Spatial demographic change and development typology for South Africa

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1. Background

Demography according to Matthews (2013, p. 271) is an inherently spatial science, that has not always been widely applied, yet it is critically important when spatial perspectives has to be developed that inform planning and investment decisions. In the developing country context viewing demography through spatial lenses can improve the understanding of area specific realities and better inform the planning process. This is also true for South Africa where urbanisation (through migration) is still a strong current reality, affecting the South African settlement landscape (Kok & Collinson , 2006). South Africa is fortunate to have a number of spatial units/ frameworks for which information is collected through censuses and additionally through surveys. Additional spatial units such as the 'CSIR's mesozones' have also been developed to aid spatial targeting and to overcome constrains associated with using administrative units. Utilising these units, typologies has been developed to distinguish areas/regions with respect to demographic constructs and trends.

Adding to the challenge of complete spatial demographic analysis and the development of typologies is the need to supplement the national statistics with other data such as migration data. This paper profiles the use of alternative spatial frameworks (mesozones) combined with census as well as alternative data to create a demographic change and development typology for South Africa.

2. The need for additional spatial frameworks

Spatial demography is concerned with spatial analysis of demographic processes and outcomes (Matthews & Parker, 2013, p. 272) and as a result does not only consider administrative units. Differing scales and demarcations also makes data integration and the comparison of data difficult (For example; environmental and socio-economic analysis adopts different spatial areas as basic units). A number of years ago the CSIR developed the ***mesozones*** (an irregular, meso-scale geoframe) which is a demarcation of South Africa into 25000 spatial units. These mesozones were created in such a way that they fit completely within the current municipalities and other significant geo-economic and historic area demarcations. The zone boundaries correspond with major travel barriers (such as rivers) as well as 'break lines' between sparsely populated areas (such as mountains) and areas with medium to high levels of human activity (such as fertile valleys or built up areas). The mesozones aim to address several problems typically found when working with spatially portrayed socio-economic data. These include the following:

- It is generally difficult to relate or compare spatial data that use differing analysis units and scales such as catchment data compared to information presented for local municipalities.
- To address the modifiable area unit problem (MAUP) - this refers to arbitrary zone-size distortions of quantity maps. The MAUP is “a problem arising from the imposition of artificial units of spatial reporting on continuous geographical phenomena resulting in the generation of artificial spatial patterns” (Heywood, Cornelius, & Carver, 1998).

The following figure presents an illustration of the mesozones for a portion of the country.

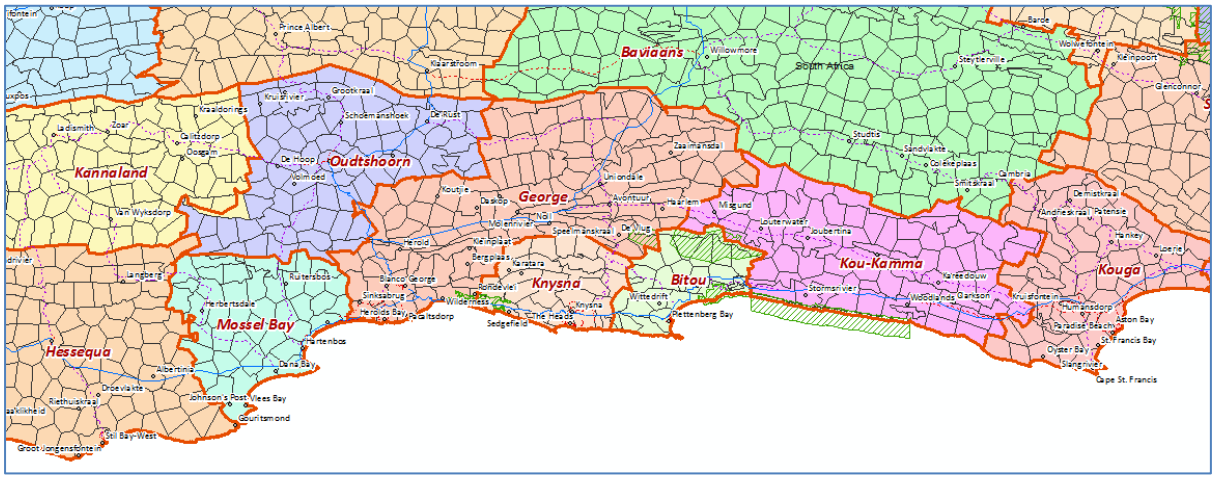

Figure 1: Example of mesozones.

The fine granularity of information of the mesozones means that more spatially specific maps can be created that allow for a better understanding of the location and extent of features or activity. Various datasets are assigned to mesozones based on an algorithm developed by the CSIR and which is based on the principles of dasymetric mapping. A dasymetric map is the result of a procedure applied to a spatial dataset for which the underlying statistical surface is unknown, but for which the aggregate data already exists (Mans, 2012). The aggregate dataset’s demarcation is however not based on variation in the underlying statistical surface but rather the result of convenience of enumeration (Eicher & Brewer, 2001) (Mennis & Hultgren, 2005). The key focus of the mesozones is referring particularly to the “how much is where?” type of question – is mainly on *human/ economic activity and population variables* and derived indicators such as *demands on infrastructure and ecosystem services*.

