RHODES UNIVERSITY

A SUSTAINABILITY ASSESSMENT OF THE INXUBA YETHEMBA LOCAL MUNICIPALITY

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MATTHEW VAN LINGEN

Student Number: **15v8920**

Supervised by: Ms. LETICIA GREYLING

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Abstract

The aim of this research was to assess the sustainability of the Inxuba Yethemba local municipality with the goal that policy-makers would use the assessment recommendations to improve their decision-making. The United Nations Indicators for Sustainable Development framework (3rd Edition) was chosen to carry out the assessment because of its indicator selection and methodology for distinguishing which indicators were relevant or irrelevant for the assessment (United Nations, 2007). If an indicator showed that the situation was improving, it was assumed to help with the overall sustainability of the area (Hedayati-Moghadam, Eskandar Seidayi and Nouri, 2014; and United Nations, 2007). The indicators for environmental sustainability showed that the area is on an environmentally sustainable path (Du Toit, 2017; United Nations, 2007). While the indicators for social sustainability showed that the living standards of the population (measured by poverty, housing, and access to electricity amongst others) had increased which is a good indication for social sustainability. The indicators for education and labour productivity showed the opposite (CHDM a, 2012; CHDM a, 2014; United Nations, 2007). The indicators for the economy showed that the economy was not growing which is not a good indication for economic sustainability (CHDM a, 2012; CHDM a, 2014; United Nations, 2007). The recommendation to policy-makers is that developing labour productivity through education and skills training is the most important area to improve, and compiling regular sustainability assessments will improve their decision making. Another recommendation is that, because 65% of the households rely on the social grant (CHDM b, 2014) this cannot be withdrawn in the short term. Furthermore, if inflation were to develop into hyperinflation, the value of the social grants would deteriorate (Market Insight South Africa, 2016). A recommendation to policy makers is that more data collection is needed in order to do proper sustainability assessments. Overall, the municipality cannot be classified as sustainable mainly on account of the poor education system, high levels of unemployed and unskilled labour, and the social, and economic dependence that the municipality has on government spending.

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List of abbreviations

CHD	Chris Hani District
CHDM	Chris Hani District Municipality
CSD	Commission on Sustainable Development
DPME	Department of Planning, Monitoring and Evaluation
GDP	Gross Domestic Product
GGP	Gross Geographic Product
GHEF	Global Health and Education Fund
GRI	Global Reporting Initiative
GVA	Gross Value Added
IDP	Integrated Development Plan
IEA	International Energy Agency
LGBAER	Local Government Budget and Expenditure Review
NDP	National Development Plan
NFSD	National Framework for Sustainable Development
NPC	National Planning Commission
SARB	South African Reserve Bank
SDSN	Sustainable Development Solutions Network
StatsSA	Statistics South Africa
WCED	World Commission on Environments and Development
UNISD	United Nations Indicators of Sustainable Development

Chapter 1 Introduction

1.1 Importance of sustainability assessments

Within a global context of increasing depletion of natural resources and increased awareness surrounding social injustices, there has been a global shift in development paradigms from one that encourages resource-intensive, socially unjust development to a more sustainable alternative (Trier and Maiboroda, 2009). "South Africa remains one of the most unequal societies in the world, [*with*] … persistently high levels of poverty… and … unemployment" (Lilenstein et al., 2016, pg.1). It is therefore appropriate that the goals of the South African National Development Plan 2030 (NDP 2030) drafted by the National Planning Commission (NPC) in 2012, are to reduce poverty, unemployment, and inequality (NPC, 2012). The NDP 2030 is a national document, which explains how South Africa plans to eradicate poverty and reduce inequality by 2030 (NPC, 2012). Moreover the NDP 2030 aims to achieve these goals through sustainable development (Department of Planning, Monitoring and Evaluation (DPME), 2014), thereby adopting an approach that fulfils the definition by the World Commission on Environment and Development (WCED) of sustainable development, which is "to meet the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987, pg.16).

At a media briefing on the NDP 2030 on 19 February 2013, Trevor Manuel articulated the importance of planning and implementation of the NDP 2030 being "informed by evidence-based monitoring and evaluation" (Government of South Africa, 2016). According to Molden and Bilhars (1999) sustainable development and sustainability measurement go hand in hand, thereby suggesting that measuring sustainability is crucial for successful sustainable development. Measuring sustainability can empower decision-makers with useful information about the consequences of their decisions (GRI, 2012), and such measurement is therefore an opportunity for decision-makers to improve their chances of implementing the NDP 2030 successfully. This research refers to assessing sustainability as a form of measuring it.

In order to assess sustainability, with the end goal of improving the chances of successful sustainable development through more informed decision-making, a region of study

needed to be chosen as the object of this research. A local municipality within the Eastern Cape was chosen because of this province's apparent inability to eradicate poverty at the same rate as other provinces in South Africa. The Eastern Cape's share of the total poverty in South Africa is reported to have increased between 2006 and 2011 (StatsSA, 2011) and poverty eradication is one of the primary goals of the NDP 2030 (NPC, 2012).

Anielski and Winfield (2002) emphasise that regions differ greatly from one another and therefore a different sustainability assessment for each region is most effective. A smaller region was chosen as a study area because of the great diversity in social, economic, and environmental characteristics within local municipalities. Chatzinikolaou and Manos (2013) state that the smaller the region of assessment, the more specific and beneficial the assessment can be. They also point out that rural regions are often neglected when it comes to sustainability and human development studies, mainly due to lack of data availability and the difficulty in obtaining that data. Studying regions that lack data could contribute to achieving a better understanding of the sustainability of these rural areas and help to explain their progress in achieving the NDP 2030 goals. (Chatzinikolaou and Manos, 2013).

The Inxuba Yethemba local municipality was chosen for assessment because it is situated in the Eastern Cape, it is a local municipality, and it has limited available data. The aim of this research is to assess the sustainability of the Inxuba Yethemba local municipality in order to provide recommendations to policy-makers which could help them achieve their development goals. An overview of the Inxuba Yethemba local municipality is given below within the context of the three pillars of sustainability, that is, its current social, environment, and economic situation (Chatzinikolaou and Manos, 2013).

1.2 Overview of the Inxuba Yethemba local municipality

Figure 1: Map indicating the location of the Inxuba Yethmeba local municipality within the Chris Hani district municipality, Eastern Cape, South Africa (Source: Municipality Demarcation Board, 2017), and in relation to the towns of Middelburg and Cradock (Source: HtonI, 2016).

Inxuba Yethemba is a local municipality situated within the Chris Hani district municipality in the north of the Eastern Cape. The Inxuba Yethemba has both rural and urban communities (Local Government Budget and Expenditure Review (LGBAER), 2011), with its two main urban centres being Cradock and Middelburg. It is approximately 240 km north of Port Elizabeth and is 11 663 km^2 in size (StatsSA, 2001). The municipality's vision is "A coherent developmental municipality putting people first and providing a better life for all its citizens" (CHDM, 2011, pg.36). To achieve this vision the Inxuba Yethemba local municipality commits itself to "unity, putting people first, and providing a better life by promoting social and economic development; ensuring effective community participation; providing and maintaining affordable services; and effectively and efficiently

utilising all available resources" (CHDM, 2011, pg.37). Put simply, the goals of the municipality are mostly socially orientated, although the importance of economic and environmental resources is also recognised.

1.2.1 Social aspects

The Inxuba Yethemba local municipality has a population of 60 297 and 16 049 households (CHDM a, 2012). The district has the best score for quality of life in the Chris Hani district, with most people having access to running water, refuse removal, adequate shelter, access to schools and hospitals and electricity (CHDM b, 2012). It also claims that it has the lowest population without electricity at 11%. Of the total households, only 39% are owned by the people who live in them and the rest are owned by government as part of the national housing programme (CHDM, 2011; CHDM, 2013; CHDM a, 2014).

Of Inxuba Yethemba residents, 63% earn less than R1500 a month and only 8% earn more than R3200 a month. This illustrates the levels of poverty and inequality in the municipality (CHDM, 2011; CHDM a, 2014). Only 56% of the working population looking for jobs are employed, and 65% of the population relies on social grants (CHDM, 2011), illustrating the extent of unemployment and reliance on the government. Government service delivery is a large employer and income provider in the area. The main socio-economic challenges are poverty and unemployment in the district. The population is young, with 68% under 20 years old and only 6% of the population over 65 years old (CHDM, 2011; CHDM, 2013; CHDM a, 2014; StatsSA, 2011).

1.2.2 Economic aspects

According to the 2011 census, the Gross Domestic Product (GDP) is growing slowly at 0.83% per annum (StatsSA, 2011). There is neither mining, nor big manufacturing in this region, and Cradock and Middelburg are classified as small retail and service nodes, serving the surrounding rural areas. The region relies heavily on the government and the agricultural sector (CHDM a, 2015). Finance business services contribute 22% of the Gross Geographic Product (GGP), trade 18%, agriculture 11%, construction 6%, while government contributes the most in the Inxuba Yethemba local municipality. It must be noted that although agriculture only contributes 11% to GGP, it is estimated that most finance business services and trade exist to service the agriculture sector (CHDM, 2011).

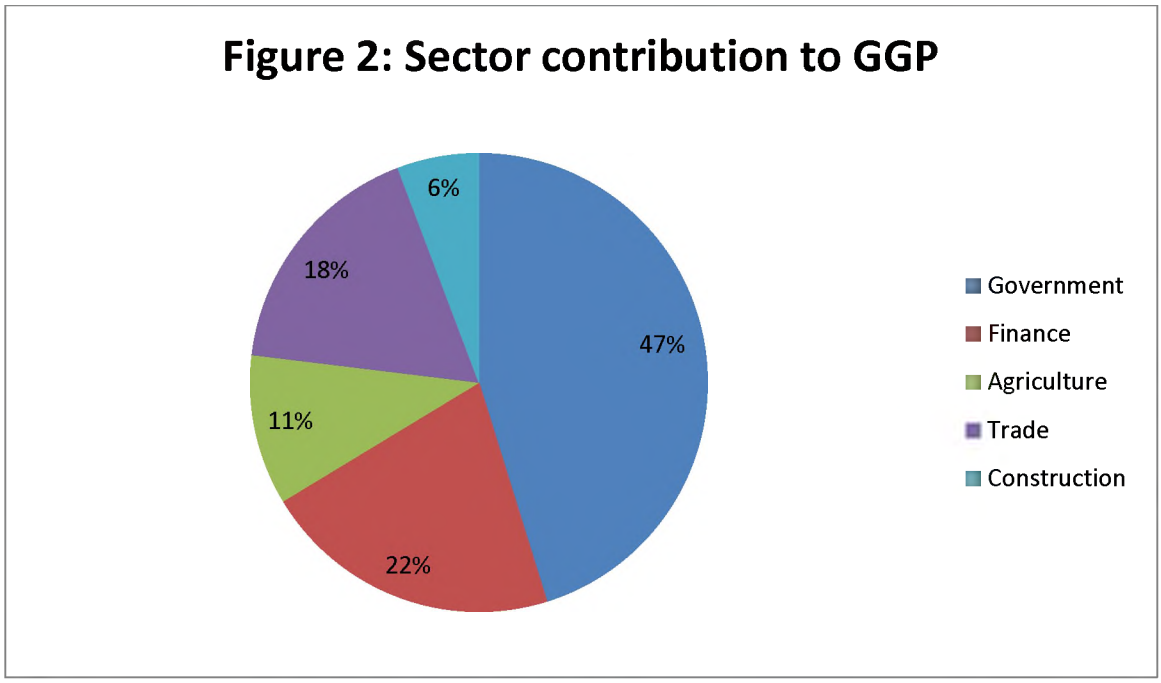

Figure 2: Pie chart showing the sector contribution to GGP of the Inxuba Yethemba Local Municipality (Source: CHDM, 2011).

Of the total working population, 30% is employed in agriculture which contributes 20% to Gross Value Added (GVA) (CHDM, 2013). Government services contribute 15% to employment and 20% of GVA. The leading products in the municipality are sheep, goats and game, with wool, mohair and meat processing being areas for potential growth. Irrigation from the Orange-Fish scheme provides opportunities for dairies and other crops like maize, oats, wheat, potatoes, lucerne, amongst others (CHDM, 2013). The Orange-Fish scheme, which provides farms and local towns with water, is an essential part of the economy for the Inxuba Yethemba region (CHDM, 2011; Orange-Fish organisation, 2016). According to the integrated development plan for the municipality, commercial agriculture is one of the main sectors with economic growth potential (CHDM, 2011).

