Spatial statistical analysis of dissatisfaction with the performance of local government in the Gauteng City-Region, South Africa

Koech Cheruiyot[1], Chris Wray[1] and Samy Katumba[1]
[1]Gauteng City-Region Observatory (GCRO), a partnership between the University of Johannesburg, the University of the Witwatersrand, Johannesburg, the Gauteng Provincial Government and organised local government. Private Bag 3, Wits 2050, South Africa.
Email: kenneth.cheruiyot@gcro.ac.za

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Abstract

South Africa in general, and the Gauteng City-Region in particular, are grappling with rising service delivery protests and increasing levels of dissatisfaction with government performance. Besides internal government performance measures, citizen satisfaction surveys are useful in providing citizen-based measurement of satisfaction with service delivery and the performance of government. With 27 490 respondents across Gauteng, the 2013 Gauteng City-Region Observatory (GCRO) Quality of Life (QoL) survey provides an interesting snap shot of attitudes towards government. A spatial statistical approach is applied to the 2013 QoL survey data to analyse patterns of dissatisfaction with the performance of local government. The analysis reveals spatial clustering in the level of dissatisfaction with the performance of local government. It also reveals percentage of respondents dissatisfied with dwelling, mean sense of safety index, and percentage agree the country is going in the wrong direction, as significant predictors of the level of local dissatisfaction. Other predictors include the percentage of respondents that think lack of maintenance is the biggest problem facing the community, and percentage agree that politics is waste of time. These results imply the need for incorporating spatial analysis and targeting in the formulation of policy aimed at improving government performance.

1. Introduction

Since the dawn of democracy in 1994, the Gauteng City-Region (GCR) has faced a mounting challenge to address housing and service infrastructure needs of a rapidly increasing population. There have been a number of achievements in this regard (as reflected in the Census 2011 results), with 98.2% of Gauteng households with access to piped water in a dwelling/yard or street taps/pipes; 96.3% with a flush toilet connected to a waterborne sewerage system, septic tank, or a form of improved pit latrine; and 87% of households with access to electricity for lighting (GCRO, 2012). The Gauteng Provincial Government, in their 20-year review, regards service delivery within Gauteng as a success. "The 20-year period has seen a massive expansion in the scale of public service delivery to ensure that all residents have access to services and an improved quality of life" (GPG, 2014). Yet there is still significant work to be done with service delivery protests escalating across South Africa in 2014 (Municipal IQ, 2014; Powell *et al.*, 2015; ISS, 2015) and increasing levels of dissatisfaction with the performance of government.

There is an urgent need for government to gain a better understanding of citizens' dissatisfaction, as "the experiences of citizens – the intended beneficiaries of government services – are a critical component of measuring the performance of government and for the delivery of appropriate and quality services" (DPME, 2013). Citizen satisfaction and dissatisfaction with the quality of government services varies across spatial areas and citizen satisfaction surveys can assist in revealing these variations (Kelly and Swindell, 2002a).

One such dataset is the Quality of Life (QoL) survey undertaken biennially in Gauteng by the Gauteng City-Region Observatory (GCRO) since 2009. The survey results show fascinating snapshots of the quality of life, socio-economic circumstances, attitudes to service delivery and other characteristics of the GCR. The latest QoL survey completed in 2013, interviewed 27 490 respondents – possibly one of the largest attitude surveys undertaken in Gauteng (GCRO, 2014).

The 2013 QoL survey asked the question: how satisfied are you with the performance of national government, provincial government and local government? Considering the results at a Gauteng-level, local government scores lowest with 51.5% of respondents dissatisfied, followed by provincial government with 47.4% dissatisfaction and national government with 45.3% dissatisfaction. (Note: dissatisfied and very dissatisfied responses are combined to reflect dissatisfaction.) Figure 1 illustrates the increasing levels of dissatisfaction since the first QoL survey in 2009 where levels of dissatisfaction were below 40% for local government and below 30% for provincial and national government. Local government across the three surveys constantly scores lowest for performance. More than a third of respondents (36.5% of the survey) in 2013 were dissatisfied with the performance of all three spheres of government.

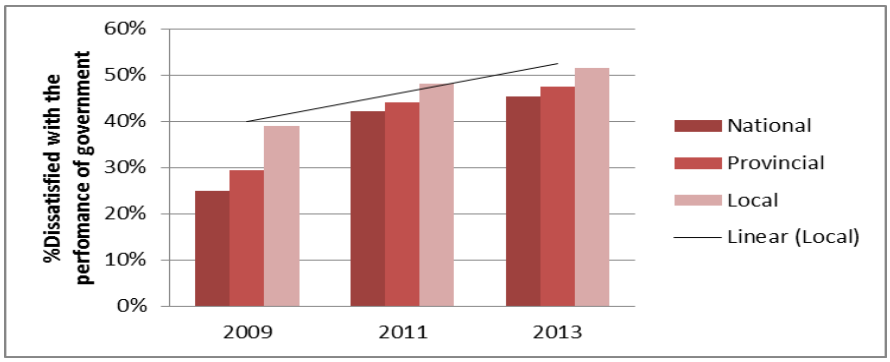

Figure 1. QoL survey respondents' dissatisfaction with the performance of government

Although this study focuses on a ward-level analysis, it is worth considering the municipal variation. Figure 2 depicts the percentage of respondents dissatisfied with local government performance per local municipality. Overall, the highest levels of dissatisfaction are observed with respondents living in the non-metropolitan municipalities, with 68% of respondents in Emfuleni and 64% in Westonaria dissatisfied with the performance of local government. The lowest levels of dissatisfaction are observed with respondents living in metropolitan municipalities, with 53% of respondents dissatisfied in the City of Johannesburg (Joburg) and 50% in Ekurhuleni. The City of Tshwane achieved the lowest levels of dissatisfaction with 46% of respondents dissatisfied.

