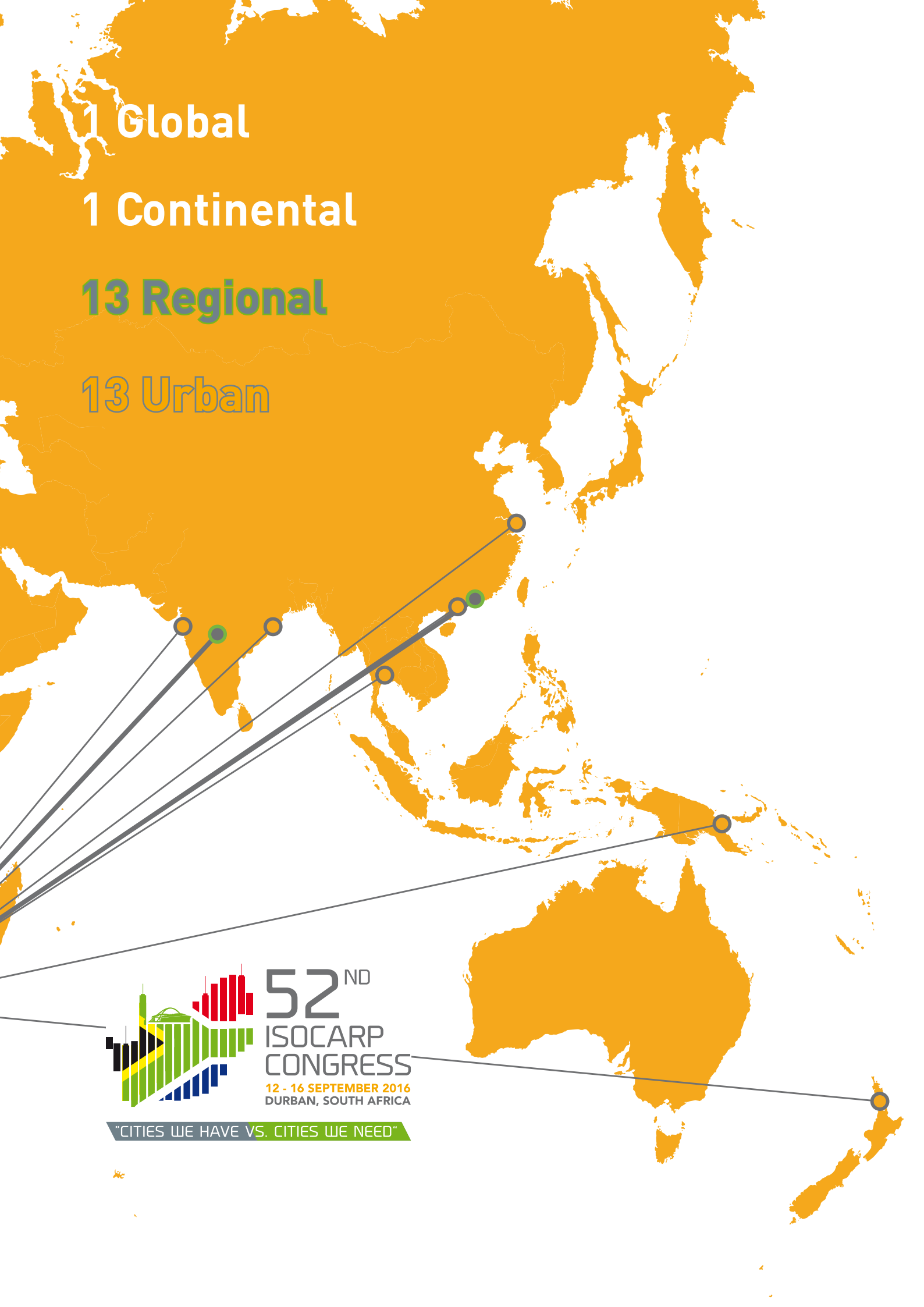

52ND
ISOCARP
CONGRESS
12 - 16 SEPTEMBER 2016
DURBAN, SOUTH AFRICA
"CITIES WE HAVE VS. CITIES WE NEED"
CONGRESS
RECAP
Part 2
PAPERS


