

Environmental Science 302

SoER Draft Project Report- 09/09/11

Group 9- Human Settlement

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Settlement Patterns in Grahamstown; are they sustainable?



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ABSTRACT

Human settlements are characterised by physical, social, cultural and organisational elements which sustain human communities. Patterns of human settlement in relation to economic activity, institutional development, infrastructural development and local food production were assessed in order to determine whether Grahamstown was capable of functioning as a ‘Sustainable City’. With the use of survey questionnaires at 5 locations in Grahamstown and the annual sales of petrol as an indicator of economic growth, the sustainability of Grahamstown’s economy and the patterns of unemployment, consumption, production and the quality of Makana Municipalities’ Service delivery were established. Orthophotos of Grahamstown from a period of 1949 to 2009 were analysed in order to determine how the areas of each land use sector have expanded over time. It was found that the informal settlements and the urban formal settlements experienced the most expansion over that time and are continually expanding. The broad majority of residents in the surrounding informal settlements did not understand nor support the concept of sustainable development and local markets and produce farms did not receive the support of the broader public. Commercial outlets such as Pick ‘n Pay and Shoprite were the main suppliers of consumables to the residents. South Africa, as a country rich in natural resources and opportunities for sustainability, has several challenges to overcome in order to move into a state of complete sustainable living. Makana and the National Government need to provide funding and facilitate sustainable living initiatives in such cities in order to allow for human settlements to incorporate sustainable practises into their development plans.

INTRODUCTION

Growing Urban population

At the dawn of the 21st century, humankind is facing many critical problems due to a growing urban population. The urban population is increasing and it is estimated to reach 70% of the world's total population by 2050 (Shen *et al.*, 2011). Moreover, governments are facing greater challenges in attempting to provide inhabitants with a good quality of life in their chosen settlement areas. Many cities around the world have begun to develop sustainable urban development plans for leading their urbanization process towards their required status of urban sustainability. However, traditional development issues such as economic stagnation, unrelenting poverty, malnutrition, and illness as well as newer challenges such as worsening environmental degradation and accelerating globalisation are some of the critical problems which demand immediate attention (Islam *et al.*, 2003). A concept which has received recent recognition is the notion of 'sustainable cities', and there are a number of cities around the world which are adopting a sustainable approach to city management and use of resources.

Human settlements are characterised by physical, social, cultural and organisational elements which sustain human communities. It has become increasingly difficult for planners and developers who are at the forefront of economic growth and improvement to balance different economic, social and environmental spheres in their strategies and ideas for the future development of settlements. The challenges which face cities are constantly becoming more adverse and increasingly harder to combat. Roy (2009) emphasises that although today's cities cover only 2% of the earth's surface, they consume 75% of all resources and produce 75% of all waste. Urban growth rates of the Third World countries have been, and are projected to continue to be, twice as high as the urban growth rate of the more developed nations, and three times as high by the last decade of the century (Hope, 1986). Urban sprawl results in a reduction in urban efficiency, an increase in costs of services, the loss of agriculture, conservation and recreation worthy land. The significant growth of the developing countries' urban population is a direct result of two major factors: rural-urban migration and natural increase of the population. Overconcentration of population in large cities and the emerging problems associated with housing, infrastructure, and social services, has caused many people to believe that there is an increasing trend of 'over-urbanisation' in these countries when seen in relation to their level of economic development (Steyn, 2003).

Hope (1986: 41) emphasises that this ‘over-urbanisation’ is mainly due to widespread unemployment and underemployment in addition to other major problems such as lack of housing and access to urban services, traffic congestion, and environmental pollution. Consequently, there has been massive proliferation of informal settlements on the fringe of major cities, and this is directly associated with numerous factors. The conventional building technologies are beyond the reach of majority of the urban poor population, mainly due to poverty (Steyn, 2003). This situation is worsened by the inability of governments and large businesses to develop a viable economic base that would support and sustain the general population. Obeng-Odoom (2009) states that “African urbanisation is variously referred to as ‘parasitic urbanism’, ‘urbanisation of poverty’ and ‘premature urbanisation’ echoing Professor Mabogunje’s claim that urbanisation has outpaced economic development”. To global economic corporations such as the World Bank, Africa’s urbanisation is “runaway, negatively correlated with economic growth and fuelled by strife in rural areas” (Obeng-Odoom, 2009). This problem, however, is enormously complex and of a multi-faceted nature: economic, sociological, environmental and cultural.

Commodification of cities

The commodification of cities has been widely linked to the idea of sustainability and obtaining the “countryside ideal”. The term “commodification” refers to the process by which goods and services are increasingly produced by capitalist firms for a profit under the conditions of market exchange (Floysand and Jakobsen, 2007: 206). According to Mitchell (1998: 274), commodification has three distinct elements: “goods and services are produced for exchange; exchange is monetized and conducted under market conditions; and the exchange of goods and services is motivated by the pursuit of profit”. Entrepreneurialism and commodification are two concepts that have been recently recognized for change in urban and, to a lesser extent, non-metropolitan communities. Since the early 1970s, investments in landscape and commodity reproduction have become a common activity in many developing settlements (Bunce, 1994). The result is a new type of post-modern community; one which is commonly known as the tourist, recreational, or “heritage shopping village”. This idea is related to a wider debate on the commodification of society that can be traced back to work on the “great transformation” from a non-market society to a market society (Floysand and Jakobsen, 2007). This has many implications for settlement sustainability as commodification

may lead to certain cities having a competitive advantage over others in terms of resource conservation, local production and cultural heritage preservation.

The Sustainable City

The term “sustainable city” implies that major cities should be individually supported by the resources produced within their immediate surrounds. In order for a sustainable city to support its population from local resources, generate its own energy, re-cycle waste, dispose of waste properly and safely and encourage the development of local markets and employment, there are certain mitigating factors which need to be overcome on an immediate level. Unemployment has been acknowledged for having a negative relationship with environmental protection and sustainability as the rural poor are more concerned with meeting their basic needs for survival and a better standard of living. The idea of ‘economic sustainability’ has been thought to be a more plausible option for developing countries. It seeks to maximise the flow of income or consumption that could be generated while at least maintaining the stock of assets (or capital) which yield these beneficial outputs (Maler, 1990). For cities in developing countries which are suffering from overpopulation and increasing urbanisation, such sustainability criteria require that an economic–ecological system remains viable enough to support the needs of current and future generations, bearing in mind the effects of their economic activities. Islam et al. (2003) emphasises that the key question is whether there is an absolute limit on economic growth imposed by ecological (and social) constraints, if so; sustainability is highly dependent on social and environmental costs and benefits.

South Africa, as a country rich in natural resources and opportunities for sustainability, has several challenges to overcome in order to move into a state of complete sustainable living. As Goebel (2007) states: ‘low-cost housing provision has been a major focus of government in post-apartheid urban South Africa, as the government attempts to address historical race based inequalities, poor municipal service provision and contemporary rapid urbanization’. The Housing Indaba, held in September 2005 brought together stakeholders in the low cost housing sector from government, the private sector and civil society. One of the main goals that came from the Indaba was the removal or improvement of all slums and informal settlements in South Africa as rapidly as possible. However, it was established that this could not occur later than 2014. Furthermore, a report issued in 2004 by the South African

Department of Housing submitted to UN-Habitat as part of its commitment to the “Sustainable Habitats Agenda”, pledged commitment to attaining human settlements that are environmentally and socially sustainable, whilst still meeting the goals of economic growth (Goebel, 2007). Even though these policy developments provide some hope for positive change, they still do not fully respond and address the complex challenge of providing services, such as housing and amenities, whilst ensuring a safe and sustainable environment. Another issue which faces South African cities and hinders the process of sustainable development is post-apartheid inequality and segregation in most, if not all, cities and settlements in South Africa. In order for South Africa to achieve sustainable urban centres and sustainable city living, these challenges need to be addressed from the onset.

Another concept which South Africa needs to consider in order to obtain sustainability in its urban areas is the idea of urban and peri-urban agriculture. May and Rogerson (1995) reveal that major United Nations research programmes, such as the Sustainable Cities joint initiative of the UNHCS/UNDP/World Bank, now include operational frameworks for urban agriculture research to assist in guiding better urban management. It is clear that local food and resource production are essential in achieving the status of a sustainable city. An analyst for the Food and Agricultural Organisation echoed this sentiment: "production of food in urban and peri-urban areas, in addition to improving the nutritional quality of the diet, can become a valuable income-generating activity for the unemployed and underemployed and can utilise spare and unused lands available in the cities" (Goebel, 2007). The United Nations Centre for Human Settlements identified that an integral component of planning for national shelter strategies is the access for the urban poor to land for food production. The major advantage of urban and peri-urban cultivation is its potential to improve the socio-economic position of the poor, addressing the ongoing issue of inequality which inhibits the success of sustainability in South Africa.

The PED Nexus

The PED Nexus, developed by the Department of Social Development, is a concept of the interactions between the Population, Environment and Development. This concept refers to the complex, multiple and reciprocal relationships and interface that exist among populations, environment and development factors anytime and everywhere (Pelser and Redelinghuys, 2009). These factors are constant and dynamic thus are mutually dependent on each other.

The concept supports that the extent of human impact on the environment is a function of three interactive processes: the population size, their per capita consumption and the environmental cost and benefits of the technology used to produce what is consumption, shown in Figure 1 below.