Manufacturing and tourism have also been noted as areas of comparative advantage. According to the municipality, the following have been identified as opportunities for growth in the area: dairy, abattoirs, meat processors, wool processors, livestock feed, honey production, wool and mohair production, chipboard production, limestone mining, waste recycling, tourism, and wholesale and distribution centres (CHDM, 2011; CHDM, 2013; CHDM a, 2014, Gopaul, 2006).

1.2.3 Environmental aspects

The region experiences some of the most extreme temperature changes in South Africa, with summer temperatures reaching over 44 °C and winter temperatures going down to below minus 10 °C (CHDM, 2011). The temperature variations and an average rainfall of only 400 mm per annum contribute to the region's fragile ecosystem and harsh climate (CHDM, 2013). The ecosystem consists of a mixture of grasslands and Karoo scrub. It is this semi-arid climate that makes the region suitable for small stock farming, as sheep and goats thrive in such climates. The low rainfall makes it unsuitable for rain-fed cropping, but the quality of the wool and mohair produced in this area is world renowned as a result of the unique climate. The land-use classification puts most of the region in the category of low to moderate grazing capacity (CHDM, 2011; CHDM, 2013).

The Inxuba Yethemba district has approximately 15 879 cattle, 379 685 sheep and 173 291 goats (CHDM, 2011). In the past decade, there has been a significant shift towards game farming, particularly in the Inxuba Yethemba district (CHDM, 2011; CHDM, 2013). The natural environment has been identified as the key area for economic growth and employment in the municipality because the natural environment is key to successful agriculture and tourism in the area. Moreover, farm numbers decreased by 60% in the same area (Nel and Hill, 2008), and according to Dean and McDonald (1994), the local natural environment has been degraded and seen a loss in plant diversity.

1.3 Overview of research

The problem statement of this thesis is: researching the best method of sustainability assessments for the Inxuba Yethemba local municipality to assist decision-makers in achieving measurable progress in their national development goals of sustainably improving the living standards of the population. The development goals of the Inxuba Yethemba local municipality are to improve social issues such as poverty, inequality, and unemployment in a sustainable way (CHDM b, 2014; CHDM a, 2015). A sustainability assessment of the region is therefore necessary to provide better information for decision-makers (Moldan and Billhars, 1999).

Before assessing the Inxuba Yethemba local municipality, the literature which covers sustainability assessments must be reviewed. The Global Reporting Initiative (GRI) (GRI,

2015), the Wuppertal framework (Labuschagne et al., 2007), the United Nations Commission on Sustainable Development (UNCSD) (Labuschagne et al., 2007), and the Institution of Chemical Engineers (IChemE) (Labuschagne et al., 2007) were reviewed to provide an understanding of sustainability assessments. Because they did not fully meet the requirements for what was needed to assess the Inxuba Yethemba local municipality, assessments which had been implemented on rural areas were reviewed. This included studies from Paracchini et al. (2011), Gomez-Limon and Sanchez-Fernandez (2010), Zahm et al. (2008), Van Cauwenbergh et al. (2007), Anielski and Winfield (2002), Gauvin(2012), and from Hedayati-Moghadam et al. (2014). All these studies included the important aspects recommended by the GRI, Wuppertal, UNCSD and the IChemE frameworks, but went into more detail for assessing regions similar to the Inxuba Yethemba local municipality. Finally, the United Nations Indicators of Sustainable Development Guidelines and Methodologies (UNISDGM (2007)) framework was reviewed in depth as it appeared to be the most compatible with the Inxuba Yethemba context.

The methodology of the research follows on from the literature review and explains the methods used to determine which sustainability framework was chosen, which indicators were used, and how the data collection and interviews were prepared. The results, which consist of the choice of framework, indicator selection and review of the Inxuba Yethemba district, follow on from the methodology. These results are then discussed and a conclusion arrived at regarding the assessment of the sustainability of the Inxuba Yethemba local municipality. Finally recommendations are made.

Chapter 2 Literature review

The aim of Chapter 2 is to define sustainability and review the importance of assessing sustainability; compare the literature on how to compile sustainability assessments with some empirical evidence of where it has been practised; review the key sustainability assessment methodologies, and evaluate the sustainability assessment frameworks which have been implemented before. The goal of this research was to find a well-fitted framework to assess the Inxuba Yethemba local municipality's sustainability. The characteristics of the Inxuba Yethemba local municipality are briefly discussed in the introduction (above) and this information is used to guide the researcher to find appropriate sustainability assessment methods that suit the region.

2.1 Sustainability defied and the importance of assessing sustainability

As mentioned in the introduction, the definition of sustainable development is "[meeting] the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environnment and Development, 1987, pg.16). Davis (2014) points out some basic examples of sustainable development such as the movement away from fossil fuels to renewable energy, and crop rotation which helps to reduce the need for fertiliser and chemicals (Davis, 2014). "Meeting the needs" refers mostly to the world's poor within the limitations "imposed by the state of technology and social organisation on the environment's ability to meet present and future needs" (World Commission on Environnment and Development, 1987, pg. 41). The concept of sustainable development is interpreted in the literature in many different ways (Chatzinikolaou and Manos, 2013). However, all the different approaches agree on the importance of incorporating the competing needs and limitations of the environment, society and the economy, known as the three pillars of sustainability (Chatzinikolaou and Manos, 2013; Hacking and Guthrie, 2008). South Africa, in its NDP 2030, has adopted this thinking in its growth plans, which state that the end goal is a better life for all and for future generations (NFSD, 2016).

The Global Reporting Initiative (GRI) states that sustainability assessments create awareness of the multiple effects that decisions make on a diversity of stakeholders (GRI a, 2017). Without this research, the state of the society, environment and economy of a

region could not be critically analysed, and therefore, fully informed decisions would be impossible to make. Furthermore, municipal sustainability snapshot assessments can be used as a tool for informing local government and the general public about the progress that is being made towards achieving sustainable communities (Maclaren, 2007). One of the most critical and difficult parts of sustainable development is measuring and monitoring it. The importance of sustainability assessments has been recognised internationally. For example, the European Union (2006) made it compulsory for every country to disclose their sustainability indicators every two years (Chatzinikolaou and Manos, 2013; GRI, 2015; Labuschagne et al., 2007).

There are already a few comparable municipalities in the world that are reporting a snapshot of their sustainability. An example is the Mackay Regional Council and the Stonningtown region in Australia. These municipalities publish their sustainability assessment at the end of each year to track sustainability progress. They state that the assessment is crucial for public trust, transparency and improvement of more informative data collection and, most importantly, to ensure the region is on the desired growth path. If a report is done every year, it is possible to track the effects of policies and any other decisions made over an extended period of time (Mackay Regional Counsin, 2013; City of Stonnington, 2015). For the reasons mentioned above, both these regions confirmed that reporting was beneficial to achieving their development goals. Therefore it is clear that doing a sustainability assessment can be essential for reaching the sustainable development goals set out in the National Development Plans 2030, and for the local development goals set out for the Inxuba Yethemba local municipality in the corridor development plan (CHDM, 2011).

2.2 Sustainability assessments and reporting

This section looks at what sustainable assessments and reporting is and then reviews popular sustainability reporting and assessment methods. In this review, indicator selection is critiqued and examples reviewed of how the indicator analyses results are illustrated.

2.2.1 Sustainability assessments

A sustainability assessment is defined as:

> "[a] complex appraisal method. It is conducted for supporting decision-making and policy in a broad environmental, economic and social context and transcends purely technical/scientific evaluations" (Sala et al., 2013, pg.314).

Sustainability assessments can be done at many different levels, for example, at a local, national, regional, sectoral, or international level. These assessments can target policies, programmes, projects, regulations, or agreements, and assess them before, after, or over a period of time. Sustainability assessments can be done for businesses, geographic regions and where major decisions are made. These assessments take into consideration the economic, social and environmental aspects, either because of a decision, or for snapshot reporting purposes (Stevens, 2013). Sustainability reporting differs from sustainability assessments merely by the fact that sustainability reports are more associated with organisations and businesses (GRI b, 2017), and assessments are associated with policy and decision making (Sala et al., 2013). There are many organisations that specialise in sustainability assessments and reporting, and who set up the platform to help businesses, organisations and governments. The next section looks at some organisations that lead the way regarding sustainability assessments and reporting, and reviews their methodologies.

2.2.2 Key sustainability assessment methodologies

2.2.2.1 The Global Reporting Initiative (GRI)

The topic of sustainability and sustainable development (mentioned as goals in the NDP 2030) is becoming more popular, but there have been no major reviews on the literature giving it direction (Hahn and Kühnen, 2013). In order to get reliable direction, the literature research starts with a perceived leader in sustainability reporting: the GRI (2012). The GRI is an international and independent organisation that helps other organisations and institutions to understand and communicate the impact that their decisions make on sustainability issues, such as climate change, human rights and corruption (GRI, 2013). The GRI's recent documents for reporting and communicating the impact of decisions are the G4 Reporting Principles and Standard Disclosures, and the G4 Implementation Manual.

The G4 is the latest of the sustainability reporting frameworks developed by the GRI, and the updated reporting standards of the G4 will come into effect sometime next year (GRI, 2016). The G4 was developed in the context of helping companies and organisations to make their operations sustainable as an increasing number of companies realised that economic gain go hand in hand with social and environmental impacts. The G4 reporting initiative helps organisations to set their goals, measure their performance and manage any change that happens (GRI, 2015) to help them become more sustainable. The report is designed to disclose the impact that the organisation has made on the rest of the world's society, environment and economy. The G4 attempts to make the abstract issues of sustainability tangible, and therefore easier to report; it also attempts to standardise all reporting so that different organisations can be compared with one another and progress can easily be measured with a common set of indicators. The G4 was developed to be as user-friendly as possible so that it can be used by all organisations around the world no matter what their size. This helps an organisation to plan its strategies and activities.

There are two parts to GRI G4 requirements for sustainability reporting documents. First the organisation has to prepare its sustainability reporting in accordance with the criteria set out by the GRI. These are the Reporting Principles and Standard Disclosures (GRI, 2015). The second part is the implementation manual, which explains how the organisation should go about preparing the information and interpreting the results. The G4 categorises the type of information it needs to compile a report into three categories, with sub-categories and aspects of the sub-categories (GRI, 2015).

The first category is *economic*, which is divided into the aspects of "economic performance, market presence, indirect economic impacts, and procurement practices" (GRI, 2015, pg.9). The economic indicators given by the GRI in the G4 report were developed to measure the impact on the economic conditions of all stakeholders and the economic systems at local, national and global levels (GRI, 2015). In other words, it attempts to measure the flow of capital among different stakeholders and the impact of this capital flow on the broader society. There are nine reporting profiles to be answered under the indicators for *economic* in the G4 report (GRI, 2015).

The second category is *environment*, which is divided into the aspects of "materials, energy, water, biodiversity, emissions, effluents and waste, products and services, compliance, transport, overall, supplier environmental assessment, and environmental grievance mechanisms" (GRI, 2015, pg.9). The environmental indicators given in the G4 report "concern the organisation's impact on the living and non-living natural systems, including land, air, water and ecosystems" (GRI, 2015, pg.43). The category covers the impact that the organisation has on the world, for example, what the effects are of its inputs and outputs. It also includes biodiversity, transport, the impact of the organisations products and services and the costs involved with the compliance of environmental regulations. There are 34 reporting profiles to be answered under the indicators for environment in the G4 report (GRI, 2015).

The third category is *social*, which is divided into four sub-categories (GRI, 2015). The first sub-category is *labour practices and decent work*, which is divided into aspects of "employment, labour/management relations, occupational health and safety, training and education, diversity and equal opportunity, equal remuneration for women and men, supplier assessment for labour practices and labour-practice grievance mechanisms" (GRI, 2015, pg.9). The second sub-category is *human rights*, which is divided into the aspects of "investment, non-discrimination, freedom of association and collective bargaining, child labour, forced or compulsory labour, security practices, indigenous rights, assessment, supplier human rights assessment and human rights grievance mechanisms" (GRI, 2015, pg.9). The third sub-category is *society*, which is divided into aspects of "local communities, anti-corruption, public policy, anti-competitive behaviour, compliance, supplier assessment for impacts on society and grievance mechanisms for impacts on society" (GRI, 2015, pg.9). The fourth sub-category is *product responsibility* and it is divided into aspects of "customer health and safety, product and service labelling, marketing communications, customer privacy and compliance" (GRI, 2015, pg.9). The social indicators given in the G4 report concern the impact that organisations have on social systems. There are 16 different profiles under the sub-category of labour practices and decent work, 12 different profiles under human rights, 11 different profiles under society and nine different profiles under product responsibility (GRI, 2015).