28 Papers



52ND ISOCARP CONGRESS
12 - 16 SEPTEMBER 2016
DURBAN, SOUTH AFRICA

"CITIES WE HAVE VS. CITIES WE NEED"

Using catchment area analysis and GIS based spatial analysis for prioritising spatial investment in non-metro South Africa

Chéri GREEN, Gerbrand MANS, Mawande NGIDI, Zukisa SOGONI & Johan MARITZ
Council for Scientific and Industrial Research, South Africa

In the search for greater equity, spatial justice and efficiency of service delivery, the concepts of central place, agglomeration, and accessibility, together with GIS principles of catchment analysis, were applied to develop service catchments for social facility provision. A geo-spatially targeted hierarchy of places was also identified to prioritise investment of regional middle-order facilities in "Service Malls" located in the most optimal towns to best serve non-metropolitan areas in South Africa. This paper outlines the background, principles and process applied. Delivery of social services in rural South Africa remains a major challenge twenty years after the demise of apartheid. Challenges include the poor planning and allocation of facilities; processes which are vulnerable to politically based decision-making.

The identification and profiling of service catchments seeks to support a more structured and equitable allocation of resource, while the identification of prioritised town points enables targeted social facility investment for the allocation of middle-order social facilities in non-metro areas. The latter aims to achieve a more spatially balanced, sustainable and efficient allocation of services, meeting the needs of both users and service providers and serving the largest number of people from the least number of service points, in line with the principles of equity, government policy and fairness.

The catchments and prioritisation form part of a larger research project focused on the consolidation and differentiation of provision standards to guide social facility development and investment in mainly rural areas.

A key finding was that, if a spatially targeted investment strategy was used for locating middle-order services, it can halve the number of potential service points required while still providing services within acceptable travel distances, to over 90% of all citizens. This could have a major impact on the rationalisation of services and the more efficient allocation of resources.

1. INTRODUCTION

In a search for greater efficiency in service delivery, the concepts of central place, agglomeration, settlement hierarchy and facility planning theory, accessibility and principles of GIS-based catchment and optimisation analysis were collectively applied to develop a geo-spatially targeted set of service points that eliminate the spatial overlap of service areas for middle-order services. The paper outlines the development of this geo-spatially targeted nodal hierarchy that can be used to prioritise investment of regional middle-order services (preferably in "Service Malls") in the most optimal towns to best serve non-metro South Africa.

The analysis outputs used to illustrate the work here are part of a project to develop differentiated provision standards for social facilities for a range of rural planning contexts that have been linked to a profile of service catchments for all areas in South Africa. In the sections that follow key issues are outlined, and the theoretical framework for defining the service catchments explained. The paper briefly touches on the development of service catchments undertaken before the eventual identification of the geo-spatially prioritised set of proposed investment nodes. It describes the processes used to develop the prioritised approach to middle-order social facility services nodes. Such nodes should comprise key facilities for transacting life, such as 24-hour health services, citizen registration, police services and application for social grants.

The paper briefly touches on the range of economic and planning frameworks that underpin the research approach.

2. PRINCIPLES AND LITERATURE

2.1 Provision of social services in South Africa

The South African constitution provides for each citizen to have access to basic services. In this respect, it has become a legislated requirement that local authorities in South Africa prepare Integrated Development Plans to promote consolidated and informed development as well as deliver services. Constitutionally, South African citizens have entrenched rights to access to healthcare and social security amongst other factors (Section 27 of the Bill of Rights). This is in line with the Integrated Urban Development Framework (IUDF 2016). Sustainable Development Goals (SDG) and the National Development Plan 2030 (NPC 2012), which requires that by 2030 South Africa should have made meaningful and measurable progress to reviving rural areas and creating more functional, integrated, balanced and vibrant urban settlements.