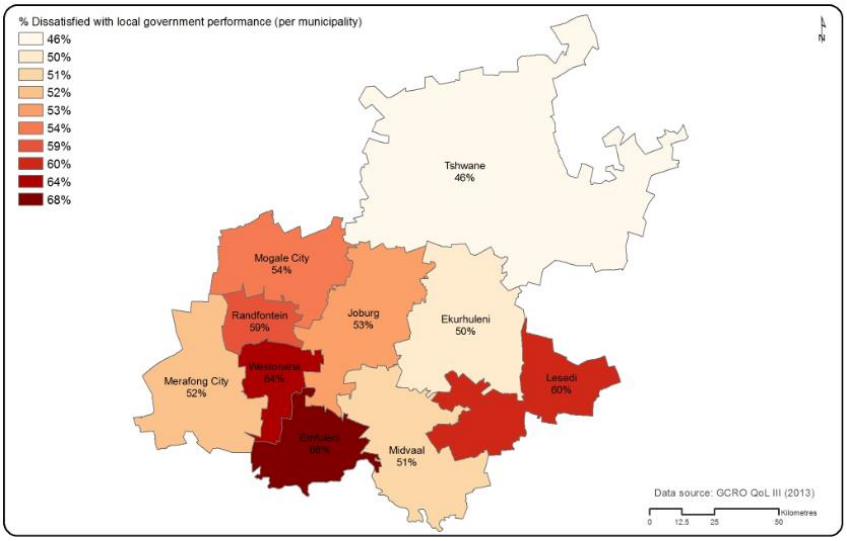

Figure 2. Percentage of respondents dissatisfied with local government performance

In contrast, over two thirds of respondents (67%) were satisfied across a range of 14 government services (GCRO, 2015). Although the levels of satisfaction vary by service and municipality, the levels of satisfaction with government provided services are high, and in fact, increased from 2011 to 2013 (based on an index of 8 services). Clearly the satisfaction with government-provided services does not translate directly to satisfaction with the performance of government. Predictably, there are other dynamics or issues that may explain the poor perception of government.

Acknowledging this disjuncture, the 2013 QoL data – geocoded at the point of interview with ward-level representative data available for all the municipalities – presents an opportunity for a detailed, spatially-based analysis. Given the poor perception specifically of local government, the analysis will focus on respondents' dissatisfaction with the performance of the local sphere of government. Further aware that the variables under consideration are possibly spatially correlated, the research adopts a spatial statistical approach by employing a spatial error model, in addition to a descriptive review and mapping analysis. The research addresses the following questions:

- Is there a spatial pattern evident in the dissatisfaction with the performance of local government responses from the 2013 QoL survey?
- What significant predictors may explain the patterns of dissatisfaction with the performance of local government?

The paper is outlined as follows. After the introduction, a review of assessing government performance and modelling government performance predictors is covered in the second section. The section also reviews government performance and measurement in South Africa and Gauteng, including service delivery protests. Section three describes the data and methods used, while section four presents the results. Section five concludes the paper.

2. Review of related literature

2.1 Assessing government performance

The need to hold government accountable has brought about the practice of evaluating government performance (Bernstein, 2000). Such a fact is also supported by the idea that public confidence in government is enhanced when government performance is monitored and reported to the general public. With government performance commonly measured by the quality of the services it provides, such an assessment should be done from the point of view of the providers and the users of the services (Kelly and Swindell, 2002b). Internal performance measures also known as 'hard' or 'objective' measures only involve the administrators or providers of the services. In such instances, the government establishes internally the benchmarks against which its performance is measured. In contrast, external measures of performance also referred to as 'soft' or 'subjective' measures are often established using citizen satisfaction surveys (Brudney and England, 1982). However, discrepancies between the two measures of performance have been highlighted in the literature to the extent of probing whether external measures of performance can also be considered as a means for evaluating government performance. Some of the concerns raised in terms of adopting external measures are that citizens' assessment of the quality of a service may be affected by their individual experiences and perceptions. For example, Kelly and Swindell (2002b) mention that race and income level could affect the way in which citizens evaluate the quantity and quality of a service rendered by local government. Furthermore, attribution errors may occur whereby citizens are not knowledgeable of the jurisdiction (or sphere of government) from which the rendered services originate. However, as noted by Kelly and Swindell (2002b), some instances exist where external measures can provide accurate evaluations as compared to internal measures. For example, local government may not be able to assess the impact of the services it provides unless it undertakes citizen perception surveys. It should be noted that some of the early work in the field of public administration, such as work by Ostrom (1973), already suggested "multiple indicators of service quality" that include both internal and external measures. Furthermore, a number of researchers suggest that external (subjective) measures be employed as valid indicators to complement internal (objective) measures (see Parks, 1984).

2.2 Modelling government performance

This section reviews the limited empirical work that has investigated government performance using statistical techniques. We use satisfaction with the quality of government-provided services as a proxy for government performance. A few examples are reviewed to provide information on candidate variables for modelling government performance. Swindell and Kelly (2005) and Kelly and Swindell (2002a) employed weighted least square regression and descriptive statistics to examine the relationships existing between socio-economic status and demographic variables as they determine the level of satisfaction with the quality of services (i.e., street repair, trash collection, police service) provided by local government. Demographic variables included race, age, and percentage of residents in the area that have lived in their neighbourhood for six or less years as a measure of neighbourhood instability, while social economic status was measured using income. The analysis used data from 17 local governments disaggregated into 141 spatial areas (places of service delivery) as units of measurement. Results from the descriptive statistical analysis for each spatial unit were compared to the overall results. They found out that the level of satisfaction with the services that local government provides varies across cities. Although, Swindell and Kelly (2005) caution that their weighted regression results for the magnitude of police and fire service satisfaction levels should not be taken as formal tests of statistical significance, because of a lack of random selection of neighbourhoods, their results showed that age, race, income, and length of stay in a neighbourhood, etc., are possible significant predictors. Some of the relationships between the response variables and predictors observed by Kelly and Swindell (2002a) are also mentioned. A strong negative association was found between the percentage of minority population and satisfaction with police service. Another strong negative relationship was also observed between the percentage of minority population and satisfaction with trash collection. In contrast, however, a strong positive association was observed between the percentage of residents over 65 years of age and satisfaction with trash collection. Kelly and Swindell (2002a) note that such findings corroborate the results of previous research.

Van Ryzin *et al.* (2004) used data from the Survey of Satisfaction with New York City Services to examine various satisfaction with urban services utilising race and ethnicity, socio-economic status (income, education and, home ownership status), and neighbourhood location as explanatory variables. When socio-economic status variables were included in the modelling, results showed the role played by race in the determining satisfaction with urban services did not diminish, in fact it increased slightly. Van Ryzin *et al.* (2004) suggested that the race gap in satisfaction with urban services cannot be attributed to socio-economic status differences between groups. In the final models, where socio-economic variables and neighbourhood dummy variables were included, it was further noted that although race

differences clearly remain across most services, there is some evidence of a diminution of the race gap when the effects of neighbourhood are factored in.

Brown and Coulter (1983) modelled the sources of citizen satisfaction with police protection using satisfaction with response time, satisfaction with treatment by police, perceived equity of police protection, and several demographics variables, including age, race, income, and education. The research found that overall assessment of the quality of local government is significantly related to all three specific parts of satisfaction levels. Brown and Coulter (1983) further noted that the surrogate measure of citizens' expectations proved to be positively and significantly related to their satisfaction with the domains of police protection.