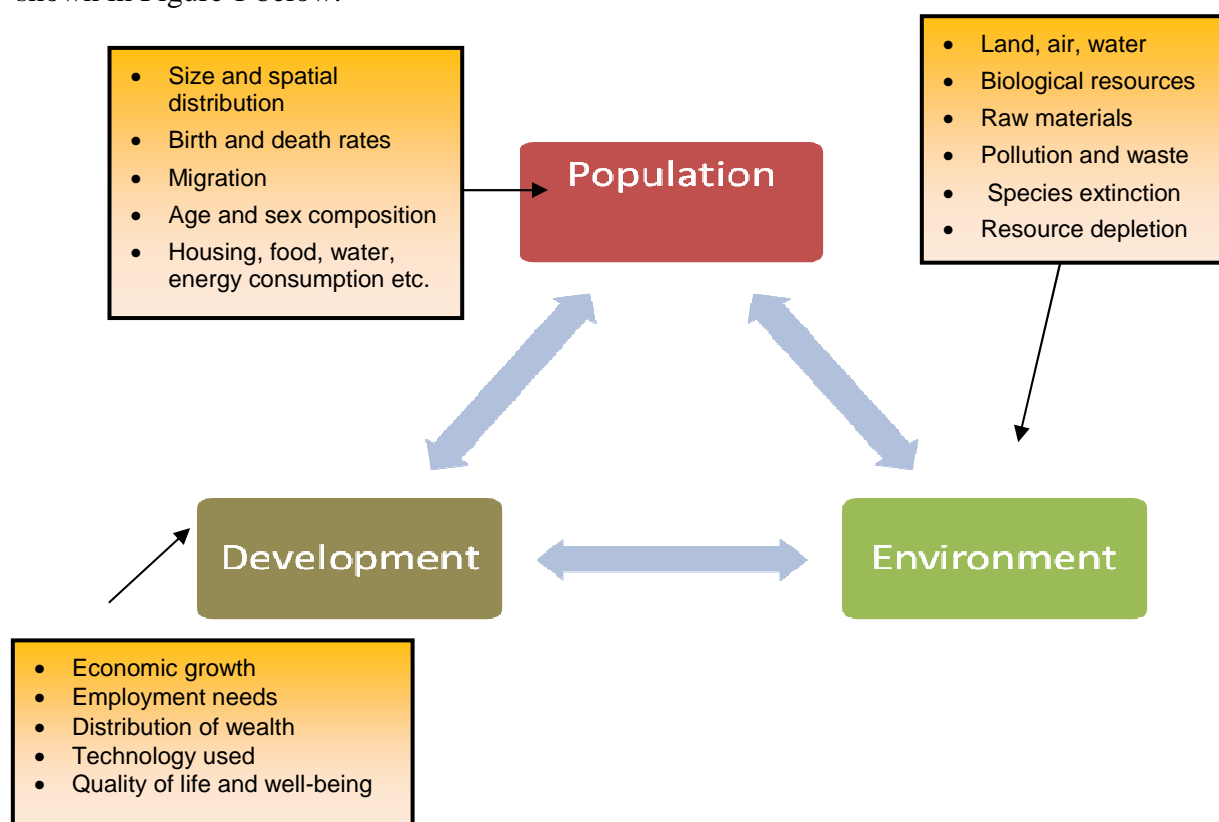


Figure 1: The PED nexus (Pelser and Redelinghuys, 2009).

With a growing population, it is inevitable that consumption will increase and therefore new technologies will be developed, and smaller cities, such as Grahamstown, are no exception. However, most of the goods sold in the town, such as food and appliances, are not produced locally. This then exacerbates the impact it has on the environment as this practice is not sustainable. It is also important to acknowledge that the three factors of environmental impact never work in isolation. Grahamstown, for example, is growing in size, but for this growth to be sustainable the “Triple Bottom Line” principle described in Pelser and Redelinghuys (2009: 8), needs to be understood. This highlights that any development initiative should include social and environmental factors in addition to the economic benefits and considerations of such a development. Furthermore, the cultural division and unemployment

in Grahamstown is impacting on the environment significantly, because more people tend to depend a great deal on the natural resources.

State of the Environment reporting and the DPSIR Framework

In order to explore the most conceivable possibilities for the creation of sustainable cities in a developing country such as South Africa, there is a need for strategic frameworks and plausible procedures on how the country could achieve full employment of its citizens, adequate service delivery such as proper waste removal, less environmental degradation from urbanisation and overpopulation, and support of local food and resource markets. The drivers and interactions between stakeholders in human settlements need to be fully understood and considered when suggesting a method of sustainable living for a city such as Grahamstown. A State of the Environment Report is such a method, or tool, which can communicate information effectively, integrating various environmental, social and economic indicators. In terms of Grahamstown, urban sustainability indicators are crucial for helping in terms of target setting, performance reviews and facilitating communication among the policy makers, experts and the locals (Islam *et al.*, 2003). By conducting such a report and involving all the necessary indicators, the measurement of progress towards sustainable development in Grahamstown and South Africa can be facilitated. Moreover, in order to assess the level of sustainability in Grahamstown, how it has changed over time and how it relates to the settlements patterns which influence it, a State of the Environment report needs to be conducted using a certain set of relative objectives.

Using the DPSIR framework, which includes driving forces of environmental change, pressures on the environment, state of the environment and relative trends, impacts on all spheres of the environment and response of society to environmental status and trend, we can form the basis for analysis of human settlement in Grahamstown and its corresponding level of sustainability. By recognising the link between drivers, pressures, responses, impacts and the state of the environment, a cross-field investigation of Grahamstown's settlement patterns was carried out with a particular focus on the key issues and challenges which face this growing city.

Study aims and objectives

Our study was conducted in the form of a research project which assessed the state of environment in Grahamstown in terms of settlement patterns and sustainability. Grahamstown has a surrounding informal settlement which places a huge demand on the municipality and its ability to deliver basic needs and services sufficiently to the growing population. Thus, the informal settlements on the periphery of the city were included in the study as they contribute significantly to resource use, demography, production of waste and sustainability. We assessed the population growth and sustainability of Grahamstown with the use of several consumption indicators as well as surveys of local markets, households and sectors of the municipality. This research formed the basis of our State of the Environment report, drawing conclusions on whether the patterns of settlement and growth in Grahamstown allow for it to be deemed a Sustainable City.

AIM

Our study aims to determine patterns and sustainability of human settlement in the city of Grahamstown.

OBJECTIVES

- i. Determine the patterns of human settlement in Grahamstown over time.
- ii. Determine the patterns and rates of economic activity in relation to human settlement in Grahamstown over time.
- iii. Establish patterns and rates of infrastructural development over time in relation to human settlement in Grahamstown.
- iv. Establish patterns and rates of institutional development over time in relation to human settlement in Grahamstown.
- v. Establish patterns of local food production in relation to human settlement.

STUDY AREA- GRAHAMSTOWN IN THE EASTERN CAPE, SOUTH AFRICA.

Brief history of settlement patterns and infrastructural development

Grahamstown is the heart of Makana Municipality, located in the Eastern Cape of South Africa. Grahamstown is situated at a latitude of approximately $33^{\circ} 18' 0''$ S and at a longitude of approximately $26^{\circ} 28' 60''$ E. This city was established in 1812 by Lieutenant-Colonel John Graham as an attempt to keep the Eastern Cape (then frontier) under British Colonial influence (O'Meara and Greaves, 1995). Grahamstown's initial population growth occurred during the 1820's when a great drought struck the area thus forcing many 1820 settlers to leave the surrounding farming community and establish themselves in a more secure and modern environment within Grahamstown (O'Meara and Greaves, 1995). By 1852 the influx of people into the area had peaked, and thereafter Grahamstown was formally known as the capital and cultural centre of the Albany area as well as the largest city after Cape Town (O'Meara and Greaves, 1995).

Grahamstown's infrastructure became established in 1813 with the first building being erected. This was used as a jail, holding many British Colonial prisoners as well as Xhosa warriors who launched attack on British authorities in an attempt to remove them from the area in 1819 (O'Meara and Greaves, 1995). Post colonialism, the prison was renamed the Yellow House and has since been used as a public library, school and restaurant.

In 1853, a Bishop of Grahamstown was elected and thereafter Grahamstown was officially proclaimed a "city" rather than a "town" (McIver, 2011). In 1904, the Rhodes Trust invested in the city of Grahamstown and thus opened Rhodes University College which became one of the major educational institutes in the region. In 1951 the college formally became Rhodes University providing internationally renowned tertiary education to citizens from all over Southern Africa (O'Meara and Greaves, 1995).



Figure 2: Map of Grahamstown (Solomon, 2010)

Demography

In terms of ethnicity, race, and population statistics, Grahamstown is said to be one of the most segregated cities within South Africa (O'Meara and Greaves, 1995). Whilst the inner city is dominated by the white population, the neighbouring townships have a large growth rate of black and coloured majorities (O'Meara and Greaves, 1995). According to STATSA (2003) the population of the greater Grahamstown is 124 758 of which 77.4% are Black, 11.8% Coloured, 10% White and 0.7% Asian.

Climate

According to Cowling et al. (1997), the city of Grahamstown is situated between four different climatic zones. Thus, weather patterns and conditions are particularly unpredictable, often leading one to experience rain, sunshine, extreme heat and cold in one day (Cowling et al., 1997). The mean temperature in summer is 26°C and 18°C in winter (Cowling et al., 1997).

Vegetation

Although unpleasant for residents, this variable climate provides a suitable environment for many different plant species and vegetation types to flourish. Subtropical thicket is the dominant biome within the region and consists mainly of evergreens, succulent trees, shrubs and vines, as these plants are able to easily adapt to extreme climatic conditions (Cowling *et al.*, 1997).