If essential services are not made accessible to all communities, even the most remote, these community members will be unable to make such vital life transactions as obtaining legal status as South Africans or residents (registering births and deaths, obtaining identification documents), accessing health services, regional-level justice facilities (courts) and grant application offices, and so forth. Such services are required to promote full productive lives, improve standards of living, and obtain social support when required to truly benefit from the vision of the new democracy. Currently, the delivery of social services is unequal and remains a major challenge even twenty years after the demise of apartheid, and especially in rural South Africa. Challenges include poor planning and the misallocation of facilities through politically biased decision-making. Owing to the complexity of the development landscape it is not suitable, neither is it sustainable, to provide the same level of services to all areas of the country. Given that departments and municipalities have limited resources to provide services to citizens, the ultimate goal is to ensure – within the parameters of sustainability – that all citizens at least have minimum access to key citizen services from the least number of service points while still meeting population service thresholds and distance requirements, considering settlement patterns, and avoiding the development of 'White Elephants".

There are currently limited universally legislated access norms and standards to guide the development of government provided social and other facilities in rural South Africa. Experience with applying facility standards has highlighted the important role played by the context of local areas and it is widely accepted that not all services can be provided at all places. Some service types have higher population thresholds and a wider service reach with longer acceptable access distances and facilities provide different levels of service, e.g. regional versus local services. Therefore, services of different levels need to be distributed in different ways and provided at different levels of settlement based on minimum population numbers for them to be feasible, equitably distributed and optimally utilised. It would thus be inefficient to provide the same level of service in all areas of a country irrespective of the area context (population densities and types of development are important factors to consider).

Past projects for the Department of Public Service and Administration, City of Cape Town and City of eThekwini amongst others (Green et al. 2012b; Green et al. 2010b; Green et al. 2010a) have proved that accessibility analysis is an extremely useful tool to sustainably locate facilities in a way that incorporates principles of access distance, service threshold and centrality. However, this process would prove very time consuming and costly if it were to be undertaken on a national level. The demand on skilled resources required would also make this impractical; thus, in 2013 the CSIR embarked on a process aimed at applying principles of accessibility planning for social facility location on a national level which would be less data intensive. The approach used was to develop a spatial logic for the efficient and equitable allocation of a range of different social facilities that incorporated the principles applied in the GIS-based accessibility planning but without the necessity to have access to the current facility supply data. This led to the development and profiling of service catchment areas around existing nodes of various levels with the aim of establishing a hierarchy of service points for South Africa that could be used as the basis for the planning of different levels of facility provision.

2.2 The role of central places in rural development

Walter Christaller introduced the concept of Central Place Theory in 1933 to explain the spatial arrangement of the number and size of settlements. Although Christaller's assumptions regarding an isotropic surface and evenly distributed population

are mostly invalid for South African conditions, where densely populated settlements often manifest outside key towns, his concept of a central settlement providing services to those living around it remains universally valid irrespective of different density types. The theory consists of two basic principles: that of threshold (minimum population required to provide goods or services at a place); and, the range or maximum distance people will travel for services (Christaller 1933). The latter is often referred to as the sphere of influence.

Accessibility analysis for facility location planning has incorporated and is dependent on two economic mechanisms, namely range or access distance and threshold; both of which are part of Central Place Theory. The first of these two major components refers to the ability to reach a facility using available and affordable transportation; the second, to the ability to be able to utilise a service which has adequate capacity. The ability to reach a service is generally governed by a willingness on behalf of the potential user to pay for the trip in terms of time and/or money. In reality, this mainly translates into a maximum distance people are prepared to travel, after which the cost of travel exceeds the usefulness of the service to be received and the trip is foregone. The introduction of the concept of range/distance to the provision of social facilities introduces a spatial dimension in planning in terms of the location, distribution and spatial organisation of services. This spatial perspective supported by GIS analysis has proved a robust approach for locating and planning social facilities.

Some important definitions:

Threshold is the minimum market (population or income) needed to bring about the selling or provision of a particular good or service. In the provision of communal free services, the minimal value will not be measured in respect of income or profit but will relate more to the efficiency of providing the service to at least a minimum (viable) number of clients;

Range (access distance) is the maximum distance consumers are prepared or able to travel to acquire goods/ services since at some point the cost or inconvenience will outweigh the need for the good/service.

2.3 Approach & methodology

2.3.1 Principles of hierarchies in service delivery

As indicated, different services or service offerings have different operational requirements and population thresholds that make a service viable from a service provider perspective. Users are willing to travel different distances to address different service needs depending on the frequency at which the service is required, as well as the value of the service to the user. These principles form the basis of facility provision standards which need to be incorporated as input parameters into models designed to support the accessible planning of facilities. For some of these, legislated guidelines are provided; others have evolved though practise or trial and error. To undertake the catchment demarcation, a clear understanding of the typical access and threshold values for different services was required.

