

Examining the Efficacy of spatial plans towards mitigating climate change at the local level: a case of Polokwane local municipality, South Africa

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Abstract

The purpose of this study is to examine the efficacy of local spatial plans towards mitigating climate change in Polokwane Local Municipality. Globally, spatial planning has been playing a pivotal role in shaping the growth of many cities and addressing environmental issues such as climate change. This is due to the notion that the pursuit of climate change mitigation requires different responses at the international, national, and local scales. However, the local level remains the core scale within which the climate change mitigation agreements, frameworks and policies should be intensified. This is because local spatial plans provide cities with the potential to reduce the increasing GHG emissions and mitigate climate change through the process of urban renewal. In South Africa, spatial plans such as, *inter alia*, the Municipal Spatial Development Framework (MSDF), Integrated Urban Development Framework (IUDF) and Spatial Planning and Land Use Management Act (SPLUMA) have the potency to mitigate climate change through the provision of sustainable transport modes, energy efficient settlements and the usage of renewable resources. These plans advocate for the integration of the transport system and the use of renewable energies such as solar system to reduce traffic congestion, greenhouse gases (GHG) emission and intensive energy consumption. The paper has used a combination of theoretical and empirical data to probe the efficacy of spatial plans towards mitigating climate change in Polokwane Local Municipality. The former data was collected through literature review while the latter was solicited through questionnaires and interview schedules. The study reveals that the municipality is confronted with multifarious challenges that impede the efficacy of spatial plans in integrating the transport system and reducing the traffic congestion, GHG emissions, intensive energy consumption and other components associated with climate change mitigation. The study concludes that plans such as the MSDF, IUDF and SPLUMA fail to effectively mitigate climate change as it is recognised within the broad environmental management. It is therefore recommended that there is a need to restructure SPLUMA and recognise climate change as a separate entity. It is further recommended that the municipality should consider installing and providing solar systems to areas that are within the urban core as this will significantly reduce the intensive electricity consumption.

Keywords: Spatial plans; Climate change mitigation; GHG emissions; Spatial Planning.

1. Introduction

The global effects of climate change are intensifying with the developing countries enduring the major brunt. The rate of urbanisation in developing countries has challenged the spatial planning, consequently leading to high consumption of

electricity, increasing emissions from vehicles, reduction of green places and arable land (Mogano & Mokoele, 2019; Mokgotho & Mokoele, 2020). Therefore, there is an urgent need to respond to climate change through different actions from various spatial scales. The global and national scales have dominated a myriad of responses in the form of policy instruments, legislative frameworks, international agreements, and mitigation and adaptation policies (Ho & Tang, 2019). According to Ho and Tang (2019), climate change is a global phenomenon where its effects are experienced at the regional and local scales, wherein the poor shows an overwhelming inability to adapt.

The goals and objectives pursued at the higher scales concerning climate change often clash with the issues faced locally. Local municipalities in South Africa are grappling with a mammoth task of providing basic service delivery to their constituencies while attempting to mitigate climate change. As such, climate change issues should also be robustly analysed and addressed at the local scale especially by cities (Mokgotho & Mokoele, 2020). Local spatial plans are regarded as the essential elements of governance, which demonstrate administrative capacity to effectively address climate change (Boštjan, 2016; Mokgotho & Mokoele, 2020). Kumar and Geneletti (2015) and Boštjan (2016) explicitly show that spatial plans mitigate climate change through controlling land use change by allocating space for various activities. Thus, local spatial plans are the essential policy framework that attempts to shape economic, social and physical development of cities (Kumar & Geneletti, 2015). The interaction of the foregoing aspects is the main driver of climate change issues at various spatial scales.

The advocates of climate change mitigation noted spatial plans such as, *inter alia*, the Municipal Spatial Development Framework (MSDF), Integrated Urban Development Framework (IUDF) and Spatial Planning and Land Use Management Act (SPLUMA) as the mechanisms within which mitigation measures can be devised and implemented (Ho & Tang, 2019). The implementation of spatial plans and climate change are intricately interlocked as they are essential in advocating for the utilisation of renewable resources such as hydropower, wind, solar and bioenergy, thereby safeguarding the environment (Busayo, Kalumba & Orimoloye, 2019). According to Busayo *et al.* (2019), spatial planning seeks to mitigate climate change through the provision of energy efficient settlements, implementation of integrated transport plans and the reduction of energy consumption in the buildings.

To mitigate climate change through local-level spatial plans, Kumar and Geneletti (2015) postulates that development authorities require detailed information about the GHG emissions, technical expertise, financial resources, strong political will and public participation. A body of literature in South Africa shows that reducing GHGs emissions is possibly beyond the capacity of municipalities (Nel, 2016; Natarajan, 2017; Strauss, 2019; Mokgotho & Mokoele, 2020). This can be attributed to the lack of climate change awareness and the subsequent failure to acknowledge the reduction of GHG emissions as a top priority. According to Govender and Reddy (2019), lack of technical expertise, financial resources, political will and significant disagreement among different stakeholders constitute a major impediment to climate

change mitigation. Polokwane Local Municipality is among the South African local governments with almost similar afore-mentioned challenges pertaining to climate change mitigation (Polokwane Local Municipality, 2018). The purpose of the study is to examine the efficacy of spatial plans towards climate change mitigation in the City of Polokwane, Limpopo Province.

