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Spatial Justice in the Distribution of Smart City Digital Technologies: Three Area-Based Case Studies of Free Municipal Wi-Fi in the City of Tshwane, South Africa

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1 ABSTRACT

In South Africa, urban planning legislation entrenches the principles of equity, good governance, and spatial justice. In countries such as China and India spatial inequalities in the allocation of digital technologies are high. Cities need to distribute digital technologies fairly and equitably so that opportunities are availed to citizens in ways that promote spatial justice. In a country such as South Africa, this is vital because apartheid has entrenched planning practices of favoring certain places at the exclusion of others. This paper provides an attempt to understand the extent to which the allocation of free Wi-Fi sites in the City of Tshwane is done in ways that promote the implementation of the principles of spatial justice, access, and equity. The paper focuses on three areas only: Pretoria Central Business District (CBD), Mamelodi Township, and Soshanguve Township. The paper used a mixed method research approach, combining a desktop literature review, empirically gathered views of some key stakeholders, as well as Geographic Information Systems (GIS) map analysis of the free Wi-Fi sites in the three areas under analysis. The authors find that there is some degree of spatial justice in terms of allocating free Wi-Fi sites in the three areas. However, it is not clear if the City has a policy to inform the allocation of the free Wi-Fi infrastructure in communities. It is also not clear if the City has some scientific, objective tool/criterion for allocating free Wi-Fi sites in different regions/areas. In the absence of such a framework, key decisions about allocating free Wi-Fi infrastructure could be based on political considerations, and threaten the sustainability of the programme. Going forward, the City needs to develop an objective policy framework, which should encapsulate principles of spatial justice, transparency, fairness, and equity for allocating free Wi-Fi infrastructure.

Keywords: Spatial justice, fourth industrial revolution, smart city, free municipal Wi-Fi, City of Tshwane

2 INTRODUCTION

The objective of this paper is to do a spatial analysis of the free Wi-Fi sites in three specific areas within the City of Tshwane, and have some informed understanding of the extent to which the free Wi-Fi infrastructure is spatially spread to accommodate a majority of residents in line with the urban planning principle of spatial justice. The three areas covered in the case study are Mamelodi Township, Soshanguve Township, and the Pretoria CBD. The outcomes of the exercise show the extent to which spatial justice principles are implemented in both central city urban core areas and townships.

3 METHODOLOGY

The paper used a Geographic Information System (GIS) maps analysis to make observations regarding the extent to which the spatial allocation of the free Wi-Fi sites in the City of Tshwane promotes the urban planning principle of spatial justice. The maps were created using Quantum GIS (QGIS). QGIS is recommended and trusted for urban planning studies (Kamaraj & Rangarajan, 2022; Ha et al., 2012). The City of Tshwane shape file was created. The final maps contain a scale bar, north arrow, and legend. The study also included the perspectives of the key stakeholders in the South African local government environment, including the views of experts who were interviewed in this study. The interpretation of the findings of the GIS maps and those of stakeholders and experts provided some nuanced understanding of the extent to which the principle of spatial justice is applied in allocating free Wi-Fi infrastructure in the City of Tshwane.

4 LITERATURE REVIEW

South Africa's past apartheid spatial planning created spatial injustice. Indeed, spatial inequality is one of the strongest predictors of disparities in the digital inequality stack. Rural-urban digital inequalities affect both emerging and developed economies. For example, rural internet users in the USA experience low-speed internet infrastructure. In addition, they have low access to internet devices in comparison to urban users. The same has been found in the United Kingdom (UK). The situation in India is also bleak. Just over 20% of people in rural India have access to internet connectivity, which is 45% lower compared to urban areas. China faces similar challenges, with the internet penetration rate in rural being less than 38% (Robinson, et al., 2020).

The solutions to remedy such situations include the provision of good quality internet and digital training. Taiwan has managed to implement this strategy with success. The introduction of mobile technologies can also go a long way to halting the widening of the gap between rural and urban residents. Important is to remember that technology supply must be augmented with capacity-building initiatives, along with investment in infrastructure and improvement of information services (Robinson, et al., 2020).

