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# Developing a system of Sustainability Indicators (SUI) for Community Participation in Physical Planning of the peri-urban area of Tlokweng, Botswana

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## Abstract

*The latest review of Tlokweng Planning Area (TPA) development plan, which borders Gaborone, the capital of Botswana, has included a large participation of numerous stakeholders and sustainability indicators (SUI) platform, in order to transform physical planning into a proactive agent of positive social, economic and environmental change. This approach has helped planners to orient towards shaping the future with an emphasis on liveability, sustainability, resilience and switch from urban-rural fringe (URF) to rural-urban fringe (RUF) land use change. In order to apply that shift, the planning team has developed a system of SUIs based on opinions from different members of the social fabric living and working in 10 planning zones of TPA. The summary of this extensive field survey is translated into Indexes and Indicator maps and accompanied statistics showing the status of planning areas in five categories: natural environment (5), built environment (10), economic environment (2), social environment (5), and political environment (4). Outcomes of this approach clearly show how SUI can help land managers, planners and decision makers in short and mid-term monitoring, control and reviews of TPA development plan individual land use zones and sites.*

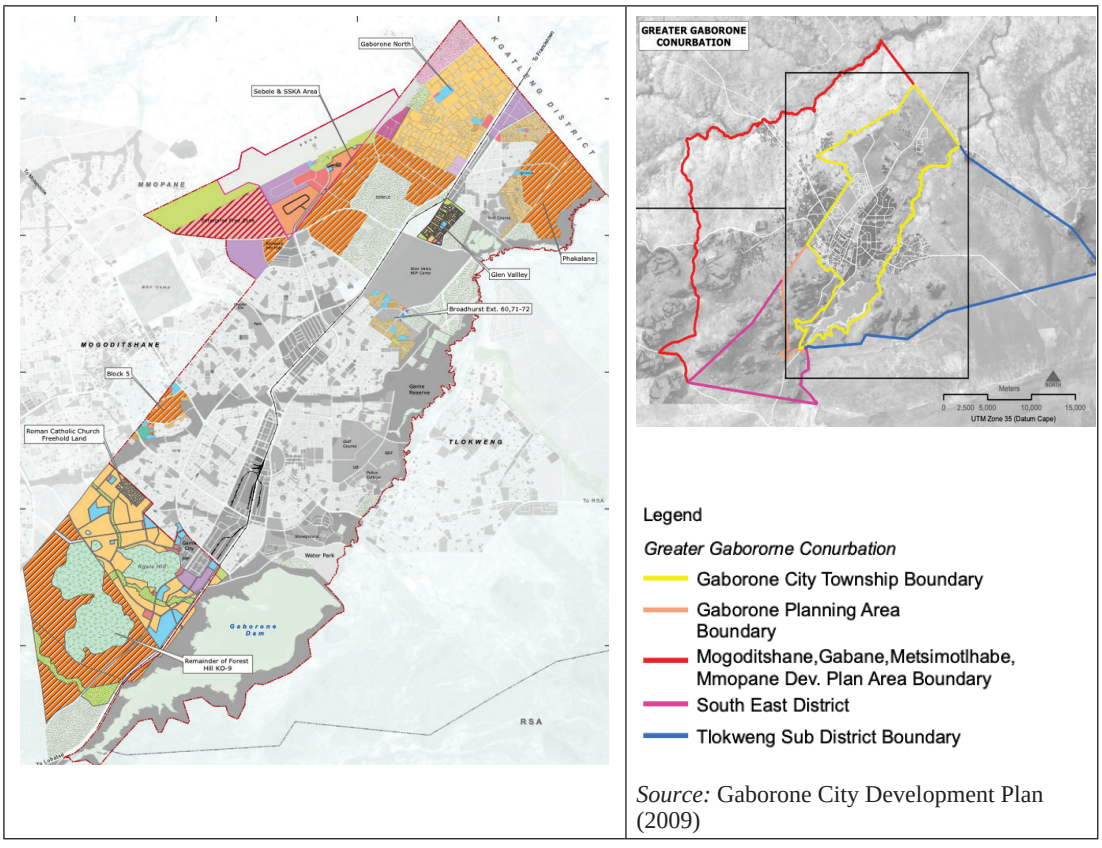
**Keywords:** *Sustainability Indicators, Indexes, GIS, URF, RUF, SUI, AI, Gaborone, Tlokweng, Botswana*

## Introduction

Since independence, Botswana's urban population has grown from 4.44% in 1966 to 71.56% in 2021 (*MacroTrends*, 2022; *World Population Review*, 2022), and this can be considered as one of the fastest urban growth rates on the African continent and around the world. Most of that urban population today is concentrated in Gaborone (208,411), the capital city of Botswana, and its metropolitan area known as Greater Gaborone (Figure. 1), which is the melting pot of the city proper with its urban-rural fringe (URF) villages of Tlokweng (35,982) and Mogoditshane (43,394), and rural-urban fringe villages of Gabane (12,884) and Mmopane (4,927). The ascendance of Gaborone to its present position as the prime urban centre of the Republic of Botswana began in 1961, when the Bechuanaland Protectorate Legislative Assembly recommended to Britain that a capital town should be built at Gaberones, an area with comparative geographical conditions. Due to impacts of intensive urban growth, Gaborone of today is a prime city which is 2 or 3 times larger than the next largest town, Francistown (89,979), and is slowly starting to face the same kind of problems like the so-called "mega-cities", but on a much smaller scale (Cavric, Mosha, Keiner, 2004).

For that reason, its urban management need to introduce the use of different planning approaches, instruments, mechanisms and tools (Hammami, 2012), which can help stakeholders such as politicians, professionals, investors, developers, environmentalists, and others to make informed decisions about fast and more complex land use and land cover changes. Recommendations for the new approaches are especially important in the areas with intensive land use changes and environmental impacts, which is a clear case with the eastern urban-rural fringe of our case study area, where the merger of Gaborone and Tlokweng is taking place and where over-spilling urbanization effects look unstoppable (Gwebu, Sebego; 2015). Due to the fact that room for Gaborone's further horizontal (sprawling and leapfrogging) expansion within the city's boundaries is limited, a normal consequence would be its fusion with Tlokweng on the east, and Mogoditshane and Mmopane on the west side. The borders between Gaborone City and planning areas of these three dormitory URF villages and their planning areas, are not any more physically visible except on administrative and planning maps of Gaborone City, South East and Kweneng District Councils.

**Figure 1. Gaborone and Greater Gaborone Region urban-rural and rural-urban fringes**




*Source:* Gaborone City Development Plan (2009)

This article's case studies, the Tlokweng Planning area (TPA) and Tlokweng settlement, are showing hybrid formation with both urban and rural characteristics. The settlement originated as a traditional one; then over the years has metamorphosed and modernized in terms of size, morphology and economic structures. The general morphology, architectural mix, policy intervention processes and the resultant physical and spatial configurations within Tlokweng bear testimony to the hybrid nature of the settlement. However, in recent years, especially due to its proximity to the South African border, some new development opportunities such us: special economic (duty free) zones, opportunities for intensified precise and feed lot agriculture, irrigation and water harvesting and saving infrastructure, urban tourism and light industry may change current settlement images into more urban looking structures with better economic prospects.

The rapid urbanization of Tlokweng is apparent showing the growth of almost 188% from 3,906 inhabitants in 1971 to 37,364 in 2011 (Kalabamu & Bolaane, 2013). This growth can be attributed to a number of factors which include the dormitory role which Tlokweng was playing many years in relation to Gaborone. Tlokweng provides accommodation to a sizeable proportion of those who work in Gaborone and in addition, several commercial and industrial activities choose to locate in Tlokweng on account of lower rentals, compared to neighbouring Gaborone. All that triggers daily migration in both directions. Some people work and live

in Tlokweng as it is a healthier and roomy natural environment compared to Gaborone. At the same time, some people use more services (work, school, shopping, recreation, etc.) in the capital, and then come back to their dormitory homes in the evening. All in all, many advantages and disadvantages linked to Gaborone-Tlokweng urban-rural continuum, requires adequate instruments for settlement planning, design, development and management.