Land Use

As previously mentioned, Grahamstown is a particularly diverse environment dominated by agricultural activities such as crop and livestock farming as well as high harvesting rates of natural fuel wood (Martens, 2009). This is due as there is a widespread distribution of informal settlements within Grahamstown which stereotypically host members of the community with very little, or no income. Thus, many of these citizens rely on the surrounding commonage for crucial needs as well as for economic potential. There are three main regions of the Grahamstown commonage namely; the southern commonage, the eastern commonage and the northern commonage (Martens, 2009). Whilst the southern and eastern commonages are predominantly used for grazing of cattle, growing of crops and collection of fuel, the northern commonage is dominated by recreational use particularly by local white residents (Martens, 2009).

Although the commonage is used by local residents, its upkeep and monitoring is the responsibility of the Makana Municipality, Grahamstown's local government. This is not an easy task due to the current drought which Grahamstown is experiencing as well as the overuse of the land. Martens (2009) confirms that the tragedy of the commons regime is also a significant proposition to this area whereby local users exhaust land of its essential properties in fear of other users receiving more benefit than themselves. This leads to severe land degradation and the breakdown of ecosystems.

METHODS

Data Collection

Petrol sales as an index of economic activity

Annual petrol sales from Beaufort Service station were viewed as a meaningful index of the overall economic activity and consumption in Grahamstown. The petrol station provided sales data from the period November 1995 to December 2010. By adding the total litres sold in each month, total annual sales were calculated and graphed. The manager from the Beaufort Service Station was interviewed to explain certain factors that may have affected petrol sales during specific time periods.

Questionnaires

A sample size of a hundred questionnaires was used to determine the rate of human settlement in Grahamstown and to obtain information on economic activity of members of the public (Appendix 1). Questionnaires were taken from five locations in Grahamstown, thus a total of 20 surveys were completed at each location. The locations used were:

- High Street
- Pick 'n Pay in Pepper Grove Mall
- Local Produce market outside Old Gaol
- Shoprite in Beaufort street
- Various intersections in the neighbouring informal settlements

The data collected from the surveys were entered into an excel spread sheet to allow adequate analysis of the data to be represented in a graphical form and further used in GIS.

With regards to objectives (i) and (ii), the questionnaires helped acquire background information on the people in Grahamstown and their views on service delivery, economic activity and sustainability. This, in conjunction with census data obtained from Stats South Africa of 2003, was used to make a comparison of settlement patterns over time. This information also included the employment status of members of the public. More recent information from the Municipality was difficult to obtain as the municipality archives were not in order and various employees were striking during the data collection period. With

regard to objective (v), details were asked as to the location of where the majority of household food was purchased in order to determine the sustainability of produce consumables of Grahamstown and whether there was knowledge that these are being bought within the Grahamstown biosphere.

Orthophotos and GIS

With regards to objective (iii), aerial photographs at scales of 1:32 000, 1: 36 700, 1: 52 000, 1: 61 000 and 1: 40 000 provided by the Environmental Sciences department of Rhodes University, were used to determine the geographical landuse types and how each sector of the city has expanded spatially, using the cut-and-weigh method. Five photographs were used, representing the period of 1949 to 2009. As the photos were all at different scales, the scales had to be determined using a 1: 10 000 map of Grahamstown as a basis for calculation. These photos were photocopied and the total area of the cities in each year was determined. Within this total area, the area of each landuse type was calculated. The landuse types were divided into the following categories:

- Urban formal
- Urban informal
- Industrial
- Recreational
- Commercial
- Army base
- Rhodes University campus

For each map, the landuse area was cut out and weighed on a scale to establish the area. It was calculated that 1 cm² of paper weighed 0.01g, therefore with the weight of each land use type, the area was calculated. Once this was determined for the respective years, the data was tabulated and further analysed to show a trend in geographical expansion and development in Grahamstown.

Employment data of members of the public (obtained from the surveys) combined with GIS was used to show the proportion of the public who are currently unemployed at each of the locations. This provided a comparison between employments of people in different areas of Grahamstown from which the surveys were taken. Through the use of Global Positioning Systems (GPS), provided by Rhodes University's Department of Geography, x and y coordinates were obtained of the 5 locations where the surveys were conducted. This, combined with employment status, was used to demonstrate the differences of employment in different areas of Grahamstown.

ASSUMPTIONS AND PITFALLS

Assumptions

Due to the nature of this study, there are various aspects which must be considered with regards to the reliability of the data at hand. It is assumed that the information and data obtained from Statistics South Africa is accurate as well as the information and data obtained from the Makana Municipality. Although the aerial photographs used for this study are from a credible source, it is assumed that the calculated scales are correct and furthermore that these aerial photographs were taken during the alleged periods suggested by the Rhodes University Geography Department. A large portion of data was obtained through a survey interview process, thus, one presumes that the respective individuals which part took in this research were honest in providing feedback and other required responses. In addition, only a hundred surveys were collected during data capture, thus, whilst these were performed at various collection points around town, it is assumed that the sample groups selected were a fair representation of the greater Grahamstown population.

PITFALLS OF THE STUDY

Whilst carrying out this project there were numerous limitations faced, particularly with regards to finding the correct methodology to go about measuring sustainability. The lack of appropriate research on human settlement patterns in the city of Grahamstown was a major limitation as well as the difficulty in obtaining up to date statistics on the Grahamstown population and employment rates. Another major shortcoming was the lack of response from Pick 'n Pay supermarket. A letter had been sent to the appropriate manager requesting the recorded sales of Coca-cola for the period of 1990 to 2010. As Coca-cola is an imported entity from outside of the greater Grahamstown biosphere, such records would have

represented the rates of consumption and the cities reliability on externally produced luxuries. Furthermore, some individuals did not take kindly to part taking in the survey or interview process. Thus, it was often challenging to find members of the public to become involved in this aspect. Lastly, time constraints were also a limitation and thus it was not possible to carry out research on all the relevant variables or indicators from the human settlement chapter, and so forth, only a few indicators from the State of the Environment report were selected.

RESULTS

Figure 3 shows that the consumption of petrol over the past 15 years in Grahamstown has increased significantly. In 2002 there was striking decline in the sales of petrol. Overall, it can be established that there is a general trend of an increase in petrol consumption in Grahamstown, indicating that it is likely that sales will continue to rise over time ($R^2=0.7334$).

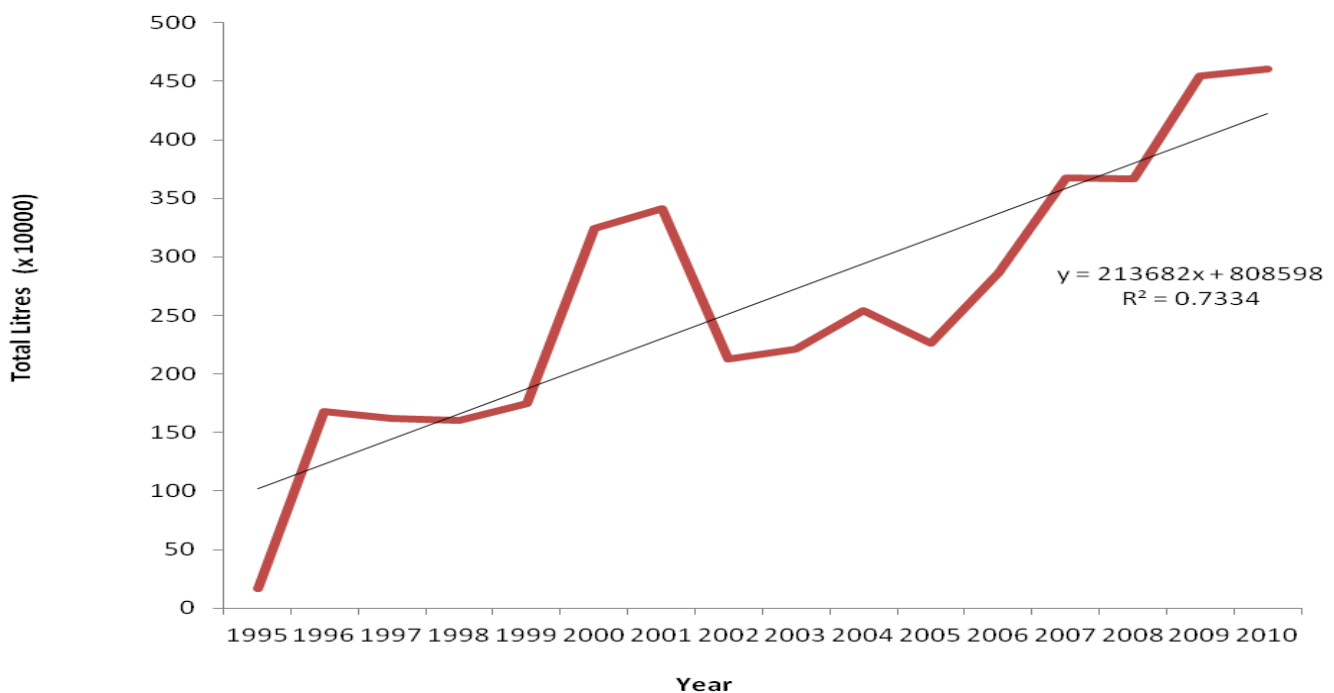


Figure 3: Annual petrol sales from 1995-2010 from the Beaufort Petrol Station, Grahamstown

Figure 4 illustrates that most of the township residents in Grahamstown were satisfied with the quality of the service delivery of the Makana Municipality. Over 70% of the residents strongly agree that there is regular waste collection, while less than 5% strongly disagree. There is a mixed reaction in respect of water quality and this can be seen in the more evenly spread percentages across all four categories. The vast majority of the participants have access to running water, with 33% and 53% agreeing and strongly agreeing respectively.