In South Africa, the Spatial Planning and Land Use Management Act, Act 16 of 2013 (SPLUMA) remains one of the most important pieces of legislation for municipalities to drive spatial transformation. In this regard, some of the principles promoted by this Act are inclusivity, efficiency, equity, etc. Other principles are good administration, spatial justice, efficiency, sustainability, and resilience (RSA, SPLUMA, 2013). A key implication of this Act is that any municipality in South Africa that chooses to invest in smart digital platforms and/or technologies must ensure that such investments will have the effect and outcome of building and constructing inclusive cities, communities, and people (spatial justice). In other words, municipalities must not use digital technologies and innovations to entrench and reinforce apartheid spatial injustice in South Africa.

There are several dimensions of spatial inequality (Turok, Scheba, & Visagie, 2017). Scholars such as Todes (2006, 2008, 2011, 2012) have researched extensively on spatial planning in the South African context. The South African apartheid spatial planning regime produced the 'apartheid city model'. So, the new planning regime under the democratic dispensation still must ensure spatial justice. The reality is that South African spatial planning is grappling to meaningfully respond to the real needs of disadvantaged groups. There are still stark spatial inequalities in South Africa (Shifa, David, & Leibbrandt, 2021).

Mkhize (2018) investigated spatial inequalities in Msunduzi municipality and concluded that spatial inequalities can be addressed by ensuring that infrastructure is located in all spaces. This means that spatial inequalities can be reduced by ensuring that there is a link between the provision of infrastructure and spatial planning. Through implementing the concept of 'polycentric' development; infrastructure can be directed to places closer to where people stay/reside, thus 'creating a city within a city'. Turok, Scheba, & and Visagie (2017) argue that another way of reducing spatial inequalities is through better regulation.

Physical location is one of the key dimensions of spatial inequality (Turok, Scheba, & Visagie, 2017). In terms of policy approaches on how to respond to spatial inequalities, there are two broad schools of thought. These are place-based, and people-centered approaches. The issue of spatial rebalancing can be necessary. People-centered approaches can be crucial for social stability and national cohesion. Spatially-blind approaches may disregard the special economic advantages of some spaces over others. A key weakness of the space-blind approach is that it overlooks the impacts (social, economic, etc.) of unevenly spread infrastructure. Place-based approach requires direct interventions, especially at the regional and/or local levels. Nonetheless, place-based approaches are not in themselves a magic wand (Todes and Turok, 2017).

Measuring spatial transformation can be done through the usage of a wide range of indicators. According to the South African Local Government Association (SALGA) Spatial Transformation Barometer (2022), in the key performance area of proximity and access, some of the indicators include daily commuting, commuting costs, access to public transport, access to roads, health, education, police station, etc. In the area of basic services and human settlements, the key indicators would include access to water services, energy/electricity, sanitation, waste/refuse removal, access to the internet, density, population change, etc. Other indicators include poverty, inequality, household composition, gender imbalances, dependency ratio, employment, education, skills, etc. Taiwan is one of the countries that has managed to use the provision of data to reduce

digital inequalities spatially. So, the introduction of digital technologies by cities can go a long way to enhance spatial justice.

5 PRESENTATION OF FINDINGS

The discussion covering the three areas follows below.

5.1 Mamelodi Township Analysis

The first area of focus is Mamelodi Township. Mamelodi is one of the oldest townships in Tshwane. This township was established in June 1953, then called Vlakfontein, according to the Group Areas Act. The aerial picture of Mamelodi Township is provided below (Figure 1):

Figure 1: Aerial picture of the Mamelodi Township, CoT. Source: CoT (2023)