The latest operative Development Plan for Tlokweng Planning Area was prepared in 2001 as a long-term forward planning document, meant to guide and ensure orderly spatial developments in the area up to the year 2025. However, with the passage of time and given that it is now 22 years since the plan was prepared, it is evident that the physical, social, economic and environmental conditions upon which the plan's proposals and recommendations were premised have significantly changed. As a result, new planning issues and challenges of sustainability, resilience, climate change and demographic diversity drive have emerged in the Planning Area, while most of the old issues and problems of tribal vs. private vs. government land tenure, urban and rural sprawl, irregular horse-shoe pattern in village centre, and frequent flooding, have continued to persist. This request for a planning change has also been attributed to the ever-dynamic nature of planning activities which were taking place in Tlokweng and its vicinity to two economic magnets -- one being the city of Gaborone on one side and the Tlokweng border area with Republic of South Africa on the other side. Ever since the latest plan was prepared, these two have influenced Tlokweng's development prospects. For the Planning Authorities to be able to address the prevailing and emerging planning issues and challenges faced by Tlokweng, it has become necessary that the latest operative Development Plan (2001) be reviewed and a revised Plan prepared for the time horizon beyond 2025 (GISPlan, 2016 & 2018).

With all the above, it has been considered important to launch a premier planning approach that aims to address emerging problems and recommend a successful model for tracing and monitoring land use and environmental change at different Tlokweng spatial planning levels (planning area, planning zones, wards eg. neighbourhoods and individual sites). Furthermore, the question was: which other approaches should be chosen in order to create a balance between available time, technology, resources and public participation within spatial extent and units that will assist field survey efficiency and visual and spatial foreseeability in expected planning scenarios generation, their evaluation and selection of the best future planning proposal. In order to successfully achieve all these, the planning team has embarked on the creation of a system of Sustainability Indicators (SUI) for community participants and physical planning professionals, which can also inform all the land-oriented decision makers and key players. The Tlokweng SUI system is based on analysed international indicator frameworks, which have employed GIS technology in order to process public and professional views for their incorporation into creation of (1) sustainable planning development alternatives, followed by recommendation for (2) regular annual monitoring, mid-term reviews and informed decision-making during the plan implementation period (5-25 years).

This initiative is especially significant in a situation where Botswana has been involved in several previous indicator projects under UN Habitat initiatives, but without practical results. This is why the subsequent parts of this article aim to present their application in

real project conditions of recently prepared and approved development plan for the Tlokweng Planning Area. These innovations were built around public scrutiny whose outcomes were incorporated into the plan proposals, tracing the way forward for regular use of GIS SUI model which has assisted the creation of sustainable planning development alternatives, followed by recommendations for monitoring, review and informed decision-making in the plan's forthcoming implementation phases.

## Literature Review

Quantitative, qualitative and descriptive measuring of the quality and sustainability of urban life has a long tradition in many parts of the world (Gahin, Paterson, 2001; Ghosh, Vale & Vale, 2006; Cavric 2011). These measurements were developed within the social sciences first (Sawicki, 2002), mostly urban sociology, and then urban ecology as an antecedent of inter-disciplinary urban studies (McDonald & Patterson, 2007; Wong, 2002). Their specialized applications in urban planning, management and governance based on principles of sustainability (Flood, 1997), became recent phenomena in 21st century. Today, many cities, regions and countries have decided to introduce sustainable urban indicators (SUI) in spatial plan preparation and implementation processes, and in order to secure efficient quantitative, qualitative and descriptive monitoring and measuring of the progress which should lead to the achievement of sustainability goals, improvements of spaces and human well-being (OECD, 2017).

SUI are simple instruments for multidimensional measuring of well-being or quality of life (Tenon, 2015) in human settlements which include natural, built, economic, social and political sustainability dimensions. In a technical sense, SUI presents information on changes and trends in the course of time or in a particular time framework. In organized and functional setting, the SUI are usually illustrated by diagrams, GIS maps, graphs, schemes, tables, statistics and figures, enabling people to see the trends or current state of affairs in the simplest and fastest way. Laurini (2001) especially points out the prominence of multi-media and geographical information systems (GIS), which affect the extreme processing precision, presentation and SUI information use in e-government applications. The recent appearance of artificial intelligence (AI) will be another contributing technological factor in strengthening the role of automated SUI systems as has been discussed in recent literature (Arfanuzzaman, 2021; Rohde, 2023).

Bührer's research work from 2002 represents the first systematic contribution to the development of indicators for sustainable and integrated planning of Gaborone City which has been selected as the case study area, along with Santiago de Chile and Johannesburg, under the Alliance for Global Sustainability (AGS) international project on "Designing, Implementing and Measuring Sustainable Urban Development" (DIMSUD) for small and medium-sized cities. The project was executed from 2002 to 2004 by consortium composed of the ETH Zurich (Switzerland), KTH Stockholm (Sweden), MIT Boston (USA), Catholic University, Santiago de Chile, Witwatersrand University Johannesburg (Republic of South Africa) and University of Botswana in Gaborone. Since spatial development of Gaborone was becoming

more complex, it was important to introduce tools and models, which help to reduce this complexity and assist in a systematic spatial observation of sustainable urban development accomplishments. Based on the discussion with different stakeholders involved in Gaborone city planning and development, the DIMSUD project at that time proposed the three sets of sustainability indicators for the City of Gaborone which are shown in Table 1.

**Table 1.Gaborone City Sustainable Urban Indicators (DIMSUD, 2004)**

| Society | Economy | Environment |
|---|---|---|
| • Water quality<br>• Water consumption<br>• Provision of water<br>• Provision of electricity<br>• Self-Help-Housing Agency<br>• Unemployment<br>• Poor population<br>• Infant mortality rate<br>• Crime incidents<br>• School enrolment<br>• School staff<br>• Class size<br>• Health care | • City product<br>• Privatization<br>• Local government revenues<br>• Employees per sector<br>• Unemployment<br>• Shopping facilities | • Land use change<br>• Plot size<br>• Space for recreation<br>• Waste disposal<br>• Sanitation connection<br>• Air pollution<br>• Noise pollution<br>• Energy consumption |

The concept of sustainability as it is treated here is based on well-balanced development of its three dimensions -- society, economy and environment. These three dimensions remain in permanent competition, especially in urban areas, and development is likely to be at the expense of one of them. Thus, as a first step, the city of Gaborone is analysed with a particular focus on the most severe problems. This analysis is mainly based on the review of national and local development plans, policies, interviews and questionnaires. The detected problem areas which are considered to be urgent, such as poverty, HIV, land use or waste management are described and attached to one of the three dimensions of sustainability.

The “Vision 2036” (2016) is the support strategic framework of the Government of Botswana, which is meant to guide all national policies and programmes, and contains a monitoring and evaluation (M&E) system. This is to enhance the implementation of the development objectives of the preceding Vision 2016, and also of those fixed in the national development plans. This M&E system is designed as an on-line database system. Based on the formulated future challenges for Botswana, an indicator system with more than 100 indicators has been developed in four groups: sustainable economic development; human and social development; sustainable environment; and governance, safety and security. Government and other stakeholders report their activities, mainly in the form of data referred to the defined indicators.

The ISO City Indicators Report (2018) obtained from the Botswana Bureau of Standards (BOBS, 2019) shows very clearly in which direction the SUI agenda should go in order to be in conformity with international requirements which stipulate the SUI performance measurement

design at the local, regional, continental and global levels. The proposed ISO indicators' model depicted by Figure 2, suggests adoption, standardization, consistency and comparability over time and across different urbanized territories focusing on the following sub-categories: (1) indicators for city services and quality of life; (2) indicators for smart cities; and (3) indicators for resilient cities. In summary, the model operates "with the core, supporting and profile indicators classified into themes according to the different sectors and services provided by a city. The classification structure is used solely to denote the services and area of application of each type of indicator when reported on by a city. This classification of themes has no hierarchical significance and is organized alphabetically" (p.4).