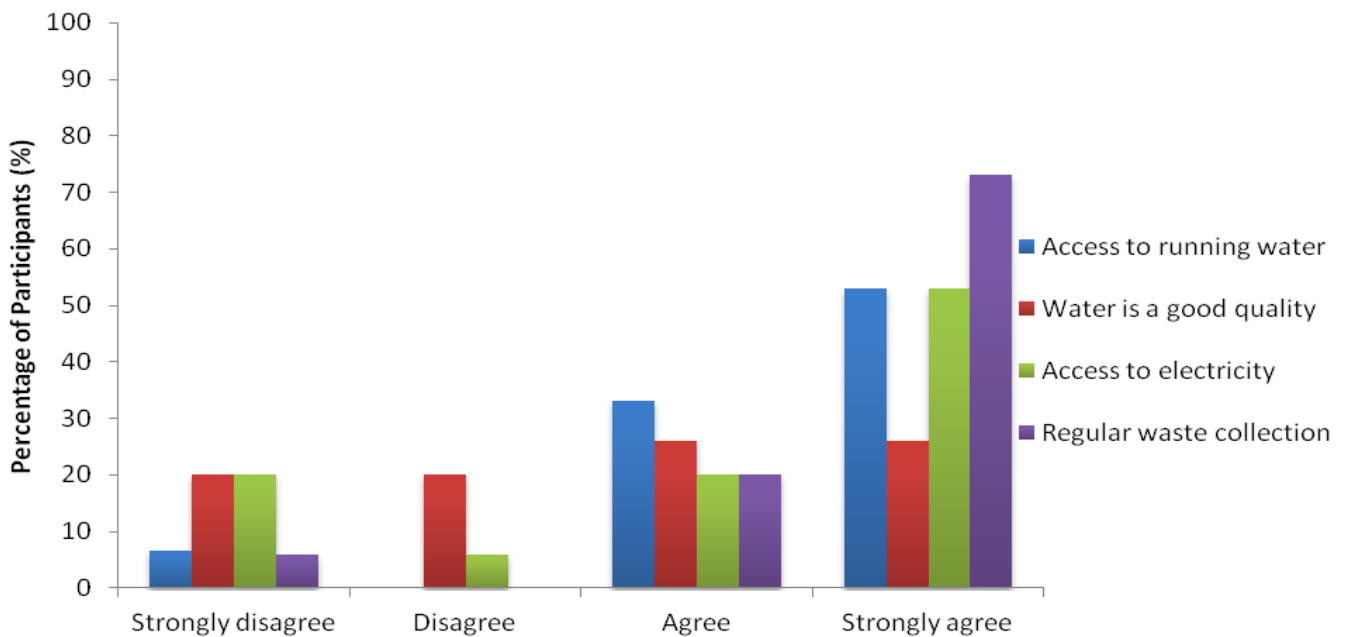


Figure 4: Township residents response to the quality of Makana Municipalities' service delivery

Figure 5 illustrates that the vast majority of the township residents interviewed believed that there were not enough employment opportunities in Grahamstown. 73% of the residents strongly disagreed with the statement the there are enough employment opportunities in Grahamstown, while only 6% of the interviewed residents strongly agreed.

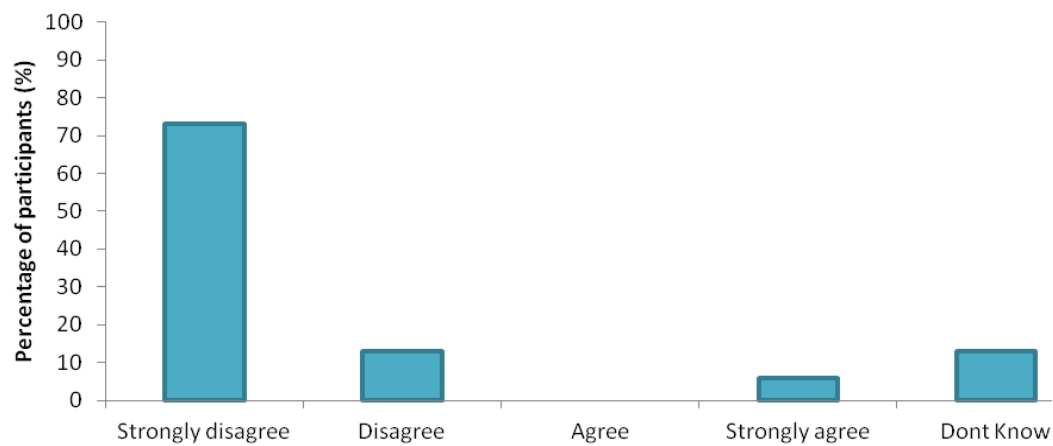


Figure 5: Township residents response to the idea that there are enough employment opportunities in Grahamstown

Figure 6 shows that 66% of the township residents purchased the majority of their food and produce at retail outlets. Only 26% stated that they buy their food at local markets. It is worth noting that none of the residents interviewed stated that they buy from any local farms in and around Grahamstown.

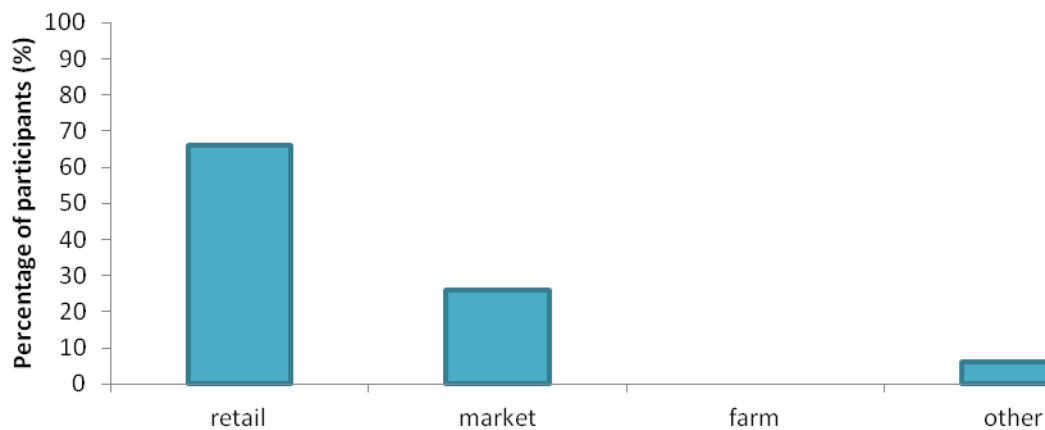


Figure 6: Outlets from which township residents purchase their food and produce

Figure 7 shows the percentage of participants who felt that they use water and electricity sparingly and who recycle waste adequately. In the township 12% of the participants strongly disagreed that they used water and electricity sparingly and 33% strongly disagreed that they recycled waste adequately. 32% of the participating population in the location disagreed that

they recycle waste and none disagreed that they use water and electricity sparingly. 53% of the participating population agreed that they used water sparingly and 11 % agreed that they recycle waste adequately. However, 32% of the population of the participating population in the location strongly agreed that they use water and electricity sparingly and 20% strongly agreed that they recycle waste adequately.

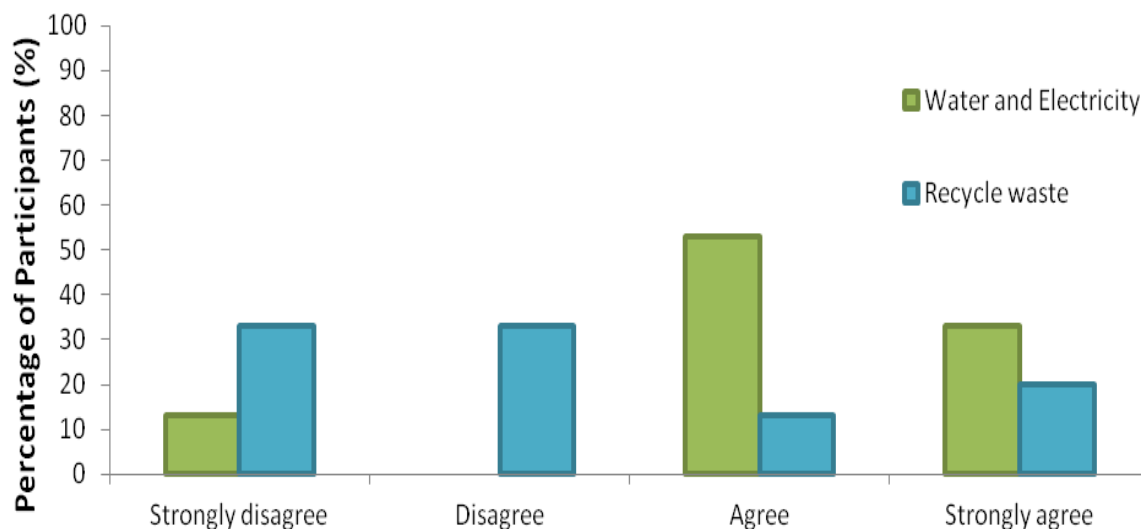


Figure 7: Percentage of participants from the township who feel they use water and electricity sparingly and recycle waste adequately

Figure 8 shows the participants from Pick ‘n Pay which were interviewed. 9% of the participating population strongly disagreed that they used water and electricity sparingly and 22% strongly disagreed that they recycled adequately. 19% of the population strongly agreed that they use water and electricity sparingly, with 20% of the population strongly believing that they recycled waste adequately. Thus, there is no major discrepancies between the participants who live in urban formal areas and purchase products from commercial centres such as Pick ‘n Pay who feel that they do their best to recycle and save water and energy, and those who feel that they do not.