Kusow *et al.* (1997) examined whether race and residential location interact in their effects on citizen attitudes toward the police after controlling for other explanatory variables (i.e., age, whether one has been a victim or not, gender, and education). In the model, that included the interaction between race and residential location as explanatory variable, results indicated that residential location is the most important predictor of perceived satisfaction with the police when all socio-economic and demographic variables are included in the model. Race, victim variable, education, and age also had a significant impact on perceived satisfaction with the police.

It is clear that location played a key role in these studies. This agrees with Tobler's first law of geography that states "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970).

2.3 Review of government performance in South Africa

2.3.1 Background to South Africa governmental structures and roles

South Africa's government is a three-tier system with the national government as the tertiary or top tier level of government broadly responsible for policy, the setting of objectives for the country as a whole, co-ordination and regulation (Everatt *et al.*, 2011). A number of national departments are also responsible for direct delivery, where neither provincial nor local government play a role. The provincial as the secondary or middle tier focuses on provincial deliverables, such as provincial housing, planning, sports and transport departments. Local government represents the bottom or primary tier which is responsible for local service delivery, including building regulations, zoning, water, street lights and waste removal. There are, however, overlaps and shared responsibilities across the three spheres of government. As such the National Planning Commission in its National Development Plan acknowledged that "South Africa cannot afford to continue with the current level of confusion about how responsibilities are divided, shared and monitored across local, provincial and national government" (NPC, 2013: 366).

Administratively in an effort to ensure they are adequately responding to their respective mandates, the different spheres of government have their own departments and systems to monitor performance, such as the national Department of Performance Monitoring and Evaluation (DPME), which are largely dependent on government monitoring itself (DPME, 2013). At a local level, performance management systems are utilised to improve organisation and individual performance aimed at enhancing service delivery. Several legislations govern local government performance management. These include: The Municipal Systems Act, (Act 32 of 2000); The Municipal Planning and Performance Management Regulations, 2001; The Municipal Finance Management Act, (Act 53 of 2003); and The Municipal Performance Regulations for municipal managers and managers directly accountable to municipal managers, 2006 (City of Johannesburg, 2012). Given that the focus of this paper is on citizens' perceptions of the government rather than government performance measurement mechanisms, the next section focuses on a discussion of citizen's perceptions of the government.

2.3.2 Measuring government performance using citizen satisfaction surveys

The use of customer satisfaction surveys is a common instrument to gauge citizens' perceptions of government performance and service delivery (Poister and Henry, 1994; Donnelly *et al.*, 1995; Kelly and Swindell, 2002a; Van Ryzin, 2004). Apart from the GCRO's biennial QoL survey, both provincial and local governments conduct citizen-based surveys in Gauteng. Jennings (2012) provides a summary of these surveys undertaken from 2008 to 2010. The surveys include annual perceptions surveys for the Office of the Premier and annual customer satisfaction surveys in each of the metropolitan municipalities. The City of Johannesburg considers the results of its survey as "a critical tool to use in determining the perceptions of customers about the quality of service delivery" (City of Johannesburg, 2010).

At the national level, the Framework for Strengthening Citizen-Government Partnerships for Frontline Service Delivery Monitoring was approved by Cabinet in August 2013 in response to the lack of citizens' experience of government services reflected within the government's monitoring systems, and the lack of a systematic use of this evidence to improve performance (DPME, 2013). The framework summarises a range of citizen-based monitoring methodologies used both locally and internationally, with citizen-based monitoring pilot studies planned for 2014/15.

2.3.3 Increasing service delivery protests and dissatisfaction with government

The attempt by DPME to introduce citizen-based monitoring systems across all three spheres of government, is in response to the growing levels of dissatisfaction and service delivery protests aimed mostly at local government. Municipal IQ's Hotspots Monitor database captures major community protests staged against a municipality, as documented by the media or other sources in the public domain, such as South African Police Service media releases (Municipal IQ, 2014). In 2014 alone (Figure 3), Municipal IQ reported a record number of service delivery protests – 185 from January to November – with Gauteng recording the most protests (Municipal IQ, 2014). Municipal IQ (2014) concludes that "such protestors raise issues that are the responsibility or perceived responsibility of local government (such as councillor accountability, the quality and pace of basic service delivery, and in metro areas, housing). These protests may be violent or peaceful, but there is a clear dissatisfaction with the management of a municipality."

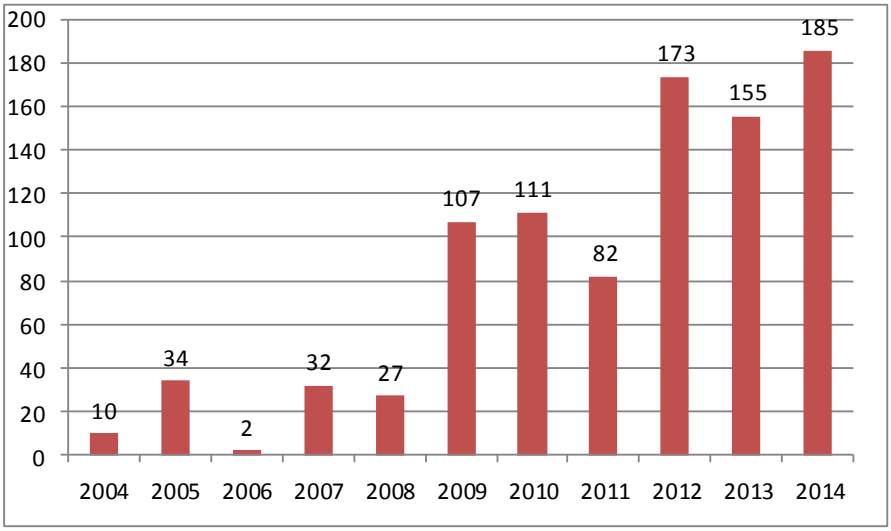

Figure 3. Major service delivery protests, by year (2004 – 30th November 2014)
Source: Municipal IQ Municipal Hotspots Monitor (Municipal IQ, 2014)

The Municipal IQ findings correlate with the civic protest barometer which recorded an all-time-high of 218 protests in 2014 (Powell *et al*., 2015). A civic protest in the barometer refers to organised protest action within a local area directly targeting municipal government or as a means to express grievances against the state more broadly. The civic protest barometer utilises on-line news aggregators and social media reports, with over half (52%) of grievances raised by the protestors related directly to municipal services or issues of municipal governance. Only 10% of the protestors' grievances related to non-municipal services (such as schools and policing), which according to Powell *et al.* (2015), indicate that municipalities are often considered by protestors as a proxy for the failures of higher tiers of government. The 2013 QoL survey asked the respondent if he/she had participated in a service delivery protest in the past year, with 4% (or 1 089 respondents) taking part in protests. Of those respondents that had participated, 63% were dissatisfied with local government compared to 56% dissatisfied with provincial government and 55% dissatisfied with national government. These results indicate a high level of dissatisfaction with local government by QoL survey respondents who had participated in service delivery protests. Possible reasons for the high levels of dissatisfaction were highlighted within a recent provincial strategic long-term planning document, namely "high levels of actual and perceived corruption, regular broken communication and pervasive mistrust between communities and local government" (GPC, 2014: 146).

