted high density and only a few were in the category of low density (Table 6).

Table 6. Plot sizes in the case study areas.

Plot category	Plot size (M²)	Kimara Matangini	Percent	Kibululu	Percent	Dovya	Percent
High density	301-600	62	91	59	92	52	87
Medium density	601-800	5	8	5	8	8	13
Low density	801-1,200	1	1	0	0	0	0
Total		68	100	64	100	60	100

Source: Household interviews and observation studies, June, 2021

Further observations from these areas revealed that some of the plots were below the prescribed standards. This was attributed to the fact that plot owners were free to subdivide and sell plots without any town planning consideration or intervention from the planning authorities. Plot owners were also changing the use of their plots from residential to commercial uses without permission from planning authorities contributing to increased density and the changing form of the settlements in terms of land use.

Factors for choice of the residential area

The factors which influenced people to settle in one settlement varied across the three case study settlements. In Kimara Matangini and Dovya settlements for example, availability of community services was reported to be the leading factor for respondents to settle in that area. This factor accounted for 24 and 18 responses of the sample population respectively. In Kibululu settlement, affordable house rent was a leading factor which accounted for 22 responses of the sampled population. Other factors that influenced people's choice of settling in a specific settlement included; family decided to settle in the settlement, social security, closeness to work place, acquisition of house to suffice household needs, availability of cheap land and proximity to city centre (Figure 8).
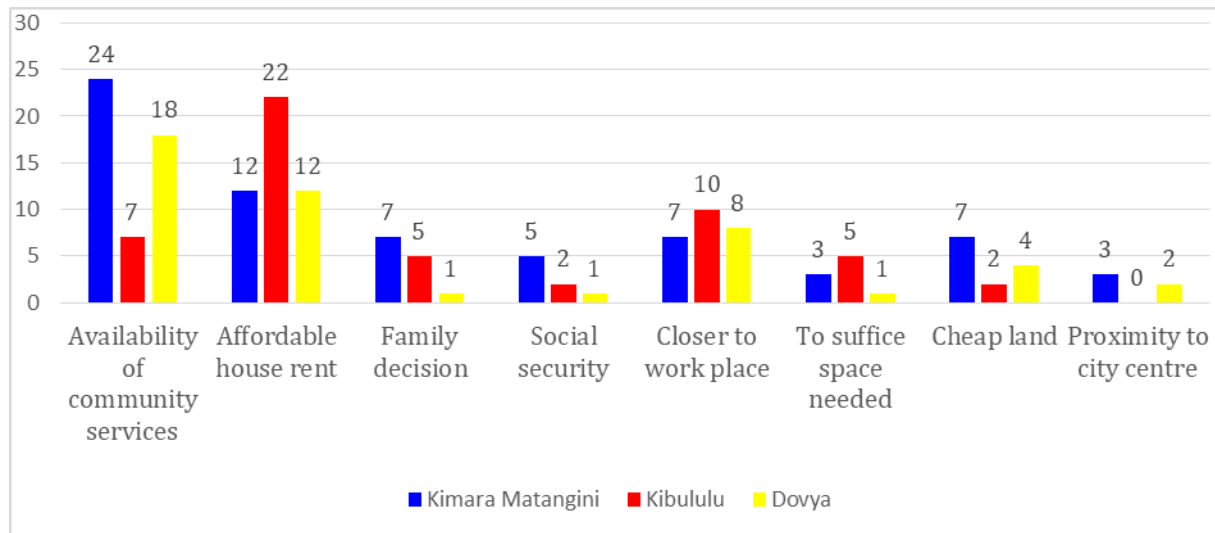
Figure 8. Factors for choice of residential areas.
Source: Household interviews and observation studies, June, 2021

The location and ease of transport accessibility to the workplace has also been highlighted as important element in the selection of a residential area. This is also related to a person's position in the life-cycle. Some researchers have modelled residential mobility at the micro level and clarified the link between place of residence and place of work on the assumption that household residential relocation is strongly embedded in housing market conditions at the local and national levels. This factor has an impact on residential choices to residents due to the reason that people look for an easy way of optimizing their living condition as well as their economic status [9].

Availability of affordable land influence residents to choose certain settlements to live and this factor vary from one settlement to another. This is probably one of the main factors contributing to city sprawl because people strive to buy and develop houses for both owner occupation and renting in peri-urban areas.

Satisfaction of residential choice

Residents' satisfaction of their choice to live in respective settlements was also assessed. Reasons for satisfaction to the residential area again varied from one settlement to another. While comfortability was highly responded in Kimara Matangini, availability of community services was reported by the majority of respondents from Kibululu and Dovya. Other responses included; proximity to the city centre, closeness to workplaces and affordability of house rent (Figure 9).

Figure 9. Satisfaction of residential choice.
Source: Household interviews June, 2021

Livability, mobility and proximity to basic facilities in case study areas

From people's perspectives, livability was examined from resident's perception to and actual availability of services for their daily life. Specific focus was paid to education and health facilities namely; nursery and primary sch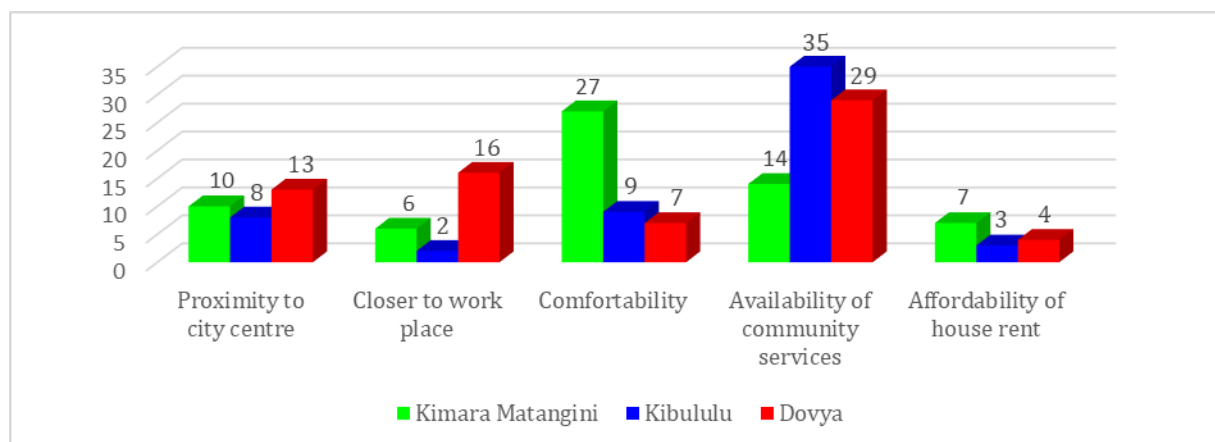ools and dispensaries and health centres because these are basic services provided at local level such as ward or sub-ward areas.

Kimara Matangini had five primary schools, one secondary school and one health centre. Kibululu had two primary schools and one secondary school. Dovya had two primary schools and two secondary schools. Mobility and proximity were analyzed based on optimal distances people had to travel to these services. From household interviews and threshold map analysis (Figures 10, 11, 12, 13, 14, 15 and 16), majority of the residents could reach basic services within a threshold distance of a half to one kilometre. For example, 31 percent of the respondents in Kibululu settlement could reach a primary school within half a kilometre, 30 percent could reach a secondary school within the same distance and the same pattern applies for nursery schools, dispensary and health centre. If one Kilometre is considered the optimal distance to basic services, then all the three settlements had these services within optimal walking distance (Table 7).

Table 7. Mobility and proximity to basic services.

Settlement	Facility		Distance to reach the facility							
			½ km	%	1 km	%	1km +	%	Total	
Kimara Matangini	Education	Primary	28	42	22	32	18	26	68	100
		Secondary	31	46	26	38	11	16	68	100
	Health	Health centre	27	40	31	46	10	14	68	100
Kibululu	Education	Nursery	18	28	32	50	14	22	64	100
		Primary	20	31	34	53	10	16	64	100
		Secondary	19	30	32	50	13	20	64	100
Dovya	Education	Nursery	11	18	28	47	21	35	60	100
		Primary	16	27	23	38	21	35	60	100
		Secondary	16	27	23	38	21	35	60	100
	Health	Dispensary	23	38	19	32	18	30	60	100

Source: Household interviews, June 2021

Figure 10. Proximity analysis for primary schools in Kimara Matangini.
Source: Base map of Kimara Matangini, June, 2021