2. Literature review

The densification of urban population has created a multiplicity of challenges such as traffic congestion, air pollution and climate change (Cobbinah, Erdiaw-Kwasie & Amoateng, 2015). The implementation of spatial plans provide a crucial factor to effectively address these issues. The effective design of urban form through spatial planning can contribute significantly to climate change mitigation. The conceptualisation of spatial planning is very significant in understanding land-use planning and integrated transport planning in the quest towards climate change mitigation. Turok (2016) postulates that spatial planning is a multi-sectoral and multi-stakeholder involvement phenomenon in nature, wherein the planner's role is to consolidate diverse inputs into a unified framework for intervention. The contemporary literature on spatial planning revolves around the recognition of private sector, local communities, municipalities and civil societies as the multifaceted actors that impact significantly on urban space (Hegazy, 2015; Natarajan, 2017). More recently, Bassett (2020) notes the emergence of mobility and access to urban areas as central concerns within the spatial planning discourse. This planning is the answer to the issues associated with coordination and integration of municipal sectoral plans through a space-based approach (Natarajan, 2017).

The foregoing planning results in the spatially coordinated and integrated sectoral plans such as the Municipal Spatial Development Framework (MSDF), Integrated Development Plan (IDP), Integrated Urban Development Framework (IUDF), integrated human settlement plans and integrated transport plans, among others. It is, however, worth noting that these spatial plans are forward looking and two-dimensional visions of how a city or region should look (Cirolia & Berrisford, 2017). For instance, the MSDF provides a clear indication on how land around the city should be utilised (Natarajan, 2017). The MSDF also shows the location of where the public and private investment on land is going to be channelled in dealing with, *inter alia*, low-density housing, urban sprawl, traffic congestion, GHG emissions and high electricity consumption (Odendaal & McCann, 2017). However, worth noting is that the IUDF plan cut across all these plans as it advocates for spatial integration, promotion of social and economic inclusion, and improving access to services in urban areas (Odendaal & McCann, 2017).

In South Africa, Kenya, Zimbabwe and Ethiopia, the contemporary structure of spatial plans has three execution tools namely: land use regulation, infrastructure investment and land allocation (Cirolia & Berrisfor, 2017). Land use regulations set out the rules, criteria, indicators and standards, which specify how land in selected areas can be utilised (Cirolia & Berrisfor, 2017). Infrastructure investment concerns

the provision of necessary urban services including energy, transportation, water, electricity and road development (Cirolia & Berrisfor, 2017; Cirolia, 2020; Goodfellow & Haung, 2020). Thirdly, land is allocated to appropriate uses within urban areas, including land valuation systems, property rights and commercial facilities (Turok, 2016; Cirolia & Berrisfor, 2017). These execution tools are important in addressing the contemporary challenges facing most cities such as traffic congestion, GHG emissions and high consumption of electricity. Thus, spatial planning plays a critical role towards climate change mitigation (Mokgotho & Mokoele, 2020). However, it should be noted that regulation is just one aspect of spatial plans implementation. Combining infrastructure investment, land allocation practices and regulatory efforts will ultimately make a fuller picture of the spatial plan implementation toolbox.

2.1. The institutional barriers in spatial planning and implementation of plans

Municipal spatial plans have over the years provided an integral part of urban planning to address challenges such as urban sprawl, urbanisation, rural-urban migration and climate change (Cobbinah *et al.*, 2015). However, the implementation of spatial plans has been confronted with multiplicity of institutional barriers in urban areas. The implementation of the spatial plans (SPLUMA, MSDF and IUDF) helps to address the urban environmental problems. The integration of multiple stakeholders is important to enhance municipal governance. However, the implementation of spatial planning in South Africa is confronted with multiple challenges such as poor governance, budgetary constraints, political will and lack of capacitated human resources (Booth, 2017; Meyer & Auriacombe, 2019; Mokgotho & Mokoele, 2020). Consequently, traffic congestion, high electricity consumption, high wastes production became endemic and characteristics of towns and cities in South Africa. Due to the multiplicity of development challenges and service delivery backlog within most South African local municipalities, Mogano and Mokoele (2019) and Mokgotho and Mokoele (2020) argue that the local communities have the ability to contribute towards climate change mitigation. This can be achieved through the reduction of electricity consumption and installing hybrid energy systems (solar system and batteries).