3. Developing typologies

Using the abovementioned mesozone framework, a typology was developed previously for South Africa to provide a mechanism to profile (identify, calculate and analyse) a set of development information and trends pertaining to the towns and cities, as well as high density rural settlements across South Africa. This dataset is known as the CSIR/SACN typology. It was developed to highlight

the importance of the functional urban and rural concentrations and to avoid a mere focus on cities/towns in terms of a hierarchy of population size or economic activity (Maritz, 2014). It can be utilised to develop profiles that enable the geographic specific analyses of the network of settlements, towns and cities and the hierarchical and functional relationships between them. Subsequently various government departments indicated the need to categorise regions in South Africa according to their economic and demographic development realities (at a finer grain) as this would inform national and regional spatial planning interventions. This framework would be used to develop a spatial demographic change and development typology for South Africa.

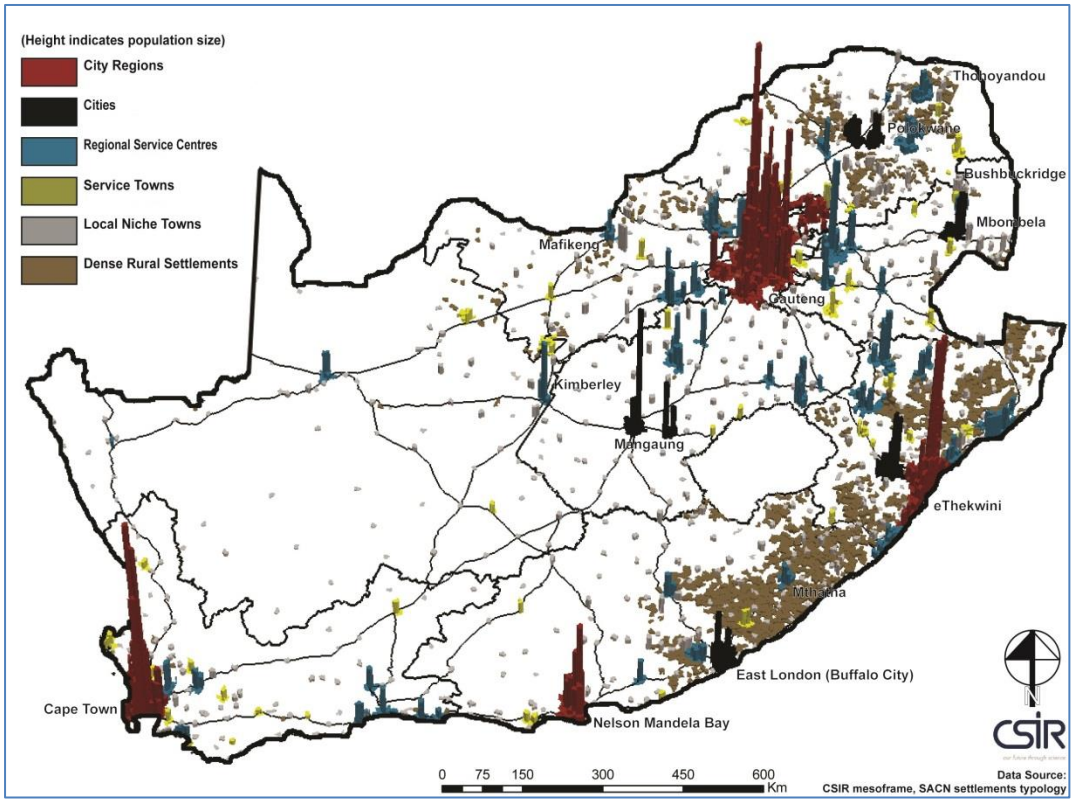

Figure 2: CSIR/SACN settlement typology.

4. Methodology

The existing mesozones is being used as a base for further development. Additional demographic attributes have been added to the mesozones using a dasymetric mapping, which included a broad spectrum of attributes comprising education, age and migration information. Due to the limitations within the national census migration information is limited. Using separate voter registration data from the Independent Electoral Commission (IEC), migration movement (origin/destinations) could be detected. All information was related to the mesozones. Much can be done when considering single attributes such as population numbers, net migration, age groups etc. The objective however is to create a new typology to reflect demographic change and development and subsequently temporal information is required for all attributes. Previous research and development work also linked economic and natural geography data to the mesozone framework which can be used to identify correlations and can further enhance the typology development.

The methodology will also include the following:

- Theoretical framework - to provide the basis for the selection and combination of indicators and to ensure fit-for-purpose
- Multivariate analysis – to assess the suitability and select the data. Principle component analysis is being considered
- Links to other data – to explore correlations and links to other data or indicators
- Visualisation – explore the most effective ways to present this information both spatially and graphically.

5. Expected findings

(Note – the analysis of the results is currently being undertaken and the following indicates some of the expected findings)

- There could be a strong correlation with population growth and migration trends with economic growth and decline (currently several mining areas are in decline resulting in an exodus to other urban centres)
- Some areas of South Africa can be categorised as remittance or public sector sustained due to the effect of government and financial transfers
- Age structures align with settlement types (important considering South Africa's spatial development past.)
- Distressed rural district are experiencing a readjustment of population due to the lack of services and economic opportunities

(The above are just some expected findings – the full paper will feature the complete outcomes)

6. Bibliography

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