When one considers facility planning thresholds and access distances, it is clear that different facility types can also be grouped based on their having similar threshold and/or access distances and that these can be broadly divided into three categories of services: low-order basic services; high-order services; and, those in between, that form the 'middle-order' facilities. Low-order facilities that serve a fairly small number of people and are accessed frequently, such as schools, should be located as close as possible to all communities of minimum size, while middle-order facilities, such as 24-hour clinics and Home Affairs offices, that serve a higher threshold of people but are used on a much less frequent basis can be located at further spaced intervals in more established places. Higher order facilities, such as universities and large hospitals, can be spaced even further distances apart and require many more people to be sustainable.

This hierarchical nature of social service delivery can ideally be linked to a hierarchy of centres that clusters social facility provision such that the widest possible area and highest number of people are served. The establishment of a hierarchy was thus considered a logical spatial structure for equitably allocating facilities of various types to different levels of catchments/settlements.

2.3.2 Planning for the location of communal services and economic geography

It is not possible to rely on the market to regulate the distribution of social facilities, especially in sparsely populated poverty ridden areas with limited demand, and thus the welfare approach is appropriate for the provision of social services in South Africa. Smith (Amer 2007) presents the key concept of the welfare approach as being "who gets what, where and how",

which provides the fundamentals of facility planning for most services irrespective of income. The "what" refers to the service provided and the "where" to the concept of spatial variation, whilst the "how" refers to the broader social and political functioning. A fundamental issue in respect to facility location is the population that the facility will serve ("who"), as well as a good understanding of "where" this population lives, how they are distributed and what their profile is. By looking at the "who", planning for a specific target group based on the threshold, and by examining "where" demand is located relative to facility location, and by setting a maximum access distance, time or cost limit, a certain level of equity and balance in service provision can be achieved.

In understanding the "where" of facility location, one can look to economic location theory. The theory assumes that both suppliers and users will tend to minimise their costs and that the service/ outlet will be located "where" the provision of goods and services, including transport, is optimised. Thus, travel or access distance is critical in facility location planning. People live at different densities and at different distances from facilities and their reasons for selecting a facility may include a range of factors. However, by introducing the concept of facility thresholds and applying similar threshold (or population ratios) relative to facility size and similar distance limits it is possible to work towards broader equity across a region for the "what", i.e. the service being provided. This is true even if some citizens choose to make alternative choices based on various social, economic and cultural factors or perceptions as well as the available public transport options. Modelling or planning facility location based on the assumption of informed citizens making a rational choice to visit the closest facility may not always be universally realistic; however, when applied at a strategic level such an approach can provide informed decision-making to achieve potentially greater equity in meeting service delivery backlogs.

Demand targeting and estimation in the provision of social facilities is critical for correctly calculating the size of the service while cultural, economic and social factors in facility use are also important considerations. A key output of the research undertaken was to demarcate and profile 'wall-to-wall' service catchments and to calculate the demand within each service catchment, as well as within a specific distance of the central node of each catchment, to gain a better understanding of "where" services are needed and can best be located. To this end, a critical component of the project was to develop a clear understanding/description of the different service catchments including their settlement morphology, which is the subject of a separate paper (Sogoni et al. 2016).

2.3.3 Spatial equality and social well-being/ quality of life

In the provision of services, citizens should as far as is possible not be discriminated against because of where they live. Irrespective of where people choose to live (within reason), the right to access certain basic services needs to be recognised and some effort made to provide access (even if infrequently/ periodically) within the restrictions of the available funding. The issue remains that the more sparsely populated an area is, the more difficult and costly it proves to provide communal services and, in some cases, mobile, periodic or electronic based services are the only options. Discrimination based on gender, creed or race is not acceptable, and it is argued that so too is discrimination based on place of residence (Amer, 2007). Smith (1995) also highlights the need to achieve social justice within the spatial and geographical arena.