In summary, the GRI covers a vast number of aspects in an attempt to create a reporting process that covers all the consequences of decisions. The G4 is aimed more at businesses than municipal areas, and includes indicators which would be beyond the scope of this research. Compiling a G4 report is expensive and requires experts in the field of reporting, although it does set the standards for reporting, with the inclusion of social, economic and environmental indicators, amongst others (GRI, 2015). Reviewing the GRI exposed the fact that a simpler and more geographically orientated reporting assessment framework was needed for the work in the Inxuba Yethemba local municipality.

Labuschagne et al. (2007) compiled a report in which they attempted to identify the most influential sustainability reporting initiatives. The GRI was included, along with three other sustainability frameworks. The other three are the United Nations Commission on Sustainable Development (UNCSD) framework (Labuschagne et al., 2007; United Nations, 2007), Sustainability Metrics of the Institution of Chemical Engineers (IChemE) (Labuschagne et al., 2007) and the Wuppertal Sustainability Indicators (Labuschagne et al., 2007). These were chosen from the literature because they incorporated the three pillars of sustainability (social, environment and economy) and because of their focus on regional and organisational sustainability.

2.2.2.2 Wuppertal

The Wuppertal Institute uses one additional category for assessing sustainability than the GRI, which is the effects institutions have on sustainability. The Wuppertal framework gives directions on how to choose indicators under each sub-category. The advantage of allowing the sustainability assessor to choose indicators is that the chosen indicators can be area-specific and can be chosen based on how relevant they are and how much data are available on that region. Spangenberg and Valentin (2000) also compiled frameworks for sustainability assessments and agreed with the Wuppertal-type framework for the same reason. Spangenberg and Valentin (2000) maintain that there is no point in choosing indicators if it is not possible to collect good data about them. The drawback with the Wuppertal framework is that the actual indicator selection, although guided by

the framework, increases the chances of subjective selection by the researchers compiling the assessment.

2.2.2.3 The United Nations Commission on Sustainable Development (UNCSD)

The UNCSD has also constructed a sustainability indicator framework which focuses on the governmental progress towards regions fulfilling the development goals set out for them. They, too, have a large number of indicators (15 main themes and 38 sub-themes) and, like the Wuppertal institute, include institutions as a pillar of sustainability (Labuschagne et al., 2007). Labuschagne et al. (2007) emphasise that the only major difference between the GRI and the UNCSD is that the UNCSD includes institutional factors. The UNCSD does not provide indicators for the use of business, but on national sustainability.

2.2.2.4 The Institution of Chemical Engineers (IChemE)

The IChemE have also developed their own set of indicators in order to measure the sustainability of business processes. The usefulness of the IChemE is that the reporting forms are all tabulated and they emphasise the importance of uniformity among sustainability reporting (Labuschagne et al., 2007). This particular framework is simple to use and there is a definite bias towards the environmental aspects.

2.2.2.5 GRI, Wuppertal, IChemE and UNCSD summary

The GRI, Wuppertal, IChemE and UNCSD form a strong foundation on which to guide further research on suitable frameworks to assess regions and businesses (Labuschagne et al., 2007). All these frameworks agree on the three pillars of sustainability and some include the institutional factor. A framework that is aimed at regional sustainability with set indicators is more suitable for assessing the sustainability of an area like the Inxuba Yethemba district. Another drawback to using the four frameworks is that measuring the indicators in the detail they recommend is beyond the scope of this research and no suggestions have been made on how to simplify the frameworks. Therefore more specific literature needed to be reviewed; literature that focuses on rural and urban regions and that was more practical to implement.

2.2.3 Sustainability assessment for implementation in rural and urban areas

As mentioned above, the Inxuba Yethemba local municipality is classified as a rural and urban area and has an economy dominated by agriculture, agricultural-related industries, and government spending (CHDM, 2011). The objective of this section is to review some empirical studies on the assessment of sustainability in similar areas in the world in order to see how sustainability has been assessed before. No sustainability assessment that incorporated economic, social and environmental aspects was found in the literature which covered municipal areas in South Africa.

To compile a sustainability assessment, relevant objective indicators for each category or sub-category are needed. Indicator assessments are fundamental for guiding policies on sustainable development (United Nations, 2000). Indicators take intangible terms, thoughts and feelings about an area and put them into measurable figures so managers and policy-makers can understand and make more informed decisions (Bell and Mores, 2003). Indicator choice is guided by its ability to be used by policy-makers and so indicators have to be factual and measurable to the extent that policy-makers can use them to understand the trade-offs that exist between society, economic growth, and the environment in an area that is developing and changing. Indicators should be designed to indicate where the problem areas are in order to highlight the concerns to policy-makers (Waas et al., 2014). Most sustainability literature agrees on environmental indicators, but there is much dispute regarding economic and social indicators (Chatzinikolaou and Manos, 2013). For the purpose of this section, literature that encompasses the four pillars of sustainability and aims to deliver sustainability for geographical regions is reviewed.

Chatzinikolaou and Monos (2013) noted the drawbacks of choosing a broad framework (such as the GRI, Wuppertal, UNCSD and IChemE mentioned above) for assessing the sustainability of areas or regions. In an attempt to find appropriate indicators, Chatzinikolaou and Monos (2013) identified four studies from the literature which aim to deliver economic, social and environmental sustainability for a rural area. The studies were chosen because of their acknowledgement of the importance that institutions, specifically governmental institutions, play in shaping the functioning of regional society. All four of these studies by Paracchini et al. (2011), Gomez-Limon and Sanchez-

Fernandez (2010), Zahm et al. (2008), and Van Cauwenbergh et al. (2007) have been used before to assess the sustainability of a region (Chatzinikolaou and Manos 2013). These studies narrow down and simplify the four frameworks mentioned above.

2.2.3.1 Study by Paracchini et al. (2011)

Paracchini et al. (2011) designed a sustainability framework to assess the impact of policy scenarios on the multi-functionality of land use. They use an integrated assessment method which includes agriculture, forestry, transport, tourism and energy. They use residential land services, land-based production and infrastructure as the economic indicators. Abiotic resources, provision habitat and ecosystem processes are used for the environmental indicators, while work, health and recreation, and culture are used for the social indicators (Chatzinikolaou and Manos, 2013). The methodology is developed in such a way that this study can be done on a global scale in any regional areas (Paracchini et al., 2011). Paracchini et al. (2001) aggregate each of the indicators and display them in such a way that the intricate relationships between each indicator can be easily understood, in order to make policy-maker's decisions easier. Thirty indicators were considered and reduced to only nine in order to make the study more manageable. The indicators are displayed in such a way that if you change one indicator, then the other indicators will have to change. For example, if the land is used for building, then land-based production comes down, and infrastructure goes up, as well as environmental factors being affected and the social issues that arise in the urban and rural areas (Paracchini et al., 2011). This method requires intricate and extensive data about the area of analysis (Chatzinikolaou and Manos, 2013).

2.2.3.2 Study by Gomez-Limon and Sanchez-Fernandez (2010)

Gomez-Limon and Sanchez-Fernandez (2010) developed a more practical methodology than that of Paracchini et al., (2011). Sixteen composite indicators are used to assess the sustainability of farms and farming areas, all of which include the three pillars of sustainability (Chatzinikolaou and Manos, 2013). The aim of the study is to create a useful tool which can be used by policy-makers when developing policies for agricultural regions (Gomez-Limon and Sanchez-Fernandez, 2010). The study is useful in that it is possible to analyse several sustainability indicators in conjunction, making its results more robust.

The study claims that its results and its methodologies could help rural development policy development. Their economic indicators are: income of producers, the contribution of agriculture to GDP, and insured area (Gomez-Limon and Sanchez-Fernandez, 2010). The environmental indicators are: economic dependence on agriculture activity, specialisation, mean area per plot, soil cover, nitrogen balance, phosphorus balance, pesticide risk, use of irrigation water, energy balance, and agro-environmental subsidy areas (Gomez-Limon and Sanchez-Fernandez, 2010). The social indicators are: agriculture employment, stability of workforce, and risk or abandonment of agriculture activity (Gomez-Limon and Sanchez-Fernandez, 2010). The indicators for this study are thorough, but gathering this information is the drawback of this method. Gathering information about soil cover and specialisation for example, would be a long and expensive task.

2.2.3.3 Study by Zahm et al. (2008)

The third study was carried out by Zahm et al. (2008), who chose 41 indicators to represent economic, social and environmental aspects of a region (Chatzinikolaou and Manos, 2013). This study is unique in that it is designed to be used as a self-assessment tool for rural residents and for policy-makers. The results help decision-makers in government and in business to become more sustainability-conscious (Chatzinikolaou and Manos, 2013). The advantage of such a method is that it allows the people who know most about the situation to contribute, even though it may introduce a fair degree of bias. The model acknowledges that there are many different ways to measure and achieve sustainability and so brought this flexibility into its model. The lesson drawn from this research is the concept of designing the assessment framework in such a way that it can be given to stakeholders within the region so that they can begin to understand and measure their own sustainability (Chatzinikolaou and Manos, 2013). This is potentially beneficial as the Inxuba Yethemba local municipality has little data and, allowing people who transact within the area to come up with their own indicators and frameworks could result in an addition to the literature. However, allowing people to come up with their own indicators does expose the research to bias.

2.2.3.4 Study by Van Cauwenbergh et al. (2007)

The fourth study was carried out by Van Cauwenbergh et al. (2007) and is focused more on agriculture and agriculture practices (Chatzinikolaou and Manos, 2013). The aim in choosing the indicators is however consistent and carried out in a formulated, structured way. The objective of the study is to obtain indicators and values for each indicator. The lesson drawn from this study is the way in which the indicators are given values for comparisons and assessments (Chatzinikolaou and Manos, 2013). Determining the value for each indicator requires experts in each field which makes the study more challenging to implement.

2.2.3.5 Study by Anielski and Winfield (2002)

A further study done by Anielski and Winfield (2002) researched 16 sustainability framework assessments in order to create one framework which could be used by all the rural districts in Canada. They conclude that many indicators lack strength regarding a framework and that the indicators should not be standardised because every region is different (Anielski and Winfield, 2002). Each framework uses numerous categories, but none of the frameworks grouped the indicators in the dimensions of economic, society and the environment. Anielski and Winfield (2002) found fault with all of these frameworks, mainly due to the complexity of sustainability and each framework's method of trying to simplify some aspect in order to make the research implementable.

2.2.3.6 Study by Gauvin(2012)

More recently, Gauvin(2012) reviewed numerous sustainable development models created by various institutions and reviewed sustainability as being a concept or aim that can never be achieved, but will always be work in progress. The Community Capital Framework Model reviewed by Gauvin (2012) is an outcome of sustainable rural capital development. The goal of this model is to empower people to make a difference in their communities in a sustainable manner (Gauvin, 2012). It examines seven different capitals, which is merely an expansion of the triple-bottom-line approach (Fort Collins, 2010). The seven capitals are natural, cultural, human, social, political, financial and built capital (Gauvin 2012). All these capitals overlap and if one is over-used it may compromise other capitals. According Gauvin (2012) this is a good model for assessing

sustainable development. The one drawback of the model is that it relies on human capital to introduce technology, whereas technology could be included separately, as technology can be a large exogenous factor in a region. Gauvin (2012) motivates rural assessment by stating that, without rural communities, urban communities cannot exist. Rural sustainability is vital for countries' sustainability because they provide food and quality of water from the catchment areas (Gauvin, 2012). Gauvin (2012) also emphasises that measuring sustainability indicators is a critical part of rural sustainability, but no framework on how to choose indicators for a particular region is discussed. With regard to illustrating the results, each indicator for each of the seven capitals mentioned above is scored either high, medium, or low. For example, under natural capital, one of the indicators might be fish populations. If the fish populations are growing, or are stable at capacity, then it will be scored high. If the fish populations are below the stream's capacity, but are not dwindling then it will be scored medium. If the population is dwindling, then the score will be low. This was the simplest method this research found to illustrate the condition of regional sustainability, but the advantage of this is that it does not let the complexities of measuring sustainability get in the way of measuring. The results of a method like this will be merely an indication for policy-makers to alert them on certain issues which can be further researched.