3 Study area, data and method

3.1 Study area

Figure 4 below shows the map of Gauteng province, the core of the GCR and our study area. The GCR as South Africa's largest economic agglomeration is a subnational extent that is functionally organized around the three large metropolitan municipalities of Johannesburg, Tshwane and Ekurhuleni (Everatt *et al.*, 2011). The research uses the ward – a spatial delineation of political administrative boundaries within local municipalities – as a unit of analysis. The analysis incorporated 506 wards (out of a total of 508) in the Gauteng province delineated as per the 2011 local (municipal) elections. Two wards in the Merafong City local municipality were excluded, namely ward 74804015 (as it only had 4 respondents that were interviewed) and ward 74804019 (as it had become an island with no neighbouring wards with the exclusion of ward 74804015).

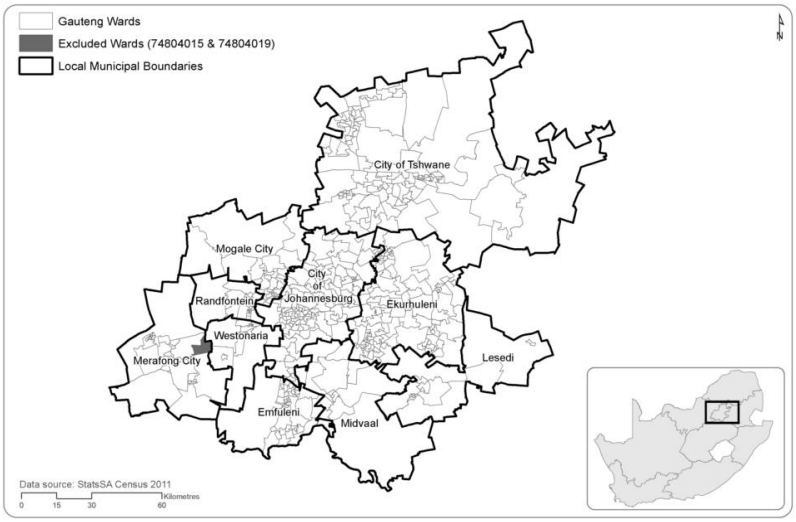

Figure 4. Map of study area

3.2 Data

In this research we use 2013 QoL survey data, with the 27 490 respondents analysed at a ward-level. Details on the survey sampling methodology, weighting and results are available on the GCRO QoL data viewer website www.gcro.ac.za/qolviewer. Our dependent variable is the level of dissatisfaction with local government performance as measured by the percentage of the respondents who were dissatisfied with local government performance.

Several variables were hypothesized as explaining the pattern and the level (as percentage) of dissatisfaction with local government performance. The selection of the variables was guided by empirical work (e.g., Everatt *et al*., 2011; GCRO, 2012, 2013 and 2015; GPC, 2014; and review of literature in section 2.2). Table 1 shows the selected variables. Appropriate diagnostic tests were carried out to ensure robust analysis and results. For example, a histogram was produced for the dissatisfaction with local government dependent variable, indicating a fairly-normal distribution, thus no need for transformation. This check was necessary to satisfy the regression assumption that the dependent variable is normally distributed.

Table 1. Description of model variables

Dependent variable	**Variable label**
Dissatisfaction with local government performance	Local_Diss
Explanatory variables	
Unemployed	Perc_employment
Percentage Black	Perc_African
Percentage Coloured	Perc_Coloured
Percentage Indian	Perc_Indian
Percentage White	Perc_White
Percentage formal dwelling	Perc_Formal
Percentage informal dwelling	Perc_Informal
Dissatisfaction with dwelling	Perc_DissDwelling
Average number of years of education	Mean_Edu
Percentage no batho pele principles	NOBathoPele
Percentage never interact with government officials	NeverInterract

Average score access to services index	Mean_Access
Average score satisfaction with access to services	Mean_AccessSats
Average score satisfaction with other government services	Mean_SatsOther
Average score sense of safety index	Mean_SenseSafety
Percentage agree corruption main threat to democracy	Perc_CorrupThreat
Percentage paid a bribe	Perc_PaidBribe
Percentage agree country going in wrong direction	CountryWrongDirec
Average household income per ward (in Rands)	Mean_Income
Percentage participated in service delivery protest	Perc_PartSerDel
Percentage think crime main problem	BigPro_Crime
Percentage think foreigners main problem	BigPro_Foreigners
Percentage think high cost of living main problem	BiGProb_CostofLiving
Percentage think housing main problem	BigPro_Housing
Percentage think hunger main problem	BigPro_Hunger
Percentage think lack of basic services main problem	BigPro_LackofServices
Percentage think lack of maintenance main problem	Bigpro_Maintenance
Percentage think poverty main problem	BigPro_Poverty
Percentage think unemployment main problem	BigPro_Unemployment
Percentage agree people cannot influence developments	Anomie
Percentage agree politics waste of time	BigPro_PoliticsWaste
Percentage community deteriorated	CommDeter
Percentage did not attend community meeting	Perc_NoParticipation
Percentage did not contact government	Perc_NotContact
Johannesburg dummy	JHB
Ekurhuleni dummy	EKU
Lesedi dummy	LES
Midvaal dummy	MID
Emfuleni dummy	EMF
Mogale City dummy	MOG
Randfontein dummy	RAN
Westonaria dummy	WES
Merafong City dummy	MEF
Tshwane	Reference municipality

3.3 Choice of analytical techniques

Further aware that the variables under consideration were possibly spatially correlated, diagnostic tests were performed to explore if a spatial statistical approach was needed. Spatial dependence (also autocorrelation) occurs where similar values (high or low) or dissimilar values (high and low) for a random variable tend to cluster in space. These spatial effects need to be accounted for in spatial regression so as to have robust models and estimation results. In situations where spatial dependence is present and is not accounted for in the model, the regression estimates will be biased and inefficient (in the spatial lag case) and inefficient, but unbiased (in the spatial error case) (Anselin, 1988). We used a row-standardized spatial Queen Contiguity weight matrix constructed between wards with contiguous borders and edges (Anselin, 2005). The data was analysed in SPSS and GeoDa.

Initial diagnostic tests for spatial dependence showed that Moran's *I* of 0.387 was highly significant ($p = 0.001$). Sensitivity analysis using random permutations and the drawing of random envelopes on the Moran's *I* statistic further confirmed its statistical significance (Anselin, 2005). Further diagnostic tests with regards to which of the two possible spatial models that capture spatial dependence (i.e., either the spatial autoregressive model (SAR) or the spatial error model (SER)) was appropriate were carried out using simple and robust Lagrange Multipliers tests. The SER model was finally chosen to incorporate error dependence.