**Figure 2: Standardization of indicators for sustainable development of communities (ISO, 2018)**


## Methodology

The SUI can be organized in complex groups on strategic, tactical or operational levels or in the form of specific SUI system developed to assist planners and decision makers in providing many answers the for planning area in question. Different stakeholders, key land players, developers, investors, politicians, residents and individuals always ask questions which require instant and appropriate answers. For example: *Does our city, town, village become a better or worse place for living and working? Do the plans and programmes address residents' requirements and needs? Do they contribute to the improvement of overall natural and built environment? Do they effect displacements of vulnerable groups, services and facilities, and in what sense and to what degree? Do planning proposals make land use and ownership justice?*

Normally, all these queries require certain availability of a very specific type of raw data generated first from primary and secondary sources and then transformed into meaningful information, and subsequently into decision-making indicators and indexes. In the case of Tlokweng Planning Area (TPA), the SUI have been used first to improve ***awareness*** about current situation and needs for more sustainable development solutions in Tlokweng built-up

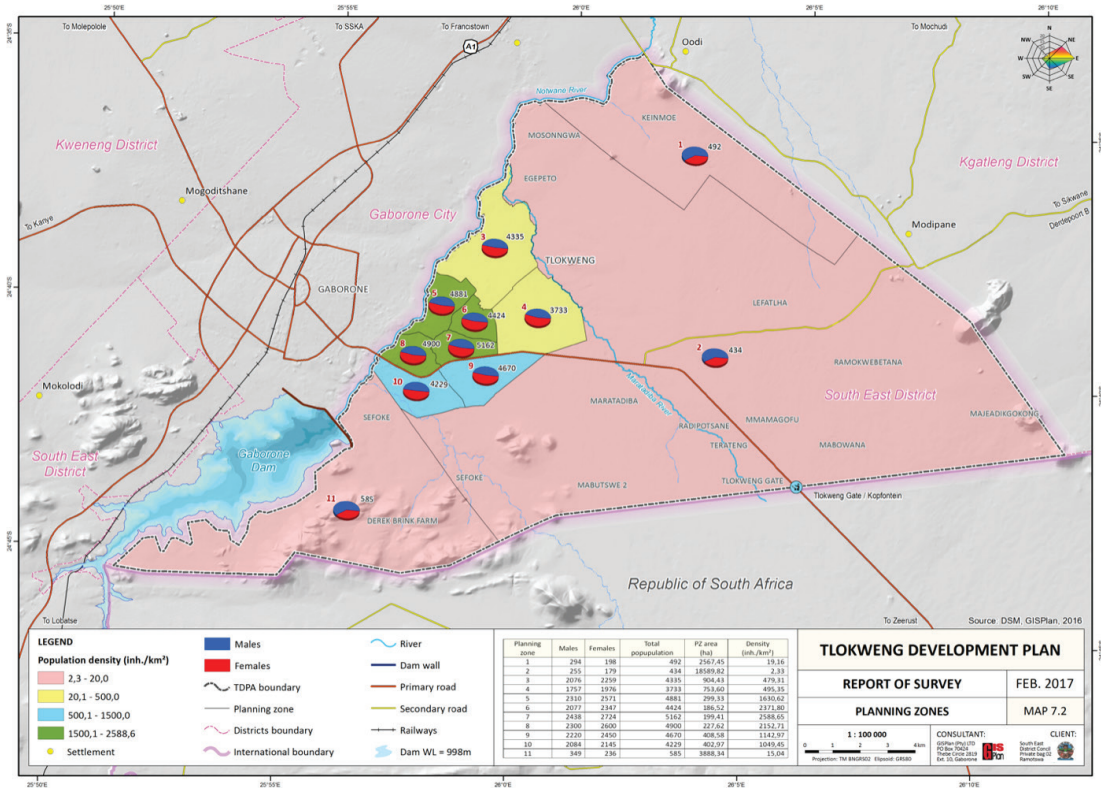
area, rural hinterland and Notwane river corridor which makes a natural buffer between TPA on the east and Gaborone City on the west.

The second function of SUI after the TPA development plan is prepared and approved is ***monitoring*** where particular indicators have to be selected in order to describe situations susceptible to frequent land use changes. The third SUI function in TPA planning process will be ***decision-making*** where SUI could be used to implement adequate development methods and compare planning scenarios with their various impacts. The next SUI role is linked to ***development control***, where it is expected to provide information on distance from the proclaimed objective, combining function of measuring sustainable development progress with function of necessity to take actions. And finally, the SUI could be exploited as a ***reference point*** for performance testing, or benchmarking of different projects during the entire life cycle from ground-breaking to their completion and commission.

Due to limitation of space for more extensive elaboration of SUI utilization prospects, the focus of the remaining part of this article will be on the first SUI function which is fostering ***awareness***. This was done through massive field survey and public participation which helped to secure opinions from different members of the social fabric living and working in 10 planning zones (at strategic and tactical levels) shown in Figure 3. These zones included Tlokweng Central - Old Village Core (zones 5,6,7 and 8), Tlokweng Village South (zones 9 and 10), Tlokweng Village East (zone 4), Tlokweng Village North (zone 3), Tlokweng Ruretse (zone 1) and Tlokweng Lands Area (zone 2). Unfortunately, physical access to zone 11, the private land of Brink's farms has not been granted to our field surveyors.

The TPA filed surveyors used a ***quantitative corpus*** as an applied research method in order to obtain raw indicators' data and receive opinions from the public. A systematically prepared written questionnaire and field surveys protocols on digital tablets and as paper back-up copies were utilized for recording the research data. Besides the digital and hard copy survey questionnaire, overview maps of every survey (planning) zone and its vicinity in analogue format were used by every field surveyor. The basic research sample comprised 301 respondents from TPA's 10 planning zones. Within each zone, 1% of the population was surveyed by ***method of random selection***, which means that the sample type was a simple random sample. Research sub-samples, a total of 10, were also processed by random selection of respondents. Given the research objectives, some characteristics of respondents were controlled. Only the residents who lived in particular research (planning) zones that were defined as research sub-samples were selected for the survey. At the same time, not more than one member of a household was eligible to be selected as a respondent. Guests or passers-by were not eligible to be chosen as respondents in this investigation.

**Figure 3. TPA Planning and SUI Field Survey Zones**




| Planning zone | Males | Females | Total popupulation | PZ area (ha) | Density (inh./km²) |
|---|---|---|---|---|---|
| 1 | 294 | 198 | 492 | 2567,45 | 19,16 |
| 2 | 255 | 179 | 434 | 18589,82 | 2,33 |
| 3 | 2076 | 2259 | 4335 | 904,43 | 479,31 |
| 4 | 1757 | 1976 | 3733 | 753,60 | 495,35 |
| 5 | 2310 | 2571 | 4881 | 299,33 | 1630,62 |
| 6 | 2077 | 2347 | 4424 | 186,52 | 2371,80 |
| 7 | 2438 | 2724 | 5162 | 199,41 | 2588,65 |
| 8 | 2300 | 2600 | 4900 | 227,62 | 2152,71 |
| 9 | 2220 | 2450 | 4670 | 408,58 | 1142,97 |
| 10 | 2084 | 2145 | 4229 | 402,97 | 1049,45 |
| 11 | 349 | 236 | 585 | 3888,34 | 15,04 |

The survey questionnaire consisted of 26 questions with a total of 302 variables grouped into five categories: ***natural environment*** (5-60), ***built environment*** (10-113); ***economic environment*** (2-45); ***social environment*** (3-45), and ***political environment*** (4-39). Information about individual respondents' socio-demographic and socio-economic profiles were obtained through 15 indices which were also a part of the survey instrument.

**Table 2.Categorization of SUI for Tlokweng Planning Area (TPA) Development Planning**

| | SUSTAINABILITY INDICATORS FOR PLANNING OF | | | | |
|---|---|---|---|---|---|
| | **Natural Environment** | **Built Environment** | **Economic Environment** | **Social Environment** | **Political Environment** |
| 1 | Natural resources & Conditions (8) | Level of development in the built-up areas (7) | Economic development sectors (24) | Community prospects (5) | Public participation (12) |
| 2 | Environmental Quality & Protection (9) | TPA vision in 10 years ahead (6) | Types of services & goods (21) | Community | Negative practices (7) |
| 3 | Environmental Pollution & Disaster Risk (13) | Authorities consideration for growth vs. non-growth (6) | | Community satisfaction (32) | Levels of influence (15) |

| | SUSTAINABILITY INDICATORS FOR PLANNING OF | | | | |
|---|---|---|---|---|---|
| | **Natural Environment** | **Built Environment** | **Economic Environment** | **Social Environment** | **Political Environment** |
| 4 | Environmental Impacts (7) | Land Development Control (9) | | | Authorities performance (5) |
| 5 | Environmental Issues for Planning proposals (23) | Land Use Zoning Regulations (6) | | | |
| 6 | | Building types (6) | | | |
| 7 | | Building materials (17) | | | |
| 8 | | Housing quality satisfaction (16) | | | |
| 9 | | Physical infrastructure &services availability (23) | | | |
| 10 | | Social and community services availability (27) | | | |
| | **60** | **113** | **45** | **45** | **39** |

Most of the 26 questions were closed-type and respondents chose from offered answers, except for one open-ended question within the category of the natural environment and five open-ended and three semi-open questions within the category of basic data about the respondents. The questionnaire used a 5-point measuring scale, whose values were defined as follows: 1 - *poor/not important*, 2 - *fair/somewhat important*, 3 - *good / important*, 4 - *very good / very important*, 5 - *excellent / highly important*. Descriptive statistical indicators are shown for all units of the survey questionnaire. Examples of questionnaires, and 120 page-long stand-alone statistical visual compendium were available for inspection and future use by South East Sub-District Tlokweng Council who were considering possibilities of embarking on separate indicator's project which is recommended by HABITAT Agenda and is of very high importance for SE District managers and decision-makers.