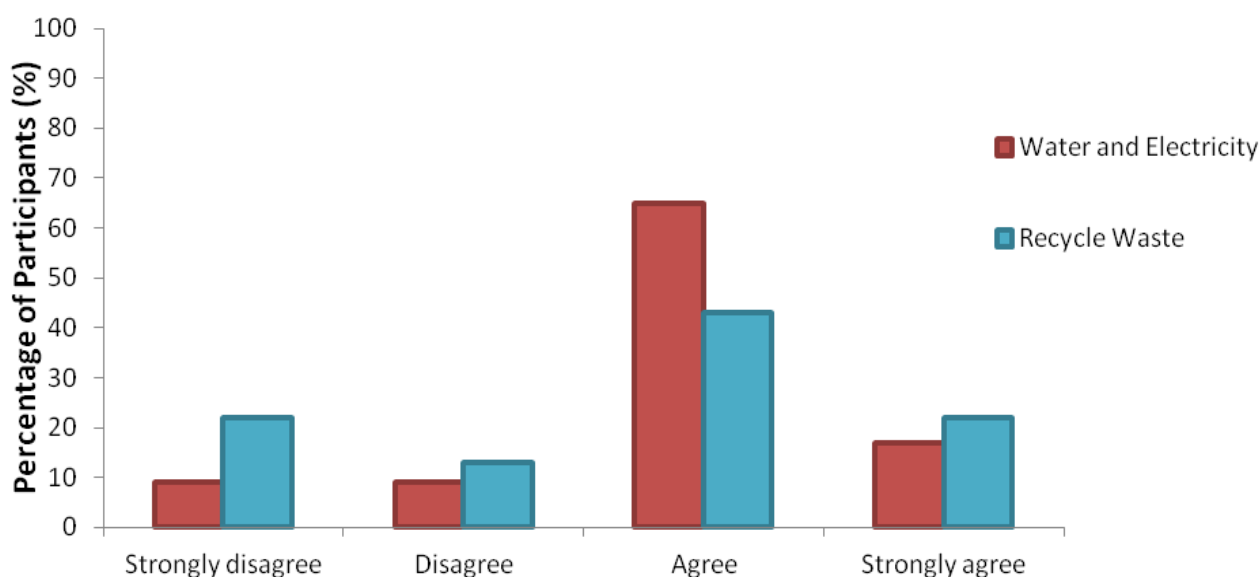


Figure 8: Percentage of participants from Pick 'n Pay who feel they use water and electricity sparingly and recycle waste adequately

The questionnaire addressed the issue of whether or not the participants who shopped at commercial outlets such as Pick ‘n Pay were aware of the local produce farms around Grahamstown. It was established that, although they do not purchase fresh produce from such farms, 74% were aware of the farms and 26% were not. This indicates that these participants are not supporting local produce initiatives and find it easier to purchase food from a nearby commercial outlet.

Figure 9 illustrates the percentage of participants that believe the area they reside in is hazardous towards resident’s health in terms of environmental factors. 42% of the Pick ‘n Pay participants strongly disagreed that the area they stay in is hazardous to them and 20% of the township and local market participants believe that the areas they live in is environmentally hazardous. 19% of the participants from Pick ‘n Pay agreed that their area is hazardous to their health in some way, whereas 26 % of the township participants and 7% of the participants at the local markets strongly believed that their area is hazardous to their health from an environmental perspective. It is important to note that none of the participants from Pick ‘n Pay, the majority of which resided in the urban formal residential area, strongly agreed that their area poses health problems to them due to the level of degradation of the surrounding environment.

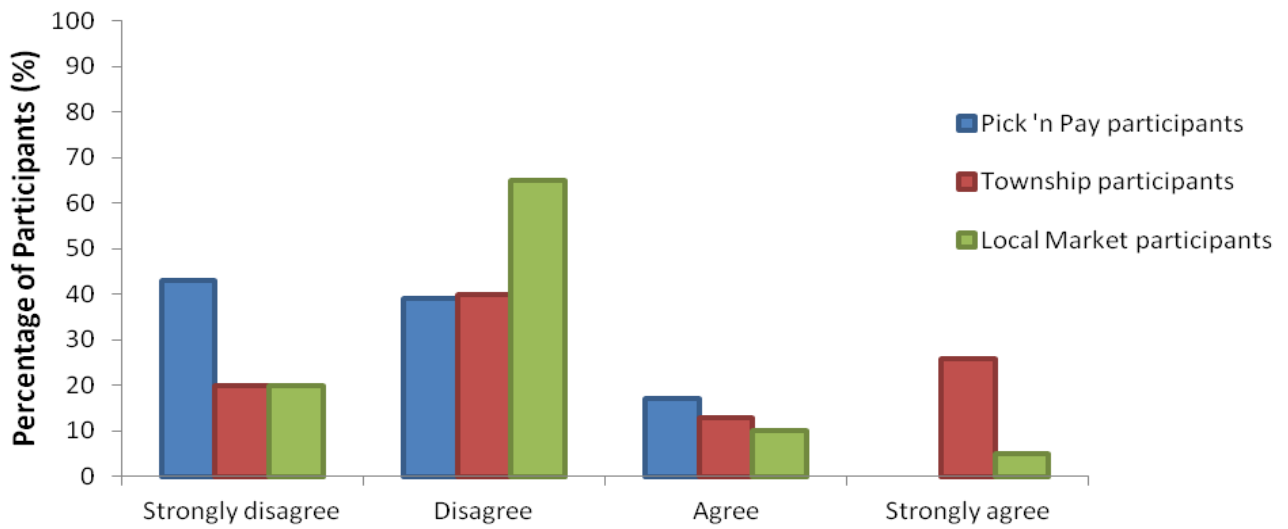


Figure 9: Percentage of participants who believe the area they live in is hazardous to their health from an environmental perspective

Figure 10 shows the percentage of participants that feel that the Grahamstown’s current infrastructure will not be able to support the growing population in the future. 95% of the participants from Pick ‘n Pay agreed with this statement and felt that the population is growing too rapidly for the current infrastructure to handle. 100% of the Shoprite participants agreed with this, indicating that there is almost a unanimous agreement that more needs to be done to the state and quality of Grahamstowns infrastructure to accommodate for the future population.

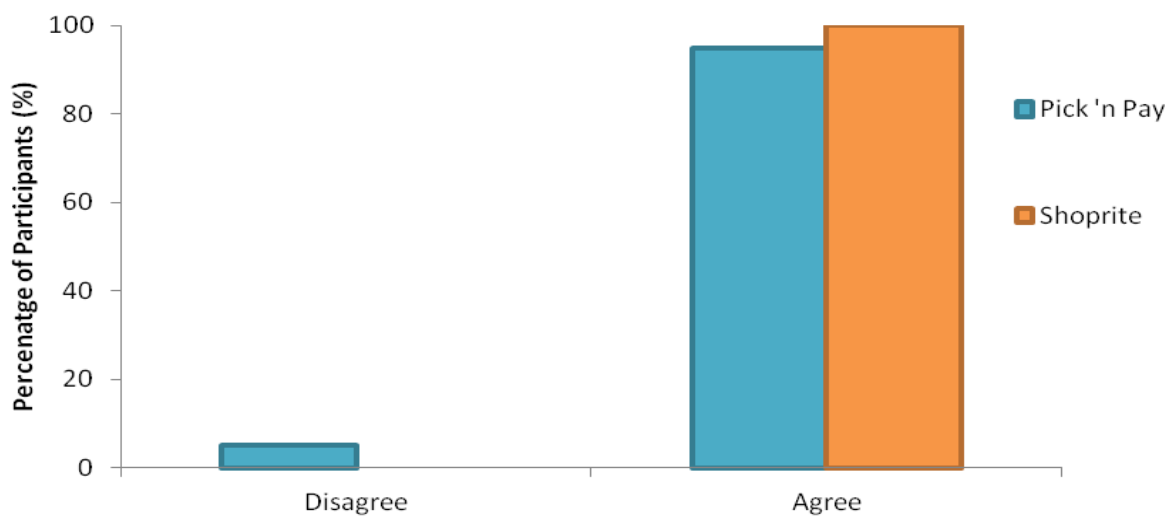


Figure 10: Percentage of participants that believe Grahamstowns current infrastructure will not be able to support the population in the future

Figure 11 indicates the percentage of participants who understand and support the concept of Sustainable development. 73% of the participants from the township did not understand nor support this concept. On the other hand, the participants from Pick ‘n Pay had some understanding, with 48% agreeing and 22% strongly agreeing with this statement. Thus, there was a notable difference between the township residents and the residents from the urban residential areas regarding their understanding of the concept of sustainable development.