Poor governance

Meyer and Auriacombe (2019) argue that poor governance is a major impediment to the effective allocation of land for different activities. This often occurs in the form of land grabs, excessive political interference, lack of transparency and accountability (Meyer & Auriacombe, 2019). For instance, if municipal officials as the implementers of spatial plans are subjected to day-to-day political supervision, are less likely to apply a technical rationality to effectively achieve the end goal (Albrechts, Balducci & Hillier, 2017). In Palestine, national authorities are using spatial plans as a tool to extend their territorial claims and exclude the citizens who have less political power (Kalantari, Ferreira, Keesstra & Destouni, 2018). The allocation of space in many Palestinian urban municipalities is characterised by complex governance

arrangements and the unstable political situation (Daoud, 2017; Kalantari *et al.*, 2018). Similarly, a body of African literature notes outdated legislative frameworks, complex land tenure systems and undue political interference as some of the factors affecting the implementation of spatial plans in South Africa, Ethiopia, Egypt, Ghana and Tanzania (Hegazy, 2015; Cobbinah, 2017; Cobbinah & Darkwah, 2017). The exclusion of citizens is entrenched in the South Africa spatial planning landscapes despite the existence of many legislations and spatial plans that advocate public participation. Therefore, the lack of citizen involvement in spatial planning has the potential to deter the commitment towards climate change mitigation through high electricity consumption and pollution.

Budgetary constraints

In spatial planning, power configurations shape the relationships between public and private interest groups, promulgation of policies, legislation, acts and plans to guide the allocation of land in urban areas. However, the development of clear land allocation and energy conservation policies does not automatically guarantee effective implementation of spatial plans. Budgetary constraints often impede the municipality's ability to invest in policies and programmes responsible for operationalising spatial plans (Suparman, Chandra & Sari, 2019). Additionally, most municipalities do not have adequate funds that are explicitly dedicated for the implementation of climate change mitigation projects. Oliveira & Hersperger (2018) argue that without adequate capacity to effectively utilise financial resources and avoid corruption; urban development plans and climate change mitigation projects will continue to be theoretical concepts whose implementation remain the largest part unknown. According to Cirolia & Berrisfor (2017), rampant corruption; maladministration and lack of capacity to spend money resulted in poor implementation of spatial plans in South Africa, Kenya and Ethiopia.

Lack of human resource capacity

Globally, many local governments are found to be populated by a myriad of unskilled professionals who are responsible for spatial plans preparation and implementation. Booth (2017) attributes the persistence of urban challenges across the world to the inability of the municipal officials to balance the conflicting views during spatial planning. This includes the harmonisation of the views from the politicians, business owners, environmentalists and development agencies. Arguably, depending on the capability of the facilitator, the recurring meetings between these contrasting actors can have notable effects. In eMalahleni, eThekweni, eKurhuleni, Johannesburg and Tshwane, among other rapidly growing South African municipalities, spatial planning officials are found to lack notable expertise in dealing with illegal developments, land invasions and the plight of communities living in hazardous conditions (Govender & Reddy, 2019). As a result, the implementation of MSDFs in these municipalities is often caught up in the micro-politics of negotiations and conflict resolutions, which derail the ability to address the challenges that have become the character of many cities (Booth, 2017). This implies that officials ought to understand the social dynamics

and political ideologies for spatial plans to be effectively implemented.

2.2. Spatial plans review in terms of climate change mitigation

The implementation of spatial plans such as SPLUMA, MSDF and IUDF, which promote the use of clean energy sources, environmental protection and the employment of energy mix is imperative to mitigate climate change (Mokgotho & Mokoele, 2020). These plans coupled with the National Development Plan advocate for the reduction of GHG emissions (Mokgotho & Mokoele, 2020) from the sources such as, *inter alia*, mines, vehicle emissions, power generation plants and landfill areas (Busayo *et al.* 2019). However, major emissions are not visible although cities are responsible for the GHG emissions. These are emissions from the landfill sites that are located outside the city and power generation plants due to high consumption of electricity from cities and urban areas.

The design of the spatial pattern of urban development contained in the plan encourages compact city and sustainable transportation which enable cycling, walking, public transportation, and reduced use of private vehicles (Firoj, 2017; Mokgotho & Mokoele, 2020; Jehling & Banon, 2020). Spatial plans also help in achieving a low-carbon future through the promotion of new technologies for creating new urban forms. The implementation of spatial plans plays an increasingly crucial "role in achieving climate change targets by helping mitigate GHG emissions through the rational allocation of land uses" (Wang, Huang & Huang, 2018: 23) and protection of green infrastructure. It is worth noting that mainstreaming GHG emissions within spatial plans does not automatically imply effective climate change mitigation. Addressing "climate change within spatial plans must be supported by the municipal employee capacity, political will and the provision for funding" (Mokgotho & Mokoele, 2020: 477).