## Findings

### Natural Environment Indicators

The natural environment portion of the survey aimed to capture any possible shortcomings and problems related to natural resources and conditions (soil, water, vegetation, pollution, endangered wildlife, disaster risks, etc.). Elements of the natural environment are important for future planning, because this determines how people live in individual zones and to what extent the natural environment shapes that life. The results were presented in the form of natural environment index and indicators for individual environmental aspects (Figure 4).

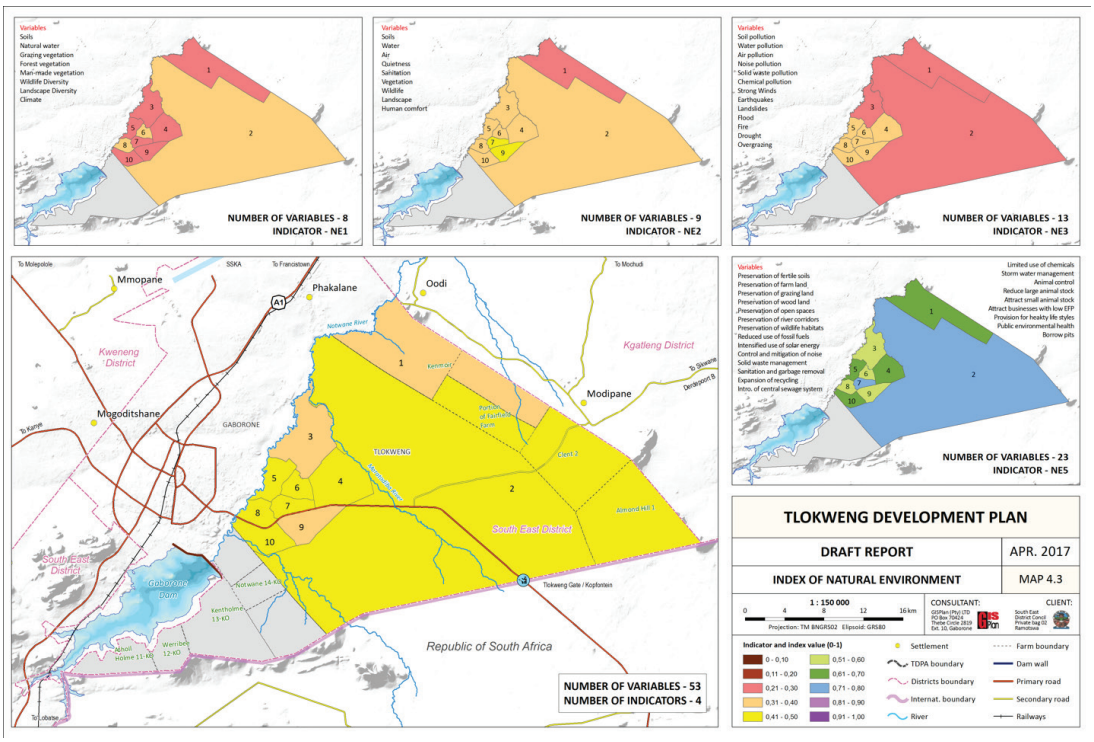
Respondents expressed their level of satisfaction on a scale of 1-5, regarding drinking

water, vegetation for grazing, forest vegetation, climate, soil, cultivated vegetation, diversity of flora and fauna and landscape diversity. In a separate question, respondents were asked to rate the importance of certain elements of the environment for life in a particular area of the village. The results of the quality and endangered elements of the natural environment indicated different problems in the zones, as evidenced by the fact that there was a very small percentage of responses *excellent* or *very good*. Lastly, respondents were also asked to rate the importance of a variety of issues for future planning proposals in that area. The responses from this question are helpful for the determining the urgency of any issues with the natural living environment.

Overall, while the satisfaction with the climate was reported as one of the highest rated elements throughout all zones, in zones 8-10, and 4, there was noticeably greater satisfaction with the climate than in other zones. Even so, while the climate was the most well received natural environment element, other elements such as the quality of air in zones 9 and 10, and water in zone 10, were noticeably well off.

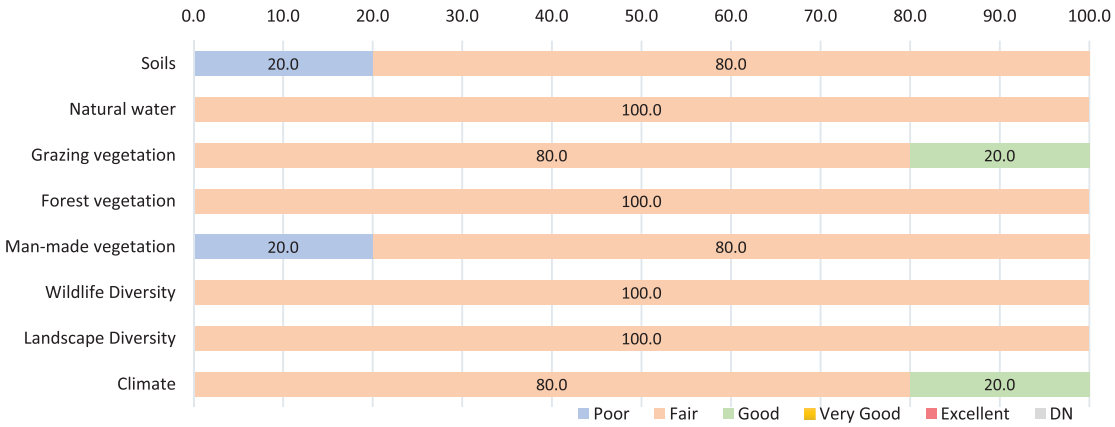
While it may be safe to assume the air and climate of Tlokweng is of no concern, it would be wrong to conclude such about the water quality. There were a handful of reports in zones, which we mention below, that reported low water quality. Upon further examination, we find the zones with higher water quality ratings are positioned along major watercourses. Another major finding is the amount of dissatisfaction with the soil quality across all zones. Lastly, in all zones most respondents were extremely satisfied with the level of human comfort in their communities.

**Figure 4. Natural Environment Index for TPA**



When looking at the results of the natural environment portion of the survey, it can be said there needs to be a stronger emphasis on improving the quality of the drinking water supply in relevant zones, as well as improving waste management given the known link it has to soil quality. In general, however, improving sanitary conditions should be of great concern given they are also essential to prevent possible infection and epidemies.Graphical example of natural environment indicator is given in Figure 5.