Faced with high multicollinearity, heteroskedasticity, and non-normal errors when we ran regression model using all the hypothesized variables in Table 1, we employed model builder in SPSS to select variables or "best" predictors that allowed for robust results. All the automatic procedures (i.e., backward elimination, forward selection and stepwise regression) that were explored returned consistent variables as the "best" predictors. These "best" predictor variables were:

- Percentage dissatisfied with dwelling
- Mean sense of safety index
- Percentage agree the country is going in the wrong direction
- Percentage think lack of maintenance is the biggest problem facing the community
- Percentage agree politics is waste of time.

Further to this, exploratory regression using ArcMap's spatial statistical tool returned the same variables as the "best" predictors above. These variables were therefore chosen as the "best" predictors for the dependent variable (dissatisfaction with local government performance) in all further analysis.

4 Results and discussions

4.1 Descriptive results and related discussions

Univariate statistics for the model variables are listed in Annexure 1, with the dependent variable and explanatory variables ("best" predictors) used in the regression analysis highlighted in bold. Mapping the dependent and explanatory variables at a ward-level (using choropleth maps with natural breaks) reveals some interesting localized results not visible at the municipal scale.

Figure 5 illustrates the percentage of respondents per ward dissatisfied with local government performance. Dissatisfaction varies across the GCR with the highest levels of dissatisfaction with local government performance (greater than 71.2% dissatisfied) visibly clustering in the Bekkersdal area (Westonaria) in the west; Sebokeng/Vanderbijlpark in the south (Emfuleni); and Alexandra wards within the City of Johannesburg at the centre of the map. There are also clusters of high dissatisfaction (greater than 57.4% dissatisfaction) in Khutsong (Merafong City), Randfontein and Krugersdorp (Mogale City) in the west; the remaining wards in Emfuleni; areas in and surrounding Soweto in the City of Johannesburg; central Germiston, Daveyton and the Ekurhuleni/Lesedi border in the east; and Winterveldt/Hammanskraal wards in the north (Tshwane). The highest dissatisfaction is concentrated in the Emfuleni wards, as noted in the municipal-level maps (Figure 2), with the lowest local government performance dissatisfaction levels mainly scattered throughout the core of the GCR.

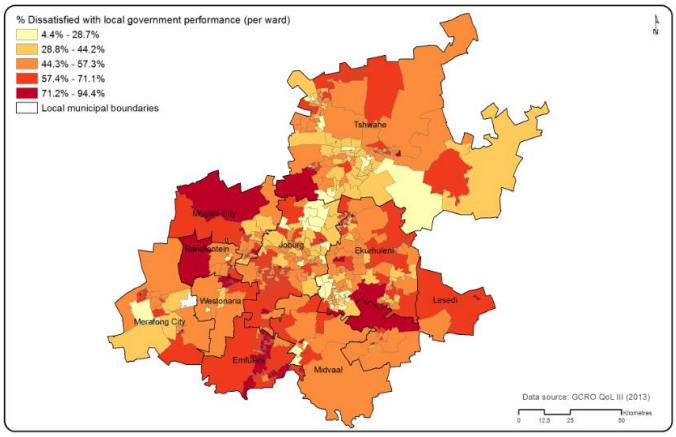

Figure 5. Dissatisfaction with local government performance

The pattern is repeated with the map (Figure 6) indicating dissatisfaction with dwelling. The highest dwelling dissatisfaction occurred in the Khutsong and Bekkersdal areas in the west; Sebokeng/Vanderbijlpark in the south; central Germiston, Tokoza and Daveyton in the east (Ekurhuleni); Mamelodi and Winterveldt/Hammanskraal wards in the north; and Orange Farm, Alexandra and Diepsloot areas within the City of Johannesburg. These areas can be categorized as either former Apartheid townships or government public housing scheme developments. In contrast, wards with low levels of dissatisfaction with dwellings can be observed in the wealthier wards in the centre of the GCR.

The percentage of respondents who think maintenance is the biggest problem in their community is more of a mixed bag (Figure 7). The highest levels of agreement with this statement occur in northern and western suburbs of Johannesburg and Khutsong, as well as scattered wards across Ekurhuleni. However, the area that appears to experience the biggest maintenance problems is in the hotbed of Sebokeng/Vanderbijlpark in Emfuleni.

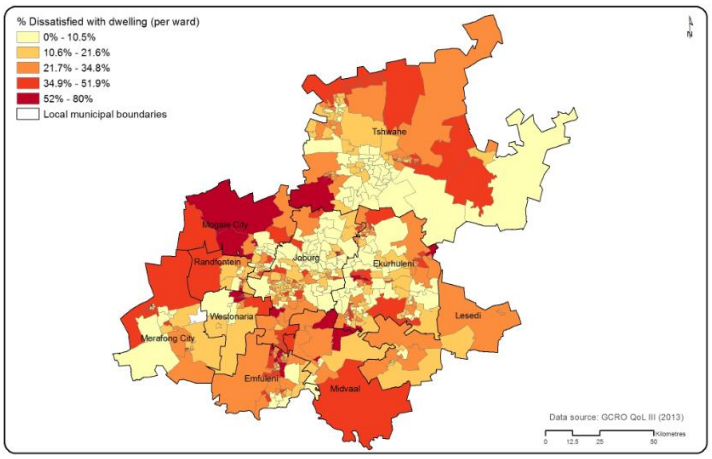

Figure 6. Percentage of respondents dissatisfied with dwelling

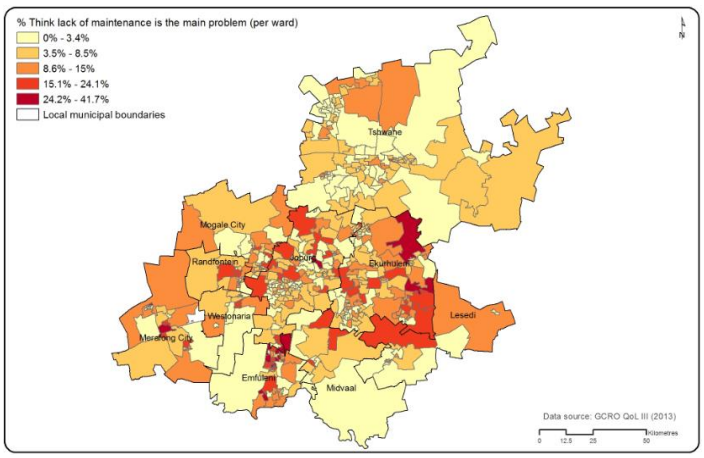

Figure 7. Percentage of respondents who think lack of maintenance is the main problem

Figure 8 depicts the mean score sense of safety index across the GCR. The index was constructed from five QoL survey questions measuring respondents' sense of safety and crime – the higher the index (with a score out of one), the more sense of safety experienced by respondents within a given ward. Therefore a lower score in this case is worse. A few of the central business district wards, such as Johannesburg, Benoni and Boksburg, exhibit a low sense of safety, while other areas such as Khutsong, Bekkersdal, Alexandria, Daveyton, Tokoza and Orange Farm/Sebokeng/Vanderbijlpark are again highlighted. Diepsloot, in the north of Johannesburg is also visible as a low sense of safety area in the map.