Figure 11. Proximity analysis for Secondary Schools in Kimara Matangini.
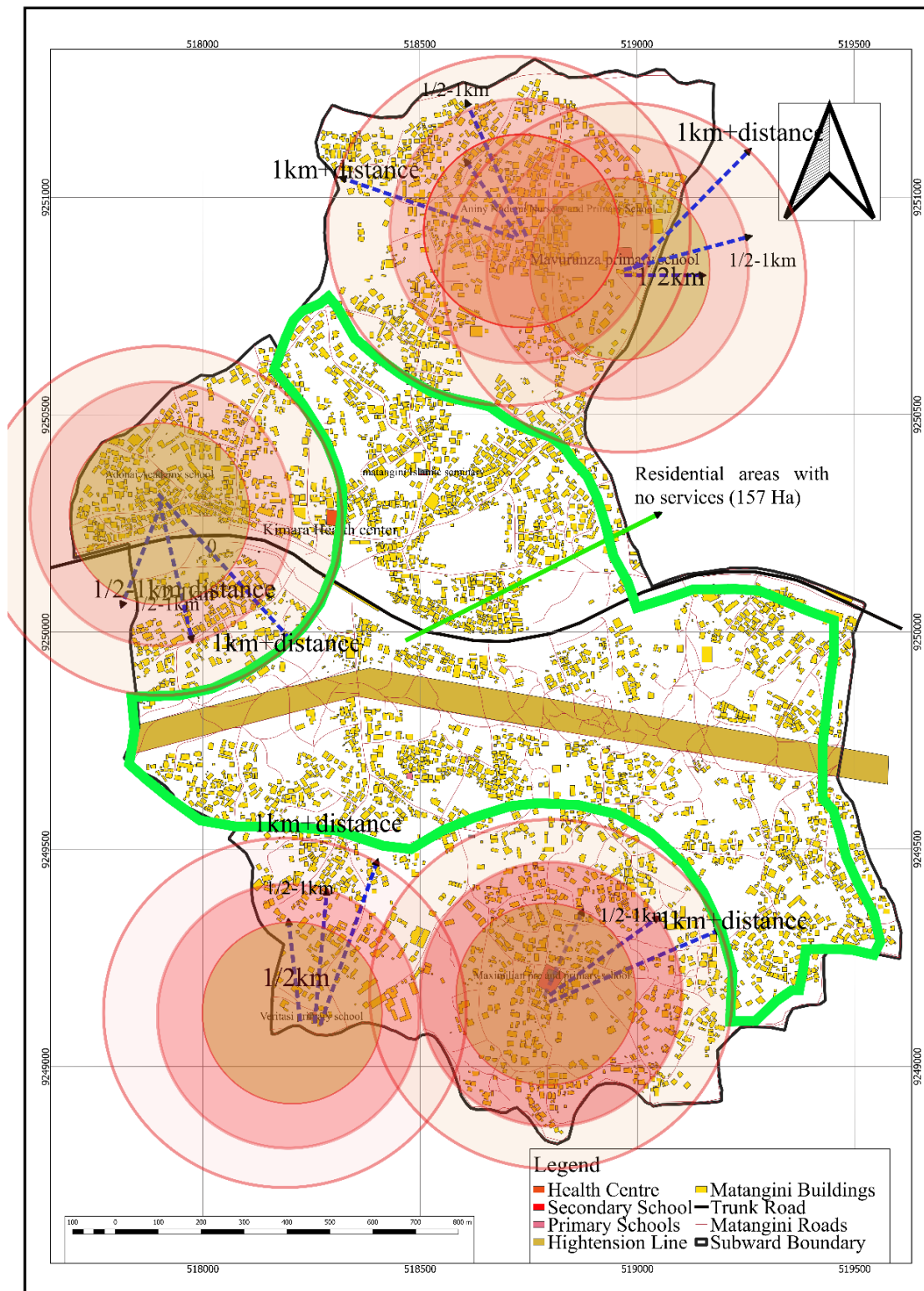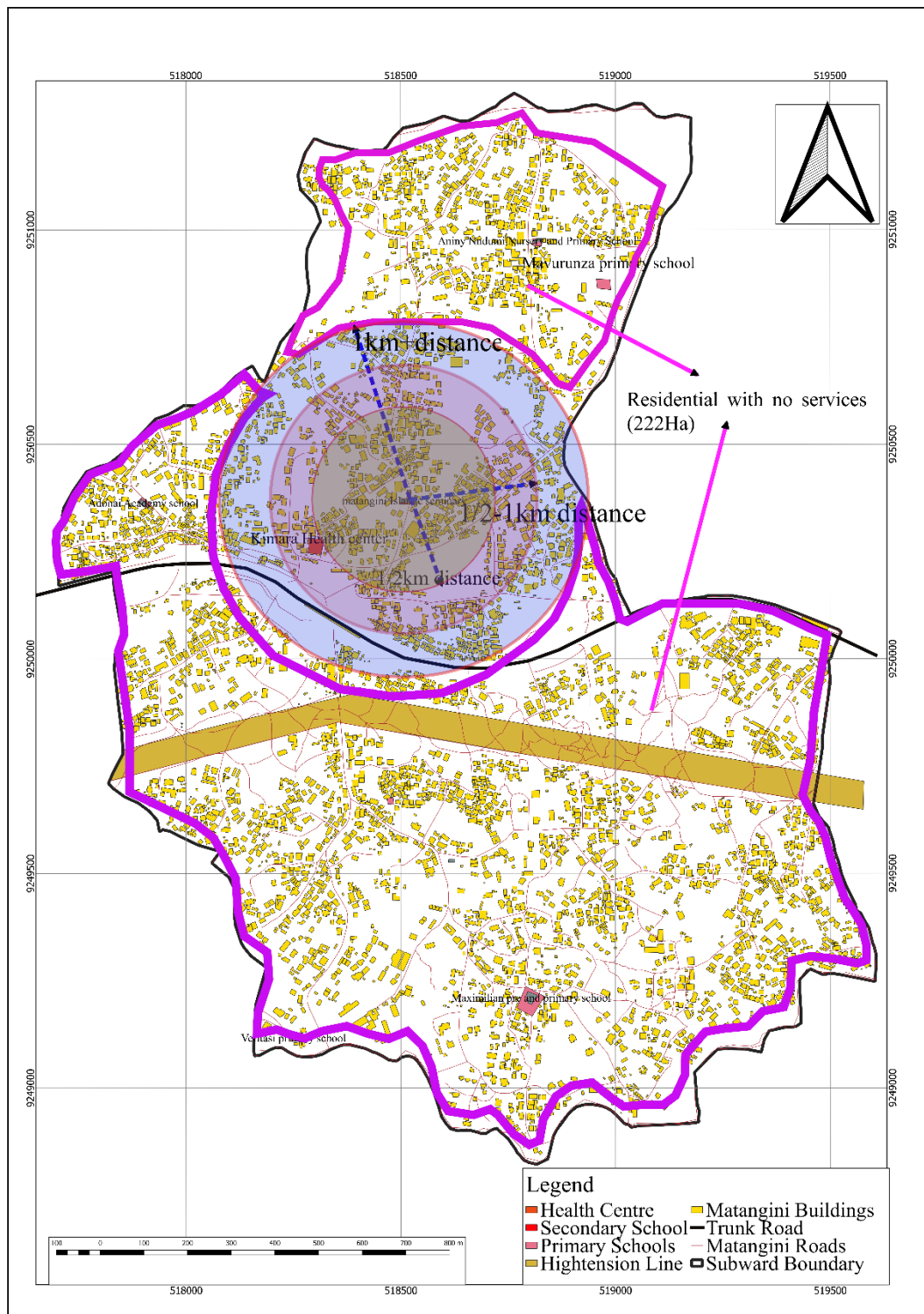Source: Base map of Kimara Matangini, June, 2021
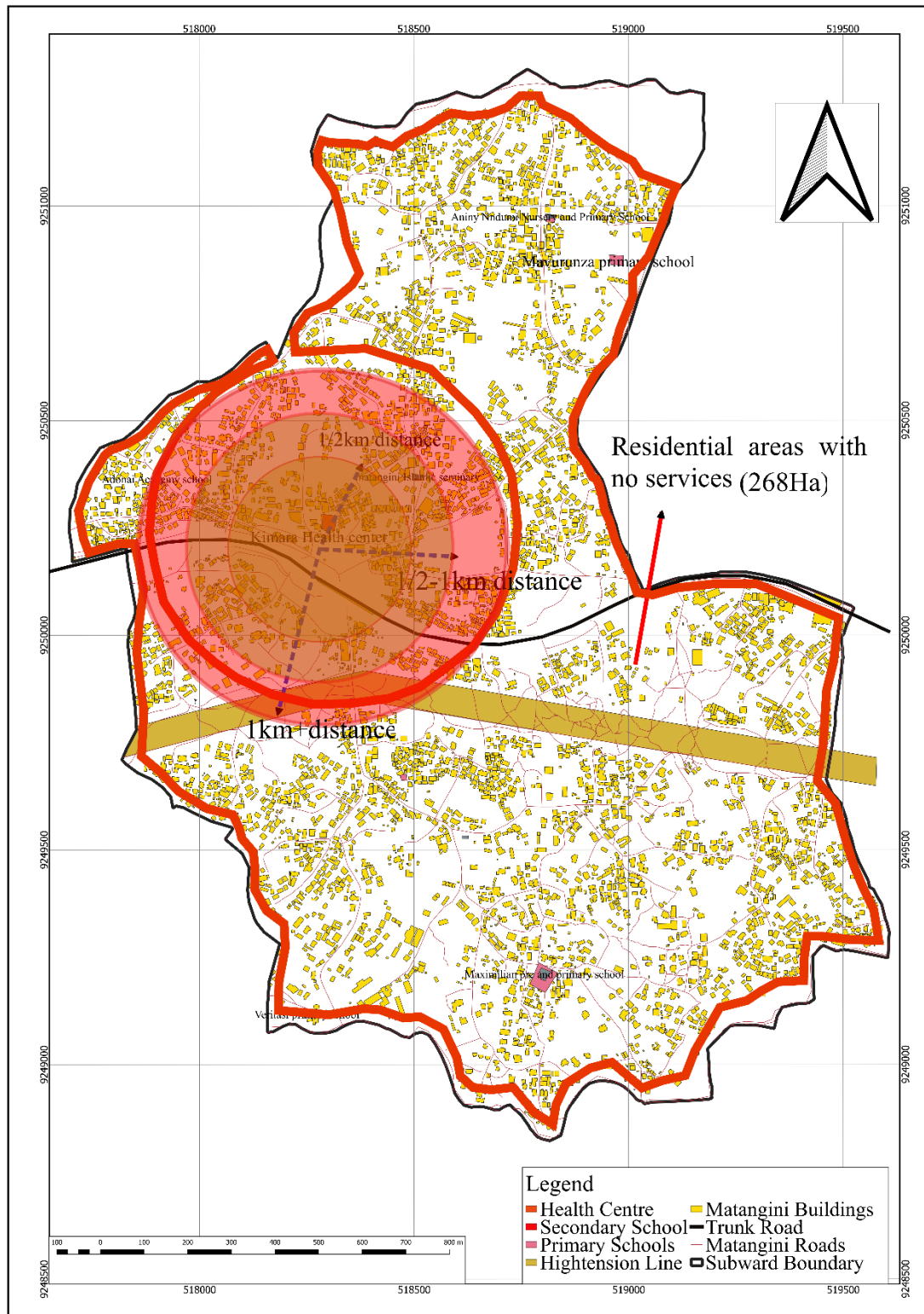
Figure 12. Proximity analysis for a health centre in Kimara Matangini.
Source: Base map of Kimara Matangini, June, 2021

Figure 13. Proximity analysis for Primary Schools in Kibululu sttlement
Source: Base map of Kibululu June, 2021
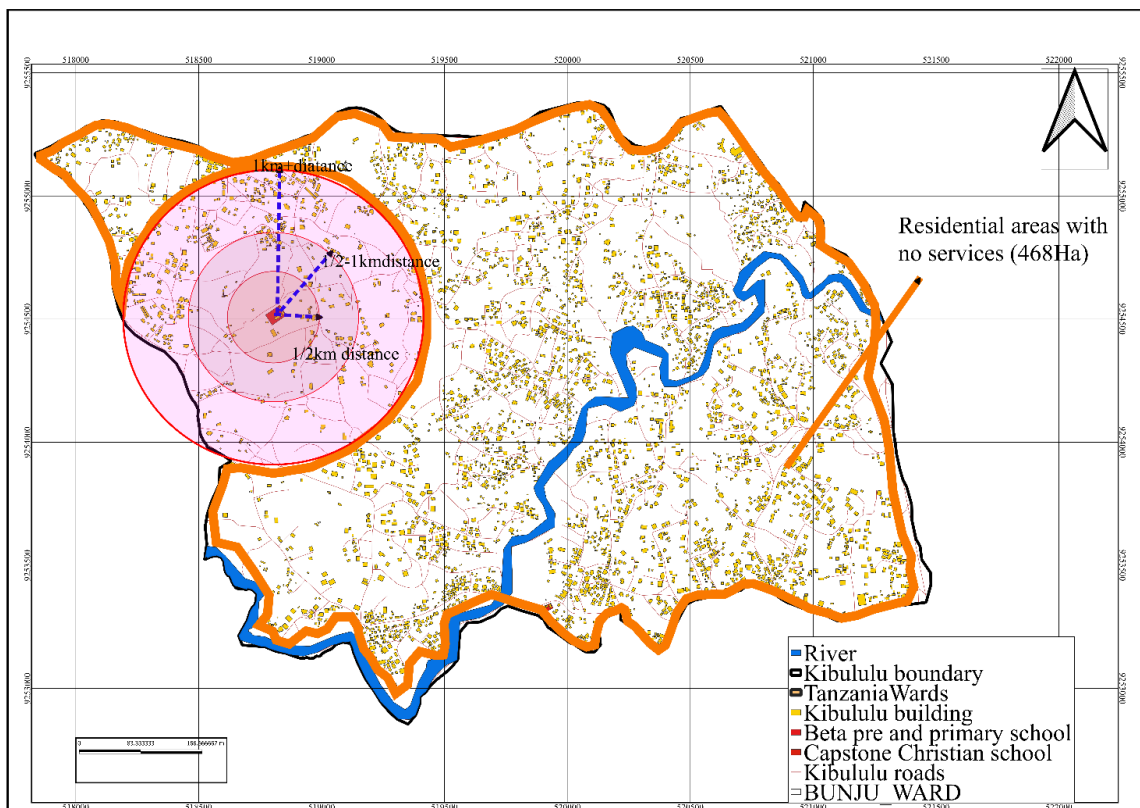
Figure 14. Proximity analysis for Secondary School in Kibululu sttlement.
Source: Base map of Kibululu June, 2021

In this analysis, the location of a facility largely defined locational accessibility and whether there was a balanced service location and accessibility. For example, while Kimara Matangini had five primary schools, these schools were located at the peripheries of the settlement leaving the larger central part without primary schools (Figure 10). Applying the principle of one kilometre as the optimal threshold distance for walking to reach primary schools, most of the central parts of the settlement covering 157 hectares 591 hectares representing 57 percent of the total area had longer distances to primary schools. In Dovya settlement, 591 hectares representing 62 percent had longer distances to schools and 417 hectares for Kibululu represented 70 percent. The same pattern was observed for secondary schools where in Kimara 80 percent were outside the threshold of one kilometre, 63 percent for Dovya and 79 percent for Kibululu (Figures 10, 13, 15 and Table 8). The fact that a health centre was located in Kimara settlement, its locational accessibility was more or less similar to secondary schools and about 97 percent of the area was located outside the threshold of one kilometre.

Table 8. Area coverage and accessibility to schools.