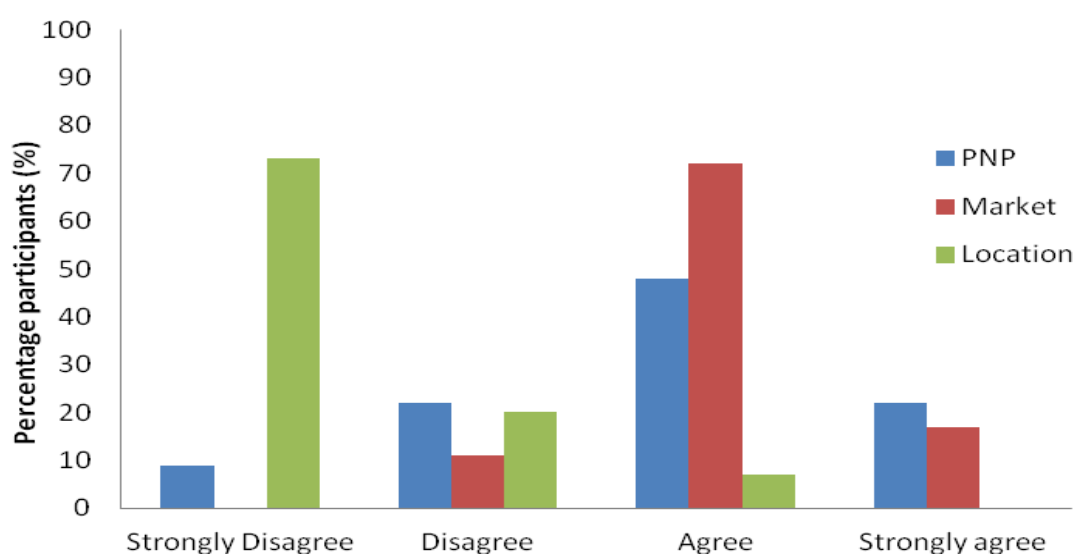


Figure 11: Percentage of participants who understand and support the concept of sustainable development

Figure 12 represents the spatial growth (in ha) of Grahamstown over time in terms of each of the major land use categories. The urban formal and urban informal (township) sectors have notably expanded the most since 1949, although their growth peaks occurred at different times. The urban formal sector grew from 240 ha in 1940 to 775 ha in 2009, and the urban informal from 350 ha in 1949 to 800 ha in 2009. The urban formal sector experienced rapid expansion during the period of 1963 to 2005, and has continually expanded since. The urban informal sector, however, only experienced rapid expansion after 1998, with a rapid rise since. Soon after 1949, the industrial sector expanded extensively and has expanded at a constant rate. The military and recreational sectors have remained more or less constant in size with a very gradual increase. The commercial sector has gradually and consistently increased in size from 1949 to around 1970, and then further increased after that, with a gradual expansion from year to year. Overall, the total size of Grahamstown has vastly

increased since 1949 from 640 ha to 2140 ha in 2009, indicating that this city has experienced rapid urban, commercial, industrial and rural expansion.

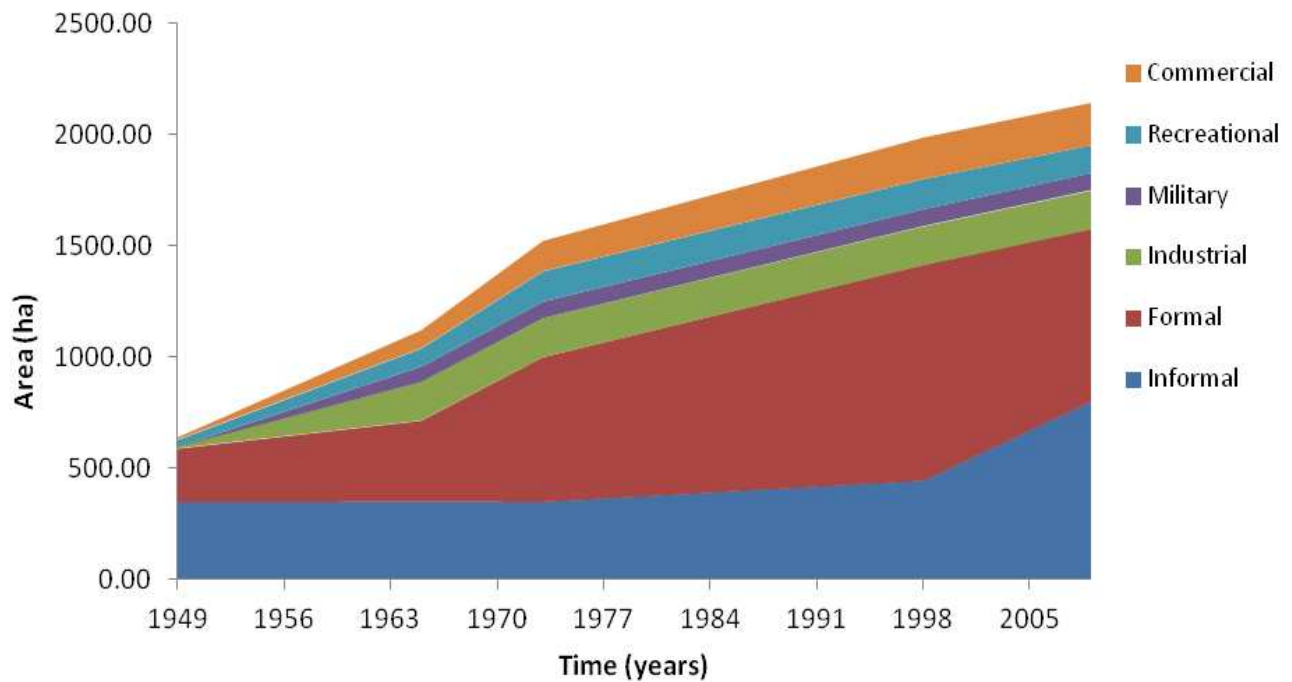
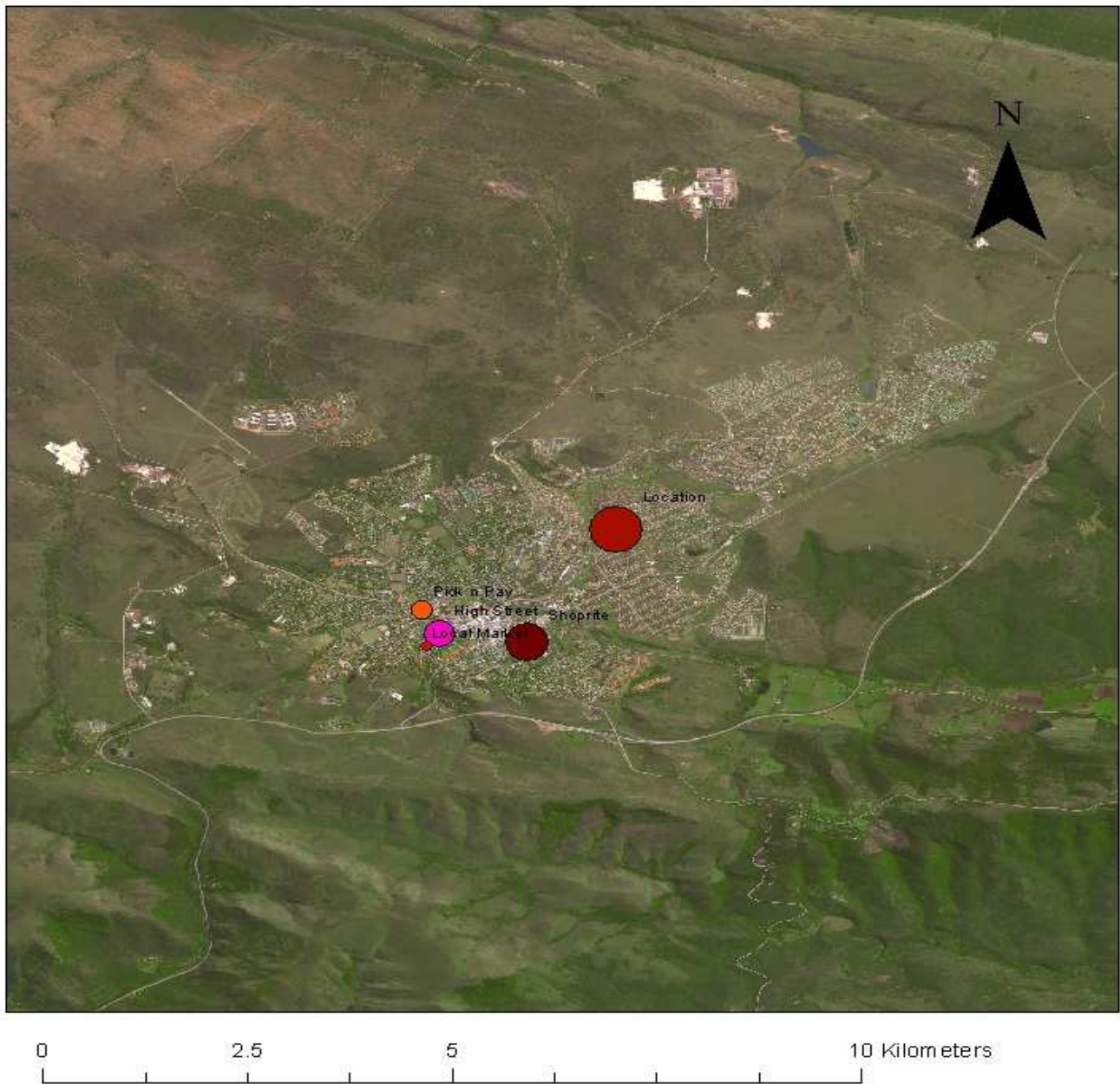


Figure 12: Growth in area (ha) of the different land use sectors in Grahamstown over time

Figure 13 shows the percentage of unemployed residents in each of the 5 survey locations. The proportion of residents that were unemployed was combined with the GPS points from each survey location in order to represent which location had the highest and lowest percentage of unemployed residents. The highest percentage of unemployed residents was in the location (85%). The lowest unemployment was amongst the participants from the Local Market (25%). Pick 'n Pay also showed a low amount of 30% unemployed compared to the 40% unemployment of High Street and 50% at Shoprite. This data correlates with figure 11, indicating that there is a relationship between employment and supporting the notion of sustainable development.