2.3. South African's Spatial Plans Review in Terms of Climate Change Mitigation

SPLUMA stipulates that all the three spheres of government ought to formulate and adopt a Spatial Development Framework (SDF) (Afinowi, 2018; Mokgotho & Mokoele, 2020) in promoting efficient urban renewal. In terms of section 7(c)(ii) of SPLUMA, the implementation of SDFs should ensure the minimization of the negative impacts on the environment (Afinowi, 2018), which enable environmental protection. The Municipal SDF plays a key role in mitigating climate change by integrating and aligning the, *inter alia*, transport, energy and housing departments. However, Odendaal and McCann (2017) and Mongala, Tema, Mokoele and Manamela (2019) argue that the MSDF and IDP do not devote explicit attention to climate change mitigation as it is embraced within the broad environmental management. It should therefore be noted that even in the presence of spatial plans, there will not be robust climate change mitigation in as much as the MSDF classifies it within environmental management. This connotes that spatial plans stipulate that municipalities ought to

promote environmental management with an implicit reference to climate change. The inability to explicitly recognize climate change mitigation in MSDF, SPLUMA, Integrated Urban Development Framework (IUDF) and Integrated Development Plan (IDP) paint a blurry picture for South Africa to contribute enormously towards climate change mitigation. However, the City of Cape Town has, in its MSDF, highlighted that it aims "to achieve developmental outcomes such as more sustainable use of land and natural resources, lower carbon emissions, efficient use of infrastructure and effective public transport systems" (Cape Town Metropolitan Municipality, 2018:57). The recognition of climate change mitigation in the MSDF, IDP, IUDF and SPLUMA should produce detailed spatial directives on how the GHG emissions will be cut, measured and monitored.

3. Methodology

The study was undertaken in the City of Polokwane under Polokwane Local Municipality, which is one of the four local municipalities located within Capricorn District Municipality, Limpopo Province in South Africa (Capricorn District Municipality, 2019). The City of Polokwane is the capital city and economic hub of Limpopo Province. The City of Polokwane has various sources of pollution such as mine, manufacturing industries, landfill sites, smelters and emissions from vehicles. The study adopted a mixed method approach to solicit data using questionnaire and interview schedule. The data was collected from the 33 employees of Polokwane Local Municipality. The 33 employees are from the Department of Local Development and Housing (11 respondents), Department of Environmental Affairs (11 respondents) and Department of Transport and Community Safety (11 respondents). Quantitative data was collected from 2 participants at a managerial level.

4. Presentation of findings and discussion

4.1. Municipal capacity in implementing spatial plans

Figure 1 examines the municipal capacity in the implementation of spatial plans in Polokwane Local Municipality. Figure 1 shows that 54.6% of the respondents agree that the municipality lacks capacity in terms of skilled professionals, budgetary skills and the ability to involve the communities in the implementation of spatial plans. Moreover, 42.4% of the respondents strongly agree that there is a lack of municipal capacity. However, only 3.0% of the respondents disagree that there is a lack of municipal capacity to implement spatial plans. The majority of the respondents attribute the ineffective implementation of municipal spatial plans to the lack of municipal capacity.

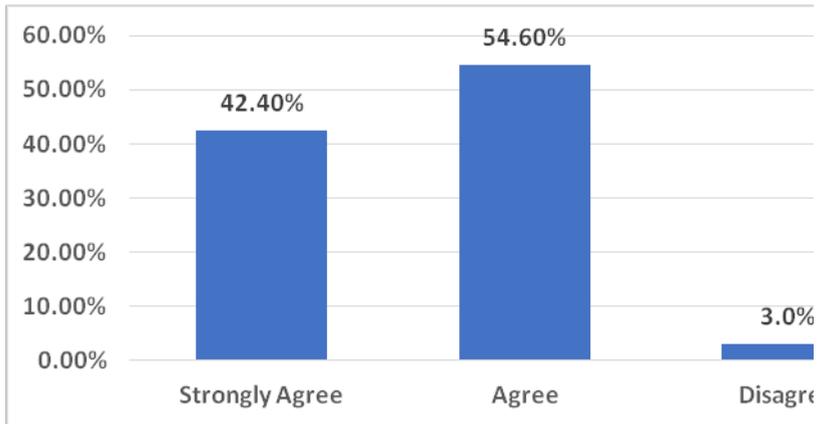
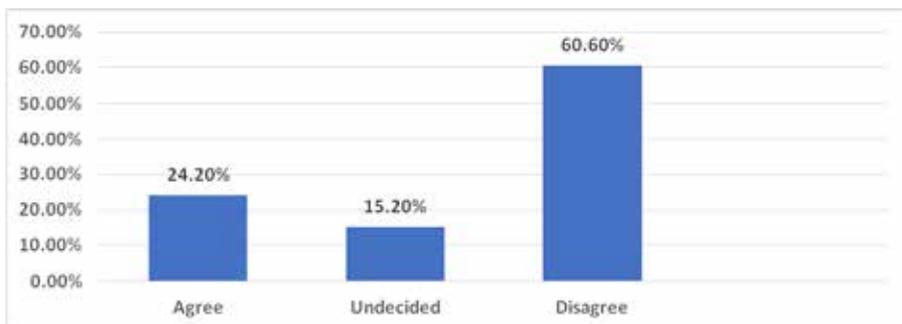