Settlement	Total area (Ha)	Accessibility to primary schools (Ha)	Percent	Accessibility to secondary schools (Ha)	Percent
Kimara Matangini	277	157	57	222	80
Dovya	944	591	63	593	63
Kibululu	592	417	70	468	79

Source: Threshold analysis from respective settlements, June 2021
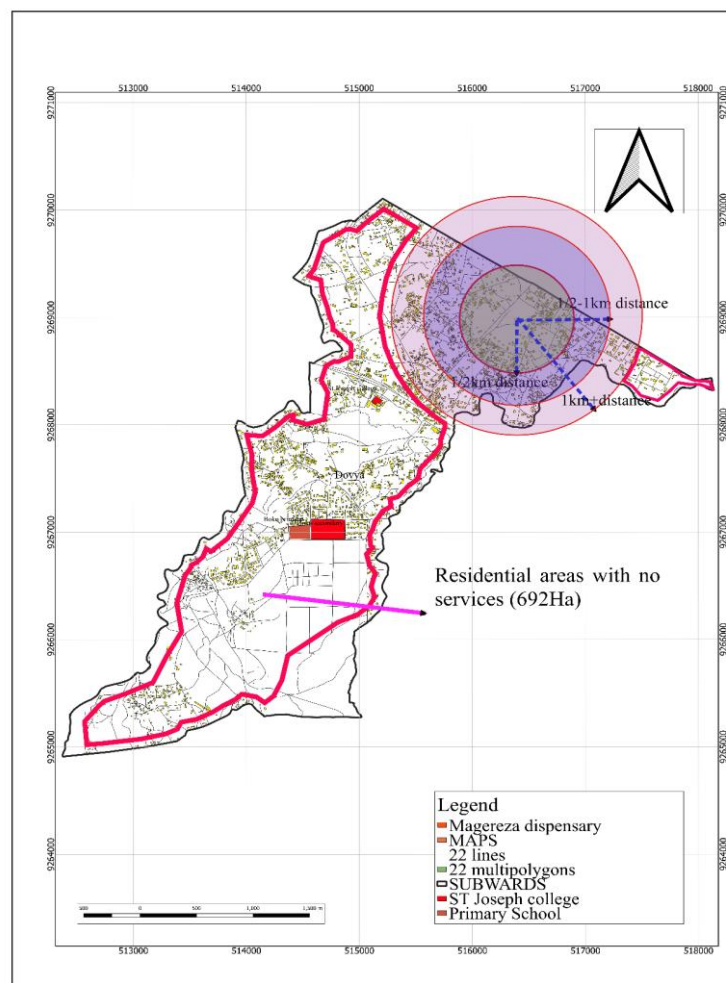
Figure 15. Proximity analysis for Primary School in Dovya settlement.
Source: Base map of Dovya, June, 2021
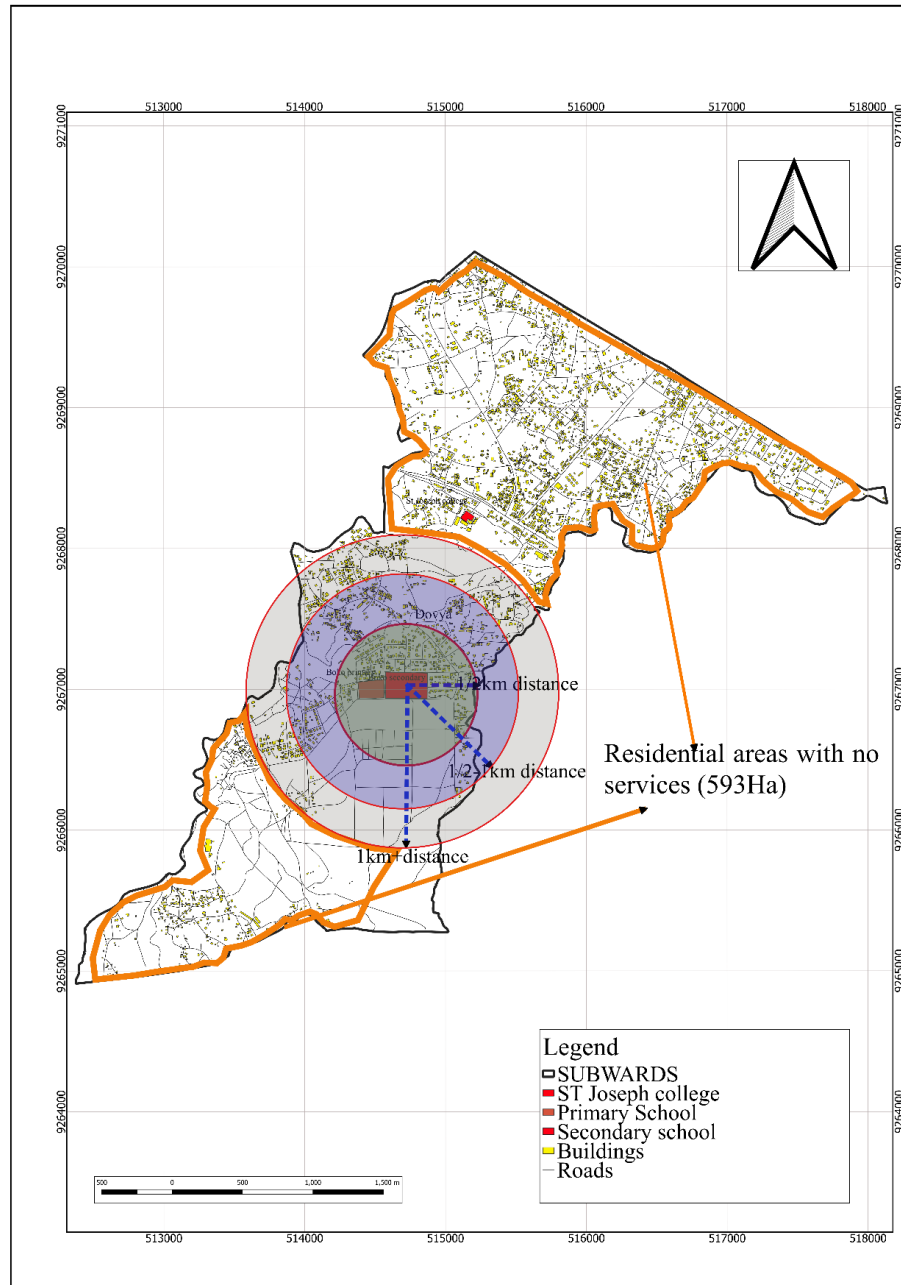
Figure 16. Proximity analysis for Secondary School in Dovya settlement.
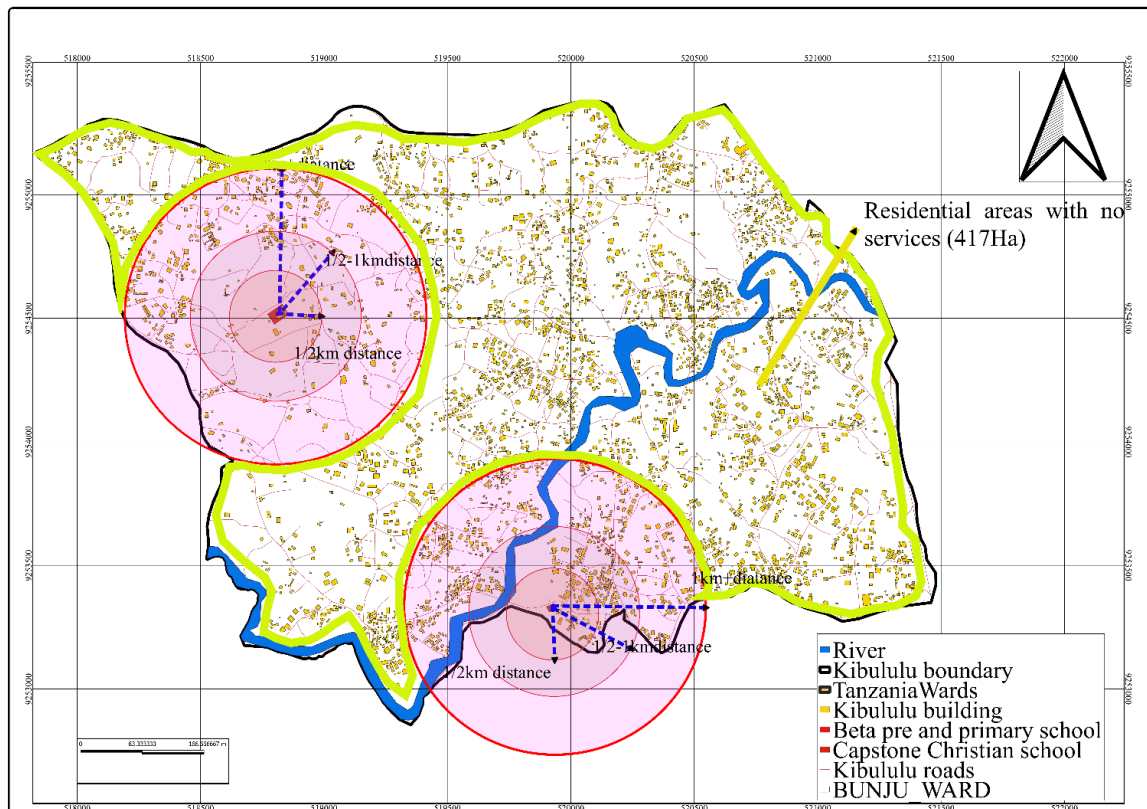Source: Base map of Dovya, June, 2021

The spatial analysis of locational accessibility to services was complemented with household interviews to gather responses from residents of the three settlements. Residents from these settlements responded to the type of facility available in their settlement and whether it was easily accessible or not. Results show that where these facilities were located within a half and one kilometre distance, many respondents indicated that the services were easily accessible. Within half and one kilometre the responses were accessible and beyond one kilometre the responses indicated that it was difficult to access such services (Tables 9, 10 and 11).

Table 9. Accessibility to education facilities in Kimara Matangini

Settlement	Education facilities	Name	Location	Distance			Accessibility
				½ km	½-1km	1+km	
Kimara Matangini	Primary	Mavurunza	Within	34	26	8	Easily accessible
		Maximilian		27	20	21	Easily accessible

		Aniny		30	27	11	Accessible
		Adonai		38	21	9	Accessible
		Veritasi		12	37	19	Accessible
	Secondary	Matangini Islamic seminary	Within	42	12	14	Easily accessible

Source: Household interview, June, 2021

Table 10. Accessibility to education facilities in Kibululu

	Education facilities	Name	Location	Distance			Accessibility
				½ km	½-1 km	>1km	
Kibululu	Nursery	Beta	Within	34	22	8	Accessible
		Capstone		12	37	15	Difficult
	Primary	Beta		34	22	8	Accessible
		Capstone		12	37	15	Difficult
	Secondary	Capstone		12	37	15	Difficult

Source: Household interview, June, 2021

Table 11. Accessibility to education facilities in Dovya

	Education facilities	Name	Location	Distance			Accessibility
				½ km	½-1km	>1km	
Dovya	Nursery	St. Salome	Within	9	17	34	Difficult
	Primary	Boko		5	14	41	Difficult
	Secondary	Boko		8	14	38	Difficult
	College	St. Joseph college	Within	13	33	14	Easily accessible

Source: Household interview, June, 2021

5. DISCUSSION

The Sustainable Development Goal (SDG) number 11 urges nations to turn cities and human settlements more inclusive, safe, resilient and sustainable. Target 11.1 of this goal focuses on ensuring access for all to adequate, safe and affordable housing, basic services and upgrading of slums. However, one of the challenges in addressing this goal and its targets has been the unavailability of data to facilitate monitoring locally and internationally [32]. This paper has attempted to analyze service accessibility for people living in peri urban settlements of Dar es Salaam even though not in a strict sense as stipulated in the targets of the SDGs. On the other hand, the National Human Settlements Development Policy (2000) of Tanzania envisages to have well organized, efficient, healthy, safe and secured, and aesthetic sustainable human settlements. The same policy emphasizes that control over physical growth of urban areas is necessary in order to reduce urban sprawl and facilitate balanced urban expansion in terms of economy in the use of land and in the provision of infrastructure services and community facilities. The underpinning variables of balanced urban expansion as highlighted in Figure 1 included accessibility, service availability, sustainability and density.

Empirical evidence indicates that Dar es Salaam has overgrown its provided services and sprawled to the limits of its jurisdictional boundaries notwithstanding that its development has been largely influenced by informal settlements. This pattern of growth has not been accompanied by the provision of basic services such as schools and health centres that are located within the recommended thresholds (that is within walking distance). Some authors have argued from compact development point of view or jaggedness and observed that the city compactness was still too low to guarantee city spatial sustainability in terms of effective utilization of land and infrastructure [20]. In other words, the city had sprawled horizontally with larger parts characterized by low-rise buildings that are contiguous in terms of land coverage. Based on similar observations the authors argued that if the number of stories in the low-rise house type areas could be doubled, the extent of the built up area for the city could be reduced from

57,211 hectares to only 11,331 hectares. Similarly the horizontal expansion of the city could be reduced from 30 kilometres to 14 kilometres radii [20].

The city of Dar es Salaam is experiencing rapid population growth, spatial pattern expansion, and land cover changes. The spatial pattern of the city is largely influenced by individually driven efforts of low-income households to secure land that is affordable and in a reasonable location, often in peri-urban areas. Actual land development has been also influenced by informal land markets through the sale and buying unplanned and un-serviced land with limited control from central and local governments. This pattern of city development has rendered majority parts of these settlements developed without basic services especially schools and health facilities. This has led to un-balanced urban expansion manifest externality effects and partly revealed by long distances to reach these services.

The Urban Planning [Space] Standards (2018) recommends for the location of public physical facilities near residents facilitating walk ability and safety [32]. In preparing detailed planning schemes, the same guidelines provide for primary schools be located within one kilometre diameter or impliedly a half a kilometre radius. Empirical evidence presented in this paper reveal that residents from the majority of parts of these settlements had difficulties in accessing these basic facilities including the longer distances beyond the recommended thresholds.