**Figure 5. Graphical example of natural environment indicator variables**

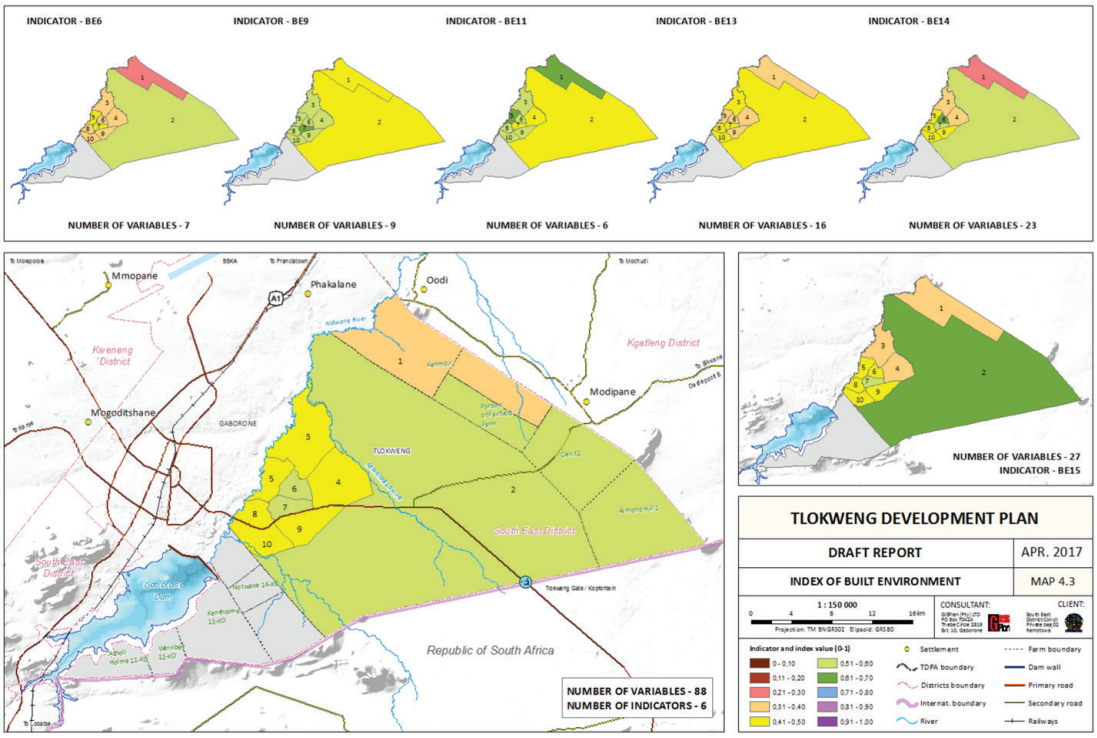



## Built Environment

Analyses of different aspects of the built environment have a direct effect on the livelihood of families, businesses, and industry, as well an indirect effect on the development of the area. This segment of the survey required respondents from different zones of TPA to evaluate the current built environment with values ranging from low to very high as it is presented in Figure 6. As a whole, the least built were the open spaces and recreation areas, while the most built were those allocated for residences.

Questions about the built environment also focused on the future aspirations of the residents within a ten-year period, where two responses prevailed across all zones. Firstly, residents believed that in 10 years Tlokweng would be a self-contained town with industrial, agricultural and commercial activities. Secondly, they saw it as a part (suburb) of the capital Gaborone. Only in zones 1 and 2 did the respondents reply that they saw Tlokweng as a small agricultural community (40% of respondents in zone 1 and 40% in zone).

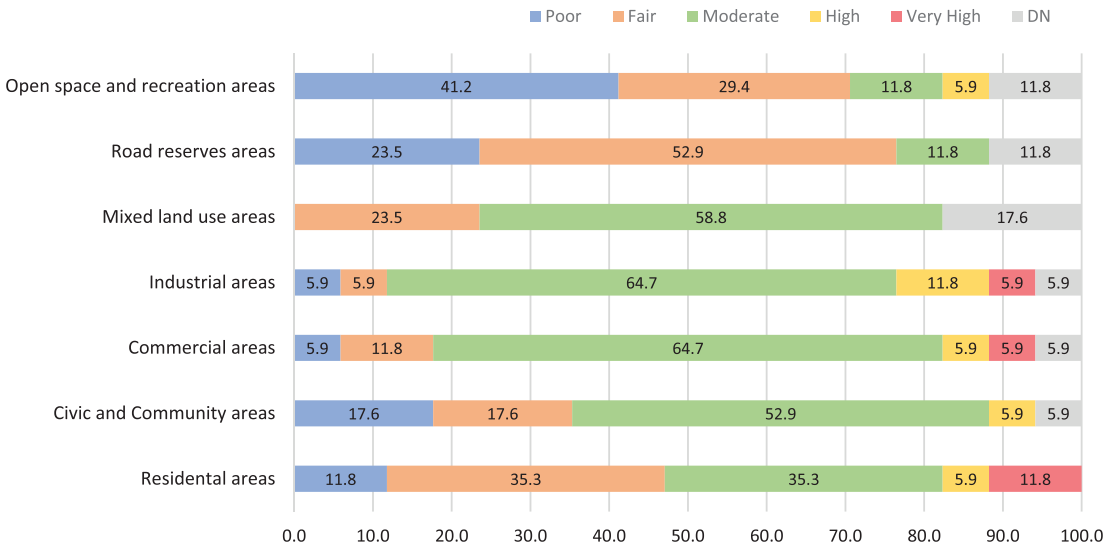
**Figure 6. Built Environment Index for TPA**




Additionally, the residents were asked to express their opinion regarding the type of buildings which should dominate in Tlokweng. Given that most of the village area is composed of residential areas, it was also important to explore the satisfaction of the inhabitants with housing quality. The indicator quality of housing was examined on the basis of 16 variables (look and design of housing, the purchase price, the quality of housing for the elderly, etc.) In general, respondents usually rated the availability, i.e. the affordability of apartments /houses as inadequate.

The availability and quality of the physical and social infrastructure were also assessed based on 23 and 27 variables, respectively. Here, social infrastructure referred to the institutional assets which provide social services. However, it is worth nothing that the types of content found in the man-made environment are not equally important to all age groups. Therefore, it is important to investigate the opinion of the entire population in a zone, regarding certain public facilities, their distance, quality, availability and the like. In the analysis of the results, special attention was given to the units that were rated as inadequate so that they could be improved in the future. Graphical depiction of selected built environment indicator is displayed in Figure 7.

**Figure 7. Graphical example of the built environment indicator variables**



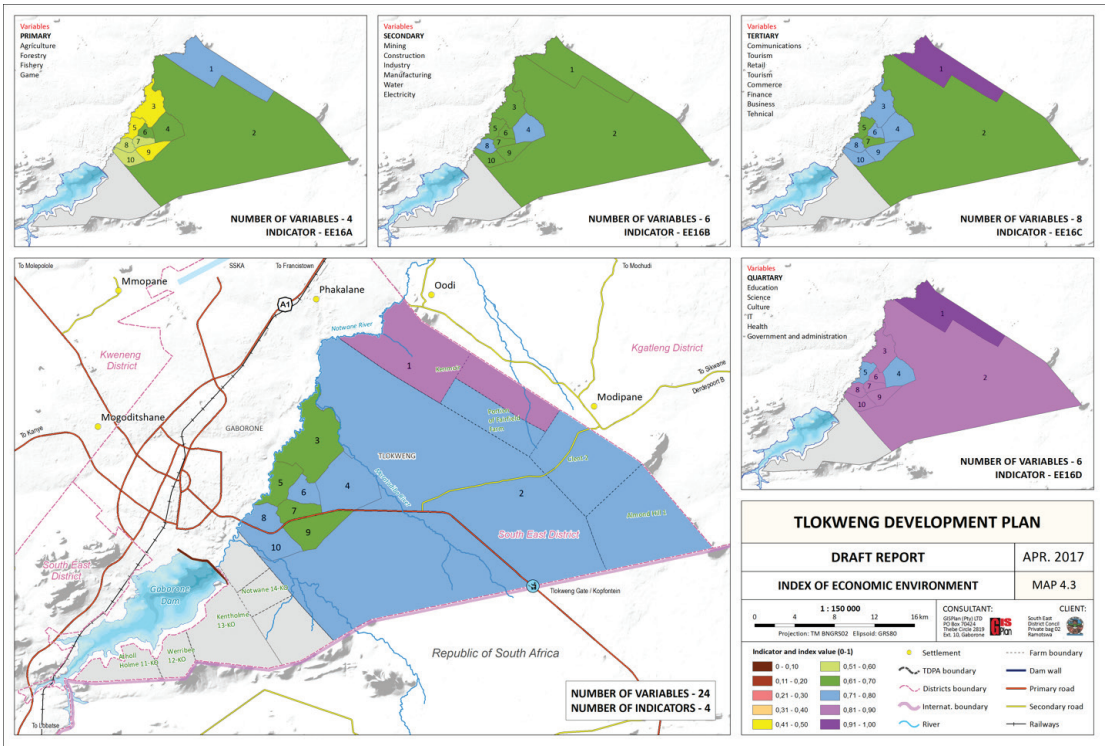

## Economic Environment

The principal goal of analysis of the economic environment was to determine the sectoral development priorities of inhabitants and to better understand where economic gravity lies (i.e. where market forces dictate that certain types of trade occur). Economic environment research divided economic activity into primary, secondary, tertiary, and quaternary activities within which assessment variables were defined and presented in the form of summary economic index and indicators (Figure 8).