Figure 1: Lack of municipal capacity to implement spatial plans

4.2. The use of renewable energies within municipal buildings

Figure 2 shows that 60.6% of the respondents disagree that there is a usage of renewable energies within municipal buildings. 24.2 percent of the respondents agree that the municipality uses renewable energies in its buildings. Furthermore, 15.2% of the respondents are undecided on whether or not the municipality uses renewable energies in its buildings. The majority of the respondents stated that the Polokwane Local Municipality does not use renewable energies in its buildings. This means that the municipality does use renewable and clean energy sources such as solar systems and gas appliances. However, it is important to note that 15.2% of the respondents were undecided. This suggests that the people do not understand the applicability and the feasibility of using clean energy within the municipality. On the other hand, a few respondents seemed not to be aware if the municipality uses renewable energies in its buildings or not.

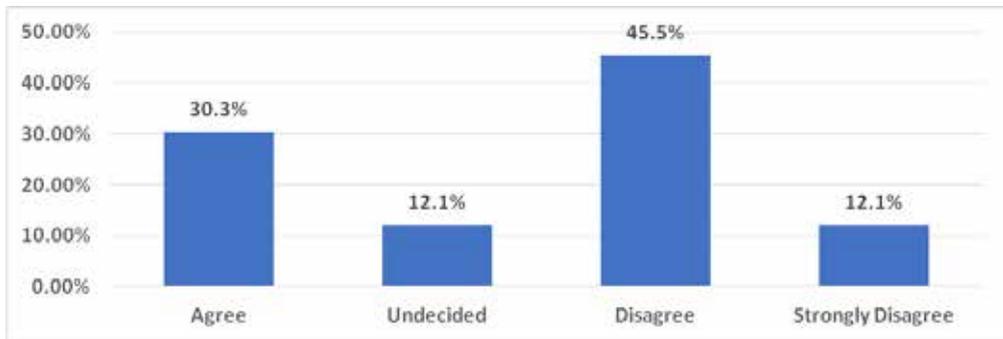
Figure 2: The municipality uses renewable energies in its buildings



4.3. Implementing municipal spatial plans towards climate change mitigation

Figure 3 explores the perception of the respondents on whether the spatial plans are implemented towards climate change mitigation within the Polokwane Local Municipality. Figure 3 shows that 45.5% of the respondents disagree that municipal spatial plans are implemented explicitly towards climate change mitigation while 12.1% strongly disagree with this idea. However, 30.3% of the respondents agree that spatial plans are implemented to mitigate climate change while 12.1% were undecided. The majority of the respondents have a perception that Polokwane Local Municipality does not implement spatial plans such as SPLUMA, IUDE, IDP and MSDF towards climate change mitigation. This suggests that the spatial plans are not implemented explicitly towards climate change mitigation and to reduce GHG emissions. The undesirable effects are based on the spatial plans' inability to reduce urban sprawl, traffic congestion, electricity consumption, commuting distances and thus, addressing GHG emissions.

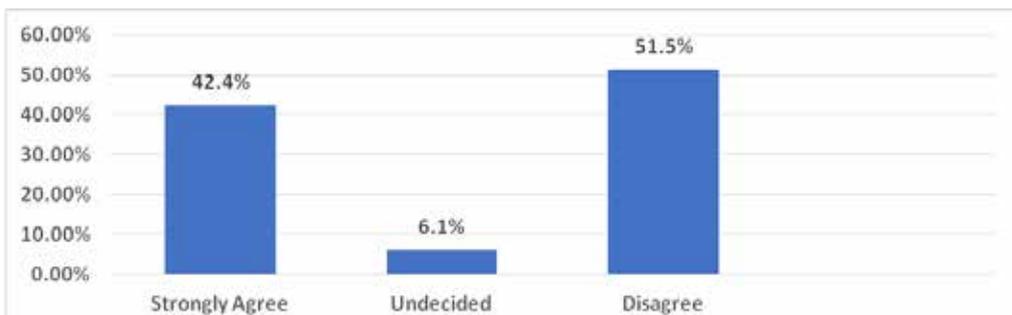
Figure 3: Implementing municipal spatial plans towards climate change mitigation



4.4. The implementation of integrated transport to abate GHGs emissions

Figure 4 shows that 51.5% of the respondents disagree that the integrated transport plans in Polokwane Local Municipality explicitly reduce GHGs emissions. However, 42.4% of the respondents strongly agree that the integrated transport plan reduces GHGs emissions around the municipality while only 6.1% remained undecided. Majority of the respondents have a perception that the Polokwane Local Municipality has not implemented the integrated transport plan explicitly towards the abatement of GHGs emissions. There is also a significant proportion of respondents who have apperception that the municipality has implemented integrated transport plans to reduce GHG emissions. This is attributed to the fact that the Polokwane Local Municipality has constructed walking paths and Bus Rapid Transit (BRT) (*Leeto*) operating around the City of Polokwane. This might suggest that the municipality is implementing integrated transport, although the manifestation of traffic congestion around the City of Polokwane demonstrate the inadequacy of these integration.