Researchers have discussed the concepts of sustainability and livability from values and preferences local community places for amenity, wellbeing aspect and sense of place or belonging [8]. Even though the latter was not explored deeply in this paper, many respondents expressed this variable on the varied opinions of satisfaction. This was expressed in terms of comfortable living in the settlements, availability of community facilities, closeness to work places and proximity to the city centre. The self-assessment of the satisfaction of the settlements could as well be related to the relative assessment of the respondents when comparing their settlements with other unplanned settlements in Dar es Salaam City. Yet this does not mean these settlements were adequately provided with all necessary services frequently discussed under sustainability and livability perspectives.

6. CONCLUSIONS AND RECOMMENDATIONS

This paper has attempted to illustrate that informal urbanization that drives city spatial development is the major factor that leads to unbalanced city expansion in Dar es Salaam. The underlying causes of urban informality has been linked to poverty, limited capacity of city governments to provide serviced and affordable land for housing, stringent and unaffordable development conditions (serviced land) especially to economically weaker groups. These limitations have contributed significantly to unbalance city spatial development patterns.

The effects of unbalanced urban expansion has been manifest in a number of ways including limited service availability in informal settlements, locational inaccessibility where these services were provided and relatively longer walking distances as compared to recommended guidelines and walking thresholds. The overgrown city that has largely developed with limited planning intervention especially in the peri-urban areas render service provision more difficult and attempts to regularize these settlements to be difficult if the pattern and processes of land markets and development are not regulated timely. Field findings and analysis indicate that limited and inaccessible public services characterize informal settlements that are developing in peri-urban areas of Dar es Salaam. This implies that as consolidation continues unabated in these settlements, the future sustainability of these settlements will be at risk and retrofitting service provision is likely to be costly and more challenging as it will entail compensation of developed properties to pave way for public services. In view of these looming challenges it is recommended that the government in collaboration with key stakeholders at grass root levels should strengthen development control in peri-urban areas so as to monitor development and potential service requirements. The government should also acquire some parcels of land that would in the future be developed for services, strengthen the previous twenty thousand plots project focusing in peri-urban areas as well as the on-going regularization activities to provide for way leaves for infrastructure provision. There is also a need of conducting a city wide analysis on the unbalanced pattern of informal settlements especially in rapidly urbanizing peri-urban areas.

Acknowledgement

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Romania's urban policy in the context of COVID-19 pandemic time

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Abstract: Under the conditions of frequent changes, of some edifying transformations and perpetual challenges, urban policy undergoes changes/adjustments/updates over certain time intervals. These changes generate increasingly more complex requirements that impose drafting a flexible multidisciplinary framework able to support the future development of a territory. In full debate-process, the new urban policy of Romania promotes sustainability, resilience and inclusive growth, on the background of a critical period under the dominance of the SARS-CoV2 pandemic. This new policy brings around the discussion table experts from relevant fields: decision factors, urbanists, economists, architects, citizens, civic initiative groups, etc. The national urban policy must address all categories of urban areas (defined as a city area considered as the inner city plus built-up environs, irrespective of local body administrative boundaries), being fundamental in implementing the goals set by the New EU Urban Agenda, approved in the framework of the Habitat III conference of the United Nations (2016) and the new provisions of the New Leipzig Charter (2020). Urban policy must ensure a single planning framework that would support the implementation of the programs and projects financed from European and national funds, preparing thus the financial exercise 2021-2027. Considering the above mentioned, the present paper aims to review the important and strategic elements of the future urban policy from Romania and its role in promoting and supporting balanced territorial development under the conditions of the SARS-CoV2 pandemic crisis which is far from over.

Key words: urban policy, regional development, territorial resilience, social cohesion, COVID-19 crisis

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1. INTRODUCTION

In spite of the restrictions imposed by the COVID-19 pandemic, the New Leipzig Charter titled *The transformative power of cities for the common good* adopted on 30th November 2020 begins to produce its effects by establishing a general urban development framework applicable to all member-states and urban areas of the EU.

Developed in relatively difficult conditions, characterized by the SARS-CoV2 pandemic, by the visible and unpredictable climate changes, by economic, social, political, etc. uncertainties, the Leipzig Charter requires from the cities to set up integrated strategies of urban development for the period 2021-2027, which subsequently will contain programs and projects financed by the new regional policy. The mentioned document is directly correlated with the *Cohesion and Regional Development Policy* of the European Union, urban areas being regarded as core elements of this policy.

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The New Leipzig Charter covers three classic dimensions of community development: *sustainability (ecologic), just (socially equitable) and prosperous (productive)*, determining thematic fields of action for each of them. At the same time, it proposes a compact, multifunctional urban planning and an architectural urban environment of high quality that would ensure welfare and prosperity. Moreover, digitalization is the common denominator of all three dimensions and as opportunities are mentioned here smart mobility, energy efficiency or efficient public services.

The principles of this strategic document are correlated with good, integrated, operational governance at multiple levels and focused on the concept of *place-based approach*. The New Leipzig Charter does not derail from the 2030 Agenda for Sustainable Development, and especially from the Objective no. 11 regarding sustainable development, an objective dedicated to inclusive, safe, resilient and sustainable cities. Due to its profound community character, the Charter overlaps with the principles and objectives established by the New European Urban Agenda, based on the Paris Agreement, and the Green Pact of the European Commission. Here should be mentioned also the Green Deal, as it aims for Europe to become the first climate-neutral continent. Synthetically, the New Charter establishes a unitary and shared policy framework, built on all European agreements and on those assumed at global level, that target in particular and directly the urban level (the urban area).

In the current pandemic context, the Charter indicates also associated risks, risks related to protecting private life and a new spatial and social division [1]. Taking into account the pandemic phenomenon and the global health crisis the New Leipzig Charter approaches also the issues triggered by the COVID-19 infection (shown mostly in high urban agglomerations and affecting these stronger than other categories of territories), by giving more power to cities and assisting them in unlocking their transformative power of adjusting to the new conditions. By attempting to provide viable solutions, here are reminded the restrictions and the additional requirements related to hindering the outspread of the virus, including the decrease/increase in migration flows, various blocks, total or partial lockdown, the high pressure on urban medical centers, closing some companies, and shifting to telework, etc.

The COVID-19 crisis highlighted, as well, the interdependency between urban and rural areas, especially regarding the organization of food chains in Europe and the need of increased mobility in the urban areas and a new organization of work.

Next to the Charter, an important role has the cohesion and regional development policy which comes to strengthen the role of urban areas in the period 2021-2027. The five goals of the cohesion policy are centered on smart, ecologic, more connected and social development, and on the closeness to citizens, allotting substantial funds in urban areas investments and policies (8% of the ERDF resources).

Joining the large EU urban area, Romania's cities play an important role in the national economy being regarded as engines of economic growth, pillars of resilience and inclusion. This fact is supported also by the report drawn by the World Bank which shows that the eight large cities of Romania, Bucharest, Braşov, Cluj-Napoca, Constanţa, Craiova, Iaşi, Ploieşti and Timişoara gather 50% of Romania's population and 75% from the fixed incomes of the country [2].

2. STATE OF THE ART

Urban policy and planning are part of a trans-and multidisciplinary approach which pursues by territorial arrangement actions to identify the specific issues of cities (environment-pollution, financial-unemployment, poverty, social segregation, etc.) and to provide viable recovery solutions (innovative, creative, etc.). The perspective of high quality of urban life is, as a rule, evaluated with the help of some relevant economic and social standards and indicators.

From the definition point of view, the urban area is defined in a World Bank Report (2009) as all settlements above a certain minimum population size and minimum population density that are within a certain travel time by road. The Organisation for Economic Co-operation and Development (OECD) approach are similar but more elaborate approach. The OECD methodology consists of three main steps: identifying contiguous or highly interconnected densely inhabited urban cores; grouping these into functional areas; and defining the commuting shed or 'hinterland' of the functional urban area. The OECD uses population size cutoffs (50,000 or 100,000 people, depending on the country) as well as population

density cutoffs (1,000 or 1,500 people per sq. km.) to define the urban cores, and then selects those areas from which more than 15% of workers commute to the core as hinterland.

A notion vaster and more complex than urban policy, territorial arrangement is about urbanism activities, being regarded as the main tool in investigating and knowledge, for forecasting and planning, of nurturing and permanent readjustment of the human capital, and of the material framework created by society and indispensable for its existence.

Without detailing too much the theories about territorial planning, we might remind here one of the earliest formulated by Ernest Burgess for explaining the structures of land use in the cities (1923) [3]. The theorists (urbanists, architects, economists, sociologists, etc.) attempted to explain the fundamental aspects of urban life by resorting to the tools employed in applied research (general and specific). We might remind here a methodologic analysis pattern used by A. Campbell, W. Rogers, Th. Convers by which the characteristics of urban life might refer to the satisfaction degree regarding the needs of the inhabitants. The perspective of a certain urban image has at the basis psycho-sociologic researches realized and based on the analysis of perceptions, symbols, and images with the aid of which the inhabitants of the city understand "the place" [4].

In certain researches and analyses, we identified highlighted three important moments that occur in urban planning: formulation of the issues, enunciating the policy and its implementation. One of the most renowned forerunners of urban planning, Kevin Lynch, in his work *City Sense and City Design* [5] is pioneering the field by highlighting the importance of the design principles in urban planning. The sensorial elements that individuals meet in the cities where they live are closely linked to the general principles of urban design, to the way in which the city is structured and operates. Lynch launches the so-called concept of *imaginability* supported by the theory of urban spatial design. Many cities in America that Lynch K. researched and explored in his works were to a certain degree successful because they had as focus the people, and planning pursued to so-called humane design (in spite of the fact that the majority of cities all over the world are strongly dependent on cars) [6].

Out of analyzing urban theories, is detached the so-called global perspective of urban development, that studies how and in which way global trends affect the development of a city. The relationships at local and national level are analyzed, in order to pursue subsequently based on the so-called dependent urbanization the connections between the urban communities at national level, and the ones at international level. Out of this analysis are deducted various definitions of the city: bazaar-city, jungle-city, city-as-body, or the engine-city [7].

The specialized literature finds that there is a certain divergence in the way of evaluating urban systems at global level. As regards the databases, the literature uses the following key-words: "indicators for smart and sustainable city", "indicators of urban metabolism", "sustainable development indicators', "standardization for smart city" and "urban indicators" (Annex 1) [8].

Urban planning has as its core focus the city defined with the aid of three major criteria: critical minimum size, often linked to a necessary threshold of the demand for urban services, a certain level of population density, the presence of some technical-municipal endowments that meet the requirements of the inhabitants.

According to the Guide for Developing Integrated Strategies of Urban Planning territorial planning has at the basis the following principles [9]:

1. *Compact development* – compact urban development requires pro-active, balanced planning, as well as limiting uncontrolled urban expansion and defining some priority zones of development where local policies of densification and diversification are applied.
2. *Urban regeneration* – aims to increase the attractiveness of the urban nucleus by revitalizing the public space, the quality of life in the residential districts and valuation of the urban assets for strategic investments (including in disaffected industrial zones).
3. *Improving connectivity and access to services within the development zones and between the urban and peri-urban zones* – aims to diminish the dependency on automobiles, facilitating non-motorized mobility, increasing the accessibility to services inside the districts (using the principle of pedestrian accessibility of 15–20 minutes), and equitable access to public services.

In regard to the actual pandemic crisis, there is not sufficient exploratory evidence on the existing effects upon city design and public spaces [10,11]. Nevertheless, there have been many debates in the media regarding the link between the prevalence of COVID-19 and urban design.

The existing literature do not indicate in detail how different design measures can affect the capacity of urban areas to respond effectively to the pandemic although the planners are strongly recommending to keep supporting the development of urban areas [12]. In this matter, the World Economic Forum (2015) suggests that the planners should be provided with the following strategic recommendations. [13] (Table 1):

Table 1. Eurostat preventive measures and recommendations for urban areas.

Preventive measures	Recommendations
Zoning regulations (e.g. land-use control, sensitive pattern models, building design, city configuration)	Long term: physical planning of urban area should be revised by the involved stakeholders Short term: disease prevention protocols that define maximum occupancy in comercial and recreational facilities need to be followed, planning policies need to be more flexible, reorganization of buildings and space to enable people to work safely
Informal settlement	Long and short term: suburbs redevelopment, change the pattern of land ownership for green and open space, integrate urban factory strategy.
Inclusive planning	Long and short term: a participatory, holistic and sustainable approach should be developed for communities through recovery plans, job creation, promoting the efficient and green technologies, renewable energy; mixed solutions can be also developed to reducind plastic pollution.
Resilient urban feature	Long and short term: to highlight the importance of qualitative studies regarding the pandemic-resilience in the urban area through the collaboration of urban experts. Furthermore, the quantitative studies can explore the link between city resilience and pandemic propagation.