Across TPA, respondents expressed substantial support for economic development, giving the most support for the expansion of tertiary and quaternary activities. At the village level, this meant strong support for development of education and health services (quaternary), development of business and trade (tertiary), development of electrification and water supply (secondary), and support of agriculture (primary), as has been given in graphical example

Almost identical responses were received across planning zones regarding the measures of economic development and residents' distance and ease of finding goods and services. A great deal of Tlokweng's inhabitants' economic activity occurs within the village; however this survey makes no attempt to quantify the level of economic activity which occurs in a particular geographic area, but simply the breakdown of sectoral activity. This analysis finds that the relative economic gravity of Gaborone is great, while the gravity of South African border towns tends to be fairly low, which is now changing due to COVID-19 impacts on national and regional economies.

**Figure 8. Economic Environment Index for TPA**

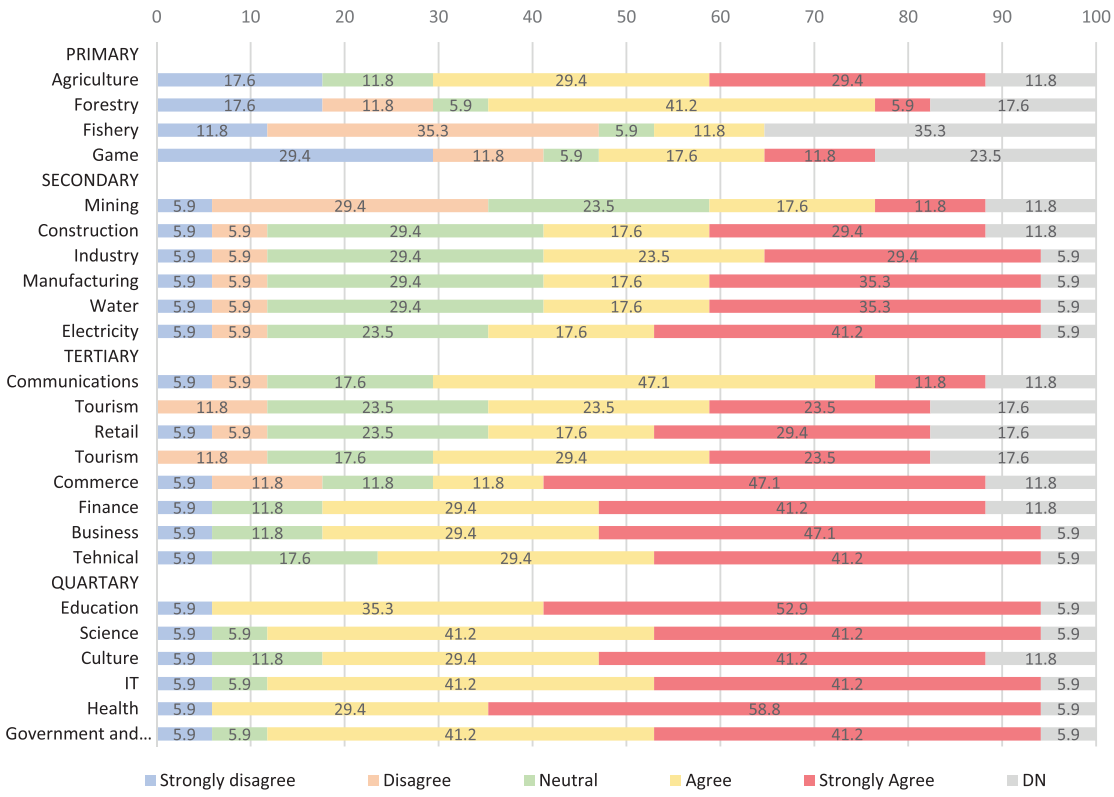



The strongest support across TPA was in the development of tertiary and quaternary activities -- in other words, education and health services, and business and trade respectively. Of secondary activities, electrification services received the widest positive responses.

Survey results suggest that the economic gravity of Gaborone is substantial and that many economic activities conducted by residents of Tlokweng happen not in the village, but in Gaborone. In zone 2, visits to the hairdresser (80%), cleaning (80%) and laundry (80%) were done in Tlokweng, as well as purchases of alcoholic beverages (60%) and agricultural products (80%). All other goods and services, however, were obtained in Gaborone. These responses were largely replicated in zone 3, where they stated that they visit beauty salons (58.8%) and hairdressers (76.5%) in Tlokweng, where they also purchase goods such as groceries (82.4%) and fuel (52.9%) but that they go to Gaborone for a majority of other goods and services.

Comparing the zones to one another, it becomes obvious Tlokweng businesses are providing a lot of residents, regardless of zone, with fuel and the services of hairdressers and laundromats. However, in the same zone, car repairs (4.5%) were provided in Zeerust (in the Republic of South Africa – RSA) while clothing purchases (2.3%) were made in Gauteng (Johannesburg and Pretoria in RSA). We should then focus on the areas of improvement for the future businesses of Tlokweng through potential establishment of the duty-free or special economic zone in the part of TPA which borders with RSA.

**Figure 9. Graphical example of economic environment indicators' variables**




Upon further examination, the purchase and use of goods and services in RSA, is perhaps correlated with the VAT structure, whereby alcoholic beverages are taxed more in Botswana, and the greater proliferation of certain industries (auto services). Nonetheless, the results of this portion of the survey suggest future businesses and investors looking to set up shop in Tlokweng need to offer car repairs, entertainment options, and clothing at prices competitive to businesses in Gauteng and Zeerust.

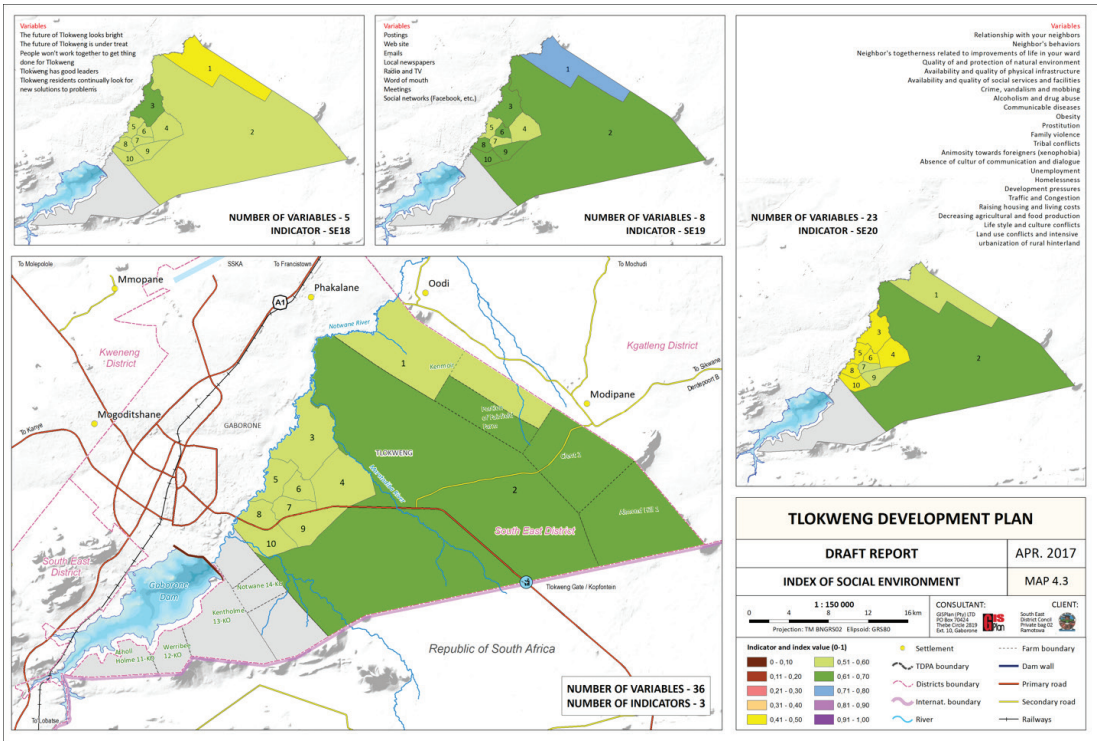
## Social Environment Indicators

Analysis of the social environment aimed to determine the extent to which people in TPA relate to each other and, secondly, what is the level of residents' access to social and physical infrastructure services which improve the quality of their lives. Here social services are described as the institutional facilities in proximity to residents in each ward (neighbourhood) while physical infrastructure is defined as the basic technical equipment that serves people within a particular planning area. The data include perceived access to social services, neighbourhood dynamics, and various social ills such as homelessness and inter-group conflict. They are summarized in Figure 10.