Figure 4: Integrated transport are implemented abate GHGs emissions



The study collected data from the official in the climate change division from Capricorn District Municipality who will be represented as participant A. Participant B will represent an official in the spatial planning section from Polokwane Local Municipality.

4.5. Barriers towards implementing spatial plans within the municipality

Literature of spatial planning has indicated that the municipalities have been facing multiple challenges such as lack of political will, lack of stakeholder engagement, lack of capacity and limited resources. Participant A stated that the municipal employees' non-attendance of spatial planning forums is a major problem that hinders effective implementation of the plans. Participant A and B reflected on these problems as follows:

"Poor attendance of the planning meetings by the municipal key employees is a serious concern that inhibits the effective implementation of spatial plans in the municipality".

"There is lack of commitment and inconsistent attendance of spatial planning forums by the key stakeholders of the municipality". "When spatial planning meetings are scheduled, the key stakeholders attend the first few meetings and decide to ignore the remaining ones". "This tendency leads to fragmentation and incoherence during implementation of the municipality' spatial plans".

The lack of commitment in planning leads to the fragmentation and incoherence of municipal spatial plans and thus derail their potentiality to contribute towards climate change mitigation. This is corroborated by literature that municipalities are confronted with multifarious challenges. Participant A and B indicated the following: *"The municipality experiences lack of funds to embark on massive infrastructural developments and effectively addressing the spatial challenges". "The lack of funds situation is mostly attributed to the misappropriation of municipal funds by some employees, the non-payment of certain municipal services by the communities and the inadequacy of the funds from the national government".*

Participant A further highlighted the following:

"Lack of funds constitutes a serious setback because if the projects budgeted for the current year are not implemented, the municipality is, however, forced to transfer those projects to the next financial year and that usually scales back the implementation of spatial plans".

Human resources, budgetary constraints, lack of professional skills and the inability to provide services to the communities paint a dire picture towards the

implementation of spatial plans to mitigate climate change. Furthermore, the lack of financial resources has the potential to result in low investments in projects that are undertaken to address urban spatial challenges such as traffic congestion and GHG emissions. Participant B highlighted the following as another limited resource capacity:

"The municipality does not have enough space to fully implement integrated transport plans and yield the optimum benefits". "During peak hours, most of the streets are always congested to a point where vehicles and people spend a lot of time to reach their destination places".

The inability to implement the integrated transport system has contributed to the continuous traffic congestion and GHG emissions within Polokwane Local Municipality. The insufficient municipal space also inhibits walking and cycling around the city. Literature on South African municipalities' experience has indicated that insufficient space and lack of human resource capacity derail the potential of spatial plans to contribute towards climate change mitigation (Mokgotho & Mokoele, 2020).

4.6. Municipal spatial plans in mitigating climate change

The implementation of spatial plans within the municipality is important towards climate change mitigation (Mogano & Mokoele, 2019; Mongala *et al.*, 2019; Mokgotho & Mokoele, 2020). This can be done through the reduction of GHG emissions, reduction of traffic congestion, reduction of high consumption of electricity and the usage of clean energy. Participant A highlighted that the municipality is providing solar energy to the households as part of reducing electricity consumption. This idea is represented by participant A as follows:

"The municipality has been trying to reduce the consumption of coal-generated electricity by providing solar geysers as part of free basic electricity to the households". "Thus far, 1500 households that are remote from the grid within the Polokwane municipal area are receiving solar geysers". "Plans are in place to increase the provision of solar geysers to other parts of the municipality". "The municipality is currently reviewing the alternatives of constructing a 90MW solar farm to complement the electricity that is provided by Eskom".

Participant B reflected the following sentiments pertaining electricity consumption: *"As one of the strategies to reduce the consumption of electricity, the municipality has embarked on a retrofit strategy to install motion sensor lights in some of its buildings". "Moreover, some of the streets around the municipality have the motion detector and Light Emitting diode (LED) lights".*

The motion sensor lights lead to less consumption of electricity when there is no movement around them. The provision of solar panels contributes significantly towards the reduction of coal-generated electricity consumption and thus mitigating climate change. Participant A and B stated that there is a move towards the implementation of the BRT system around the City of Polokwane.

"The municipality has derived, and is about to fully implement the Leeto La Polokwane Bus Rapid Transit (BRT) system to reduce traffic congestion and GHG emissions in the city". "Although traffic congestion exists during peak hours, the early stages of the implementation of Leeto La Polokwane BRT system has demonstrated a great potential to contribute towards

climate change mitigation in the municipality”.