Source: Bezzo, F.B., Silva, L., & van Ham, M. (2021)

The COVID-19 pandemic crisis has hit people and companies in different situations, in different ways and at different levels. Economic, social, psychological and health-related outcomes have been significantly affected by both the concrete risk of getting the virus, and the policies adopted by governments to stop its spread. Among these, lock-down measures in particular, which have limited people's mobility beyond their house and local area, have been found to crucially affect individual's mental health and well-being [14].

In actual context of COVID-19 pandemic, it is necessary to develop a pandemic-resilient urban strategies through analyzing the published literature. Short - and long - term solutions for pandemic resilience urban planning and design have also been provided related to different response phase. In the mitigation phase, new technological approaches can be adopted for better management of pandemics.

The physical (urban access, infrastructure, environmental factors, and land use patterns) and non-physical (socio-cultural, governance, and economic factors) aspects of resilient urban strategies have been focusing on health- and disaster-related risks in pandemic. In the preparation phase, proactive measures (capacity building of people towards any outbreak, different simulation processes, models of transmission pattern) can be adopted for future pandemics [15].

The COVID-19 pandemic has shifted the perception of local governments to the emergence of incorporating resilience into their response and recovery approaches. It has also raised a pivotal issue on changing perception towards resilience, focusing on major lessons learned to make communities against extreme coming shocks, and economic, environmental, and social impacts.

3. THE COVID-19 CRISIS AND URBAN AREAS

The COVID-19 crisis affected cities all over the world. The most severe effects of the illness are recorded in the urban areas, where the death rates were higher because of a complex combination of factors, including population density, national and international connectivity and the answers given to

public health. In Great Britain, and the US, for instance, large urban areas have higher death rates than other types of settlements, and the size of the city proved to play also an important role in determining the infection rates [16].

Throughout history, epidemic crisis (for instance the Asian cholera (1826-1937) and the Spanish Flu (1918-19) have affected frequently cities, but these recovered rapidly. However, often, "city paupers" were the ones who suffered most in the immediate pandemic period. The cholera epidemy in 1854 London, for instance, had a substantial economic impact on those living near the outbreak point over a decade or even more [17].

Previous pandemics in urban areas contributed to the development of urban areas, by improving construction and architecture standards and, implicitly, the health of the inhabitants (Annex 2). The most known example in this respect is the large London metropole where the Great Fire of 1666 occurred, a fact that led to the creation of new construction codes and to the wide-scale use of fireproof tiles. Just as well, the cholera epidemy by mid-19th century triggered the sanitation of the Thames River and the building of the sewage infrastructure, determining the emergence of the modern sanitizing process. The tuberculosis epidemy contributed to the birth of a modern movement in architecture: large windows by which sunlight could penetrate, white and clean terraces, etc. Moreover, all these consequences, fireproof buildings, sewage, green parks, wide windows, etc. (and not just in London) led to an increased quality of life in the urban areas [17].

By the beginning of the 19th century, when a series of cholera epidemics hit the world, urban life was deplorable. In the year 1850, in London, one of the main reasons for the cholera outbreak was the mixing of drinkable water with waste water [17].

Over the period 1918-1919, the most lethal pandemic based on a respiratory virus occurred 9 (the Spanish Flu) which killed over 50 million people, with obvious impact on slowing down urban development and limiting public life for a period, in order to slow down the disease outbreak. Thus, public transport was replaced with walking on the streets, and the majority of the population stayed at home, an aspect comparable with the current pandemic situation [17].

In 1908, in Philadelphia, typhoid fever and the cholera outbreaks triggered by the sewage and the water source in the river Schuylkill led to moving the houses and the businesses from the banks of the river, and building there a very wide park (Fairmount Park) [17].

COVID-19 is added to a long list of infectious diseases with rapid outspread which represented a new challenge for cities and triggered a new way of efficient planning.

Already, we might notice a similar impact of COVID-19 as its effects are forecasted by the World Bank implying that about 49 million people will be in the category of extreme poverty.

The leaders of the cities, regions and the decision factors are faced, consequently, with a "perfect storm" and must mitigate as good as possible, and manage the recovery after COVID-19 in parallel with the existing pressures resulting from climate changes, resources' exhaustion, and the continuing increase in the socio-economic inequalities.

Regarding to territorial implications, the COVID-19 pandemic crisis has a strong dimension with significant policy implications for managing its effects. Two central considerations for policy makers in urban planning are considered:

1. *the regional and local impact of the crisis is highly asymmetric within countries.* Some regions, particularly the more vulnerable ones, such as deprived urban areas, have been harder hit than others. Certain vulnerable populations, too, have been more affected. In economic terms, the impact of the crisis is differing across regions, at least in its initial stages. Differentiating factors include a region's exposure to tradable sectors, its exposure to global value chains and its specialisation, such as tourism.

2. subnational governments (regions and municipalities) are responsible for critical aspects of containment measures, health care, social services, economic development and public investment, putting them at the frontline of crisis management. Because such responsibilities are shared among levels of government, coordinated effort is critical.

The COVID-19 pandemic will have short- medium- and long-term effects on territorial development and subnational government functioning and finance. One risk is that government responses focus only on

the short term. Longer-term priorities must be included in the immediate response measures in order to boost the resilience of regional socio-economic systems [18].

4. METHODOLOGY

The methodology is simple, based on analyzing the specialized literature, the strategic documents specific to urban development, and the interpretation of some indicators existing in the Eurostat databank and în Romanian official statistics (NIS). At EU-level, the data about European cities are gathered by means of the Urban Audit and by the Audit Project for large cities. At city level, the Urban audit contains over 170 variables and more than 60 indicators. These indicators are derived from the variables collected by the European Statistical System (Annex 3). The data are published in 20 tables in the framework of 2 main groups, plus a perception survey table:

For Romania, the statistical data corresponds to the 35 cities (URBAN AUDIT), respectively Bucharest, Cluj-Napoca, Timişoara, Craiova, Brăila, Oradea, Bacău, Arad, Sibiu, Târgu-Mureş, Piatra Neamţ, Călăraşi, Giurgiu, Alba Iulia, Constanţa, Iaşi, Galaţi, Braşov, Ploieşti, Piteşti, Baia Mare, Buzău, Satu Mare, Botoşani, Râmnicu Vâlcea, Suceava, Drobeta-Turnu Severin, Focşani, Târgu Jiu, Tulcea, Târgovişte, Slatina, Bârlad, Roman, and Bistriţa.

In order to present the recent stage of the COVID-19 pandemic, has been selected a relevant indicator that reflects the influence of the virus upon the urban population: the number of cases of COVID-19 to 1000 inhabitants. The analysis of the number of cases of COVID-19 will reflect the difference in the impact of the pandemic between large cities and towns.

5. RESULTS AND DISCUSSIONS

A brief look on the evolution of the resident population in the urban areas shows that at national level there is an important decreasing trend for this indicator (as of 2021 compared with the year 2014) by about 4.34%, from 10,752,617 inhabitants (in 2014) to 10,285,960 inhabitants (2020) [15]. The majority of counties that have in their componence urban areas (towns and municipalities) underwent decreases, the highest being reported in the counties Mehedinţi (-13.63%), Brăila (-12%), Hunedoara (-11.08%). There are three counties that did not follow the diminishment trend, respectively Ilfov with an increase by 24.35%, Iaşi by +3% and Bistriţa-Năsăud by +1.74% (Figure 1).
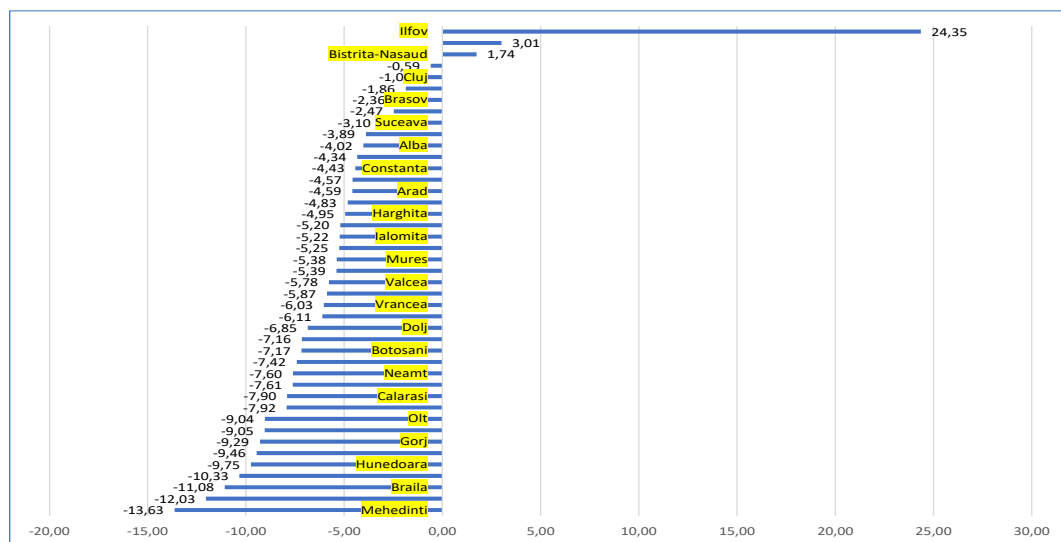
Figure 1. Dynamics of urban population in Romania, 2014-2021 (%) (resident population).
Source: National Institute of Statistics, Data Tempo-online [19].

Although urban population is on decrease, the analyses show that the total number of built houses is on increase, from 4,821,567 (in the year 2014) to 5,005,544 (2020), and an increase by 3.82%. As might be seen in figure 2, the highest increase in the number of houses was in the county Ilfov, by 29.08%, followed by Braşov (+9.4%) and Constanţa (+8.76%) (Figure 2).
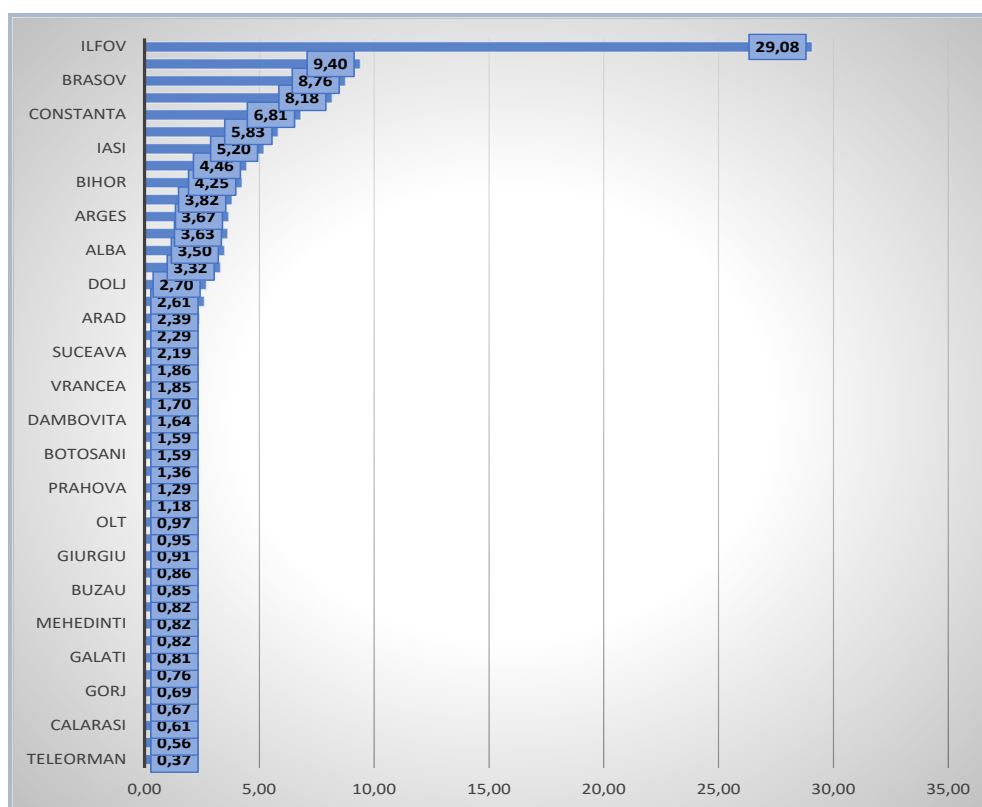
Figure 2. Dynamics of housing in urban regions in Romania, 2014-2021 (%).
Source: National Institute of Statistics, Data Tempo-online [19].

A study titled Audit Urban – Quality of life in the cities from Romania (2020)[1] had as purpose to collect comparable statistical data at European level for a considerable number of indicators, for the following spatial levels in view of substantiating urban policies [9]. Here, 134 variables were monitored at various levels, out of which 72 are available at various levels (cities, FUA or national).