2.2.3.6 Study by Hedayati-Moghadam et al. (2014)

Hedayati-Moghadam et al. (2014) compiled an almost identical assessment to the aims of this research. The study was sustainability measurement for the use of policy-makers of a rural area in the Middle East. Their findings were that achieving sustainability in a rural area and striving for sustainable development requires "noticing and recognising the involved effective elements and presenting them in a coherent framework as the set of sustainability indicators" (Hedayati-Moghadam et al., 2014). They also used social, environmental and economic dimensions as the effective elements which need to be reported on in order to report on sustainability. They chose 145 indicators based on a multi-indicator method, which means that although the indicators fall under the dimensions of economic, social and environmental, they had 23 different categories, as some indicators fitted into numerous dimensions. They went further and weighted each indicator with a co-efficient in order to help policy-makers choose which areas to deal with

first. They obtained data from library research and surveys and analysed these data on a barometer scale. Using data that were available over the past years they recorded what criteria/indicators were improving and which ones were deteriorating. If an indicator was deteriorating, it meant that an area which is considered critical for the ongoing improvement of human life was getting worse, which translates to a negative effect on sustainability. If an indicator shows that things are deteriorating, the conclusion is therefore made that the sustainability is also deteriorating in that specific dimension or criterion (Hedayati-Moghadam et al., 2014). The drawback of this research is that there is no indication on how the researchers chose the coefficients. The problem with attaching coefficients to indicators is that it will take experts in each field to decide which aspects are more important than others. This could bring subjective bias into the research.

2.2.3.7 Sustainability assessment for implementation on rural and urban areas summary

From the literature so far it is clear that a sustainability framework must include at least the three pillars of sustainability (economic, social and environmental); if possible, it must include institutional sustainability, and it must be aimed at helping policy-makers. The indicators must be simple, aimed at regional areas that are urban and rural, easy and cheap to acquire data, and avoid the tendency to promote bias. Well-defined and constructed indicators make a good framework. The indicators must be displayed in a way that can be easily understood and pinpoint the problem areas but avoid steering the audience to assume a predetermined opinion. Further research on sustainable assessment results must be encouraged so that policy-makers use the framework as a very basic tool from which more in-depth research departs. If possible, the framework could be set out to allow policy-makers to test different scenarios. There is value in creating a framework that can be adapted by any organisation as this takes advantage of local knowledge and recognises the importance of a context-specific assessment tool. Indicators that are suggested by the public should be taken seriously and can show their interconnectedness within the sustainable pillars (i.e. taking from one capital to give to another).

2.2.4 The United Nations Indicators of Sustainable Development Guidelines and Methodologies (UNISDGM, 2007)

The United Nations Indicators of Sustainable Development Guidelines and Methodologies (UNISDGM, 2007) reviewed below resonated with the aim of this research and with the study done by Hedayati-Moghadam et al. (2014), as it was South African-based and incorporated all the literature reviewed above. The aim of the UNISDGM (2007) study was to develop indicators for developing countries like South Africa, in particular, Johannesburg. The indicators they came up with are supposed to perform many functions. For example, they can help decision-makers be more effective by bringing clarity to information; they can help measure the progress towards sustainable development; they can give early warning of problems that may be arising, and they can be useful as tools for communication. The indicators that have been derived here are claimed to be well tested, have been implemented in real-life scenarios and explicitly relate to the Agenda 21 of the Johannesburg Plan of Implementation (United Nations, 2007).

The UNISDGM (2007) report adds to the GRI indicators by including the effects of institutions on sustainability. The UNISDGM (2001) edition separated their indicators into four categories (social, economic, environmental and institutional) but the latest UNISDGM (2007) framework maintains that these four categories are too interconnected. They classified their indicators into categories of "poverty, governance, health, education, demographics, natural hazards, atmosphere, land, oceans, seas and coasts, freshwater, biodiversity, economic development, global economic partnerships, and consumption and production patterns" (United Nations, 2007). Each category has its own established and listed indicators (United Nations, 2007). The UNISDGM (2007) acknowledges that some indicators will be irrelevant for different areas of a country and so explains how the indicators should be chosen and, once they have been chosen, how to measure and record them in a fashion that is meaningful (United Nations, 2007). The UNISDGM (2007) was the framework chosen to carry out the assessment and the reason for this choice forms part of the results in Chapter 4.

2.3 Literature review: concluding remarks

From the above literature analysis, it is evident that the biggest problem with sustainability frameworks is dealing with the complexity of incorporating all the consequences of a decision made. The fact that each region or municipality in the world is different from one another makes it difficult to create a framework that fits all, as each region has unique characteristics. Indicators are essential for assessing sustainability and choosing the indicators is vital to the quality of the assessment. The biggest issue with indicator selection is the quantity and quality of data, as well as the expense involved in collecting the data. Although sustainability assessments face these complex problems and it may seem that the perfect framework does not exist, such reservations must not detract from the importance of these assessments in helping decision-makers to make decisions that are sustainable and fulfil the vision of the region. Sustainability assessments must take place so that, over time, a suitable, functional framework can be developed to be used as a region's guideline. The next section looks at the methodology of choosing a suitable framework, indicator selection, and the method of using the framework and indicators to create an assessment for the sustainability of the Inxuba Yethemba local municipality.

Chapter 3 Research methodology

3.1 Aim, objectives and research paradigm

The overall aim of this research was to assess the sustainability of the Inxuba Yethemba local municipality and to give recommendations to decision-makers to help them achieve the development goals of the region. To do this, the objectives of the research are to:

a) Investigate and identify a suitable sustainability assessment framework and indicators for small urban and rural municipalities.

b) Conduct a high-level assessment of the current sustainability of the Inxuba Yethemba local municipality

c) Discuss the findings and provide an overview of the region's sustainability and make recommendations for decision-makers.

The post-positivism paradigm is adopted with critical realism as the ontology (Guba and Lincoln, 1994). Quantitative and qualitative data was used for this research. Data collection, data analysis, sampling and limitations of this research are explained below.

3.2 Data collection

3.2.1 Suitable sustainability framework

A desktop review of the key academic literature and the background of the Inxuba Yethemba local municipality was used to find a suitable sustainability framework. In order for a framework to be suitable it needed to incorporate the three pillars of sustainability (GRI, 2015), be implementable for a municipality, and simple enough to fit into the scope of this research (GRI, 2013; Labuschagne et al., 2007). Choosing a suitable framework was kept as objective as possible by using existing indicators from a developed framework. If indicators were chosen based on a perception about the area then this would add an element of subjectivity to the research. The framework chosen also needed to have indicators that were "regional in scope, relevant to sustainability assessments, relevant to development progress, limited in number, have broad coverage, understandable, clear, unambiguous, conceptually sound and within the capabilities of government to collect accurate data in a cost effective manner" (United Nations, 2000,

pg. 24). Each region in the world requires a different framework and set of indicators (Sustainable Development Solutions Network (SDSN), 2014) and as a result a framework was chosen from the existing sustainability assessment literature, which was perceived to be the closest fit and which would represent the Inxuba Yethemba local municipality, as best as possible. The framework chosen was the UNISDGM (2007) reviewed in Chapter 2 above.

3.2.2 Choice of indicators

In order to choose the relevant indicators which could be used, data from a desk-top review was needed to find out what information was available for the municipality and to discover what aspects of sustainability in the UNISDGM (2007) framework were relevant for the municipality (United Nations, 2007). The information about the municipality, and the indicator selection guidelines in the UNISDGM (2007) framework was used to determine which indicators would be analysed. Figure 3 shows a matrix from the UNISDGM (2007) document on how the indicators were chosen, based on relevance to the region and data availability (United Nations, 2007). Indicators considered irrelevant were indicators which would report on elements of the area which did not exist, for example, a marine pollution indicator cannot be used for a land-locked municipality. Irrelevant indicators were left out of the study as recommended by the UNISDGM (2007) report (United Nations, 2000). If indicators had no data available then they were also excluded. The legend of Figure 3 illustrates when indicators should be or not be used, as well as where indicators might need further investigation before they are used (United Nations, 2007). In most instances, the data that were available were a close fit to one of the indicators. In these circumstances, the data were used along with an explanation of how the indicator differs.

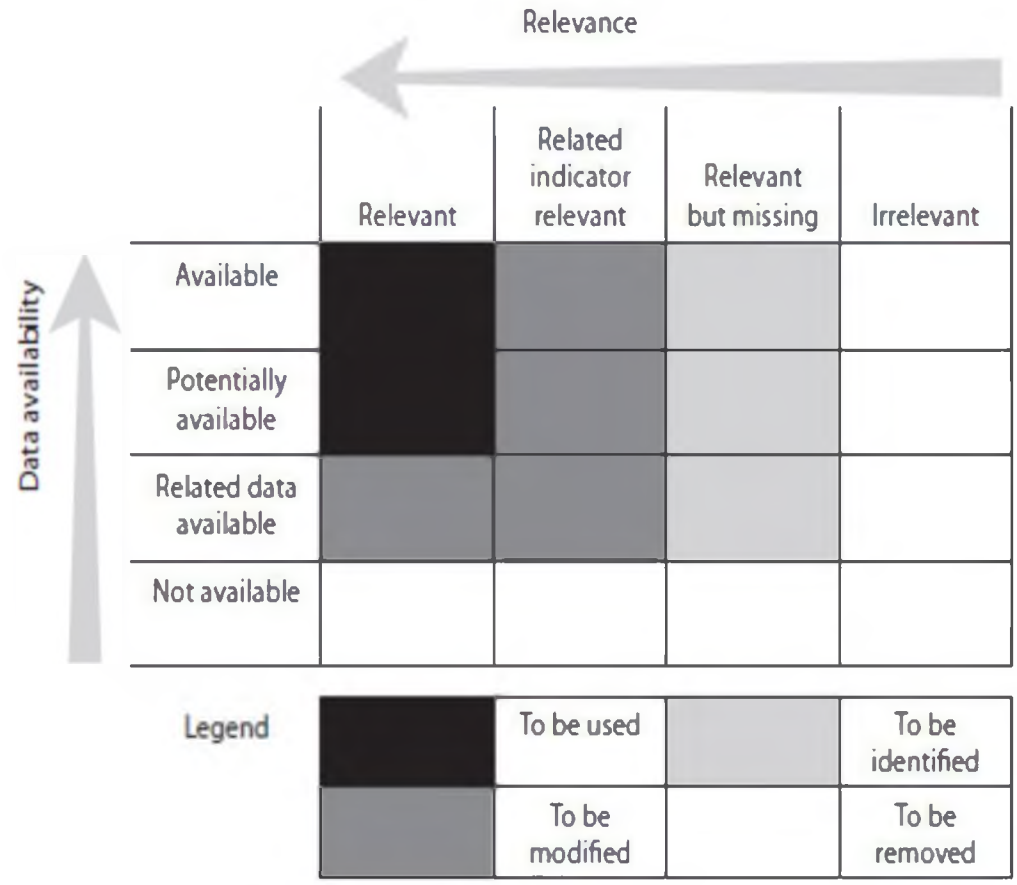

Figure 3: Matrix with two dimensions; Data Availability and Relevance. Combined they determine which indicators should be used, modified, identified, or removed (Source: United Nations, 2007).

3.2.3 High-level assessment

This data were collected in two ways: firstly, by means of document analysis of the data bases which have information about the region. The documents used were published municipality annual reports (CHDM, 2011; CHDM a, 2012; CHDM b, 2012; CHDM, 2013; CHDM a, 2014; CHDM b, 2014; CHDM c, 2014; CHDM a, 2015) which acquired all their data from the 1996, 2001, and 2011 Censuses, as well as the 2007 community surveys compiled by StatsSA. Secondly, the data that were not available through document analysis came from five interviews. Interviews were open-ended and collected quantitative and qualitative data. Interviewees were purposefully chosen (Dudovskiy, 2016) based on their perceived knowledge and academic position in nearby research institutes, such as Grootfontein Agricultural College. The reason for the open-ended interviews is because there was uncertainty about what level of information interviewees

had. The people interviewed were; Du Toit (2017), who is an ecology and climate researcher at the Grootfontein research institute (Grootfontein, 2001) within the municipality; Van de Walt (2017), who is a researcher at the same institute and focuses on economic research concerning the area; Oberholzer (2017), who is a businessman with the leading share in fertilizer sales in the municipality (Oberholzer, 2017); Nicks (2017), who is a town planner who recently worked in the Inxuba Yethemba local municipality and specilises in municipality financial sustainabilty; and Hough (2017), who works as the finance manager for the Orange-Fish irrigation scheme. The interviews were discursive and open-ended and were recorded with written notes taken by the researcher.

3.3 Data analysis:

The literature on the various key frameworks used to choose a suitable sustainability framework and the background of the municipality was thematically analysed (Braun and Clarke, 2006) to record key themes, which were used to select the framework. The literature on the municipality was also thematically analysed in order to choose the appropriate indicators from the chosen framework.