It is important to note that several of the planning zones, specifically zones 1 and 2 are distorted due to a relatively low number of respondents (n=5). Alternatively, zones 7 and 8 are

notable for their large number of respondents (52 in zone 7, 49 in zone 8). The conclusions of the social environment survey suggest that residents view relationships with their neighbours as being a source of strength while aspects such as alcoholism, unemployment, and homelessness are major and intractable problems facing the so-defined social environment.

**Figure 10. Social Environment Index for TPA**




Generally, satisfaction at the level of the village can be considered good or very good. Of the 23 elements of satisfaction, there were no dissatisfied responses for relationship with neighbours, behaviour, or neighbourhood unity, protection of the natural environment, or availability of technical and social equipment. Survey responses suggest that communities view their neighbours positively and these relationships as sources of communal strength rather than antagonistic in nature.

Unsurprisingly, there appears to be a substantive connection between viewing development of the village positively and positive perspectives about the leadership structure. Grassroots leadership was also viewed positively by the assertion that almost 30% of residents were continually looking for new solutions to problems, though it is notable that 43.2% remained neutral. The connection between positive views of leadership and positive views of the direction of development are somewhat obvious, but survey data confirms that positive views of leadership are correlated with positive views of development outlooks.

The survey has collected information about the subjective attitudes towards development in the village. Specifically, these questions aimed to determine whether inhabitants viewed so-

called development as moving in a positive direction and whether or not it was moving quickly enough. Approximately 30% of respondents believed that the future of Tlokweng *looked bright* or that, in other words, Tlokweng was developing positively, which is opposite to 12% of residents who *strongly disagreed* and stated that the development was threatened. This widespread disagreement suggests that the area is in fact developing in a positive direction.

Conversely, dissatisfaction with social factors across the entire village was centred on three specific components, evidenced by very dissatisfied scores with unemployment (34.8%), alcoholism and drug use (21.7%) and housing and living expenses (21.7%). Respondents were also concerned with prostitution, crime and vandalism that were cited as being sources of high dissatisfaction (40%). The concentration by residents on prostitution, drug and alcohol abuse, and unemployment likely lies in a root cause: unemployment which cascades into homelessness, alcoholism, drug abuse, and prostitution.

Data about leisure activities suggests that respondents are happy in Tlokweng. The residents of Tlokweng would like to spend their free time with friends, with colleagues from work, family members, and with relatives. In all zones, most respondents (over 40%) stated that they felt happy regarding life in Tlokweng. However, in zone 4, forty per cent of respondents

**Figure 11. Graphical example of social environment indicators' variables**

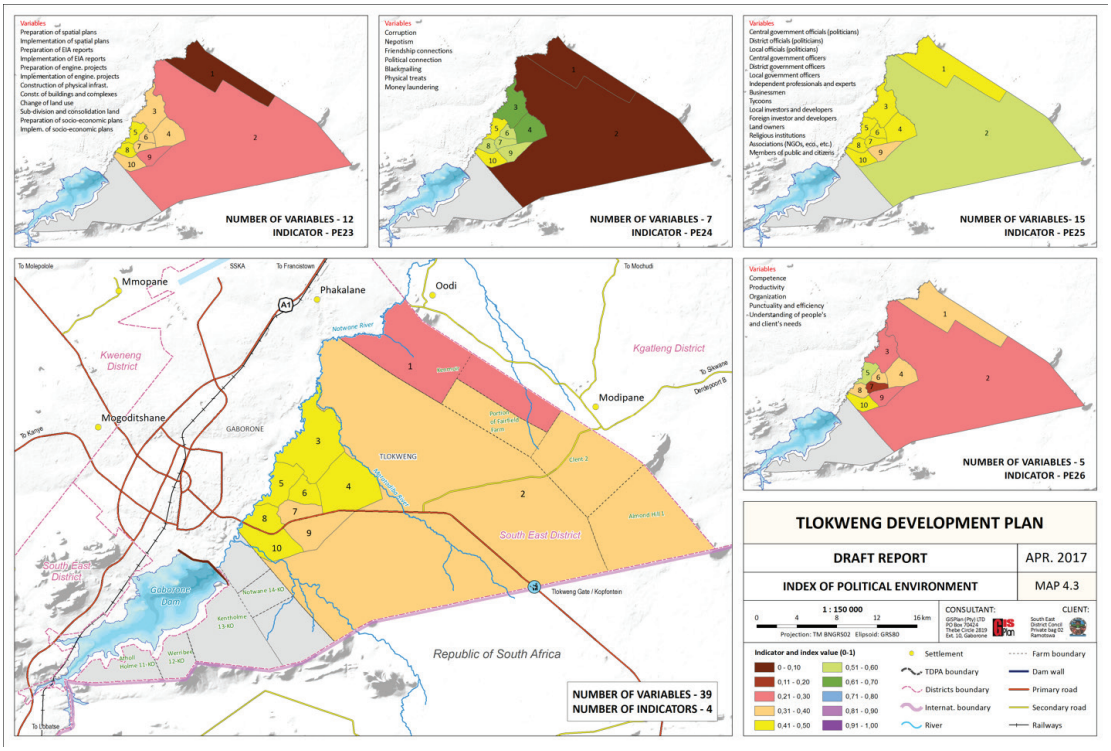
declared that they felt frustrated by their social surroundings. The respondents' satisfaction with the social environment in the village of Tlokweng was good; most were satisfied with social relationships in their environment that made them happy in general in the community and the area in which they lived. An example of one of political environment indicators and its variables is depicted by Figure 11.

Responses suggest that residents view these problems as concerning them highly and that there is relative consensus about the issues which are most troubling. These concerns suggest that future planning priorities should be focused on providing opportunities for formalized employment, housing, and alcoholism and drug abuse abatement services. Neighbourhood relationships being cited as a major source of satisfaction among residents pose a possible pathway through which to achieve better social services provision. General satisfaction with life in Tlokweng suggests that residents are invested in seeing further social development in the area.

## Political Environment

Analysis of the political environment of the village was centred on determining the abilities of local inhabitants to participate pluralistically in decision-making processes regarding village development. Fieldwork determined that a large proportion of Tlokweng inhabitants were unaware of their ability to participate in the "bottom up" plan-making process. The largest response for most of the questions regarding political participation was *I do not know*,

**Figure 12. Political Environment Index for TPA**



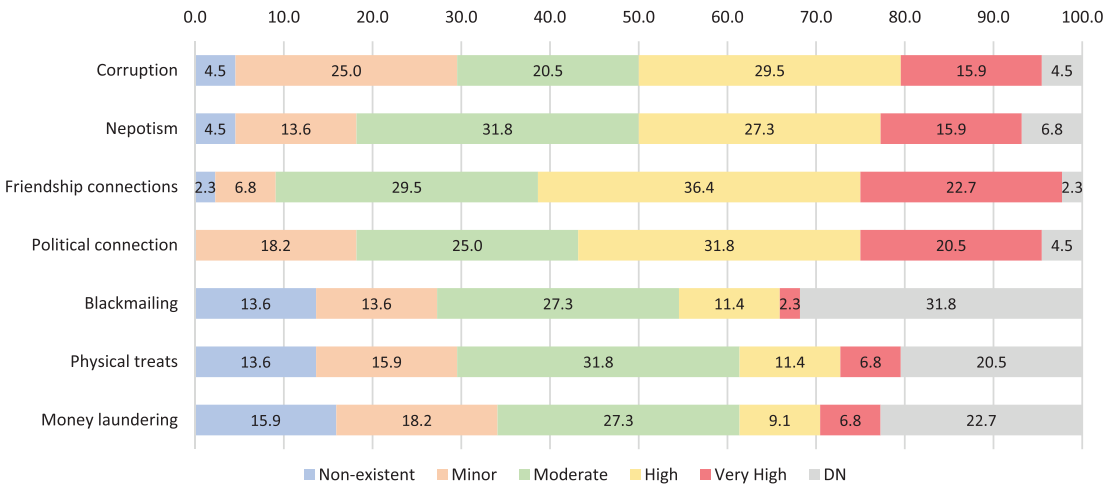
suggesting that inhabitants were unaware of their role and importance to influence planning proposals, without any fear and threat by local leaders and politicians. Concerns about negative political action were focused on money laundering, nepotism, and friendship relationships. Ultimately the relative frequency of the response *I do not know* suggests a lack of belief in the ability for individuals to participate in guiding the development of the village and civic culture at large; a lack of attention focused on the influence of a variety of actors; or an unwillingness to share these insights with researchers. Summaries of political environment index are shown on Figure 12.