Hereunder, we present some of the variables corresponding to four relevant fields (at city level) which characterize the quality of life in a society: demographics and structure on ages, housing, education and tourism (2018 is the year of reference). In the framework of the study were selected 35 cities.

1. Demographics

The 35 cities selected in the framework of the project reunite about 35.03% from Romania's population (7,76 million inhabitants), while functional urban areas reunite about 41.72% from Romania's population. The Bucharest Municipality gathers about 9.61% from Romania's population, and the functional urban area of the Bucharest Municipality reunites about 11.18% from Romania's population. An in-depth analysis of the population data indicates that the population in the functional urban area of 34 cities, without the Bucharest Municipality, represents about 30.54% from Romania's population. The population aged between 0 and 19 years is on decrease, and the population aged 65 and over is on increase, leading to a slow ageing process. The age dependency rate for elderly is relatively low, at locality level, being around the average by 23.17%, while the dependency rate for the young, at locality level, is around the average by 26.42%. The total age dependency rate is around the average by 49.60%.

2. Housing

The increase in the number of dwellings is noticeable, due to the increase in the demand for housing especially in the urban area. The living space: The space existing in 2018 in Romania was by 430,008,586 square meters, while the average living space at national level was by 19.40 sqm/person. The average living space at city level was by 18,95 sqm/person. Even though the average living conditions space increased at each 10 years, for actual development and improvement in the quality of life, investments are necessary not only for increasing the living space, but also for developing the infrastructure. The increase in this indicator originates from building new dwellings and developing cities,

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[1] Important initiative of the Directorate General for Regional Policy of the European Commission.

both horizontally and vertically. This development, and the growth in the numbers of the inhabitants in the city, might attract huge issues from the viewpoint of the infrastructure, city agglomeration and even the 'suffocation' of some areas depending on their load degree.

3. Education

From the available data at both national and local level, it is highlighted that even though the number of students increased for the last 4 years, their number remained further lower against the numbers from the period preceding the economic crisis. A drop in the numbers of students, means that the society generates less and less high-skilled labor force based mostly on brains, which in the current competitive economy represents a weakness. The descending demographic trend contributes to the drop in the number of students which Romania is facing. The demographic crisis triggered by the decrease in the birth rate is not reflected yet at major level, but in the following years this descending trend will become increasingly more marked.

4. Tourism

Focused most on natural landscapes and its rich history, it has a significant contribution to the country's economy, as well. Domestic and international tourism ensured about half of million jobs (5.8% from total jobs). After trade, tourism is the second important activity within the services sector. From the economic sectors of Romania, tourism is a dynamic and rapidly developing one, and is characterized also by huge expansion potential. From the available data, we notice an average increase over the last four years, by about 2.45% of the tourist accommodation capacity. It is noticed that the increase in the number of overnight stays, from one year to the other, between 5.42% and 7.55%. The average increase for the last four years is by about 6.35% with a high development potential.

In Romania (and not only), cities can no longer be analyzed strictly within their administrative limits, without taking into account the support role of the peri-urban territory in supplying the basic elements (goods, labor force, land resources, etc.). In this respect, some typologies of functional urban areas were created, formed out of strong urban centers, together with their adjacent territory displaying the polarizing forces, and used as integrated planning units. This new grouping might improve considerably territorial management and the urban-rural relationship. These new groups of urban areas are presented hereunder (Table 2).

Table 2. Criteria of grouping cities from Romania (2018).

Criteria	No. of urban localities	Income/employee (euro)	% of income from agriculture	% income from industry	% of income from services	% of changes in no. of employees
1. Poles of urban growth[2]	14	54.932	1%	44%	54%	6%
2. Suburban cities (peri-urban)[3]	12	57.254	1%	47%	52%	38%
3. Industrial cities	46	48,717	2%	61%	27%	19%
A. Mixed industrial cities	25	50,998	3%	44%	53%	23%
B. Specialized industrial cities	21	46,002	1%	82%	17%	5%
4. Agro-city	76	38,661	12%	47%	42%	4%
A. Cities exclusively agro[4]	9	67,123	41%	15%	45%	4%
B. Agro-cities with industry	35	38,745	7%	66%	27%	12%
C. Declining agro cities	32	31,451	8%	35%	57%	-5%
5. Tourist cities	24	34,305	3%	42%	55%	16%
6. Developing cities	100	32,882	4%	50%	45%	11%

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[2] Urban growth pols: Bacău, Braşov, Bucharest, Cluj-Napoca, Constanţa, Craiova, Galaţi, Iaşi, Oradea, Piteşti, Ploieşti, Sibiu, Suceava, Timişoara.

[3] Suburban cities: Bragadiru, Buftea, Chitila, Cisnădie, Eforie, Măgurele, Năvodari, Ocna Sibiului, Otopeni, Ovidiu, Pantelimon, Popeşti-Leordeni, Râşnov, Ştefăneşti, Tăuţii-Măgheruş, Voluntari.

[4] Amara, Băileşti, Căzăneşti, Gătaia, Însurăţei, Negru Vodă, Pogoanele, Segarcea, Tăşnad, Zimnicea.

A.Developing industrial cities	52	34,448	3%	64%	33%	5%
B. Cities with a strong public service sector	39	31,240	5%	35%	61%	2%
C.Cities with expanding labor markets	9	33,581	40%	23%	36%	18%
7. **Cities with internal labor reserves**	23	30,651	8%	55%	36%	30%
8. **Small agro-cities**	9	33,581	40%	23%	36%	18%
9. **Moderately expanding cities**	23	30,651	8%	55%	36%	30%
10. **Cities with households**[5]	15	33,106	3%	56%	41%	11%

Source: National Institute of Statistics [21].

Another study, titled URBAN BAROMETER – Quality of Life in Cities from Romania (in the period 1 July – 15 August 2020) realized a comprehensive survey at the level of 41 urban localities from Romania [22]. The cities included in the survey were Bucharest, Cluj-Napoca, and Piatra Neamț. The perception survey had a number of 13,380 respondents and just as many households. The survey is representative at national level for the urban environment, with a statistical error margin by +/-1% for a confidence interval by 99%. In the following we present the most interesting conclusions drawn from this survey. The analysis regarding the satisfaction of the inhabitants with the urban quality of life showed the results presented hereunder:

1. About 80% from the respondents are satisfied with the city they live in; most satisfied are those in the urban centers from the Centre Region (87%), and most dissatisfied those in the cities in South-Muntenia (74%). Satisfaction regarding urban living tends to increase together with the urban size, age, and individual incomes.

2. Urban transport is priority by car (44%) and its use increases together with the size of the city, of the incomes and educational level. In the majority of localities, the public transport use is positioned below its level of satisfaction. Eight cities record satisfaction values above 70%, in three of them the satisfaction exceeds 80% from total population: Cluj-Napoca (88%), Oradea (82%) and Brașov (81%).

3. Regarding the quality of health services, a bit more than half of the urban population (52%) declares its satisfaction with them. In six of the selected sample cities satisfaction levels were recorded above 60%: Iași (70%), Drobeta-Turnu Severin (67%), Oradea (67%), Alba Iulia (66%), Cluj-Napoca (66%), Târgu Secuiesc (64%) and Slatina (61%). At the other end of the distribution, another six localities record satisfaction levels below 40%, out of which is noticeable the locality Baile Herculane with a satisfaction degree of only 18%. Târgu Jiu (41%) and Piatra Neamț (37%) are county seat cities at the level of which are registered the lowest degrees of satisfaction.

4. Cultural facilities: 63% from total urban population declares its satisfaction with this type of facilities at the level of their city. Five urban centers record satisfaction levels above 80% from total population: Cluj-Napoca (88%), Oradea (85%), Drobeta-Turnu Severin (83%), Iași (82%) and Vatra Dornei (81%).

5. Educational facilities – about 67% declare that they have a high satisfaction level regarding schools and educational facilities to which they have access in their locality of residence. Three urban localities register a weight of satisfaction regarding educational services over 80%: Drobeta-Turnu Severin (86%), Băilești (85%) and Sinaia (82%). At the opposite pole of the hierarchy are concentrated three urban localities, which cumulated a weight of the satisfaction below 50%: Caransebeș, Ștefănești (Argeș) and Mihăilești.

6. The state of streets - 52% from the urban population declares its satisfaction with the state of the streets in the locality. The highest level of satisfaction regarding the state of streets is registered in the South-East region (66%), and the lowest level in the region South-Muntenia (37%).

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[5] Bechet, Cajvana, Darabani, Dolhasca, Dragomirești, Flămânzi, Liteni, Milișăuți, Răcari, Salcea, Săliștea de Sus, Sângeorz-Băi, Săveni, Solca, Vicovu de Sus.

7. State of buildings - satisfying for about half of the urban population from Romania (56% from total). A satisfaction level over 70% from the population is recorded in eight urban localities: four county seat cities Alexandria, Suceava, Drobeta-Turnu Severin and Oradea; three cities: Bicaz, Sinaia and Isaccea, and one municipality Vatra Dornei. Below 40% as regards the satisfaction level, was measured in four urban localities, and the only county seat city at this threshold was Ploieşti (24% satisfaction).

8. Public spaces - satisfaction with public spaces is determined regarding residing in the city. 65% of the urban population is satisfied with the available public spaces. The satisfaction with public spaces is high, in general. The North-West Region registers the highest satisfaction (71%), while the lowest satisfaction is in South-Muntenia (57%). Satisfaction exceeds 80% in total in Oradea (88%), Drobeta-Turnu Severin (84%), and Sinaia (82%). Below 50% regarding the satisfaction degree was measured in four urban localities: Bicaz (50%), Caransebeş (48%), Bolintin Vale (46%) and Ploieşti (42%).

9. At national level, 66% from the respondents declared they are satisfied with the green areas such as parks and gardens in the cities where they live. The highest level of satisfaction regarding the quality of green areas was recorded in the Region South-East (71%), and the lowest in South-Muntenia (49%). In four municipalities which are county seats, the satisfaction level exceeds 80%: Oradea (80%), Drobeta-Turnu Severin (81%), Cluj-Napoca (82%) and Iaşi (82%). Alexandria is the county seat which records values below 40% (respectively 38% satisfaction).

10. 60% of Romania's urban population is satisfied with the air quality in county seats. The highest satisfaction degree regarding air quality was recorded in the Regions North-East and South-East &75%), and the lowest satisfaction in the region Bucharest-Ilfov (34%). The distribution of the satisfaction regarding air quality shows high disparities at national level, from 91% satisfaction in Suceava, to 14% satisfaction in Ploieşti.

11. A bit more than half of the urban population (57%) declares itself satisfied with the noise level in the urban locality where they reside. Leaving outside the region Bucharest-Ilfov, which is ranks last in the hierarchy regarding satisfaction with the noise level, the first nine cities recording satisfaction levels over 80% include two county municipalities Suceava (85%) and Piatra Neamţ (81%). Below 40% satisfaction level is registered in Bucharest (33%), and Ploieşti (29%).

12. The weight of those declaring themselves satisfied with the cleanliness in their city is by 57%. At regional level, South-Muntenia ranks last regarding satisfaction with urban cleaning (42%), followed by Bucharest-Ilfov (46%). The highest weight of satisfaction was registered in South-East (71%). Three localities record levels of satisfaction above 80%: Sinaia (88%), Suceava (84%) and Bicaz (81%). Five of the county seats, including Bucharest, are below the average of the satisfaction measured at national level. Below 40% satisfaction level was recorded for seven localities, Ploieşti being the only county seat ranked on the last position (16% total satisfaction degree).