The indicators from the chosen framework required quantitative and qualitative data. The qualitative data came from the municipality reports and StatsSA, and the qualitative data came mainly from the interviews. The assessment of the region's sustainability was done by individually reporting the trends on each indicator. If the trend was worsening, then this was considered a bad indication for the region's sustainability; if the trend was improving, this was considered a good indication for sustainability (United Nations, 2007). In this way, qualitative and qualitative data were reported on in the same way.

3.4. Sampling

Because the household and community censuses were used for most of the data, it was assumed that the study site is; the entire Inxuba Yethemba local municipality regarding the environmental indicators, the entire municipal economy regarding the economic indicators, and the entire municipal population regarding the social indicators.

3.5 Limitations

One of the obstacles was that no framework with indicators was found in the literature that had been designed for the assessment of the Inxuba Yethemba local municipality or similar municipalities in a South African context. Another obstacle was that the frameworks in the literature required a large number of indicators and there were not enough data available on the Inxuba Yethemba region to answer all of the indicators in the framework. Using the quantitative data about the indicators from a limited number of sources and using this to draw a conclusion regarding the sustainability of the region was also considered an obstacle for this research. The critical assumption in solving this obstacle comes from the research of the SDSN (2014); GRI (2015) and Hedayati-Moghadam et al. (2014) who also noted this challenge and stated that each indicator must be treated separately for policy-makers to view and it is left up to their discretion as to where they would like to allocate resources. Giving a weighting to each indicator will make this thesis subjective because it will take personal opinions to decide which indicators are more important than others. The results of the research are discussed below.

Chapter 4 Results

Part one of the results explains how the framework was chosen to most accurately assess the sustainability of the Inxuba Yethemba local municipality area. Part two establishes which indicators in the selected framework were used, and which ones were irrelevant. Part three is a high-level analysis of the indicators with the information researched about the area and discusses the findings. Recommendations are given in Chapter 5.

Part 1: Framework selection

A framework was needed that could be used to assess a rural and urban area (regional in scope) in South Africa, which took into account limited data about the area, the GRI's assessment categories, and had indicators which were affordable to investigate and were easy to understand, measure and display in a form that would be understood by policy-makers. The framework also needed to be conceptually sound, developed by a reputable organisation, applicable to a South African context, and reduce subjective bias by having a set number of diverse indicators. The framework and its indicators also had to be simple enough in order to fit into the scope of this research and have a method of distinguishing relevant and irrelevant indicators for that region. It also needed to have a user-friendly method of illustrating the results which could be interpreted easily.

Before a framework can be selected, the indicators of the framework must be broadly analysed. For example, a framework that has predominantly irrelevant indicators for a particular region will not produce a good assessment. Indicators must be relevant to sustainability progress, simple, but remaining open-ended for the sake of future adjustments. The collection of indicators within a single framework must cover a broad spectrum of sustainable development aspects, but too many indicators, and the study becomes too complicated. They must also be easy to understand and unambiguous. The concepts must make sense, meaning that the indicators must be in context with the region of study. They must consider the international arena for comparative purposes; they must be within the capabilities of the policy-makers so that changes can actually take place and, lastly, they must be cost-effective, meaning that a cost-benefit analysis must be done to see if some indicators are worth researching (United Nations, 2007).

The GRI's G4 framework goes into detail far beyond the scope of this research and requires information that is either not available or costly to acquire. There is simply not enough information about the area to compile a basic G4 report which is designed more for organisations and is less suited for regions and geographic areas. The G4 framework is more domain-based, meaning that all indicators fit under either social, economic, or environmental criteria. Although this may simplify the report for blanket use across all organisations, most relevant indicators may fit under more than one of those domains. According to the proclaimed leaders in the sustainability reporting field (GRI 2015), a framework is needed that includes the GRI's standards of reporting.

The Wuppertal, IChemE and UNCSD reports could not be used because they required detail which would not be feasible to collect for this research and no simplification recommendations were given. These frameworks also did not include indicators which suited a more rural region.

The five reports identified from Chatzinikolaou and Manos (2013) were more specific and well-suited to this study. They were concerned with making the results user-friendly for decision-makers and have all been used to assess the sustainability of an area. Unfortunately, they were not suited to the Inxuba Yethemba context because they were too agriculturally orientated, and were designed for first-world countries.

The framework discussed in the study by Anielski and Winfield (2002) resonated with the assessment needs of the Inxuba Yethemba local municipality. However, the study indicators presented by Anielski and Winfield (2002) were more designed for a Canadian context.

The research by Gauvin (2012) also could have been used, but his method of reporting the findings was too subjective for political use. The Hedayati-Moghadam et al. (2014) study fitted the context of this study exactly but used co-efficients to determine the weighting of the indicators which either required experts or the researcher's intuition.

The UNISDGM (2007) method of sustainability assessments did not use co-efficients, instead, it recommended each indicator be written about separately, which allows more flexibility (United Nations, 2007). This method allows for the complexities within each

indicator to be explored. This helped with the problem of limited quantitative information. The UNISDGM (2007) framework elaborated how indicators must be chosen and gave guidance on how to do this. It gave a range of indicators, recommended a screening process in order to choose appropriate indicators, and the way the results are presented is simple enough to create awareness. The indicators fit a South African context, specifically including indicators that effectively assess rural areas. It was for these reasons that the UNISDGM (2007) framework fitted the criteria needed to complete this study and was chosen to assess the Inxuba Yethemba local municipality. The UNISDGM (2007) framework encompasses the strengths of the GRI, Wuppertal, SMICE, UNISDGM (2007) and the five reports identified by Chatzinikolaou and Manos (2013). The indicators of the recommended UNISDGM (2007) framework go through a screening process which is discussed in detail below.

Part 2: Selecting indicators from UNISDGM (2007)

The UNISDGM (2007) offers a method by which to choose and adapt the indicator to best represent the region. A simple matrix (Figure 3) is recommended by the UNISDGM (2007) report for use on indicators to ensure that they are suitable for the assessment of a particular region. The matrix has relevance on one axis and data availability on the other axis. Data availability is seen as the most critical issue. A lack of data should not stop a sustainability report; however indicators cannot be used if there are insufficient data or inaccurate data. Using data gathered from governmental statistics, for example StatsSA, is recommended as the best place to start (United Nations, 2007).

As seen in Figure 3 of the UNISDGM (2007) report, relevance has four categories. They are *relevant*, *related indicators relevant*, *relevant but missing* and *irrelevant*. The ideal situation is to have all indicators relevant; however this is not always the case. *Related indicators relevant* refers to indicators which themselves are not directly relevant but are very closely related to the relevant indicators. For example, some countries might include cancer as an indicator for health; but including HIV and AIDS might be more relevant in a place like South Africa. AIDS may not be stated as a health indicator, but it is related to health. *Relevant but missing* refers to indicators left out of the UNISDGM (2007)

framework, but that might still be relevant to a particular region. For example, livestock production would not necessarily be in the set of recommended indicators, but may still be relevant under the category of economics and the environment. *Irrelevant* indicators are indicators that are either impossible to retrieve, or do not exist in the specific context. For example indicators measuring coral health are irrelevant in a land-locked region (United Nations, 2007).

The other axis is data availability and it ranges from *data available*, to *potentially available*, to *related data available* and lastly, *not available* (United Nations, 2007). Data availability is normally constrained by cost and time and in some cases, it may be impossible to retrieve any data. The more available the data at the least cost, the better for an accurate sustainability study. Data that fit into the *potentially available* category may be further investigated to see if it is attainable (United Nations, 2007).

The black boxes are those indicators that should be used. The dark grey boxes are indicators that should be modified before being used, and the light grey boxes indicate those indicators which are important for a region, but not included in the UNISDGM (2007) framework. The white boxes are indicators that should be left out (United Nations, 2007).

The problem with sustainability assessors deriving their own unique indicators is that all stakeholders, including government, experts and the region's public population need to agree on what exactly the indicators should be. This type of indicator development goes beyond the scope of this research (Hedayati-Moghadam et al., 2014).

Table 1 on page 39 lists all the indicators recommended by the United Nations (2007). The indicators are listed in the left hand column (first column). The second column is taken from Figure 3 and is labelled *relevance of the indicator* for the municipality area. Most indicators were relevant; however, because the region does not have a coastline, any indicators dealing with coastal issues were seen as irrelevant. The third column is also taken from Figure 3 and is labelled *data availability*. Only data from the CHDM, 2011, CHDM a, 2012, CHDM b, 2012, CHDM, 2013, CHDM a, 2014, CHDM b, 2014, CHDM c, 2014, and CHDM a, 2015 documents as well as StatsSA and interviews from Du Toit (2017), Oberholzer (2017), Van de Walt (2017), Hough (2017) and Nicks (2017) were

used. Interviews were held to collect information where no data were found. The fourth column shows whether the indicator is to be excluded or included. If no data were available, or if the indicator was irrelevant, then it was automatically excluded. Irrelevant indicators are indicators which aim to measure something that does not exist in the region of study. In some cases the indicator was a close match to the data that were available, which then resulted in that indicator being included and referred to as *related indicator relevant* (United Nations, 2007) as suggested in Table 1. It is noted that the Indicator column in Table 1 comes directly out of the UNISGM (2007) document.

Table 1: List of indicators from UNISGM (2007), their relevance, data availability, and whether they are included or excluded (United Nations, 2007).

Table 1: illustrating all the indicators recommended by the UNISGM report, their relevance to the municipality, data availability and if they should be included based on the rules set in figure 2 above			
Indicator	**Relevance**	**Data availability**	**Include or Exclude**
1. Percent of population living below national poverty line	Relevant	Available	Include
2. Proportion of population below international poverty line	Relevant	Available	Include
3. Ratio of share in national income of highest to lowest quintile	Relevant	Available	Include
4. Proportion of population using improved sanitation facilities	Relevant	Available	Include
5. Proportion of population using an improved water source	Relevant	Available	Include
6. Share of households without electricity or other modern energy services	Relevant	Available	Include
7. Percentage of population using solid fuels for cooking	Relevant	Related data available	Include
8. Proportion of urban population living in slums	Relevant	Related data available	Include
9. Percentage of population having paid bribes	Relevant	NO DATA	Exclude
10. Number of intentional homicides per 100,000 population	Relevant	Available	Include
11. Mortality rate under 5 years old	Relevant	Related data available	Include
12. Life expectancy at Birth	Relevant	Related data available	Include
13. Healthy life years expectancy	Relevant	Related data available	Include
14. Percent of population with access to primary health care facilities	Relevant	Related data available	Include

15. Immunization against infectious childhood diseases	Relevant	Related data available	Include
16. Contraceptive prevalence rate	Relevant	NO DATA	Exclude
17. Nutritional status of children	Relevant	Related data available	Include
18. Prevalence of tobacco use	Relevant	NO DATA	Exclude
19. Suicide rate	Relevant	NO DATA	Exclude
20. Morbidity of major diseases such as HIV/AIDS, malaria, tuberculosis	Relevant	Related data available	Include
21. Gross intake into last year of primary education, by sex	Relevant	Related data available	Include
22. Net enrolment rate in primary education	Related indicator relevant	Related data available	Include
23. Adult secondary (tertiary) schooling attainment level, by sex	Related indicator relevant	Related data available	Include
24. Lifelong learning	Relevant	Related data available	Include
25. Adult literacy rate, by sex	Relevant	Related data available	Include
26. Population growth rate	Relevant	Available	Include
27. Total fertility rate	Relevant	NO DATA	Exclude
28. Dependency ratio	Relevant	Available	Include
29. Ratio of local residents to tourists in major tourist regions	Relevant	NO DATA	Exclude
30. Percentage of population living in hazard prone areas	Relevant	NO DATA	Exclude
31. Human and economic loss due to natural disasters	Relevant	Related data available	Include
32. Emissions of greenhouse gases	Relevant	NO DATA	Exclude
33. Carbon dioxide emissions	Relevant	NO DATA	Exclude
34. Consumption of ozone depleting substances	Relevant	NO DATA	Exclude
35. Ambient concentration of air pollutants in urban	Relevant	NO DATA	Exclude

