

GIS (GEOGRAPHICAL INFORMATION SYSTEMS) AS A FACILITATION TOOL FOR SUSTAINABLE DEVELOPMENT IN AFRICA

Elizabeth Hicken

INTRODUCTION

Africa has been typified in the last half century as a region struggling against poverty, debt, conflict and poor governance structures. Less obvious to the world are the inherent effects of this on the environment, biological systems and human livelihoods. The establishment of a global paradigm for sustainable development through the Millennium Development Goals of 2000, has created a benchmark for progress and cross-border standardisation and comparison for advancement.

The continent has reached a level of evolution where the tools which contribute to the achievement of these goals have become paramount. This refers to the methods and technologies used to facilitate the measurement and communication of the associated baseline data, such as information systems. More specifically, geographical information systems (GIS), as one of the Earth observation or geomatics technologies, enable data with a spatial dimension to be processed. GIS provides an ideal mechanism for the collection, storage, analysis, communication and reporting of MDG Indicator data. This paper consolidates the interrelationship between sustainable development and geographical information systems through the common element of development information and provides a practical example of this within the local governance setting of South Africa.

BACKGROUND

Sustainable development is a concept born from a necessity to address a number of global concerns related to the expansion of human populations and associated destructive development patterns. Globalisation and global shocks, climate change and natural disasters as well as environmental degradation and poverty are the most relevant of these issues. A succession of world-wide guiding documents have been created since 1992 to address these, with the MDG targets and indicators currently forming the global parameters for the measurement and comparison of sustainable progress.

According to the UNEP¹'s 2006 publication: *Africa Environment Outlook 2*, the choices that Africa makes to position itself globally in these rapidly changing conditions have become critical to the continent's well being. As a mostly developing region, Africa is vulnerable to the negative impacts of globalisation, climate change and other uncontrollable conditions. The creation of institutions and systems for sustainable

¹ United Nations Environment Programme

development is key to successful progress. International and continental commitments like NEPAD², Agenda 21, the MDGs³ and the formation of sub-regional economic communities are evidence that Africa takes its challenges seriously and is leveraging the benefits of its natural resource base and global markets. Geospatial science initiatives are increasingly being used to support these activities, emphasising the collaboration required for successful development, and the need for holistic planning between sectors and countries.

SUSTAINABLE DEVELOPMENT, GIS AND DEVELOPMENT INFORMATION

Sustainable development can be described as *the progression of humanity towards a lasting condition of peace whereby economic growth, human expansion and changing social conditions adhere to basic human rights, the preservation of the natural environment, and planet Earth as a whole.*

The majority of African countries are not expected to achieve the Millennium Development Goal targets by 2015, according to the United Nations 2007 mid term status report. Granted that Africa did not begin on an equal footing compared to other regions, the exigency of its development issues places the continent under extreme pressure to make sustainable progress over the next seven years. Technologies have been identified as a significant method to facilitate the necessary growth, and in combination with other factors are anticipated to be a significant contributor to sustainable development.

Both Agenda 21 and the Johannesburg Plan of Implementation make significant reference to geomatics technologies, development information and statistics as essential to the implementation of sustainable development. The primary basis for the measurement and reporting of sustainability is through the Millennium Development Goals and their associated targets and indicators. Indicators can be described as a method to give a quantitative value to an otherwise unmeasurable, intangible concept (Michael, 1986). For example, MDG Goal 7: *Ensure Environmental Sustainability*, Target 7B: *Reduce Biodiversity Loss*, Indicator 7.5: *Proportion of Terrestrial and Marine Areas Protected* – which can be represented as a percentage. The MDG Indicators are not only numerically based, but are linked to a particular geographical location – generally a country or region. This suggests that GIS and spatial technologies are intrinsic to capturing, analysing and disseminating location-based development data over time, to be used in the implementation of sustainable policies.

Information is the intangible capital in our evolving knowledge economy, and this places technologies like GIS at the forefront of global activities. From an African perspective, the correct adaptation and utilisation

² The New Partnership for Africa's Development

³ Millennium Development Goals

of geo data could assist in addressing existing issues caused by unsustainable development. The African Centre for Statistics acknowledges that their core functions are aligned with global sustainability and that statistics are essential to development which in turn enables improved governance and service delivery. Knowledge is the evolution of information and is a result of the experience gained from applying and analysing data. Information underpins the development and improvement of national policies, and in the third world this makes it a critical developmental resource and a primary aid to enhancing strategic governance. At an operational level, information is essential for the routine codification of daily tasks like service delivery and planning. (KMA, 2005)

Furthermore, not only do governments administrate within specific jurisdictions but 90% of a local government's business is land or property based. The majority of the resource and human issues faced by local government are dealt with by virtue of their spatial location. GIS, as a type information system has the ability to form the substructure of full ICT and e-governance solutions whereby it can be applied as a cross-cutting information tool between departments and also vertically within governance structures. Finally, GIS or geospatial science technologies in general, have a reciprocal relationship with development information. They can not only be used in the collection of data for daily decision-making, census taking and other statistical activities, but form an ideal platform through which this information can be used and shared.

THE SOUTH AFRICAN LOCAL GOVERNMENT CASE

The realisation that there is a positive reinforcing relationship between sustainable development, geographical information systems and development information has led a number of governments to increase budgets for GIS departments at a local level, and general usability and awareness of this technology is increasing. A closer look at the South African municipal setting gives rise to a number of practical obstacles and opportunities inherent in the implementation of these premises in reality.