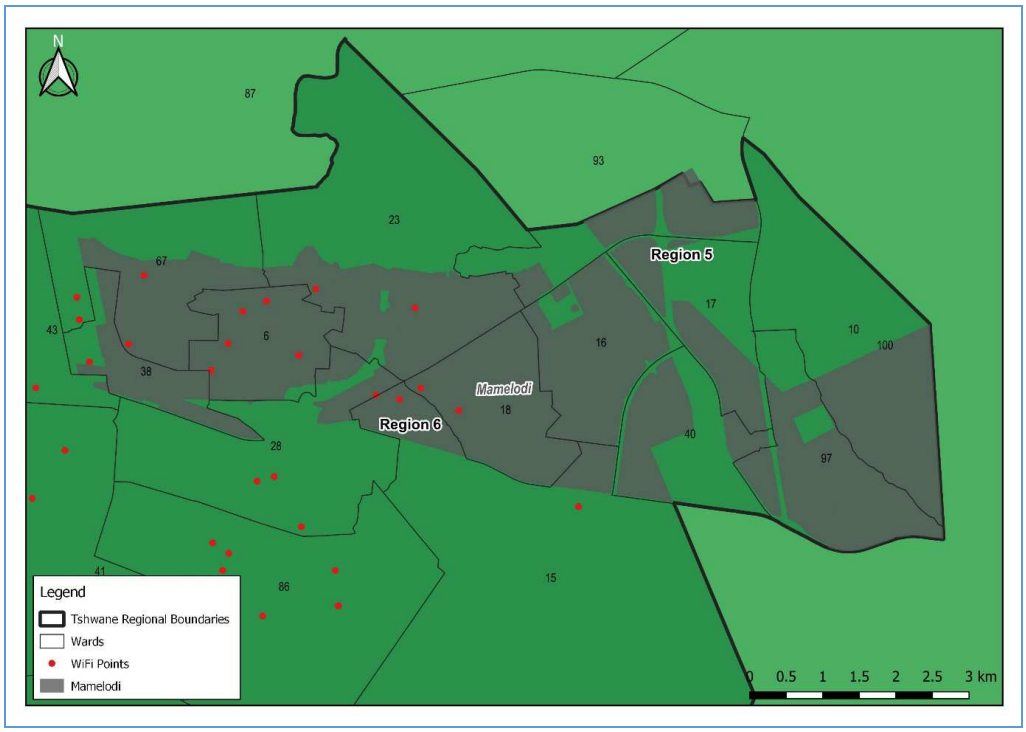

Figure 2: Spatial spread of municipal free Wi-Fi sites in Mamelodi Township, CoT. Source: Adapted from CoT (2023)

Mamelodi (affectionately called Mams) is still a black-dominated township, in terms of racial classification. Mamelodi remains one of the largest black townships in Tshwane, and certainly one of the top ten biggest townships in South Africa It is said that the name Mamelodi was given by the then South African State President, Paul Kruger because he thought Africans were able to whistle like birds (melody). The population of Mamelodi is approximately 334 557 and comprises no less than 110 703 households. Nearly all Mamelodi residents are African (98.8%), and 61% reside in formal dwellings (CoT, 2023).

5.2 Mamelodi Township Municipal free Wi-Fi Spots spatial analysis

Figure 2 shows the spatial spread of free Wi-Fi sites in Mamelodi.

Mamelodi Township is part of Region 6 in the City of Tshwane. Approximately 8 wards can be seen on the Mamelodi map above. In terms of spatial analysis, nearly all wards seem to be provided with free Wi-Fi sites. However, Ward 16 may need some attention.

5.3 Soshanguve Township Analysis

Soshanguve is situated about 30 kilometers north of Pretoria. The aerial picture of Soshanguve Township is provided next (Figure 3):

Figure 3: Aerial picture of Soshanguve Township, CoT. Source: CoT (2023)