36. Land use change	Relevant	Related data available	Include
37. Land degradation	Relevant	Related data available	Include
38. Land affected by desertification	Relevant	Related data available	Include
39. Arable and permanent cropland area	Relevant	Related data available	Include
40. Fertilizer use efficiency	Relevant	Related data available	Include
41. Use of agricultural pesticides	Relevant	Related data available	Include
42. Area under organic farming	Relevant	NO DATA	Exclude
43. Proportion of land area covered by forests	Irrelevant	NO DATA	Exclude
44. Percent of forests damaged by defoliation	Irrelevant	NO DATA	Exclude
45. Area under sustainable forest management	Irrelevant	NO DATA	Exclude
46. Percentage of total population living in coastal areas	Irrelevant	NO DATA	Exclude
47. Bathing water quality	Relevant	NO DATA	Exclude
48. Proportion of fish stocks within safe biological limits	Relevant	NO DATA	Exclude
49. Proportion of marine area protected	Irrelevant	NO DATA	Exclude
50. Marine trophic index	Irrelevant	NO DATA	Exclude
51. Area of coral reef ecosystems and percentage live cover	Irrelevant	NO DATA	Exclude
52. Proportion of total water resources used	Relevant	Related data available	Include
53. Water use intensity by economic activity	Relevant	NO DATA	Exclude
54. Biochemical oxygen demand in water bodies	Relevant	NO DATA	Exclude
55. Presence of faecal coliform in freshwater	Relevant	NO DATA	Exclude
56. Wastewater treatment	Relevant	NO DATA	Exclude

57. Proportion of terrestrial area protected, total and by ecological region	Relevant	Related data available	Include
58. Management effectiveness of protected areas	Relevant	Related data available	Include
59. Area of selected key ecosystems	Relevant	NO DATA	Exclude
60. Fragmentation of habitat	Relevant	Related data available	Include
61. Abundance of selected key species	Relevant	Related data available	Include
62. Change in threat status of species	Relevant	Related data available	Include
63. Abundance of invasive alien species	Relevant	Related data available	Include
64. Gross domestic product (GDP) per capita	Relevant	Available	Include
65. Investment share in GDP	Relevant	NO DATA	Exclude
66. Gross savings	Relevant	NO DATA	Exclude
67. Adjusted net savings	Relevant	NO DATA	Exclude
68. Inflation	Relevant	Available	Include
69. Debt to GNI ratio	Relevant	Related data available	Include
70. Labour productivity and unit labour costs	Relevant	Related data available	Included
71. Employment-population ratio, by sex	Relevant	NO DATA	Exclude
72. Vulnerable employment	Relevant	NO DATA	Exclude
73. Share of women in wage employment in the non-agricultural sector	Relevant	NO DATA	Exclude
74. Number of internet users per 100 population	Relevant	Related data available	Include
75. Fixed telephone lines per 100 population	Relevant	Related data available	Include
76. Mobile cellular users per 100 population	Relevant	Related data available	Include
77. Gross domestic expenditure on R&D as a percent of GDP	Relevant	NO DATA	Exclude
78. Tourism contribution to GDP	Relevant	Available	Include

79. Current account deficit as percentage of GDP	Relevant	NO DATA	Exclude
80. Share of imports from developing countries and from LDCs	Relevant	NO DATA	Exclude
81. Average tariff barriers imposed on exports from developing countries and LDCs	Relevant	NO DATA	Exclude
82. Net Official Development Assistance (ODA) given or received as a percentage of GNI	Relevant	NO DATA	Exclude
83. FDI inflows and outflows as percentage of GNI	Relevant	NO DATA	Exclude
84. Remittances as percentage of GNI	Relevant	NO DATA	Exclude
85. Material intensity of the economy	Relevant	NO DATA	Exclude
86. Domestic material consumption	Relevant	NO DATA	Exclude
87. Annual energy consumption per capita, total and by main user category	Relevant	NO DATA	Exclude
88. Share of renewable energy sources in total energy use	Relevant	NO DATA	Exclude
89. Intensity of energy use, total and by sector	Relevant	NO DATA	Exclude
90. Generation of waste	Relevant	NO DATA	Exclude
91. Generation of hazardous waste	Relevant	NO DATA	Exclude
92. Management of radioactive waste	Relevant	NO DATA	Exclude
93. Waste treatment and disposal	Relevant	NO DATA	Exclude
94. Modal split of passenger transportation	Relevant	NO DATA	Exclude
95. Modal split of freight transport	Relevant	NO DATA	Exclude
96. Energy intensity of transport	Relevant	NO DATA	Exclude

Of the 96 sustainability indicators listed in Table 1, from the UNISDGM (2007) report, and from the information available in the reports on the Inxuba Yethemba local municipality, 46 indicators were relevant, had a related relevant indicator and had data available. They are displayed in Table 2 below. The numbers in parentheses correspond to Table 1 above. These indicators are explained and defined in Part 3.

Table 2: List of indicators chosen for the assessment, based on relevance and quantity of data available.

Table 2: List of indicators that are relevant to the area, had related data available and had data available
1. Percent of population living below national poverty line (1)
2. Proportion of population below international poverty line (2)
3. Ratio of share in national income of highest to lowest quintile (3)
4. Proportion of population using improved sanitation facilities (4)
5. Proportion of population using an improved water source (5)
6. Share of households without electricity or other modern energy services (6)
7. Percentage of population using solid fuels for cooking (7)
8. Proportion of urban population living in slums (8)
9. Number of intentional homicides per 100,000 population (10)
10. Mortality rate under 5 years old (11), life expectancy at birth (12), healthy life years expectancy(13), percent of population with access to primary health care facilities (14), Immunization against infectious childhood diseases (15) and nutritional status of childhood diseases (17) were grouped as one indicator because there was no data on any of the individual indicators. In order to cover this as best as possible an outline of the region's health status was given reported on.
11. Morbidity of major diseases such as HIV/AIDS, Malaria, tuberculosis (20)
12. Gross intake into last year of primary education, by sex (21), Net enrolment rate in primary education (22), Adult secondary (tertiary) schooling attainment level by sex (23), Lifelong learning (24) and Adult literacy rate, by sex (25) were grouped into one indicator for the same reasons as point 10 above.
13. Population growth rate (26)
14. Dependency ratio (28)
15. Human and economic loss due to natural disasters (31)
16. Land use change (36)
17. Land degradation (37)
18. Land affected by desertification (38)
19. Arable and permanent cropland area (39)
20. Fertilizer use efficiency (40)
21. Use of agricultural pesticides (41)
22. Proportion of total water resource used (52)
23. Proportion of terrestrial area protected, total and by ecological region (57)
24. Management of effectiveness of protected areas (58)
25. Area of selected key ecosystems (59)
26. Fragmentation of habitat (60)
27. Abundance of selected key species (61)
28. Change in threat status of species (62)
29. Abundance of invasive alien species (63)
30. Gross domestic product (GDP) per capita (64)
31. Inflation (68)
32. Debt to GNI ratio (69)
33. Labour productivity and unit labour costs (70)
34. Number of internet users per 100 population (74)
35. Fixed telephone lines per 100 population (75)
36. Mobile cellular telephone subscribers per 100 population (76)
37. Tourism contribution to GDP (78)

Part 3: Indicator assessment

Part 3 assesses the information found on each of the indicators included and explains what each indicator means. The indicators that were classified as irrelevant were indicators that assess issues that do not exist in the municipality, for example, area of coral. The indicators that were relevant but did not have enough data on them were not assessed because data were unavailable. A discussion on each of the relevant indicators which had available data follows below.

1. Percent of population living below national poverty line (1):

   Percent of population living below national poverty line is:

   > "a standard measure of poverty, especially income poverty. It provides information on progress towards poverty alleviation, a central objective and requirement of sustainable development. The national poverty rate is one of the core measures of living standards and it draws attention exclusively towards the poor" (United Nations, 2007, pg.47).

   According to the latest figures available, the percentage of people living in Inxuba Yethemba local municipality below the poverty line was 60% in 2003 and this had decreased to 35% in 2013 (CHDM a, 2014). Although 35% is unacceptably high, the municipality has identified poverty alleviation as its major goal (CHDM a, 2015). Government contributes 52% to the total GDP of the Inxuba Yethemba local municipality; therefore, without government contributions and services, poverty in the area would not have necessarily improved as it has (CHDM Adopted Annual Report, 2014; Nicks, 2017). A reduction in the poverty level is a good sign of the region's sustainability (United Nations, 2007). However, if government reduce expenditure, the poverty situation might worsen.

2. Proportion of population below international poverty line (2):

   South Africa adopted the world poverty line recommendations of R1892 per month, set on 2005 prices. The number of people in poverty by this definition came down from 36 000 in 2003 to 17 000 in 2013. The population of Inxuba Yethemba is approximately 65 000 (CHDM c, 2014). A reduction in the poverty level is a good sign for a region's sustainability (United Nations, 2007).

3. Ratio of share in national income of highest to lowest quintile (3):

   This indicator shows the "extent of inequality in income distribution within a country" (United Nations, 2007, pg.47). For this measurement the GINI co-efficient is used. The GINI co-efficient measures the "inequality as a proportion of its theoretical maximum. The Gini co-efficient ranges from 0, which is no inequality, to 1 which is complete inequality" (CHDM a, 2014, pg.30). The Inxuba Yethemba local municipality has had a relatively stable GINI co-efficient of 0.5 over the past 10 years (CHDM a, 2014). A GINI co-efficient of 0.5 indicates an unequal society, meaning this region has been stable at a bad level of inequality. A very unequal society can cause social instability (Bosch et al., 2010). Therefore, the inequality level for Inxuba Yethemba does not help with the social sustainability of the region (Bosch et al., 2010). Even with a large proportion of the local economy coming from government, which is aimed at lifting the lower income proportion of the population out of poverty, there has been no net effect on the inequality of the region (CHDM a, 2014).

4. Proportion of population using improved sanitation facilities (4):

   Proportion of the population using improved sanitation facilities refers to:

   > "those with access to a private sanitary facility for human excreta disposal in their dwelling or immediate vicinity. Improved sanitary facilities range from simple but protected pit latrines to flush toilets with sewerage" (United Nations, 2007).

   This is an area that the Inxuba Yethemba local municipality has improved slightly. The percentage of homes with the improved sanitation has gone up from 72% in 2003 to 80% in 2013, faring well as an indication for the region's social sustainability. Improved sanitation is linked to a higher standard of living (Anderson and Nhlapo, 2009).

5. Proportion of population using an improved water source (5):

   This is defined as drinkable water within a convenient distance (United Nations, 2007). Safe accessible drinking water is critical for human health. Inxuba Yethemba has performed extremely well in this regard as, in 2012; they claimed

to have extended drinking water access to approximately 7000 more households since 1996. The municipality claimed that only 142 houses did not have access to clean water in 2012 (StatsSA, 2012 and United Nations, 2007). This improvement marks well in favour of the region's social sustainability because clean drinking water at a close distance is linked to healthier people who spend less time fetching water (Global Reporting and Education Fund (GHEF), 2007).

6. Share of households without electricity or other modern energy services (6):
   Share of households without electricity or other modern energy services refers to households that do not have access to electricity to light their house or use for other things like cooking (United Nations, 2007). Access to electricity is considered good for poverty alleviation and is necessary for sustainable economic and human development (IEA, 2017). According to the last community survey conducted in 2012, the Inxuba Municipality only had 955 households without electricity and over 18 000 households with electricity. Between 1996 and 2015, the number of households with power more than doubled (CHDM, 2015). The fact that a large portion of people have access to electricity in their houses is a good indication of an improvement in social and economic sustainability in the area.
7. Percentage of population using solid fuels for cooking (7):
   Although this exact data are not available at a municipal level, there are data regarding how many households use electricity for cooking. Of the 18 463 households in the municipality, just fewer than 18 000, about 97%, use electricity to cook (CHDM a, 2014). This does not answer the indicator directly but gives a good indication of the potential population that could be using solid fuels for cooking. The higher the percentage of people using electricity to cook translates to a lower percentage of people using solid fuels to cook. Using electricity is easier, safer and eliminates smoke that is released from cooking with solid fuels (International Energy Agency (IEA), 2006). This indicator is a positive sign of social sustainability as well as environmental sustainability of the region as there is less pressure on traditional fuel supplies
8. Proportion of urban population living in slums (8):

Proportion of urban population living in slums is defined as people living in a house that lacks clean water, improved sanitation, sufficient living space, physically secure house and security of tenure (United Nations, 2007). Although this information is not available, there are statistics of the number of formal and informal houses. Since 1996, the number of informal dwellings has decreased from 1594 houses to just less than 400 in 2011. The number of formal dwellings (defined as a well-structured house with water and electricity and access to ablutions) has increased by almost 6000 since 1996 (CHDM a, 2014). This is a good sign for social and economic sustainability.