78% of the employed urban population is satisfied or very satisfied with the workplace. In cities with more than 300.000 inhabitants, the satisfaction level recorded was by 86%. At the opposite pole, in cities with less than 20.000 inhabitants, the average degree of satisfaction is by 69%. Bucharest is ranked below the average, by 77% total regarding the satisfaction degree. The highest satisfaction degree was recorded in North-West (82%), and the lowest in South-Muntenia (66%). As trend, the satisfaction level regarding workplace increases together with the active age from 77%, value recorded for the age group 18-24 years, to 80% satisfaction for the age groups over 55 years. Women with higher education, who have a child in their care, with incomes above average, and employed in the budgetary system are significantly more satisfied in relation to the population average, as trend (Figure 3).
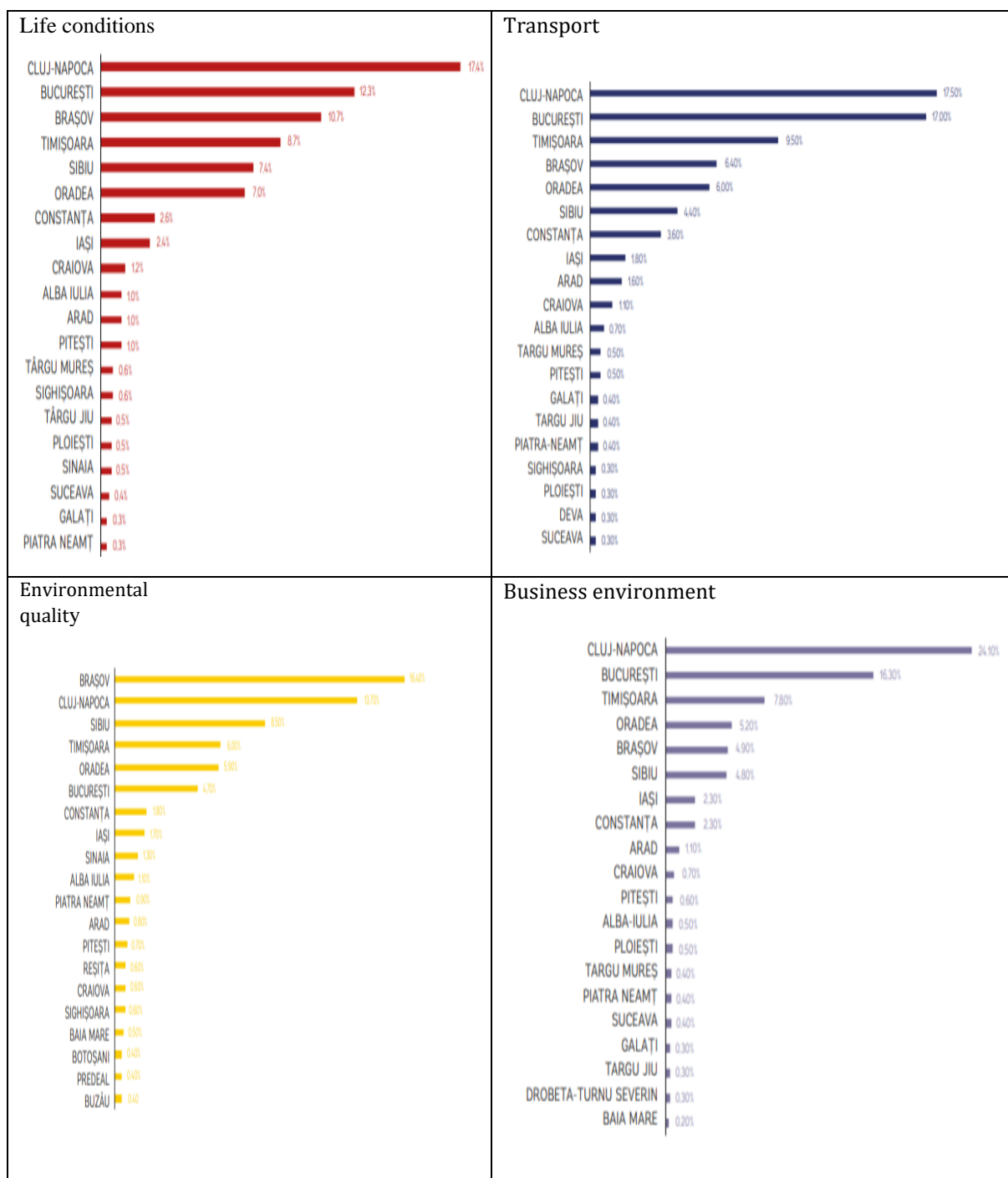
Figure 3. Top cities after some field.
Source: Ministerul Lucrărilor Publice, Dezvoltării și Administrației (2020). Politica urbană a României.
Barometru urban - Calitatea vieții în orașele din România [22]

As result of this survey, priorities were set for the urban policy in Romania, as follows: health services, air pollution, road infrastructure, lack of jobs, education and training, noise, public transport, housing safety, social services, development opportunities for businesses, connectivity with neighboring localities, lacking green areas, aspect, and architectural quality of the buildings.

From the analysis of the relationship between the degree of urbanization and the incidence of SARS-CoV2 virus, it can be seen that there is a relatively low correlation between a high incidence of the number of diseases (per 1000 inhabitants). Thus, the first places (the highest incidence) are occupied by smaller cities and not by large urban centers. The only exception is the city of Timișoara, one of the most

important urban centers in Romania, which holds the first place for infections, after a period in which they had decreased (Figure 4).

The only effect with economic impact on big cities is determined by the increase of prices on the real estate market. Thus, according to specialists in the field, the price of apartments will register average increases of up to 8-10% in 2021, already being recorded an increase of 3% over the previous year, and the pace of deliveries and sales, reaching a historical record, will continue in 2021 and 2022. The average amount requested at national level by sellers amounted to 1,507 euros per usable square meter, down 0.1% compared to August 2021, from 1,508 euros per usable square meter. Five of the six big cities constantly monitored (Bucharest, Timişoara, Iaşi, Arad, Constanţa, Cluj-Napoca, Braşov) registered increases of the average listing values on the apartments segment, the most significant growth margin being observed in Iaşi. The exception to the rule is Braşov, where the general downward trend was supported exclusively by the new housing segment (Figure 4).
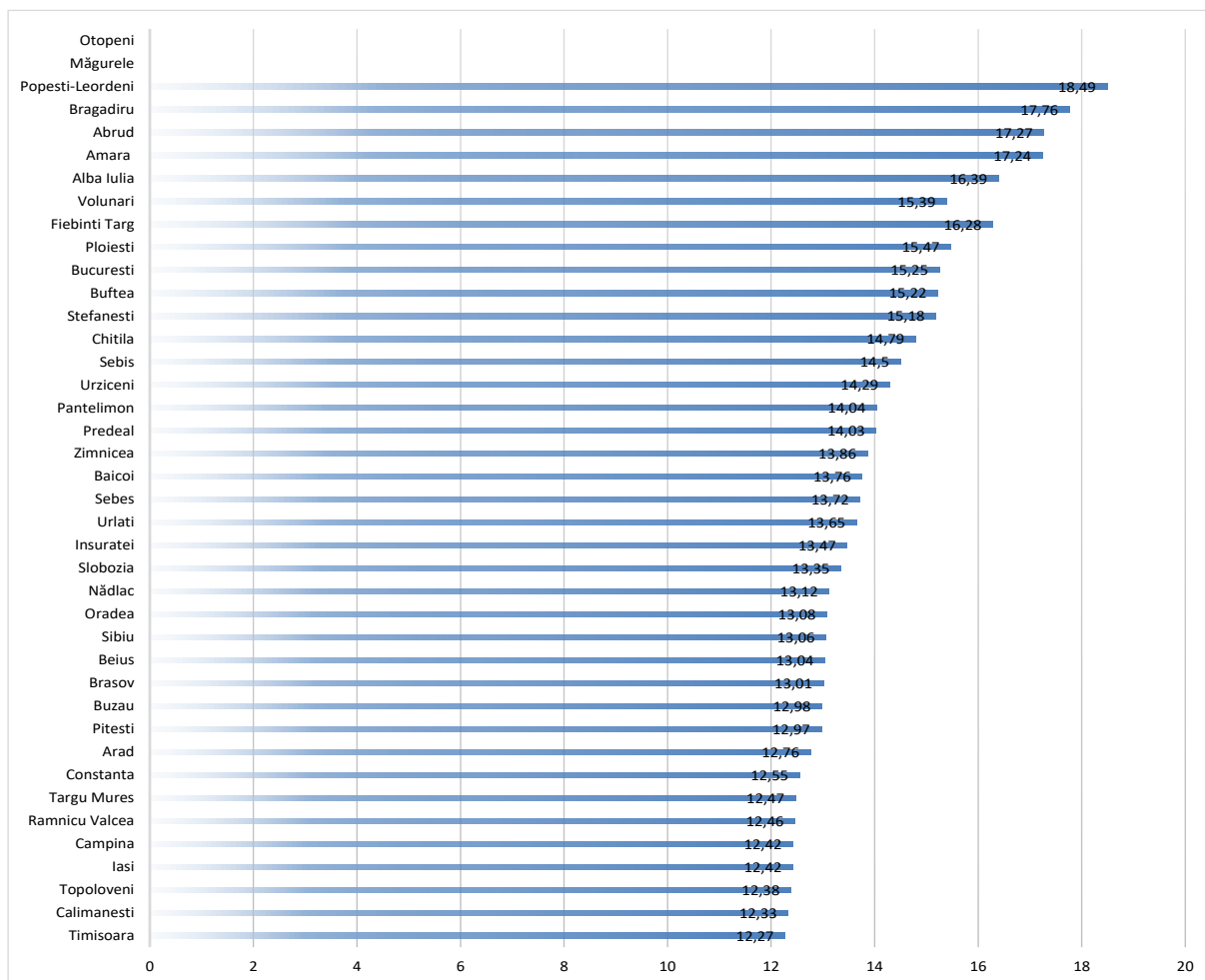

Figure 4. List of cities with SARS-CoV2 virus incidence grater than or equal to 3/1000 inhab. - 29.10.2021. Source: https://stirileprotv.ro/stiri/actualitate [24].

6. ELEMENTS OF NEW URBAN DEVELOPMENT POLICY IN ROMANIA 2021-2035

In general, the role of urban policy is to set national priorities in the field of urbanism, and to guide local urban authorities so that their cities attain the required state. Among the main objectives of urban policy are counted: increasing quality of life next to a wide range of opportunities.

The territorial development policy represents an efficient and effective tool of public authorities pursuing to coordinate a certain area (city, municipality, metropolitan area). It reflects the fundamental social agreements regarding the way in which cities are built and transformed, and the nature of the interactions between inhabitants. In brief, urban policy is nothing else but a group of initiatives of public policy aimed to impact the life of urban residents.

In Romania, the pillars of the urban development strategy are the following:

1. Green and resilient city - the strategies will include elements of climate change mitigation, adjustment and increased resilience to natural hazards. The priorities are: creating access to green space, reducing the risk of overheating, conserving water resources, increasing air and water quality, reducing air pollution, enhanced biodiversity, enhanced environmental skills, local community capacity and cohesion, enhanced connectivity between green spaces and encourage walking and cycling.

2. Competitive and productive city – actions will ensure a healthy and attractive environment for workers and residents, promote decent jobs, an adequate investment in infrastructure and basic services, eliminate inadequate business regulations, invest in education, develop skills and develop technical efficiency and financial services of urban authorities, etc.

3. The inclusive city - ensures that each individual has an equitable access to services of general interest. It focuses on inclusion and equality, with a particular focus on promoting results for groups that are particularly at risk of disadvantage and social exclusion.

4. The well governed city – it is proactive and efficient, ensuring the accessibility of governance processes for co-creating solutions (Figure 5).
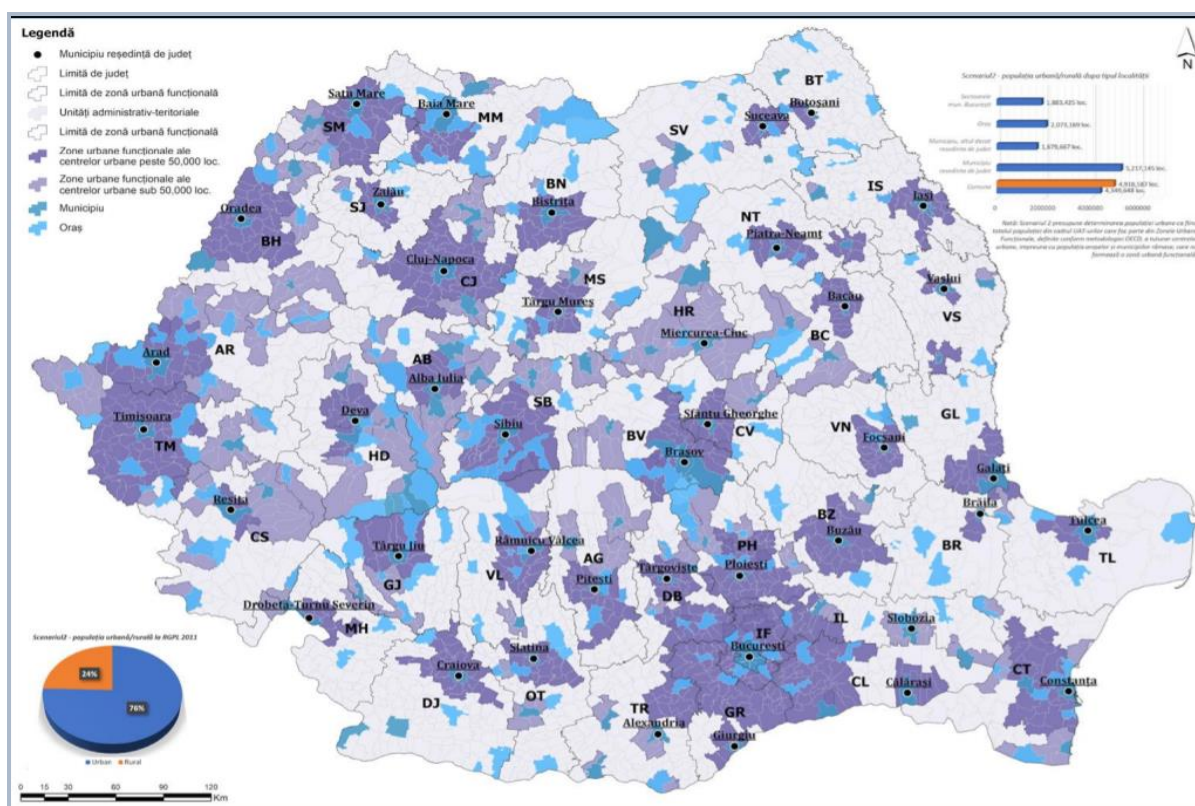
Figure 5. Urban system in Romania.
Sursa: Ministerul Lucrărilor Publice, Dezvoltării şi Administraţiei (2020) [25].