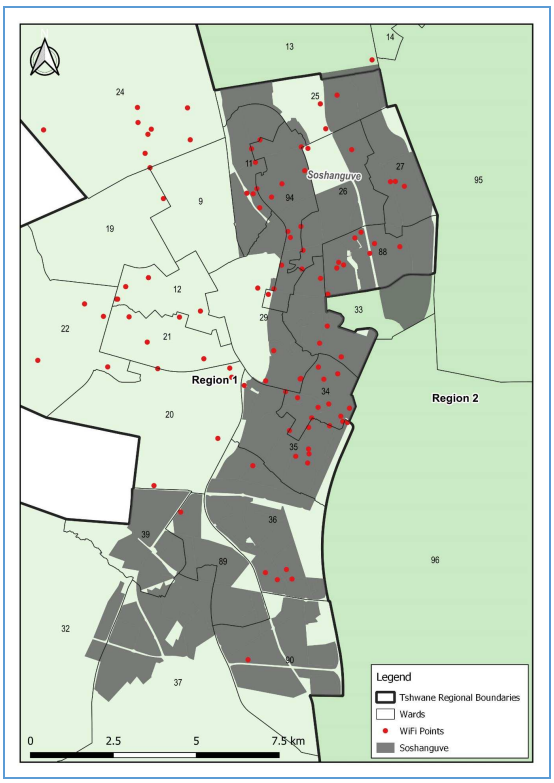

Figure 4: Spatial distribution of municipal free Wi-Fi sites in Soshanguve Township, CoT. Source: CoT (2023)

Soshanguve (affectionately called Sosh) is still a black-dominated township, in terms of racial classification. Established circa 1974, Soshanguve remains the largest black township in Tshwane and one of the top ten biggest townships in South Africa. The name Soshanguve is an acronym for Sotho, Shangaan, Nguni, and Venda. This makes Soshanguve a multi-ethnic community. The population of Soshanguve is more than 800,000. It is estimated that the population of Soshanguve would reach 1 million by 2025. Currently, nearly all Soshanguve township residents are African (99.2%) (CoT, 2023).

5.4 Soshanguve Township Municipal free Wi-Fi Spots spatial analysis

Figure 4 shows the spatial spread of free Wi-Fi sites in Soshanguve.

In terms of spatial analysis, nearly all areas (wards) in Soshanguve seem to be provided with free Wi-Fi sites. Some wards even have more than 1 free Wi-Fi site. This is encouraging, as it enhances the accessibility of the sites.

5.5 Pretoria CBD Analysis

The Pretoria CBD analysis follows next. The aerial picture of Pretoria CBD and surrounding areas is provided below (Figure 5). The CBD and the surrounding areas form part of the administrative capital of Tshwane. Strategic places in this area include the Union Buildings, the State Theatre, and the Reserve Bank of South Africa. Another important consideration is that there are many schools and institutions of higher learning in the area, including the Tshwane University of Technology, the University of Pretoria, the University of South Africa, and several private colleges. Embassy houses are hosted here as well (CoT, 2023).

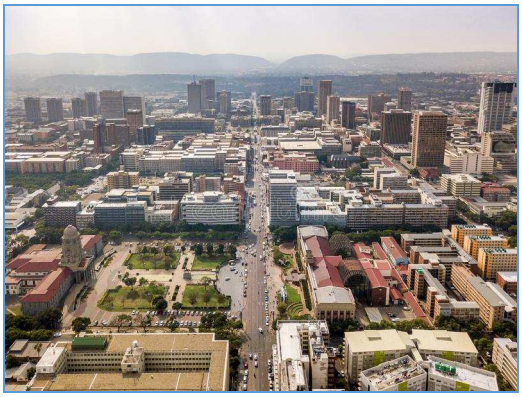

Figure 5: Aerial picture of Pretoria CBD and surrounding areas, CoT. Source: CoT (2023)

Some of the historic buildings include the Pretoria City Hall, Church Square, Sammy Marks, the Transvaal Museum, Pretoria Zoo, and the Tshwane Tourism Office. There is also Burgers Park, which is now a national monument, in addition to being the oldest park in the city (CoT, 2023). All these strategic spaces attract the need for free data, especially by the student population, and other users for commercial, business, recreational, and social media purposes.

Figure 6 shows the spatial spread of free Wi-Fi sites in the Pretoria CBD areas.

Although the Pretoria CBD is very small in terms of space, it is a high-density area. The allocation of sites also seems more equitable as well, similar to allocations in Mamelodi and Soshanguve townships. However, it would seem that the CoT is strategically prioritizing this area for free Wi-Fi infrastructure deployment as this area is one of the strategic areas for promoting the brand of the city to global visitors and other players. Access to data in the CBD is key for a range of functions.