In this aspect Zone 1 received exceptionally low political participation responses. Here 100% of respondents stated that there was no possibility to participate in the planning of the village, preparation and implantation of spatial plans, EIA reports, development projects, socio-economic plans, changes in plan use, the construction of physical infrastructure, buildings and building complexes. Again, it is important to note that the small number of respondents in zone 1 (n=5) skews the results substantially.

Similarly in other zones, the dominant response for all of these claims was *I do not know* or stating or testifying that there was no possibility to participate in the implementation of EAI reports, and preparing and implementing projects. Also, there was minor participation in the sub-division and consolidation of land, but a high level of participation in the preparation of socio-economic projects.

Attitudes towards actors in the construction of urban space in TPA and particular in Tlokweng built-up area were focused on the role of tycoons, local and foreign investors, landowners, citizens, local businessmen, local associations, and politicians, and some respondents believed that they had *moderate* to *very high* influence respectively. Responses to negative practices (behaviour) in the process of development were centred on friendship and political connections, nepotism, corruption and money laundering (Figure 13); although the

**Figure 13. Graphical example of political environment indicator's variables**



response *I do not know* still dominated responses. Of course it is impossible to differentiate between the reality of a situation and the opinion of respondents, but one can garner that there is substantial distrust of the system considering the rate at which individuals believe that nepotism and familial connections are influential.

When asked about government performance, 30.4% of respondents said the government was *poor* at being understanding of people's and clients' needs. An alternate version of the question later revealed 47.8% of respondents feel the punctuality and efficiency of the government is *poor*.

In summary the relative unawareness of respondents to the extent to which different actors are influential in the development planning of TPA has broad implications for the future conduct of policies which aim to promote democratic values such as openness, transparency, and accountability. The relative frequency of the response *I do not know,* suggests that future community engagement could be centred upon the raising of awareness of the extent to which specific actors influence decision-making processes about the built environment. Alternatively, the relative neutrality or ignorance implied by the response of *I don't know* suggests that respondents are unwilling to share information about the current state of Tlokweng.

## Discussion

Based on the survey and analysis of the collected data it was established that the lowest values were recorded for individual variables of the political environment. The main problem regarding the respondents represented the fact that the residents were not made aware of the opportunities available to them to participate as actors of planned land use and environmental change and therefore they had not been involved in the decision-making process.

The least satisfaction and the lowest ratings for all elements of the political environment were in zone 1, where 100% of respondents answered that there was no possibility to participate in the planning, preparation and implementation of spatial plans, EIA reports, development projects, socio-economic plans, changes in land use, development of the physical infrastructure, buildings and building complexes. This is a specific enclave of free land owners who were not receiving government attention in terms of social and physical service supplies. At the same time, having in mind their high living standard, they were not very interested in contributing to the indigenous Batlokwa community which was traditionally living in this area for many years. It would be expected that both sides initiate joint activities for improvement of their quality of life in TPA in general, and in their planning zones (neighbourhoods/wards) in particular.

Besides the political environment, two variables of the built environment also received low ratings, namely, the physical and social infrastructure that are important in spatial planning. The variable quality of physical infrastructure and utilities received the lowest rating in zone 4, so that this zone also distinguished itself as the area with the lowest quality physical infrastructure and utilities in the opinion of respondents. For the variable quality of social infrastructure and facilities, it was not possible to single out just one zone where

dissatisfaction predominated because the same or similar responses were obtained across the zones, but it was possible to extract one unit that was rated as inadequate in all the zones. The concerns of people in that zone are related to sport and recreational facilities, which are most frequently mentioned along with the dissatisfaction with parks and open spaces. According to the results for all types of environment, the most dissatisfied respondents were those in the peripheral zones, although in this case we should not rule out the fact that the peripheral zones had the smallest number of respondents which could lead to the wrong conclusion.

Top-rated variables are the variables for the social environment in all zones of the Tlokweng built-up area which means that there are good neighbour relations and mutual cooperation. The greatest satisfaction for the social environment was recorded in zone 9, where there are no dissatisfied responses for any of the 23 indicators. At the level of the entire Tlokweng village, the greatest satisfaction was expressed for the relationship with neighbours and neighbour's behaviour, and of all 294 variables in the survey this was the best rated.

The general conclusion of the study would be that the drafting and implementation of the spatial plan of Tlokweng village is welcome, because the majority of respondents in all the zones are dissatisfied with at least one of the five investigated segments. The results showed that, in socio-physical terms, respondents manage to rationalize the personal difficulties that they have in the area in which they live, as well as the potential solutions which they observe primarily in the context of the common good and benefit to the local community. The results showed that in the sample of the surveyed residents by zones overall, there was a predominance of affirmative (positive) attitudes and tendencies towards accepting the spatial plan, which was equally visible in the principled reflections about the modalities for resolving the highlighted problems. Based on the conducted field work, it could be concluded that during the implementation of research, a new interested segment of the public gradually appeared in the sphere of influence, with the tendency to view concerns more and more through the prism of the public, common goods (e.g. individual household problems). Based on all previous analyses, priority areas for decision-making in certain areas were identified and highlighted. Extremely high or low values of satisfaction for particular variables of the environment within the zones can be understood as important messages for certain services (e.g. utilities, services, road maintenance, etc.).

## Conclusion

Indicators of sustainable development present one of the fields wherein the adjustability and transparency with similar initiatives and programmes is expected: new political arrangements, ethics and standards, new operational frameworks on the level of local authorities, methods of providing administrative services, communal strategies, promotion of local welfare, electronic administration, developing control, and sustainable, resilient and smart dimensions of future TPA spatial planning, and many more.

Through the conducted survey an initial SUI database was created as a starting point in the creation of more comprehensive and automatized TPA SUI systems for South-East District and Sub-District authorities, policy makers, technical cadre, scientists, and the residents

themselves in decision-making and guidance, planning and monitoring spatial changes, as well as, for comparative purposes with other Botswana declared planning areas over specific time periods. Therefore, the collected data represent a practical benchmarking effort for the further development of TPA.

During the TPA planning process, the proposed SUI set has helped to facilitate a systematic analysis of the spatial development by professional planners and the public. The data were collected through field survey and other various kinds of tools and instruments depending on their availability, locally, regionally and internationally (GoV BW, SADC, FAO, UNDP, etc.). It is necessary that they are collected, managed and stored according to GIS standards, so that data transfer, analysis and calculation is possible. GIS as a useful tool has met all these requirements, and helped to implement land develop ability analysis giving an input to application of scenario techniques as crucial elements of future TPA physical planning development proposals. These two tools provided by SUI data helped to assess the changing environment and the dynamic nature of development process of the TPA today and tomorrow within planning horizon of 24 years.

Since spatial development is very complex, it was important to use the SIU tools to help reduce this complexity. The TPA planning also revealed that a systematic spatial observation and a definition of development goals are necessary in order to achieve the TPA sustainability. The proposed SUI Planning, Monitoring and Controlling Concept is therefore ideal and suits the ongoing planning process and the plan implementation and operationalization. It is a means for collecting data and information in a systematic manner, in order to be used for objective and well-informed decision-making.

However, SUI have their limits and usually are small quantities of information that reflect the status of different systems including the five subsystems (natural, built, economic, social and political) utilized in this case. Although the planning team made an effort to include as many indicators' variables as possible, it is clear that they cannot measure all objectives of the underlying strategies of the TPA development plan, but they can reflect a part of the actual state of development and direction where to go. It remains difficult to explain the complexity of spatial development by indicators only. Due to the varying interpretations of their results, even if the selection of indicators follows comprehensible criteria, indicator-based analysis remains subjective to a certain degree. One should remember that it is just the interpretation of the indicators which gives them their significance, and that any quantitative information must always be supplemented by qualitative analysis within the planning |process.

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