Urban policy in Romania aims to achieve the following five development objectives:

PRIORITY OBJECTIVE 1 – Territorial sustainability.

PRIORITY OBJECTIVE 2 – Creating inhabitable and climate smart cities, by improving green and blue infrastructure for attenuating and adjusting to urban risks.

PRIORITY OBJECTIVE 3 – Improving economic activity, providing quality living environments, well-serviced business locations and more work opportunities.

PRIORITY OBJECTIVE 4 – Improving living conditions especially by expanding access to housing and public services.

PRIORITY OBJECTIVE 5 – Improving public capacity and cooperation between jurisdictions and sectors.

The expected impact of urban policy is shown based on the following elements: teritorial sustainability, inhabitable and climate smart cities, increased economic activity, improved living conditions, improved governance.

Main activities are: land reconversion, expanded public areas, multimodal urban infrastructure, rehabilitated buildings, green and blue infrastructure, attenuating and adjusting to urban risks, urban sustainable mobility, seismic heat waves, air pollution, skilled labor force, improved quality of life, high RDI intensity, improved transport connectivity, adequate training, PPP, cultural infrastructure, health and social services, TEN-T infrastructure, social housing, price thresholds, universal access infrastructure, ITC infrastructure, personnel training, digital tools.

The urban development policy provides a beneficial development framework for the cities, thus supporting local public authorities.

7. POSSIBLE FINANCING RESOURCES

For the next years, Romania has the historic opportunity to benefit from funds from EU in the amount of 79.9 billion euros, broken down as follows [25]:

- 46.4 billion euros from the Multiannual Budget 2021-2027;
- 33.5 billion euros from the Economic Recovery Package (of which 16.8 billion euros in the form of grants and 16.7 billion euros in loans).

Architectural proposals for the Operational Programs 2021-2027:

1. The Regional Operational Program (ROP) 2021-2027 – succeeds the Regional Operational Program 2014-2020 and is one of the programs through which Romania will be able to access the European structural funds and investments from the European Regional Development Fund (ERDF) in the current period programming [19].

2 Fair Transition Operational Program (POTJ)

3. Sustainable Development Operational Program (PODD)

4. Transport Operational Program (POT)

5. Intelligent Growth, Digitization and Financial Instruments Operational Program (POCIDIF)

6. Health Operational Program (SOP)

7. Education and Employment Operational Program (POEO)

8. Operational Program for Inclusion and Social Dignity (POIDS)

9. Technical Assistance Operational Program (OPTA).

Another financing source is the National Recovery and Resilience Plan (NPRR). In addition to the European budget for 2021-2027, the EU has launched the Recovery and Resilience Mechanism (#NextGenerationEU), a temporary financial instrument in the form of loans and grants available to support reforms and investments at national level. The goal is to mitigate the economic and social impact of the pandemic caused by the coronavirus, to make savings and European societies more sustainable, more resilient and better prepared for the challenges and opportunities of the green and digital transitions.

Investments and reforms financed by NPRR funds must contribute to the achievement of the objective 20% digitization, together with attaining the climate change target, in proportion of 37%. Thus, the digital component of the projects underlying the smart city concept, as well as the green one will be advantages for the eligibility of the projects formulated in the *Strategies Integrated Urban Development*. National financing programs according to the objectives of the Urban Policy Green and resilient cities are presented in the next.

- Programs financed by the Environment Fund - Ministry of Environment, Waters and Forests (MMAP)
- Programs to increase energy efficiency of residential buildings - MDLPA
- Disaster Risk Management (DRM) Programs - MDLPA
- National Program of Constructions of Public or Social Interest (PNCIPS) - MDLPA
- National Local Development Program (PNDL) – MDLPA.

For *Competitive and productive cities,* the financing funds are:

- The National Program of Constructions of Public or Social Interest (PNCIPS)
- The National Local Development Program (PNDL).

Housing programs administered by the National Agency for Housing (Housing for young people, for rent, Program for the construction of service housing for civil servants and staff of central and local public institutions, social housing for Roma communities) – MDLPA.

Other housing programs (social housing, housing for evicted persons from nationalized housing) – MDLPA; National Local Development Program (PNDL); Well-governed cities: Elaboration and / or updating of General Urban Plans and Local Urban Regulations – MDLPA.

8. CONCLUSIONS

The territorial development policy represents an efficient and effective tool of public authorities pursuing to coordinate a certain area (town, municipality, metropolitan area). It reflects the fundamental social agreements regarding the way in which cities are built and transformed, and the nature of the interactions between the inhabitants. In brief, urban policy is nothing else but a group of initiatives of public policies aimed to impact the life of urban residents.

The present paper had as main purpose to present an overview of about the future urban policy from Romania for the period 2021-2027, by identifying the objectives, measures and actions required for its implementation. At the same time, it pursued to highlight the relevance of this policy as viable instrument, useful in particular during the process of territorial development planning.

In Romania of the year 2021, in ongoing pandemic crisis, urban development should continue the trend of the past years, but by taking into account the new issues emerged in greater cities and adjacent metropolitan areas as result of the SARS-CoV2 effects, issues that are not considered by the urban policy yet.

The three issues identified at the level of the cities in Romania - health services, air pollution, and road infrastructure – must be managed as quickly as possible, so that their negative impact is diminished in the subsequent period, as the NPRR does not include such objectives, as well. If in some areas new business, residential, mixt districts emerge, in others modernization is but incipient or lacking. Logistical parks developed around larger cities, but both urban and metropolitan areas have infrastructural problems that fall in the responsibility of local and national authorities. Several projects consider urban regeneration so that areas with tradition from the cities return to life.

According to the conclusions and results, three strategic recommendations can be provided to planners for the new urban policy:

1. First of all, the incorporation of spatial planning at national and urban level: the main purpose of such spatial planning for urban development would be the implementation of strategic urban and housing infrastructure and the facilitation of local and national governance.

2. Designing a policy framework in urban infrastructure for domestic investment: when investors obtain ideal conditions for their investment, national bodies should observe the availability of tools, for example, private-public can invest for the strategic development of urban infrastructure.

3. Developing institutions can induce capacity building among people to enrich public-private partnerships: various organizations are needed to support private groups to increase the quality of jobs in order to attract more investments in the capacity development.

The COVID-19 crisis has differentiated effects at territorial level. The differentiated impact at regional level requires a territorial approach to responses on the health, economic, social, fiscal. The COVID-19 crisis has also accelerated several mega trends and transformations, such as digitization. The response of the government's digital policy to the COVID-19 crisis has different time horizons: it reacts in the short term, resolves in the medium term and reinvents in the long term.

Immediate and effective responses to COVID-19 focuse on supporting businesses and households at the national and regional levels. Thus, many national governments have announced large economic recovery packages, focusing largely on public investment. These investment recovery packages prioritize three areas: strengthening health systems, digitizing and accelerating the transition to a carbon-neutral economy.

Investing in quality infrastructure is part of the response to the COVID-19 crisis. In this context, national and sub-national governments need to invest more, making better use of existing and potential investment resources for investment and mobilizing private investment. Local, regional and national governments also need to invest smarter by prioritizing needs, focusing on post-crisis priorities in health, digital and environmental infrastructure and better managing public investment at all levels.

The differentiated impact of COVID-19 on individuals, communities and regions gives new urgency to a place-based approach to regional development and generates greater inclusion. The role of effective partnerships and trust between different categories of actors, the need for flexibility and adaptability and the importance of a balance between top-down and bottom-up actions serve to strengthen these urgencies. It also rethinks political dialogue on regional resilience. The pandemic crisis will induce the changing in regional development priorities towards strengthening territorial resilience.

ANNEXES

Annex 1. Thematic approached by urban analyses at international level.

Economics	Environment	Social	Pandemic crisi
Jobs/employment	Air quality	Education	% in box office revenues
Innovation	Biodiversity	Governance	Job vacancies
Trade	Energy	Health	Level o reservation
Capital investments	Water, soil, and noise	Housing	Occupancy rate
Knowledge economy	Ecologic mobility	Population and social conditions	Revenue in tourism
Productivity	Agriculture and food safety	Recreation, sport and culture	No. of infections
Savings	Emissions	Social security	Np. of deaths of SARS_CoV_2
Export/import	Land administration	Urbanism	No. beds in IT
Transports	Waste treatment	Openness and public participation	No. of Immunology doctors
Telecommunications	Use and availability of resources	Bribe and corruption	

Source: UrbanizeHub (2021) [8].

Annex 2. The History of Pandemics.

Name	Time period	Type / Pre-human host	No. of death
Antonine Plague	165-180	Believed to be either smallpox or measles	5 M
Japanese smallpox epidemic	735-737	Variola major virus	1 M
Plague of Justinian	541-542	Yersinia pestis bacteria / Rats, fleas	30-50 M
Black Death	1347-1351	Yersinia pestis bacteria / Rats, fleas	200 M
New World Smallpox Outbreak	1520–onwards	Variola major virus	56 M
Great Plague of London	1665	Yersinia pestis bacteria / Rats, fleas	100,000
Italian plague	1629-1631	Yersinia pestis bacteria / Rats, fleas	1 M
Cholera Pandemics	1817-1923	V. cholerae bacteria	1 M+
Third Plague	1885	Yersinia pestis bacteria / Rats, fleas	12 M (China and India)
Yellow Fever	Late 1800s	Virus / Mosquitoes	100,000-150,000 (U.S.)
Russian Flu	1889-1890	Believed to be H2N2 (avian origin)	1 M
Spanish Flu	1918-1919	H1N1 virus / Pigs	40-50 M
Asian Flu	1957-1958	H2N2 virus	1.1 M
Hong Kong Flu	1968-1970	H3N2 virus	1 M
HIV/AIDS	1981-present	Virus / Chimpanzees	25-35 M

Swine Flu	2009-2010	H1N1 virus / Pigs	200,000
SARS	2002-2003	Coronavirus / Bats, Civets	770
Ebola	2014-2016	Ebolavirus / Wild animals	11,000
MERS	2015-Present	Coronavirus / Bats, camels	850
COVID-19	2019-Present	Coronavirus – Unknown (possibly pangolins)	848 K (Johns Hopkins University estimate as of 10:28am PT, Aug 31, 2020)

Source: LePan, N. (2020, March 14). Visualizing the History of Pandemics [17]

Annex 3. Eurostat indicators for urban areas.

Cities and greater cities (urb_cgc)	Functional urban area (urb_luz)
Population on 1 January on age groups and gender – cities and greater cities (urb_cpop1)	Population on 1 January by age groups and gender – Functional urban areas (urb_lpop1)
Population structure – cities and greater cities (urb_cpopstr)	Population structure – Functional urban area (urb_lpopstr)
Population by citizenship and country of birth – cities and greater cities (urb_cpopcb)	Population by citizenship and country of birth – - Functional urban area (urb_lpopcb)
Fertility and mortality – cities and greater cities (urb_cfermor)	Fertility and mortality - Functional urban area (urb_lfermor)
Living conditions - cities and greater cities (urb_clivcon)	Living conditions - Functional urban area (urb_llivcon)
Education - cities and greater cities (urb_ceduc)	Education - Functional urban area (urb_leduc)
Culture and tourism - cities and greater cities (urb_ctour)	Labor market - Functional urban area (urb_llma)
Labor market - cities and greater cities (urb_clma)	Transport - Functional urban area (urb_ltran)
Economy and finance - cities and greater cities (urb_cecfi)	Environment - Functional urban area (urb_lenv)
Transport - cities and greater cities (urb_ctran)	Perception survey result (urb_percep)
Environment - cities and greater cities (urb_cenv)	Population on 1 January by age groups and sex - Functional urban area (urb_lpop1)

Source: European Commission. *City statistics (urb).* Eurostat metadata [18].

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