The implementation of *Leeto la Polokwane* is important to provide an efficient transport system, which can reduce the recurring traffic congestion around the City of Polokwane. The reduction of traffic congestion in the city will reduce the emission of GHG, hence contributing towards climate change mitigation.

5. Discussion

Polokwane Local Municipality has been confronted with multifarious challenges in an attempt to mitigate climate change. The lack of adequate funds, inability of some communities to pay municipal services and lack of capacity will overwhelm the municipal capacity to implement measures that are explicitly aimed at addressing climate change. It is important to note that the municipality is putting in place measures, which are entrenched in the spatial plans to abate GHG emissions such as the provision of solar geysers to some of the households around the city and the implementation of BRT system. The provision of solar geysers to communities located away from the city might not have intended results towards the reduction of high electricity consumption. This is because a high rate of electricity consumption takes place in urban areas located in close proximity to the city and by the city itself. Therefore, this approach cannot be taken as a robust approach towards meeting climate change mitigation aspiration within the municipality. Polokwane Local Municipality is planning to embark on the implementation of a solar power plant and the installation of motion sensor streetlights. However, it was indicated that the municipality is currently facing budgetary constraints and lack of human resources capacity which will hinder the municipality from attaining the intended climate change mitigation aspirations.

6. Conclusion and recommendations

It can be deduced from the study that spatial plans in Polokwane Local Municipality remain inefficacious in dealing with climate change mitigation due to the persistence of multifarious institutional challenges. The lack of political will, lack of commitment by stakeholders, inadequate funds, inability of some communities to pay municipal services and lack of capacity inhibit spatial planning and the effective implementation of plans (MSDF, SPLUMA, IUDF, IDP) in the municipality. The persistence of these issues overwhelm the municipal capacity to implement measures that are explicitly aimed at reducing GHG emissions and addressing climate change. In spite of these issues, the municipality has attempted to reduce traffic congestion and GHG emission by constructing the walking paths, operating the *Leeto* BRT system around the city of Polokwane and providing solar geysers to some households that are remote from the urban core. However, the manifestation of traffic congestion around the city of Polokwane demonstrates the inadequacy of transport integration within the municipality. On the other hand, the provision of solar geysers to remote rural areas might not yield the optimum results as the high rate of electricity consumption takes place within the urban core. The study has found that the plans such as the MSDF,

IUDF and SPLUMA fail to explicitly address climate change as it is incorporated within broad environmental management. The study therefore recommends that the South African government should restructure SPLUMA and ensure that climate change is explicitly recognized as a separate entity, rather than being incorporated within the broad environmental management. Moreover, the municipality should instil the elements of trust, cooperation, and partnership among all its key employees so that they can be motivated to consistently attend meetings pertaining to spatial planning. This will lead to coherence during implementation of the spatial plans. The municipality should also consider providing solar systems to areas within the urban core as this will lead to a significant reduction of electricity consumption.

References

- Afinowi, O.A. (2018). *An outline and critical assessment of the role of planning laws in the regulatory framework of climate change adaptation in South Africa and Nigeria* [Doctoral dissertation, University of Cape Town]. Research Direct.
- Albrechts, L., Balducci, A. & Hillier, J. (2017). *Situated practices of strategic planning: An international perspective*. Routledge, Oxon and New York.
- Bassett, E. (2020). Reform and resistance: The political economy of land and planning reform in Kenya. *Urban Studies*, 57(6), 1-14.
- Booth, A.L. (2017). Dog eat dog world: public consultation and planning on contested landscapes, a case study of dog parks and municipal government. *Community Development Journal*, 52(2), 337-353.
- Boštjan, K. (2016). Revitalisation of open spaces, changing centralities and neighbourhoods, and the importance of spatial planning for climate change adaptation. *Urbani Izziv*, 27(1), 89-94.
- Busayo, E.T., Kalumba, A.M. & Orimoloye, I.R. (2019). Spatial planning and climate change adaptation assessment: Perspectives from Mdantsane township dwellers in South Africa. *Habitat International*, 90, 1-9.
- Cape Town Metropolitan Municipality. (2018). *Municipal spatial development framework 2018*. CTMM: Cape Town.
- Cirolia, L.R. & Berrisfor, S. (2017). 'Negotiated planning': Diverse trajectories of implementation in Nairobi, Addis Ababa, and Harare. *Habitat International*, 59, 71-79.
- Cirolia, L.R. (2020). Fractured fiscal authority and fragmented infrastructures: Financing sustainable urban development in Sub-Saharan Africa. *Habitat International*, 104, 1-8.
- Cobbinah, P.B., Erdiaw-Kwasie, M.O. & Amoateng, P. (2015). Africa's urbanisation: implications for sustainable development. *Cities*, 47, 62-72.
- Cobbinah, P.B. (2017). Managing cities and resolving conflicts: Local people's attitudes towards urban planning in Kumasi, Ghana. *Land Use Policy*, 68, 222-231.
- Cobbinah, P.B. & Darkwah, R.M. (2017). Urban planning and politics in Ghana. *Geo Journal*, 82, 1229-1245.
- Daoud, S.A.O. (2017). Negotiating space: The construction of a new spatial identity for Palestinian Muslim women in Israel. *Social Sciences*, 6(3), 72-81.
- Firoj, M. (2017). The causes and consequences of rural-urban migration in Bangladesh: A review of the relevant literature. *International Journal of Ethics in Social Sciences*, 5(1), 30-42.
- Goodfellow, T., & Haung, Z. (2020). Contingent infrastructure and the dilution of 'Chineseness': Reframing roads and rail in Kampala and Addis Ababa. *Environment and Planning A: Economy and Space*, 40, 1-10.