9. Number of intentional homicides per 100,000 population (10):

   South African police have a bad reputation for recording crimes; however intentional murder rates statistics are estimated to be accurate (Kriegler and Shaw, 2016). The number of intentional murders has been stable since 1996 at about 140 murders per 100 000 people. If murders were going up, this would indicate negatively for the social sustainability for the area; however, they have levelled off. This is neither good or bad. Further investigation may be needed to find out if the population feels that there is a climate of fear and if they feel that the murder rate reduces their quality of life (CHDM b, 2014; United Nations, 2007).

10. Mortality rate under 5 years old (11), life expectancy at birth (12), healthy life years expectancy (13), percent of population with access to primary health care facilities (14), Immunisation against infectious childhood diseases (15) and nutritional status of childhood diseases (17):

    These are grouped together because there were no data found on any of the individual indicators. In order to cover this as best as possible, a brief outline of the region's health status was reported on. HIV and Aids, TB and child mortality are considered strategic areas to improve overall health (CHDM a, 2014). It is estimated that 30% of the population has HIV and that this figure has been increasing at a decreasing rate since 1996. This does not illustrate a sustainable situation; however, the municipality has realised this and has implemented an action plan to educate and support the general public and circumcise young males.

TB has remained stable and no data were found on child mortality (CHDM, 2013), (CHDM a, 2014), (CHDM b, 2014) and (CHDM, 2015).

11. Morbidity of major diseases such as HIV/AIDS, malaria, tuberculosis (20):

    As discussed in the indicator above, HIV and AIDS infects about 30% of the population. It is unclear how many people die from the diseases, because people die mostly of diseases which take advantage of the weak immune system associated with HIV/AIDS (Nail, 2016). However, 30% of the population having a terminal disease does not bode well for the region's social and economic sustainability, if the government implements its action plan of prevention and anti-retro viral drugs effectively, there should be some stability with the effect HIV/AIDS has on the sustainability of the region (CHDM a, 2014).

12. Gross intake into last year of primary education, by sex (21), Net enrolment rate in primary education (22), Adult secondary (tertiary) schooling attainment level by sex (23), Lifelong learning (24) and Adult literacy rate, by sex (25):

    These indicators were grouped together because no data were found on any of them, but since they all concern education, a review of the region's education is given.Net enrolment rates of people between the ages 5 and 24 attending and not attending school by sex was available. In 1996, 7663 males and 7891 females attended school, and 3600 males and 3455 females did not. In percentage terms, there is no significant difference between males and females; moreover 45% of the total population of the municipality between the ages of 5 and 24 in 1996 were not attending any form of schooling. In 2011, 7847 male and 8059 females attended school, and 3455 males and 3362 females did not. Again there was not much difference between males and females. However, 43% of the total population of the municipality between the ages of 5 and 24 in 2011 were still not attending any form of schooling. It is evident that not much has changed from 1996 to 2011 (CHDM a, 2014). Although the male and female figures are almost identical, which is a good indication of a stable society, the percentage of people not attending school is catastrophic for the region's sustainability. More information needed to be able to answer all of those indicators, but there is clearly a huge threat to the

region's social sustainability if over 40% of children are not going to school (Nayar, 2013)

13. Population growth rate (26):

The population of the region grew by 8% between 1996 and 2001 and then grew by another 8% between 2001 and 2011 (CHDM a, 2014). If the economy and environment can handle this population growth and people can continue to improve their livelihoods sustainably, then this would not be considered an indication for unsustainability. However, the sustainable population growth of the area is unknown.

14. Dependency ratio (28):

Dependency ratio is the ratio of people who are dependent (children below 15 years old and adults above 65 years old) on the people who are in the working age group. It gives an indication of the financial burden experienced by the working class. The higher the ratio, the worse off an area is (United Nations, 2007). The Inxuba Yethemba went from a ratio of 61.5 in 1996 to 54.7 in 2011 (CHDM b, 2012). Although there was a decrease, the ratio was still relatively high. To put the ratio into context, upper-income countries (Sweden and Germany) had an average of 43 in 2016 (World Bank, 2017).

15. Human and economic loss due to natural disasters (31):

According to Du Toit (2017), the only major natural disasters which affect the region are droughts, floods and fires. Danckerts and Stuart-Hill (2010) report that in a severe drought 80% of perennial grasses can die and Hoffman et al. (2009) report that droughts in the Karoo can cause huge socio-economic costs (Danckerts and Stuart-Hill, 1988; Hoffman et al., 2009). Wilhite (2000) acknowledged that the economic costs of droughts are almost impossible to calculate, but that in America, Texas droughts results in losses of billions of dollars (Withite, 2000). Wilhite (2000) also stated that droughts expose the soil to the risk of erosion and, as a result of the reduced plant cover, heavy rain is more likely to run off the surface and cause floods. In short, droughts, fires and foods do not cause loss of life in this municipality, but economic losses are significant. Du Toit (2017) calculated from

historical data that the Inxuba Yethemba local municipality (on average) has not a severe drought in the past 40 years.

16. Land-use change (36):

    Du Toit (2017) stated that there had been an insignificant amount of land-use change since farmers stocked the area over a century ago. Moreover, there is about 18 000 hectares of irrigation down the fish river valley used for agriculture which has developed since 1970. The town of Cradock is growing, but not rapidly enough for it to be a concern. The possibilities of uranium mining and fracking will result in a significant land-use change. At present, there has been no land-use change which affects the sustainability of the area (Du Toit, 2017).

17. Land degradation (37):

    According to Du Toit (2017), the natural environment surrounding Middelburg and Cradock has actually improved since 1970 due to two factors. Firstly, average rainfall has increased slightly, and secondly, there has been a reduction in the amount of livestock. This is a positive sign for the region's sustainability.

18. Land affected by desertification (38):

    According to Du Toit's (2017) research, there has been insignificant land desertification in the area. It is uncertain if global climate change might do to the area (Hoffmana et al., 2009).

19. Arable and permanent cropland area (39):

    There is no land in the municipality that can be used for rain-fed cropping; however, thanks to borehole water and the Fish River irrigation scheme, there is about 18 000 hectares of irrigated cropland. The amount of borehole irrigation in total makes up a very small area (Du Toit, 2017). The number of hectares is limited by the water rights owned by each farmer. Farmers are becoming more efficient with their water and so are expanding the number of cropland hectares, but this increase is not expected to be more than 30% of the current hectarage. There is no environmental sustainability concern regarding the amount of cropland area in the Inxuba Yethemba local municipality (Du Toit, 2017).

20. Fertilizer use efficiency (40):

No data were found for fertilizer use efficiency; however, according to Oberholzer, (2017), farmers have continued to invest in chemical and mechanical methods to improve their fertilizer efficiency (Oberholzer, 2017). However, the total cropland area makes up only very small percentage of the municipality's farmland and so fertilizer efficiency is not a major concern (Du Toit, 2017).

21. Use of agricultural pesticides (41):

    The use of pesticides increases every year on the irrigated crops, but it is undetermined whether this is damaging the environment. (Du Toit, 2017).

22. Proportion of total water resource used (52):

    According to Du Toit (2017), Middelburg has managed its water reserves badly and the town now has restrictions. Cradock uses Fish River water, which is replenished from the irrigation scheme. The boreholes used by farmers are mostly self-replenishing boreholes and are used for household and livestock consumption, as well as, in some instances, small croplands (Du Toit, 2017).

23. Proportion of terrestrial area protected; total and by ecological region (57):

    Protected area in the municipality is approximately 0.7% and untransformed land accounts for 98% of the total area. Untransformed land is defined as land that is not protected, but that has not been altered to a large extent by humans (Mucina et al., 2007). This is a good sign for the region's environmental sustainability.

24. Management of effectiveness of protected areas (58):

    The Mountain Zebra National Park and a small portion of the Commando Drift Nature Reserve are part of the Inxuba Yethemba region and they are considered to be well managed, according to Du Toit (2017), which is good indication of the environmental sustainability of the area.

25. Area of selected key ecosystems (59):

    No key ecosystems were identified by Du Toit (2017).

26. Fragmentation of habitat (60):

    According to Du Toit (2017), the ecosystem was fragmented by the introduction of fences and well-used roads more than a century ago. Since then there has been no evidence of further fragmentation (Du Toit, 2017). However, Karoo

fragmentation with fences was the root cause of the annihilation of the great herds of game (Sheridan, 2014).

27. Abundance of selected key species (61):

    There is evidence to suggest that the key species are abundant (Du Toit, 2017).

28. Change in threat status of species (62):

    There is no evidence to suggest that there is a change in the threat status of species endemic to the Karoo (Du Toit, 2017). Of the 10 most endangered species in South Africa, only the Blue Crane occurs in the area and the population of these birds in the Inxuba Yethemba local municipality is estimated to be stable (Du Toit, 2017).

29. Abundance of invasive alien species (63):

    There is no evidence to suggest that there is an abundance of invasive alien species, mostly because the natural veld is too dry for most of the invasive species found in South Africa (Du Toit, 2017).

30. Gross domestic product (GDP) per capita (64):

    Gross domestic product for the region per capita is a "basic economic growth indicator and measures the level and extent of total economic output. It reflects changes in total production of goods and services. It is a powerful summary indicator of economic development" (United Nations, 2007, pg.75). The GDP per capita over the past 10 years has increased by just over 2% in comparison to South Africa which grew at just over 3%. This is a staggeringly low increase in GDP per person, considering South Africa is a developing country. The actual GDP/capita amount in 2013 was R27 900 based on 2005 price levels (CHDM a, 2014). The concern with this is that the net wealth of the population per capita is not increasing as fast as other developing nations (World Bank GDP/Capita, 2015) and this wealth includes the fact that over 52% of the region's expenditure is from government, which bodes ill for its economic sustainability.

31. Inflation (68):

    Inflation is an important indicator for economies used globally. If inflation is too high, people's money starts to lose value, as in Zimbabwe (Mithun, 2013); inflation being too low means economic growth can be stifled as in Japan (Harding, 2016).

The South African inflation rate sat at about 6.5% last year, according the South African Reserve Bank (SARB, 2017). The SARB have an inflation target which they aim to achieve and have successfully done this over the past few years by using the interest rate. Inflation in South Africa is under control and stable (Market Insight South Africa, 2016). Although the value of people's money is decreasing by about 6% every year, the SARB cannot lower without the risk of damaging the economy through higher interest rates (SARB, 2017). As long as the SARB keeps inflation stable, it will contribute to the sustainability of the Inxuba Yethemba local municipality, mainly through preventing the value of the social grant being eroded by inflation, which would drive up poverty.

32. Debt to GNI ratio (69):

No data were found for the Inxuba Yethemba local municipality, mainly because the Chris Hani district deals with most of the finances. In the latest annual financial report, the municipality claimed that all debt had been paid (CHDM, 2015). The figures for private debt were not found. The fact that the Chris Hani district has no debt is a good sign for the region's sustainability.

33. Labour productivity and unit labour costs (70):

The data for labour productivity were not available; however the fact that the region experiences high unemployment in the fields of trade and agriculture demonstrates that labour is unskilled and has low productivity in the Inxuba Yethemba area (CHDM a, 2015). Unemployment increased by about 8% from 2003 to 2013 (CHDM a, 2014) and the minimum wage is expected to reach an all-time high in March 2017 for the agricultural sector (Agri East Cape, 2016). Whether the rise in wage will result in increased unemployment is under dispute (Businesstech, 2016). A higher wage will improve the GINI co-efficient but might affect employment (Isaaces, 2016). What should be a concern for sustainability is that the economically active population, the labour participation rate, employment, rate of employment and number of formally and informally employed have all come down between 2002 and 2013 (CHDM a, 2014). What is happening to these indicators does not reflect positively on the region's sustainability.

34. Number of internet users per 100 population (74):

Data for this were found per household, not per 100 people in the population. In 2011, 4848 of the 18 463 households in the municipality had access to internet. This equates to about a quarter of households. Internet is important for businesses, finding jobs, access to information and for many other reasons, and therefore, the more households with access, the better off society is (StatsSA, 2012; CHDM a, 2015). The aim should be 100% of households with internet in order to call it a good sign for technological advancement and an improvement in economic sustainability.

35. Fixed telephone lines per 100 population (75):'

    Data for this were found per household, not per 100 people in the population. In 2001, 4349 households had a landline and in 2011 it had dropped to 2773 (StatsSA, 2012). This could be due to mobile phones being more effective and therefore this indicator is not effective as an assessment of the area's technological advancement and economic and social sustainability.