Percentage Of Unemployment 2011



Legend

Unemployment % Of unemployed

- >25%
- 25% - 29.9%
- 30% - 39.9%
- 40% - 49.9%
- >50%

Figure 13: Unemployment in Grahamstown in 2011

DISCUSSION

The future of our cities: striving for sustainability

We live in an interconnected world where actions reverberate over time and across the globe. Sustainability, based on a long-term view that the needs of humanity and the environment are interconnected, is rightly high on the agenda. Society and policy makers in the 21st Century face one of the most daunting challenges yet, establishing a way to reconcile the economic and social needs of urban populations in ways which are sustainable. This involves ensuring the well-being and a good quality of life for citizens in an environmentally sustainable manner. Our study aimed to assess the state of the environment in Grahamstown in terms of settlement patterns and sustainability with a particular focus on the settlement patterns of the city, rates of economic activity, infrastructural development and patterns of local food production in and around Grahamstown.

Cities, such as Grahamstown, originally arose from the desire of humans to meet, exchange and interact. They offer a basis for the interaction of people with different interests, experiences and knowledge. This provides the opportunity for social diversity which is as necessary for human well-being as bio-diversity is for the environment. Cities are the centers of economic development and innovation, the major source of movements for democratic and social change and a stimulus to culture. However, they also have a major impact, often negative, on environments all around the world. It may be possible for the principles of sustainability to be applied to cities. Guidance on how this can be done was not clearly stated in Agenda 21 or other United Nations documents (Keating, 1993). Anders (1991:17) in a global review of the sustainable cities movement, stated: “The sustainable cities movement seems united in its perception that the state of the environment demands action and that cities are an appropriate forum in which to act”. Other studies have suggested that any sustainability initiatives should be focused on strategies for designing, redesigning and building sustainable cities (Yanarella and Levine, 1992: 760). It is thought that cities are the foundations which shape the world, thus sustainability initiatives and processes will never be successful unless related to cities and the way in which they function.

Indicators as a measure of economic activity

Our study focused on many different measures and indicators to assess the settlement patterns of the city in relation to sustainability. As Gagliardi et al. (2007: 795) highlight, an indicator

furnishes a synthetic description of an environmental reality, by a value or a parameter. By using petrol sales at a local petrol station as an indicator, we were able to see a clear trend in the rise of sales over time, indicating high levels of economic growth. It goes without saying that economic growth and development alter the structure of an economy by changing the relative importance of different sectors and spatial population distribution and concentration (Kimuyu, 1993: 403). Consequently, these structural shifts are accompanied by changes in the structure of energy demand arising from changed fuel requirements and use propensities. Urbanization promotes intensive energy needs and use tendencies as it is responsible for shifting increasingly larger proportions of the population to commercial and administrative centres during development. Kimuyu (1993: 403) emphasises that these demanding tendencies include increased reliance on the energy intensive transport sector enhanced by increased rural-urban, inter and intra-urban transport requirements. The Beaufort petrol station is used mainly by public transportation which transport residents from the informal settlements in and out of the city daily. Thus, the sales from this specific station indicate how the informal settlement surrounding Grahamstown has expanded vastly, as the figures from 2007 to 2010 indicate high sales of petrol, which are continually increasing.

In a study conducted by Kimuyu (1993) on urbanisation and the consumption of petroleum products in Kenya, it was established that urbanization appeared to have a positive impact on the consumption of most petroleum products. Kenya splits its total throughput equally between the domestic and regional re-export markets, having important implications for sustainability in the country. Furthermore, these facilities influence the type and quantity of products available in the market, thus regulating fuel choices and use inclinations. This emphasises how the growth of rural settlements around Grahamstown an increasing urbanisation has definite impacts on the consumption of petrol and other products in the city.

The link between sustainability and economic performance is vital in developing countries and growing cities such as Grahamstown.

The quality and efficiency of Makana Municipalities' service delivery

South Africa's constitution states that "government is constituted as national, provincial and local spheres of government which are distinctive, interdependent and interrelated" (Layman, 2003: 8). The constitution also mandates local authorities to ensure the provision of services

to local communities in a sustainable manner. Post-apartheid policies have aimed at focusing on the effective and efficient delivery of services to the majority, particularly those who were previously deprived of basic essential services such as water and sanitation, housing, electricity and health facilities. Makana Municipality has this task for Grahamstown and the surrounding areas, where a large proportion of its residents live in rural communities. The responses of residents in the surrounding townships regarding the quality of Makana's service delivery revealed that the majority of the population surveyed was satisfied with the delivery of water, the quality of water and their access to electricity. Only a small percentage (20%) were dissatisfied with these aspects, indicating that Makana has succeeded, to a certain degree, in satisfying the majority of their population in terms of basic needs.

At this stage in South Africa's development, the government's policy of improving the living conditions of poor households by directly increasing access to basic services is taking place alongside the slow process of transformation and capacity building at municipal level (Khumalo *et al.*, 2008:4). Thus, it is a near impossible task for local municipalities all over the country to sufficiently provide basic needs and services to each and every resident in their area. A factor worsening the issue is that many municipalities face problems of severe lack of funds to carry out their constitutional mandates to improve the quantity and quality of basic services to citizens (Khumalo *et al.*, 2008: 4). Plummer (2000: 6) reveals that local government services backlogs in South Africa are estimated at between R47 – R53 billion, with an annual service backlog of R10 billion. These amounts are required for municipalities, such as Makana, to increase access to services and deal actively and successfully with the immense backlogs. Townships which surround urban areas such as Grahamstown are characterized by a general lack of affordability amongst poor households. These factors aid in reducing the flows of funds to Makana for service delivery, thus causing their task of handling the backlogs in basic social services extremely difficult (Khumalo *et al.*, 2008: 7).

Customarily, the provision of basic services was seen as primarily the preserve of the state and public institutions. Stacey (2007: 80) highlights that the current idea is that state institutions or local authorities should create a framework of policies, regulations and incentives to facilitate non-governmental actors with the necessary institutional and technical expertise, capacity and financial resources to aid in the direct provision of services to the community. However, this poses many issues as often such alternative service delivery options are not properly regulated by the government. The notion of municipalities ceding

service delivery responsibilities to independent providers presents the major concern in that the socio-economic rights and entitlements of the poor will be compromised as commercially oriented service providers are often only concerned with making profits (Khunou 2005: 70). In addition, Hemson (2002:70) states that: “ there are several other problems associated with such alternative service delivery arrangements: corruption in the tendering and contract drafting processes, higher user fees, inflated directors’ fees, wide scale retrenchments and anti-union policies and practices”. The South African Communist party offers a very valid point that alternative service delivery options may be highly beneficial given the current resource constraints and institutional capacity boundaries of municipalities, as well as the fact that drawing the private sector into delivery of municipal services does not render local governments “weak”, it may actually serve to strengthen local government and enhance its credibility if carried out appropriately (SACP, 2010). Makana Municipality should consider alternative arrangements for the provision and purification of water as well as the generation and supply of energy as this works to improve the quality of service delivery to all residents as well as creates a pathway for job creation.

Unemployment: a bump in the path to sustainability?

Unemployment and its rise are viewed by some as the most severe threat facing South African society and its governance. Kingdon and Knight (2003:381) highlighted that unemployed people in various developed countries have much lower levels of satisfaction and well-being than those who are employed, thus rejecting the notion that unemployment is voluntary. However, in developing countries such as South Africa, it is possible that unemployment is due to a severe lack of job availability and a lack of willingness to search. There is evidently a lack of productive activities available to peri-urban communities. Models of rural–urban migration, which would typically take place in a city such as Grahamstown, emphasise that there is an equilibrium level of urban unemployment. This equilibrium condition is that, with the urban formal sector wage higher than the competitive level, the “expected wage” is equal to the rural supply price (Kingdon and Knight, 2003: 381). The results from our study showed that residents from the township strongly disagreed with the idea that there are enough employment opportunities in Grahamstown. Ayanda Kota (2010), chairperson of the Unemployed People’s Movement, highlighted how much of Grahamstown’s unemployment may be due to the closure of many labour absorbing industries. These include the railway from Grahamstown to Alicedale, a kaolin processing

factory and a large poultry farm, all of which left many labourers without work and unequipped with the skills needed to acquire jobs in the city.

Land use and the geographical expansion of Grahamstown

In concert with technologies and consumption styles, the form of settlements and the way human activities are organised in geographical space represents vital research fields as far as ecological equilibria are concerned (Camagni *et al.*, 1998: 104). Land consumption is directly dependent on the relative solidity of human settlements and on residential density and energy consumption. It also indirectly depends on these variables due to their linkage with mobility patterns such as trip length and modal choice between private and public means. With respect to the land use and the physical expansion of Grahamstown, it is evident that there has been a vast physical expansion of several areas of Grahamstown since 1949. The OECD (2000: 15) highlights that many urban areas spread out and ‘dilute’ over space in a form of development whose features have been very effectively described with the term ‘urban sprawl’. This is characterised by low density development which extends to the extreme edge of the urban region, which is a random segregated fashion, in specialised mono-functional land uses, and largely dependent on different means of transportation. In particular, the rural settlements on the outskirts of the city have seen an increase in area from 350 ha in 1949 to 800 ha in 2009. This has implications for the city in terms of resource use and the ability of the municipality to provide basic needs, such as housing and sanitation.