South Africa is considered the economic and political vanguard of the African continent, and includes the dual paradigms of the first and the third world. Although the country has achieved, or is likely to achieve, the 2015 MDG targets, and the Constitution specifically places a duty on municipalities to fulfill their mandate of service provision to local communities in a sustainable manner, the *National Framework for Sustainable Development* states that it was acknowledged in 2005 that debilitating incapacities at local government level were the result of service delivery failures, and therefore these objectives were not being met.

This framework and the associated action plan are still intended for completion, and there remains an evident lack of understanding or integration of sustainable principles and practices at a local level. In the interim, various socio-economic, development and environmental Acts and regulations guide local government in South Africa, who are also required to produce annual Integrated Development Plans (IDPs). These are short, medium and long term strategic plans for the successful management and development of the region, and link resources to objectives through comprehensive budgets (DPLG, 2005). The IDPs are the basis for municipal operations and are the main reporting mechanism to the public and to higher levels of government.

A general lack of GIS coordination, and absence of a spatial data substructure at a local level, as well as GIS solutions not being sufficiently applied to specific municipal problems are identified as the current primary obstacles to fully enabled geo environments within local government. In terms of development information, local data for daily planning is often gathered on an ad hoc or project basis. An otherwise top-down data approach is applied, and there is insufficient alignment of planning data with spatial data infrastructure. There is little evidence of a formal or systematic linkage between national census data, MDG indicator data and municipalities.

TRENDS AND OPPORTUNITIES

Although the Municipal Integrated Development Plans provide a sound foundation for the course of municipal activities during a year, they are not obliged to be prepared in a format which will allow their information to be aggregated numerically or graphically to a national level for comparison and trending. An SDF, or Spatial Development Framework in terms of land use management, is a requirement of the plans, but similarly no data format is specified for this. Maps and statistics may accompany, but are not a stipulated accompaniment of, the plans. Creating a bottom-up system to communicate development information in a spatial format would increase the efficiency and effectiveness of data provision for daily planning, which could also be aggregated to national levels for MDG reporting.

Geographical information systems are increasingly being implemented as part of broader information and content management systems enabling multiple departments and users of varying skills to apply GIS functionality in their daily work from a centralised database. This trend is likely to progress into full municipal ICT implementations, where increasingly corporate solutions follow general IT and technological trends. A system of shared GIS services is also appropriate for countries with uneven settlement patterns and outlying rural areas. In

municipalities where full GIS functionality does not make sense, they are able to leverage the services of neighbouring or higher level units.

In developing countries, where much of the land is occupied informally or by an indigent population, it is critical to move beyond landholding databases and management systems to a reality where local governance units are capacitated to act as the primary collectors and communicators of electronic socio-economic and demographic statistical and infrastructural services data. These decentralised municipal information processes could improve the quality and timeliness of information transmission for better and quicker decisions. The implementation of the relevant spatial information technologies and processes would facilitate both the collection and dissemination of this data, as well as enabling the interpretation and sharing of existing and external information.

CONCLUSION

Africa is experiencing a strong developmental phase and, coupled with global concerns, is at a crossroads where both sustainable development and unsustainable transgression are possible as a result of this turbulent evolutionary process. African countries need to be guided by policies which maximise the efficiency of their extensive natural resources to the benefit of the population, without negatively impacting on the biological environment or longterm resource supply. The concept of sustainable development is seen as critical to the African continent if social and poverty issues are to be overcome, environmental resources are to be maintained and economies are to be grown to leverage the potential of global markets.

Technology does not exist as a solution in itself to solve environmental, social and economic problems, but rather it is a medium through which to effect transparent reporting on the status and change in issues relating to the principles of Sustainable Development. Societal imbalances and environmental degradation require the direct application of their own particular solutions according to a complex set of causes within their cultural, infrastructural, legal and governance settings. Sustainability in the context of this study means self reliance, and correct information management is critical to this concept. From the perspective of an African country, the provision of bottom line planning data is key to Sustainable Development. Geographical Information Systems as a member of the Geomatics or Earth Observation systems is a tool which could significantly contribute to the attainment of the required information substructure, if used to its full potential.

REFERENCES

- DPLG, 2005. Department of Provincial and Local Government of South Africa: *Municipal Integrated Development Planning (IDP)*. [Internet] <
<http://www.thedplg.gov.za/subwebsites/annualreport/IDP%20booklet.pdf>> [Accessed 5th August 2007]
- KMA, 2005. Knowledge Management Africa: *Knowledge to address Africa's development challenges, Edited proceedings of the inaugural KMA conference, Johannesburg 2005*
- Michael, 1986. Tools for policy-making: Indicators and policy assessment in Bulmer et al: *Social Science and Social Policy* cited in NFSD 2006
- UN, 1992b. The Rio de Janeiro United Nations conference on Environment and Development: Declaration of 3-14 June 1992, A/CONF.151/26 (Vol.1)

ACKNOWLEDGEMENTS

The Geo-Informatics Development fund of South Africa,

The United Nations Economic Commission for Africa, Geo-Information Systems Section,

Kingston University,

The following South African persons and departments for their participation in the case study:
(The opinions expressed in this paper are not necessarily those of the primary research participants.)

Mr Chris Carter of MHP Geospace
Mr Lance Nel of TGIS
Mr Dudley Smith on behalf of Ingwe Municipality, KwaZulu-Natal
Mr Samuel Yirenkyi on behalf of the KwaZulu-Natal LGTA
The Western Cape EADP

,and to those persons and organisations who wish for their contributions to remain confidential.