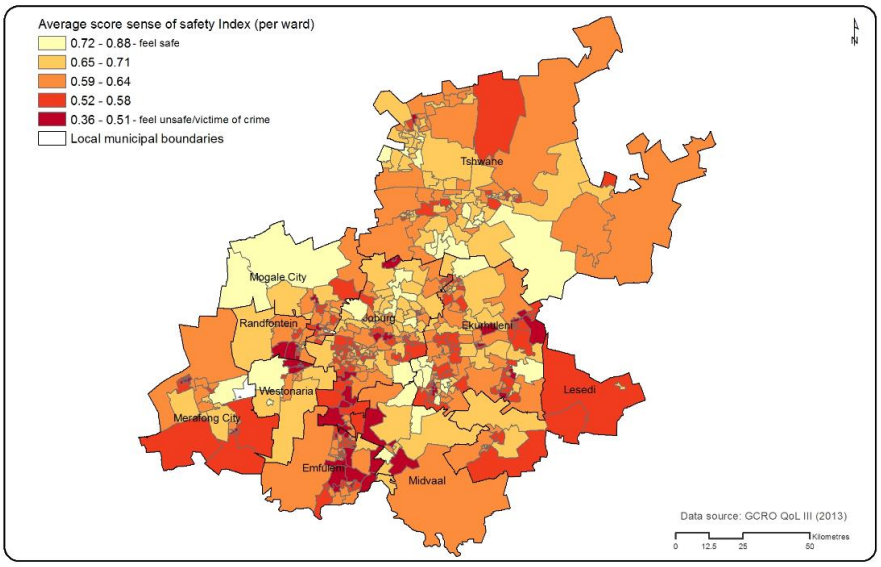

Figure 8. Mean sense of safety index

The percentage of respondents that agree with the statement politics is a waste of time is visible in Figure 9. There are number of wards with strong agreement in Lesedi, Midvaal and Mabopane in Tshwane, but the areas in Khutsong, Soweto and Sebokeng/Vanderbijlpark are once again prominent. The wards that agree that the country is going in the wrong direction (Figure 10), cluster in a wider range of areas, including wards in the south west of Tshwane; central core of Ekurhuleni (Boksburg, Benoni and Kempton Park) and northern suburbs of Johannesburg; as well as Sebokeng/Vanderbijlpark, wards in and surrounding Soweto, Tokoza, Mamelodi and Mobopane. Evidently, there are overlaps in the spatial variation of the above explanatory variable and dependent variable maps. We further explore these relationships between the variables using advanced statistical techniques in the next sections.

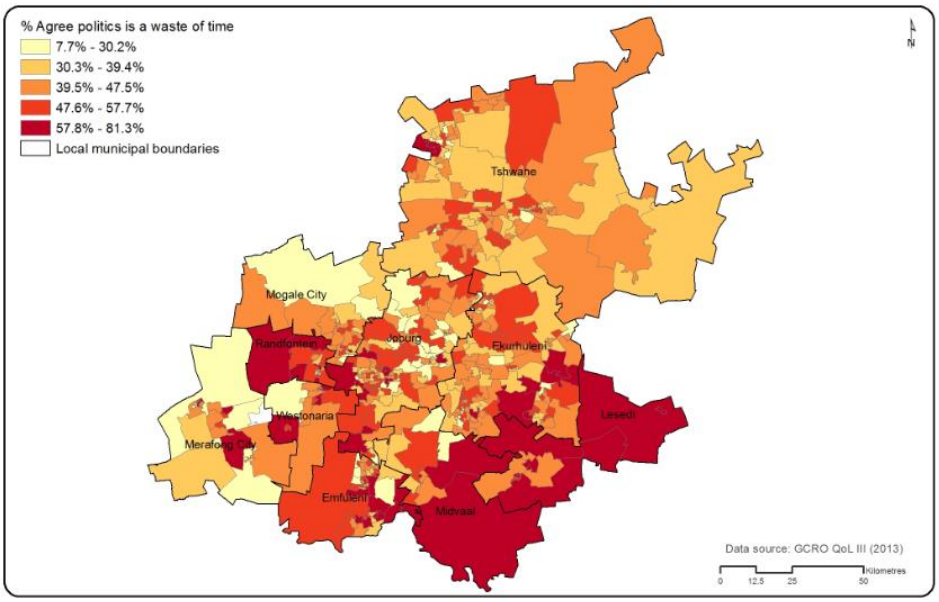

Figure 9. Percentage of respondents who agree politics is a waste of time

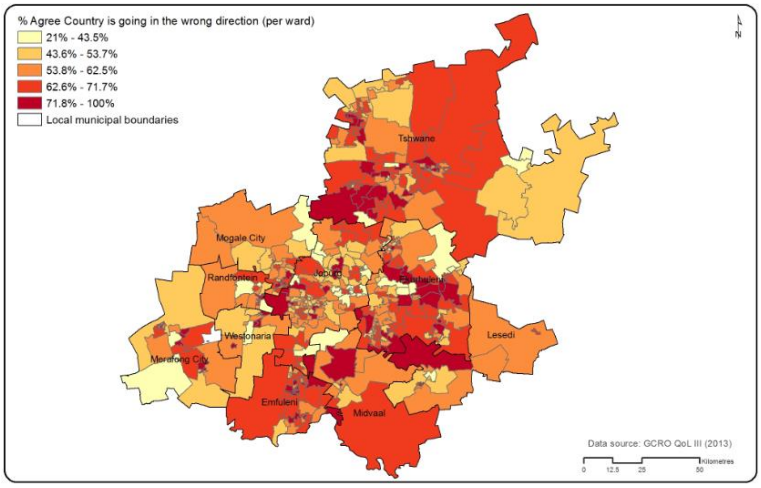

Figure 10. Percentage of respondents who agree the country is going in the wrong direction

4.2 Spatial results and related discussions

With the confirmed spatial effects described in the previous section, we proceed to explore and estimate the results statistically using a spatial statistical approach.