6 STAKEHOLDER AND EXPERT INTERVIEW ANALYSIS

There are mixed messages regarding whether the Tshwane Free Wi-Fi is serving all people of Tshwane equally well irrespective of their geographic location. Some respondents believe that the municipal free Wi-Fi is only beneficial to those living within the range of the Wi-Fi. Other participants (46.7%) believe that free Wi-Fi is making an immense contribution in terms of enhancing spatial justice, followed by 25% who feel that it is making a modest contribution. A majority of stakeholders (72%) either strongly agree or agree that

since the introduction of the Tshwane Free Wi-Fi, some people no longer have to travel to the central city/town to do things that can be done through digital platforms.

Figure 6: Spatial distribution of municipal free Wi-Fi sites in the Pretoria CBD, CoT. Source: CoT (2023)

7 DISCUSSION OF FINDINGS

The authors managed to do a spatial analysis of the free Wi-Fi sites in three specific areas Mamelodi Township, Soshanguve Township, and the Pretoria CBD. Through the use of Geographic Information System (GIS) maps analysis and engagements with stakeholders and expert interviews, the authors conclude that the spatial allocation of the free Wi-Fi sites in the City of Tshwane promotes the urban planning principle of spatial justice. The conclusion is important, considering South Africa's past apartheid spatial planning, which birthed spatial injustices, among others. One of the lessons from Taiwan is that the provision of good quality internet and digital training is important. Important is always important to remember that technology supply must be augmented with capacity-building initiatives, along with investment in infrastructure and improvement of information services (Robinson, et al., 2020).

The City of Tshwane seems to be on course in ensuring that a key implication of the SPLUMA, i.e. that any municipality in South Africa that chooses to invest in smart digital platforms and/or technologies must ensure that such investments have the effect and outcome of building and constructing inclusive cities, communities, and people (spatial justice) is being advanced. As scholars such as Mkhize (2018) found, spatial inequalities can indeed be addressed by ensuring that infrastructure is located in all spaces. This paper conforms to this notion. So, spatial inequalities can further be reduced in Tshwane by ensuring that the links between the provision of infrastructure and spatial planning are strengthened practically. Through implementing the concept of 'polycentric' development; free Wi-Fi infrastructure can be directed to places closer to where people stay/reside.

Indeed, physical location is one of the key dimensions of spatial inequality (Turok, Scheba, & Visagie, 2017). The question of whether to respond to spatial inequalities, through a place-based or people-centered approach is important so that the issue of spatial rebalancing can be necessary. Spatial justice is not an end in itself. Proximity and access to other facilities and services, such as public transport, access roads, health, education, police stations, etc. are important as well.

Although the authors find that the City of Tshwane seems to be on the right track in terms of ensuring some degree of spatial justice in the allocation of free Wi-Fi sites in the three areas under the study, there are some concerns. The main concern is that it is not clear if the city has a policy with some scientific, objective tool/criterion to inform the allocation of the free Wi-Fi infrastructure in different regions and/or areas. This is so, even though the city has some basic data that can assist in making decisions that are informed by facts. For instance, in terms of population, Soshanguve has about 334,577 people, whilst Mamelodi and Pretoria CBD have 403,162 and 741,651 respectively. In terms of population density, Soshanguve has about 3180 persons/km2, whilst Mamelodi and Pretoria CBD have 7403 persons/km2 and 1079 persons/km2 respectively. The dependency ratio in Soshanguve is 44.2, 35.7, and 33.4 in Mamelodi and Pretoria CBD respectively. Regarding average household size, the situation in Soshanguve is 3.7, 2.9, and 2.6 in Mamelodi and Pretoria CBD respectively. All this data is available on the website of the StatsSA, and the city can use this type of data to inform its decision-making processes.

8 CONCLUSIONS

Spatial injustice can threaten urban sustainability. However, in this paper, the authors conclude that similar to Taiwan, the City of Tshwane seems to be on the right track in terms of using the provision of data to reduce digital inequalities spatially. However, it is not clear if the city has an objective tool to inform decision-making regarding the allocation of digital technologies in different regions/areas. In the absence of such, key decisions about allocating free Wi-Fi infrastructure could be based on political considerations, thus threatening the sustainability of the programme. Going forward, the City needs to develop a robust policy framework policy to guide the implementation of the principle of spatial justice in allocating digital technologies.

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