- Govender, N. & Reddy, P.S. (2019). Urban regeneration in South Africa-the apartheid legacy and legislative framework re-examined-the case of eThekweni municipality. *African Journal of Public Affairs*, 11(2), 83-102.
- Hegazy, I.R. (2015). Integrating strategic environmental assessment into spatial planning in Egypt. *Environmental Development*, 15, 131-144.
- Ho, K. & Tang, D. (2019). Climate change in Malaysia: Trends, contributors, impacts, mitigation and adaptations. *Science of the Total Environment*, 650(8), 1858-1871.
- Jehling, M. & Banon, F. (2020). Looking for innovation: Trajectories of land transaction and readjustment in West Africa. *Cities*, 106, 1-8.
- Kalantari, Z., Ferreira, C.S.S., Keesstra, S. & Destouni, G. (2018). Nature-based solutions for flood-drought risk mitigation in vulnerable urbanizing parts of East-Africa. *Current Opinion in Environmental Science & Health*, 5(3), 73-78.
- Kumar, P. & Geneletti, D. (2015). How are climate change concerns addressed by spatial plans? An evaluation framework, and an application to Indian cities. *Land Use Policy*, 42(6), 210-226.
- Meyer, N. & Auriacombe, C. (2019). Good urban governance and city resilience: An afrocentric approach to sustainable development. *Sustainability*, 11(19), 55-65.
- Mogano, P. & Mokoetele, N.J. (2019). South African climate change adaptation politics: Urban governance prospects. *International Journal of Social Sciences and Humanity Studies*, 11(1), 68-83.
- Mokgotho, K.D. & Mokoetele, N.J. (2020). The efficacy of municipal spatial plans implementation towards mitigating climate change: South African institutional challenges. In M.P. Sebola, *Revalising Public Administration, Development and Economic Growth*. The 5th annual International Conference on Public Administration and Development Alternatives (IPADA), Virtual Conference. 7-9 October 2020.
- Mongala, S., Tema, K.S., Mokoetele, N.J. & Manamela, M.G. (2019). Dilemmas of implementing climate change adaptation policies: The prospects and constraints of multilevel governance. In M.P. Sebola, *Democracy, Elections and Administration in Africa*. The 5th annual International Conference on Public Administration and Development Alternatives (IPADA), Southern Sun Hotel, OR Tambo International Airport, Johannesburg, South Africa. 03-05 July 2019.
- Natarajan, L. (2017). Socio-spatial learning: A case study of community knowledge in participatory spatial planning. *Progress in Planning*, 111, 1-23.
- Nel, V. (2016). A better zoning system for South Africa? *Land Use Policy*, 55, 257-264.
- Odendaal, N. & McCann, A. (2017). Spatial planning in the global south: Reflections on the Cape Town spatial development framework. *International Development Planning Review*, 38(4), 405-423.
- Oliveira, E. & Hersperger, A.M. (2018). Governance arrangements, funding mechanisms and power configurations in current practices of strategic spatial plan implementation. *Land Use Policy*, 76(8), 623-633.
- Polokwane Local Municipality (PLM). (2018). *Integrated Development Plan Review 2017/2018*, Polokwane Local Municipality, Polokwane.
- Strauss, M. (2019). A historical exposition of spatial injustice and segregated urban settlement in South Africa. *Fundamina*, 25(2), 135-168.
- Suparman, N., Chandra, D. & Sari, A.L. (2019). Bureaucratic behavior in the implementation of capital expenditure budget in the office of public work and spatial planning of Sumedang regency. *Journal of Home Affairs Governance*, 11(1), 99-109.
- Turok, I. (2016). Getting urbanization to work in Africa: The role of the urban land-infrastructure-finance nexus. *Area Development and Policy*, 1(1), 30-47.
- Wang, S., Huang, P. & Huang, S. (2018). Can spatial planning really mitigate carbon dioxide emissions in urban areas? A case study in Taipei, Taiwan. *Landscape and urban planning*, 169(3), 22-36.