4.2.1 Cluster mapping

Figures 11 and 12 show evidence of localised spatial clustering in the level of dissatisfaction with local government performance. The cartogram in Figure 11 maps the data by replacing the original layout of the areal units (i.e., wards) with a layout in which the size of the area is proportional to a given variable (i.e., in this case % dissatisfaction with local government performance). The placement of the circles is such that the original pattern is mimicked as much as possible, both in terms of absolute location as in terms of relative location (neighbours, or topology) (Anselin, 2005). With associated colour coding, the cartogram is useful in providing additional information, such as the presence of outliers and clustering of similar values, etc. The blue-coded circles in Figure 11 depict lower dissatisfaction values, while the red circles depict higher dissatisfaction values. The existing pattern shows clustering of lower values, especially in central and northern part of the province, and spatial clustering of higher values in the southern (Khutsong) and south western (Sebokeng/Vanderbijlpark) wards in Gauteng. Four of the lower outlier wards are in Ekurhuleni and one in Merafong City.

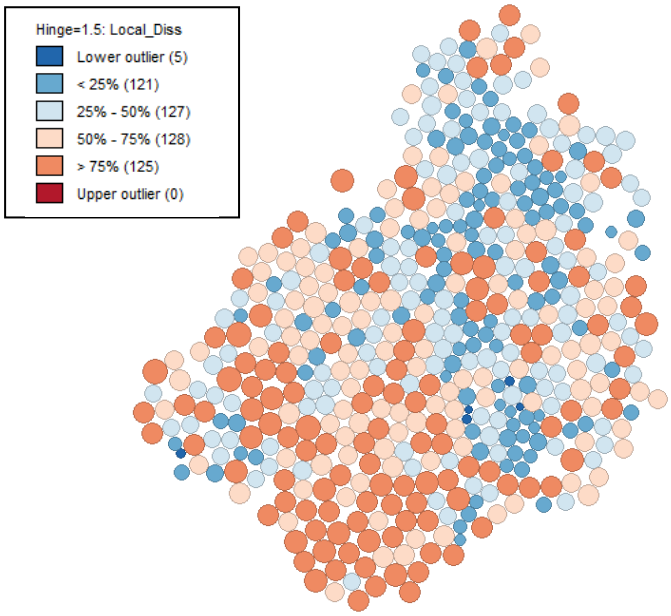

Figure 11. Circular cartogram of dissatisfaction with local government performance

Figure 12, in particular, supports the presence of clustering as observed in Figure 11. The constructed significance map of dissatisfaction with local government (not reported here because of space limitations) supported the presence of clustering by indicating varying of levels of statistical significance less than 5%. Wards with low levels of

dissatisfaction and low dissatisfaction in the neighbouring wards are depicted in blue and mainly occur in the central areas in Johannesburg, extending up through the southern and central areas of Tshwane. The wards with high levels of dissatisfaction and high dissatisfaction in the neighbouring wards are clearly visible in a corridor extending from Vanderbijlpark/Sebokeng area in Emfuleni to Bekkersdal in Westonaria. There are also patches of high-high significance in Khutsong, Soweto, Alexandria, Erasmia and Hammanskraal.

With the diagnostics tests in section 3.3 confirming the use of the SER model, the next section is focused on further analysing the data using the SER model.

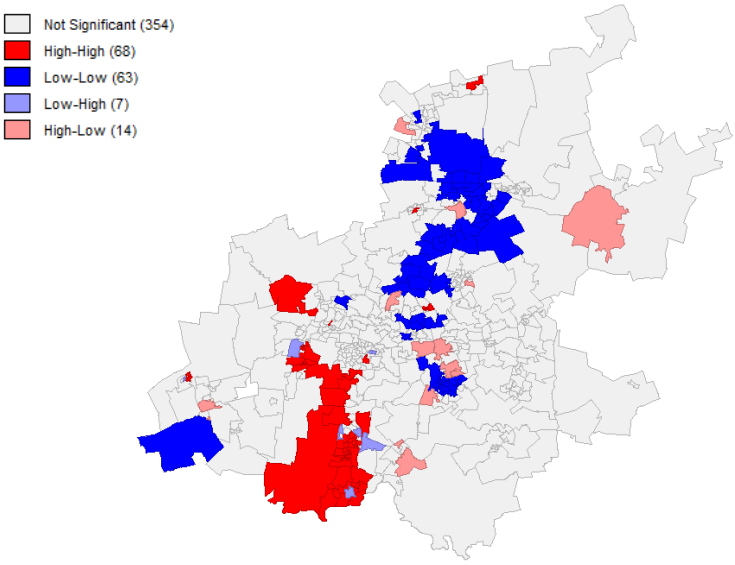

Figure 12. Cluster map of dissatisfaction with local government performance

4.2.2 SER model

The SER model is applicable where errors in a given location are related to errors in neighbouring locations. This violates the regression assumption of uncorrelated error terms. The SER model adopts the following functional form.

$$Y = X\beta + \varepsilon, \quad [1]$$

where $\varepsilon = \lambda w + \mu$, [2]

In addition, Y represents the dependent variable, X is a vector of predictor variables, λ measures the effect of nuisance disturbance, W is the row-standardized weight matrix, while ε is i.i.d. $\sim N(0, \sigma^2 I_n)$ nuisance term. In addition to the "best" predictor variables identified earlier, dummy municipality variables were included to estimate the effects of the municipalities on the levels of dissatisfaction at a ward-level in equation 1. Tshwane metropolitan municipality was used a reference municipality since overall municipal-level results show that dissatisfaction with local government performance in Tshwane municipality is lower vis-à-vis other municipalities in Gauteng (see Figure 2).

In Table 2, we report results for SER regression modelling. The model results show adjusted R^2 of 0.589, meaning that 58.9% of the level of dissatisfaction with the performance of local government is explained by the model. The results also show the signs of regression coefficients for all our predictors are as hypothesized as well as statistically significant. This implies that these variables are predictors of the level of dissatisfaction with local government performance. Except for the mean sense of safety that is an index, interpretation of the other explanatory variables is similar, in the sense that they are seen as a change in the respective variable by 1-percentage point causes a respective change equivalent to the given magnitude of the regression coefficient. Thus, for dissatisfaction with dwelling, percentage agree country is going in the wrong direction, percentage of respondents who think lack of maintenance is the biggest problem, and percentage of respondents who agree politics is a waste of time, a 1-percentage point increase in these variables will lead to 0.427, 0.213, 0.207, and 0.178-percentage points increase in the level of dissatisfaction with local government performance, respectively. For mean sense of safety, a 1-unit increase will lead to 0.546 unit-decrease in the level of dissatisfaction with local government performance.

The results indicate that a focus by local government and other stakeholders on addressing the more objective issues of housing, safety and maintenance; may lead to increased levels of satisfaction with local government. The more subjective issues, such as the opinion that politics is a waste of time, may reflect a deeper loss of faith in the government and may be harder to address.