Rural-urban migration has had a large impact on Grahamstown and the informal settlements are continually expanding due to rural people searching job opportunities and a supposed better standard of living in the city. Consequently, a large difficulty for Makana Municipality is how to forecast locations of future development. The results on the expansion of land use sectors in Grahamstown showed that satellite imagery and photography can be an important aid in designing decision support products allowing city development visions. Weber (2003) proposed the ‘potential model’, which is an interaction model designed to link the forecasting and satellite images of urban development. Another use of such a model was proposed by Weber and Hirsch (1997) who emphasised that the integration of potential model results and geographic information system (GIS) can help assess development trends of urban settlements over years. The grouping of potential development zones and accessibility buffers leads to a realistic scheme of the urban growth in cities such as Grahamstown. With the use

of such models and GIS technology, municipalities such as Makana and urban planning institutions will be able to spatially determine ways in which Grahamstown can expand and develop sustainably.

Encouraging sustainable ways of living for the residents of Grahamstown

It was established through the use of questionnaires that the majority of the rural residents interviewed did not understand nor support the concept of sustainable development. South Africa, as a post apartheid country, faces several challenges when it comes to sustainable development as it is said to be one of the most racially segregated countries in the world. This segregation hinders sustainability as there is no sense of unity in striving towards protecting and preserving the environment. Residents who shopped at the local markets appeared to understand and strongly support sustainable development. This can be attributed to their understanding of ways in which to promote sustainability and reduce the amount of commercial products imported and sold in Grahamstown. Unsustainable patterns of consumption creating challenges such as waste generation, air pollution and water shortages.

The absence or shortage of commercially supplied energy in a society, especially electricity, tends to stress the presence of social asymmetry in living conditions. This can take the form of higher levels of poverty, lack of opportunity for development, movement to large cities and a society's disbelief regarding its own future. There is a general belief that, with the arrival of electricity, such societies might acquire a higher degree of economic sustainability and a better quality of life (Pereira *et al.*, 2010: 1229). This is important as an increased standard of living reduces vulnerability and thus promotes sustainability. Thus, a sustainable outlook focuses on quality of life and meeting needs rather than simply producing commodities.

As Jackson (2005: 13) so rightly stated “understanding consumer behaviour is a pre-requisite for understanding how to motivate or encourage pro-environmental behaviour”. Recognising the complexity of different lifestyles is the first step in creating more sustainable lifestyles and one needs to look beyond economics when considering policy, infrastructure, services and products. It is important that younger generations find that sustainable lifestyles are a new and exciting opportunity for them to shape their future, and thus motivate the need for change towards more sustainable ways of living.

Sustainability and local food production

Urban growth is linked to a reliable supply of agricultural produce, in which the contribution of peri-urban agriculture may be significant (Weinberger and Lumpkin, 2007:1468). The increase in the price of food in the early 1970s encouraged many countries to implement policies that increased domestic food production, in order to promote food self-sufficiency and reduce food imports (USDA, 1983). The peri-urban environment around Grahamstown has proven attractive and appropriate for agricultural activities such as the growth of perishable products like vegetables and fruits. Several produce farms have been developed in the area that supply produce to local markets and supermarkets in the Eastern Cape (i.e. Lungi's farm stall). Sustainable farming benefits the local community and local economy while supporting the environment by enriching the soil, protecting air and water quality, and minimizing energy consumption. In most parts of the country, industrial food production is the primary source of food for the urban population. However, this industry is entirely dependent on fossil fuels and encourages the production of chemical fertilizers and pesticides. LaSelle et al. (2010: 25) emphasise that sustainable agricultural practices have the potential to increase food production by up to 79% while actively reducing the effects of farming on climate change through carbon sequestration. Thus, such practises, if maintained and facilitated on a larger scale, may have the ability to support the residents of Grahamstown by maintaining a certain level of food security and limiting the need for externally produced consumables.

Nugent (2000: 69) highlights that peri-urban agriculture represents a source of employment and income to many of the urban poor or disadvantaged. The Sustainable Agriculture and Rural Development (SARD) Initiative, facilitated by the Food and Agricultural Organization (FAO), has targeted developing countries in order to help civil society organizations and governments identify local successes in SARD and build capacities, particularly of the poorest and most disadvantaged groups, to adopt, replicate and scale up good practices. A limitation of many similar initiatives is their accessibility and applicability to development on the ground and the level of ability of rural communities. Thus, this resource facility provides online access to information, expertise, training materials and case studies of good practices to assist rural communities in their progress toward SARD. The partnerships and collaboration between interested national governments and rural communities is vital in implementing good practices. Thus, with the help of teams such as 'steering groups', such

initiatives will be able to provide advice and help identify resources and opportunities for collaboration, and communicate project activities. Currently, local farmers in Grahamstown a series of small realistic steps to begin the transition to sustainable agriculture, however, this is fundamental in the development and encouragement of local and sustainable agriculture and plays a major role in the movement of cities, such as Grahamstown, to the desired status of sustainability.

CONCLUSION

Integrated view: challenges on a local level

The first World Summit on Sustainable Development at Rio de Janeiro in 1992 formulated Agenda 21, suggesting that all countries enforce economic policies that have a minimum impact on the environment (UN, 1992a). Following that, the European Community recommended that the Members State aim to achieve long-term economic growth in ways which are respectful of the welfare of the environment and individuals as well as encourage social cohesion. Central to the outlook of sustainable cities is an integrated view that sees the whole picture across the scales of time and space, from now and into the future, the local and the global. However, there is a primary issue in the long path of sustainability, starting at the local level. Makana Municipality has the task of encouraging infrastructural and institutional development sustainably, providing adequate services to its population and encouraging local production within Grahamstown's immediate biosphere. This will prove to be a difficult task considering the current rate of employment, attitudes and lack of awareness of the vast rural population, as well as the rates of consumption in the city. The biggest challenge facing the municipality is improving the standard of living of the growing rural population in order to form the basis for the implementation of sustainable livelihoods and practises across the different socio-economic boundaries.

Opportunities for economic sustainability in Grahamstown

When assessing the extensive increase in the sales of petrol, a clear representation of the rise in economic growth within Grahamstown is evident. According to Kimuyu (1993: 403), such a rise in economic activity is bound to cause change not only within the economic structure of a city but furthermore will promote change with regards to settlement patterns and population

distribution. Such a scenario is evident within Grahamstown as the expansion of the informal sector is synonymous with the economic growth experienced. This is a fairly contradicting principle as although there is a definite increase in revenue within the Grahamstown economy, more citizens are residing in poor living conditions. In terms of economic activity in Grahamstown, the business sector possesses unique skills sets and resources to catalyse the move towards more sustainable lifestyles, however, this needs to be facilitated and driven further. There is a need for products and services that make sustainability easy and transparent for the consumer, hyper efficient through collaboration and innovation in value chains, and resilient by applying understanding of human behaviour motivations and triggers (UNEP, 2010: 13). It is evident that the market for sustainable products is growing and the number of people choosing locally produced foods and considering sustainability in their purchase is increasing, yet the reliance on externally produced consumables, especially luxuries, is hindering this movement. The United Nations Environment Program (2010) highlights that, with markets in developed countries becoming increasingly competitive, the 'bottom of the pyramid' or 'markets of the poor', offer great opportunities. It is important that more companies and industries in Grahamstown include locally developed and adapted products and develop more inclusive business models.

Sustainable lifestyles in Grahamstown

This study has shown that factors from social, environmental and economical spheres must be considered and integrated in the assessment of settlement patterns and sustainability. Education is vital to encouraging sustainable lifestyles and having an understanding of the way we impact on the world around us will enable people to make better personal and professional decisions. Engaging people in sustainable lifestyles through targeted and participatory education makes a lasting impression and a new global generation of responsible individuals can be shaped through building these crucial steps. Furthermore, the participation, interest and motivation of the public is the key to social and economic change as well as the drive towards a sustainable city.

The UNEP (2010) suggests that instead of investing heavily in inefficient municipal services and bulk infrastructure projects, the government should make use of the energy of the people, to build new housing projects, operate local systems of service delivery, promote self-governance, and harvest resources available to the local community. It is often found that

communications around sustainable lifestyles have come from government or environmental groups, which can be disapproving and prescriptive rather than motivating. It is important that Makana facilitate interest through positive messages and creativity in order to engage their residents in discussions and actions around sustainability.

As our study has shown, Grahamstown does not yet have the capacity to function as a complete Sustainable City, as all the factors discussed above place a limit on what Makana Municipality and the residents of Grahamstown are able to do in terms of patterns of sustainable settlement. With the support of the national government and co-operation of all the residents, rural and urban, Makana will have the tools, expertise and funds to carry out sustainable practises, support sustainable modes of spatial development and encourage sustainable peri-urban agriculture which will aid the city of Grahamstown in paving the way to the status of a Sustainable City.

Acknowledgements:

Prof. Fred Ellery

Dr. James Gambiza

Kathy Cassidy

Zelda Odendaal

Gillian McGregor

Yolandi Ritcher (Beaufort Service Station)

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