36. Mobile cellular telephone subscribers per 100 population (76):

    Data for this were found per household, not per 100 people in the population. In 2001, 3377 households had access to cell phones and in 2011 the number had grown to 14 322. This is a good sustainability indicator (StatsSA, 2012). Moreover, it can be estimated now that almost all households have access to at least one cell phone. The more connectivity people have, the more economic and social opportunities they are exposed to, therefore increased mobile telephone subscribers indicate economic and social sustainability.

37. Tourism contribution to GDP (78):

    These data were only found for the Chris Hani district. It was reported that tourism stayed steady at 10% from 2002 to 2010, and then decreased steadily to 7% in 2012. Tourism is considered by the municipality as an area for potential growth (CHDM a, 2015). The decrease in the percentage of tourism is not a good indication, considering that it is ear-marked as a growth area. This is an area for concern and does not bode well for the area's sustainability if the trend continues downward.

Chapter 5 Discussion

The research question of this thesis was to assess the sustainability of the Inxuba Yethemba local municipality with the aim of giving recommendations which could be used to achieve the goals set out for the region to policy-makers. This chapter attempts to address this question, and give the key findings of the research.

The motivation for carrying out a sustainability assessment on a region came from the NDP 2030 (2012) which emphasised that its goals are to reduce poverty, unemployment and inequality in a sustainable manner, while reporting its progress along the way (NDP 2030, 2012). It was found that the Eastern Cape had been lagging behind the rest of the country with regard to these NDP 2030 goals (StatsSA, 2011), and that limited assessments had been done at the local municipality level (CHDM a, 2015). Research by Moldan and Billhars (1999) established that sustainability assessments were important for sustainable development, and research by Anielski and Winfield (2002) and Chatzninikolaou and Manos (2013) found that the smaller the region of study, the more accurate the findings. This revealed an opportunity for research into sustainability assessments at the local municipality level. StatsSA only report down to the level of local municipalities in their community surveys (StatsSA, 2011). The Inxuba Yethemba local municipality was chosen for assessment because it falls within the Eastern Cape, no sustainability assessment was found on the area, and it is a local municipality with limited data available (CHDM a, 2014).

In order to compile an assessment for the Inxuba Yethemba local municipality, the literature on sustainability assessments was reviewed and 11 frameworks (found in Chapter 2) were identified. The finding here was that a framework with indicators was needed in order to carry out an assessment (GRI, 2013), and that the framework needed to be suitable for the assessment of a municipality region like Inxuba Yethemba (Labuschagne et al., 2007). The characteristics of Inxuba Yethemba which make it unique are the fact that there are limited data available about the area within the context of sustainability, it is a semi-rural and semi-urban, and the economy is dominated by agricultural and government spending (CHDM, 2011).

The finding from the 11 frameworks with regard to sustainability assessments was that a framework needs to include economic, social, environmental and, where possible, institutional indicators (Chatzinikolaou and Manos, 2013; Labuschagne et al., 2007). Moreover, a framework for an area like Inxuba Yethemba also needs to factor in the region's unique characteristics. From the 11 frameworks, the GRI, Wuppertal, IChemE and the UNCSD laid the foundation on which to establish a suitable framework mainly by introducing the necessity of including a minimum of economic, social, and environmental indicators, as well as the fact that recommendations should be aimed at policy-makers (Labuschagne et al., 2007). None of these frameworks was chosen because they were not aimed at regional assessments, the measuring and data collection of their indicators was beyond the scope of this research, and no sound recommendations were made on how to adapt the framework in order for it to become a more suitable assessment framework.

The findings from Paracchini et al. (2011), Gomez-Limon and Sanchez-Fernandez (2010), Zahm et al. (2008), Van Cauwenbergh et al. (2007), Anielski and Winfield (2002), Gauvin(2012) and Heydayati-Moghadam et al. (2014) were that an assessment framework suitable for Inxuba Yethemba must be simple, aimed at regional areas, easy and cheap to acquire data, and objective to avoid bias. Moreover, the findings from the assessment must be displayed in order for policy-makers to make use of them. None of these frameworks was chosen mainly because they were not developed for a South African context.

The UNISDGM (2007) framework was chosen as a framework to assess the Inxuba Yethemba local municipality because it included indicators which covered a broad range of aspects; the framework gave a simple method of selecting which indicators to include from the given indicators; it had a South African context; it included all the aspects of sustainability recommended by the GRI and the literature reviewed above; it acknowledged the difficulties with doing an assessment with limited data, and it recognised that reporting on the indicators must be done in the fashion most suitable for the readers of the report. The main reason for choosing the UNISDGM (2007) was because it was used for the Agenda 21 and the Johannesburg plan of implementation

and thus was the framework that was geographically the closest fit to the Inxuba Yethemba local municipality (United Nations, 2007). As mentioned above, the framework gave recommendations on how indicators should be chosen, which contributed to the next set of findings.

The choice of indicators was made using the matrix displayed as Figure 3 from the UNISDGM (2007) framework. It sifted out all indicators which were irrelevant, in this case any indicators that dealt with forests and coastlines. It also sifted out any indicators which had no data available and recommended that where data were partly available and where indicators were marginally relevant that reporting should still take place. Forty-six out of 96 indicators were considered relevant and having sufficient data to report on them. Seven indicators were considered irrelevant, and 43 indicators were relevant, but did not have enough data or any relevant data for analysis. These 43 indicators found in Table 1, demarcate an area that policy-makers should consider looking at to see which indicators are important enough to start investigating. The finding here was also that the government reports mainly on social issues. Out of the 46 indicators reported on, 27 were social based, 15 concerned environmental issues and four concerned the economy. Most indicators overlap between social, economic and environmental categories (for example cell phone use could be economic or social), but social indicators are still reported on most often. Of the 15 environmental indicators, most were answered in an interview with an ecology researcher from the local research station, as there was almost no peer-reviewed information about the environmental indicators. The economic indicators were also poorly reported on (United Nations, 2007). The finding here is that if the Inxuba Yethemba local municipality reports mostly on social issues, more attention should be given to economic and environmental research in order to achieve a holistic sustainability assessment that can be useful for tracking changes in the region (United Nations, 2007).

Poverty, sanitation, water quality, electricity, informal housing, dependency ratio and electronic communication have all improved since 1996 (CHDM a, 2014). This is a great achievement for the region and a sound indication of social stability and sustainability (United Nations, 2007). However, government spending is more than half the region's total annual expenditure (CHDM c, 2014). The finding here is that although these social

indicators demonstrate positively towards the overall sustainability of the area, government spending could be the cause of this achievement. This raises the question of how sustainable is the region if government spending and social grants are largely responsible for the indicator improvement?

Inequality (GINI co-efficient), murder rates, health, have all moved sideways with no real improvement and no real decline since 1996 (CHDM a, 2014), indicating a moderate social sustainability scenario. All of these indicators are seen as high, but not catastrophic. The findings here suggest that more research needs to be done on the medical and health aspects in this municipality and the GINI and murder rates need to be watched that they do not start to slide. Schooling, one of the social indicators, showed that from 1996 to 2011 over 40% of children between 5 and 24 did not attend school. This means that 40% of the people reaching the legal working age over the past few years would not have attended school (CHDM a, 2014). The main finding here is that education is probably the biggest concern for the region's social sustainability (CHDM a, 2014), and where policy-makers need to focus (United Nations, 2007).

With regard to the environmental indicators for the municipality, there seem to be no current and major unsustainable practices and the protected areas are estimated to be well managed (Du Toit, 2017). Furthermore, because crop farming takes place on a very small proportion of the municipality, it poses less risk of environmental damage (Du Toit, 2017). According to Du Toit (2017), the environment of the Inxuba Yethemba is on a sustainable path and threats to the sustainability of the environment might come from bad grazing practices, uranium mining, fracking and extended droughts.

With regard to the economy of the area, the GDP of the municipality has grown exceptionally slowly in comparison to other developing countries, and even in comparison to other areas in South Africa (CHDM, 2015). This can put pressure on the society as people do not create wealth as fast as they should be doing in order to improve their livelihoods (United Nations, 2007). Labour productivity is also a major concern as it is regarded as low due to the high number of unskilled, unemployed people (CHDM, 2015). Labour productivity improves with education, which is an area already discussed. On the other hand, the pressure of high unemployment and slow economic growth are relieved

by stable inflation experienced over the past few years (SARB, 2017). A different scenario would emerge if South Africa experienced hyperinflation as this would diminish the social grant's buying power (Mithun, 2013) on which 65% of households in the municipality rely (CHDM, 2013). Tourism is another area policymakers should be considering because income from tourism is declining. With regard to agriculture, irrigated crops, which constitute 2% of the total agricultural area, generate approximately 70% of the total agricultural turnover and 98% of the total agricultural area (extensive farming) produces approximately 30% of the total turnover (Van de Walt, 2017; Hough, 2017). This illustrates the importance of irrigation to the economy of the area.

The limitations of this study were the available data found on the indicators of the UNISDGM framework. Another limitation was that data were often extracted from the latest community survey which was in 2012, and so may be slightly outdated. Where data were not available found, interviews were conducted and interviewees were purposefully selected, which could have biased the research.

Chapter 6 Conclusion

6.1 Main findings

The main findings of this thesis were that South Africa is attempting to sustainably eradicate its poverty by implementing the NDP 2030 (NPC, 2012). However, successful and sustainable implementation of the NDP 2030 requires sustainability assessments of different geographical regions (Moldan and Billhars, 1999), and this was acknowledged in the NDP 2030 (NPC, 2012). Sustainability assessments are most effective when practised on small local municipalities or regions (Anielski and Winfield, 2002). The Inxuba Yethemba local municipality was chosen for assessment because it is located in the Eastern Cape which is performing badly regarding poverty alleviation (CHDM a, 2014), and where there has been little research (CHDM, 2011), thus marking the area as a potential area where a contribution could be made. The UNISDMG (2007) framework was chosen to assess the sustainability of the Inxuba Yethemba local municipality because it best represented the unique characteristics of the area (NPC, 2012; CHDM, 2011) and included important aspects from other frameworks.

When choosing the indicators from the UNISDMG (2007) framework it was found that the government and reporting agencies do not report on many of the indicators (CHDM a, 2014) and therefore, the conclusion is that there are data absent which might be useful for policy-makers in achieving their development goals (NPC, 2012)

From the indicators which were assessed, it was found that, contrary to the Eastern Cape poverty figures, the Inxuba Yethemba local municipality had made good progress on poverty, and although unemployment was exceptionally high, inequality had remained stable (CHDM a, 2012; CHDM b, 2014). Other social indicators such as electricity in households, formal housing, amongst others mentioned in Chapter 4, had also shown signs of great improvement (CHDM a, 2014). However, the major finding was that, contrary to the idea that this was a sign of social stability and sustainability, most of these achievements had been directly attributed to government handouts (CHDM b, 2014). This raises the question of how sustainable is poverty relief if it comes straight from the government coffers. Another factor of concern is that education and skills training are the Achilles heel of this region and serious attention needs to be given to this area.

Regarding the findings on the environmental indicators, it was found that, contrary to the findings of Dean and McDonald (1994), the environment seemed to be in a sustainable and stable condition. If fracking and uranium mining were to take place, then more assessments would need to take place (Du Toit, 2017). The Inxuba Yethemba economy has not grown nearly as fast as was required in the NDP 2030 goals, and of that economic growth, a large part of it comes from government spending which makes up almost half of the GGP (CHDM a, 2014; NPC, 2012). Another economic finding was that hyperinflation would seriously impact the value of the social grant on which 65% of the households in the area depend. Overall the assessment found that there is not enough data being recorded on sustainability indicators to form a proper assessment, the region's sustainability is vulnerable due to the high reliance on government spending, education and skills training needs attention and the environment on average seems to be on a sustainable path.

6.2 Recommendations

The recommendations are that government should complete a full sustainability report as often as needed in order to expose the weaknesses and strengths of the municipality. This will allow them to monitor and track the progress that has been made and result in more informed decisions as seen in some of the Canadian states (Gauvin, 2012). This will help the decision-makers to put the region onto the desired sustainable growth path outlined in the NDP (2030) report (NPC, 2012).

Another recommendation for government is that they cannot stop the social grant spending and government contribution to the area because, without this support, the region may become totally socially and economically unsustainable. Recommendations for further research are to investigate to what extent government spending contributes to the sustainability of the area, and how sustainable this spending is.

Education and skills training were highlighted at the biggest area of concern for the municipality (CHDM a, 2014). This needs to be improved at all costs in order to make the region more sustainable (Nayar, 2013). In summary, the region's social and economic sustainability can be imagined as a migraine, with government spending acting as a

painkiller. It helps with the sustainability in the area now, but further research may need to be done to see how the issues causing the migraine can be solved.

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