The model results also show that dummy variable coefficients for Johannesburg, Lesedi, Emfuleni, Mogale City, Randfontein, and Westonaria municipalities are statistically significant at 5%. Dummy variable coefficients for Ekurhuleni, Midvaal, and Merafong City municipalities are insignificant at 5%. Interpreting these results with respect to Tshwane, which was our reference municipality, implies that the level of dissatisfaction with local government performance is higher for wards that are located in Johannesburg, Lesedi, Emfuleni, Mogale City, Randfontein, and Westonaria municipalities.

Table 2. SER model results

Variable	**Coefficient**	**Std. Error**	**z-value**	**Probability**
CONSTANT	0.509	0.062	8.193	0.000
Perc_DissDwelling	0.427	0.033	12.880	0.000
Mean_SenseSafety	-0.546	0.077	-7.062	0.000
CountryWrongDirec	0.213	0.046	4.646	0.000
Bigpro_Maintenance	0.207	0.069	2.984	0.003
BigPro_PoliticsWaste	0.178	0.047	3.787	0.000
JHB	0.046	0.020	2.295	0.022
EKU	0.000	0.021	0.016	0.987
LES	0.098	0.042	2.305	0.021
MID	-0.030	0.038	-0.793	0.428
EMF	0.112	0.028	3.956	0.000
MOG	0.051	0.029	1.780	0.075
RAN	0.081	0.034	2.368	0.018
WES	0.081	0.034	2.368	0.018
MER	0.010	0.034	0.296	0.767
LAMBDA	0.333	0.062	5.363	0.000
N	506			
Adj R^2	0.589			

5. Conclusions

In this paper, we suggest that by focusing on a ward-level analysis and using a spatial statistical approach, Gauteng's local governments in particular will be able to better understand the patterns and determinants of dissatisfaction with local government performance at a more fine-grained level and assist in spatial targeting of specific policies, where applicable.

Using ward-level dissatisfaction with local government performance as the dependent variable, univariate statistical results showed a huge variation across Gauteng ranging from a minimum of 4.4% to a high of 94.4%. Mapping these ward-level results revealed patterns not visible at the municipal level, with pockets of high levels of dissatisfaction clustered throughout the GCR. A more detailed spatial analysis showed evidence of localised spatial clustering in the level of dissatisfaction. The cartogram and the cluster map revealed the areas where low and high levels of dissatisfaction with local government performance exist. For instance, we observed that the main clustering of higher dissatisfaction values in the southern areas of Gauteng along a Vanderbijlpark/Sebokeng/Westonaria corridor.

Further spatial analysis using spatial error model (SER) provided predictors (as explanatory variables) of the percentage dissatisfaction with local government performance. These "best" predictors are: percentage of respondents

dissatisfied with their dwelling, mean sense of safety index, percentage of respondents who agree that the country is going in the wrong direction, percentage of respondents who think the lack of maintenance is the biggest problem in their community, and percentage of respondents who agree politics is a waste of time. Apart from the mean sense of safety index that has a negative relationship with the level of dissatisfaction with local government performance, all the other predictors have positive relationships with the level of dissatisfaction with local government performance. Highlighting the municipal effects on the level of dissatisfaction with local government performance at a ward-level, the results also show that being located in Johannesburg, Lesedi, Emfuleni, Mogale City, Randfontein, and Westonaria has a statistically significant positive ward-level effect on the level of dissatisfaction with local government performance, compared to the City of Tshwane municipality, which was utilised as a reference municipality. When the above predictors were visualised using choropleth maps, variation was evident across the GCR.

Overall, this paper's results place greater emphasis on local government and other stakeholders to focus on issues of housing, safety and maintenance; as addressing these issues may lead to increased levels of satisfaction in the identified areas.

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Annexure 1: Univariate statistics of model variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Local_Diss	**506**	**4.41%**	**94.44%**	**53.09%**	**15.89%**
Perc_unemployment	506	0.00%	69.23%	29.81%	15.95%
Perc_African	506	4.92%	100.00%	76.91%	28.01%
Perc_Coloured	506	0.00%	87.50%	2.98%	9.72%
Perc_Indian	506	0.00%	83.82%	2.33%	7.87%
Perc_White	506	0.00%	93.44%	17.23%	24.77%
Perc_Formal	506	0.00%	100.00%	83.79%	18.88%

Perc_Informal	506	0.00%	100.00%	13.99%	17.49%
Perc_Dwell	506	0.00%	77.78%	2.22%	7.74%
Perc_DissDwelling	**506**	**0.00%**	**80.00%**	**22.30%**	**16.78%**
Mean_Edu	506	7	14	10.67	1.244
NoBathoPel	506	21.95%	100.00%	68.14%	14.33%
Never_interract	506	0.00%	68.29%	14.10%	11.36%
Mean_Access	506	0.07	1	0.8166	0.16481
Mean_AccessSats	506	0.13	1	0.8333	0.15026
Mean_SatsOther	506	0.08	1	0.8204	0.17495
Mean_SenseSafety	**506**	**0.36**	**0.88**	**0.6046**	**0.07431**
Perc_CorruThreat	506	46.30%	100.00%	89.82%	8.48%
Perc_PaidBribe	506	0.00%	50.00%	9.31%	7.84%
CountryWrongDirec	**506**	**20.97%**	**100.00%**	**60.68%**	**11.54%**
Mean_Income	506	R832	R77 654	R9 340.97	R10 530.36
Perc_PartSerDel	506	0.00%	50.00%	9.31%	7.84%
BigPro_Crime	506	0.00%	64.71%	19.38%	12.79%
BigPro_Foreigners	506	0.00%	25.40%	2.23%	3.58%
BiGProb_CostofLiving	506	0.00%	36.36%	2.93%	5.25%
BigPro_Housing	506	0.00%	50.00%	4.22%	6.19%
BigPro_Hunger	506	0.00%	10.00%	0.48%	1.39%
BigPro_LackofServices	506	0.00%	55.91%	10.83%	9.72%
Bigpro_Maintenance	**506**	**0.00%**	**41.67%**	**7.42%**	**7.28%**
BigPro_Poverty	506	0.00%	25.00%	1.77%	3.03%
BigPro_Unemployment	506	0.00%	73.33%	24.03%	16.03%
Anomie	506	0.00%	71.43%	31.31%	12.17%
BigPro_PoliticsWaste	**506**	**7.69%**	**81.25%**	**44.31%**	**11.29%**
CommDeter	506	0.00%	71.43%	8.39%	8.67%
Perc_NoParticipation	506	11.11%	100.00%	51.09%	20.15%
Perc_NotContact	506	45.45%	100.00%	88.15%	8.77%