3. OBJECTIVES/ RESEARCH QUESTIONS

As the free market cannot successfully regulate the distribution and provision of social facilities and there are insufficient funds to provide all the required facilities in every settlement in a developing country such as South Africa, choices need to be made as to which locations to service first and which to develop later when funds become available or the population grows. It can also be rationally argued that within the context of budget constraints, services should be provided where they can have an impact on the largest number of people (Green et al. 2008) and, therefore, the identification of those places of greatest need and accessibility to residents should be prioritized for investment.

Thus, the identification of a prioritised hierarchy of places – as discussed in this paper – that can be used as a means of spatially targeting the largest number of people from the least number of service points is important.

4. APPROACH & METHODOLOGY

4.1 Analysis approach

In the project, two levels of analysis were followed. The first was to demarcate catchments based on centrality to central places and then to profile these based on a range of relevant planning parameters. Following which they were ranked based mainly on

services (e.g. a 1 000-person threshold for schools, a 5 000-person threshold for a fixed 5-day a week clinic, and a 20 000-person threshold for a Home Affairs office) informed the number and range of catchment levels defined. By understanding the frequency of service use and typical acceptable travel distances for different services, and using the key parameters of service threshold and access distance of selected facilities, it is possible to group different facility types and to link these with catchments of similar thresholds. The creation of a hierarchy of catchments thus forms an important regulating system for the equitable and efficient distribution of services.

5. RESEARCH ANALYSIS & FINDINGS

5.1 Research analysis

An evaluation of the number of people by each catchment category confirmed the concentration of people in the higher order catchments, with over 50% living within the influence sphere of a metro, city or regional service centre. There is also a clear predominance of non-metro catchments which have concentrated settlements and which display a clear nodal structure in the South African settlement morphology, thus reinforcing the use of town points as focal areas for middle-order service location.

Since the key focus of the main project was on differentiated service provision levels to support the application of standards in rural areas, service packages linked to the typical threshold values were developed for each level, with allowance for extra services in more remote areas or adjustment of the package based on the morphology. For effective application of the standards packages, an understanding of the internal settlement morphology of the catchment is vital. The morphology and its implication on service distribution networks has been addressed in a paper by Sogoni et al. (2016) as well as through the development of project related application guides.

The provision standards are focused on aspects of access and threshold in relation to a range of functional service areas rather than facility design and structural elements. Service provision packages were drawn up based on the crucial concept of providing a minimum of key services to transact basic life requirements. If these essential services are not accessible, community members will be unable to make such vital life transactions as birth registrations, and obtaining access to grant, education and health services. These key services thus form the basis of any service package offered to a community. Depending on the size of communities and their location and distribution, the service packages will provide different levels of service specialisation or frequency of use.

To further evaluate service access provision and support planning of middle-order services such as 24-hour clinics and citizen registration services, a travel distance and density analysis was undertaken to test the centrality of all town points at the centre of the catchments. The analysis focussed on the 30km distance range. The reason for this is that, based on the most commonly provided middle-order services, there is a clear convergence of distances between several services as indicated below:

- 15 to 24km – police stations, FET colleges and community halls in a rural context;
- 25 to 30km – Home Affairs offices, Department of Labour offices, multi-purpose centres/ Thusongs, SASSA offices, hospitals or community health centres depending on density.

Many of the above social facilities form the core of the so-called "Social Services Mall" concept where middle-order services, that are considered to be critical for all citizens, can be clustered together in close proximity or even under one roof in a Thusong or multi-purpose centre.

Typically the service offering of such middle-order facilities can be incrementally increased based on the elasticity of demand, thus no maximum threshold of people to be served was applied. The 30km distance was selected as an appropriate structuring mechanism for most parts of the country for distribution of middle-order services. In sparse areas in the western part of the country (less than 10 person/km2), this distance was extended to 50km to support service viability and cost-efficiencies in low density contexts. The examination of service statistics show that at the 30km (or 50km in sparse areas) distance these services would be accessible to 91% of the population if services were non-selectively placed in all catchment nodes of Levels 1 to 7 (535 places). Catchments of Level 7 and above all contain at least 20 000 people. To achieve a 95% coverage of middle-order service to all catchments with at least 10 000 people (thus including Level 8 catchments) in a non-spatially selective manner would require that 805 service catchments be provided with services. This may result in overlapping service areas in some instances where towns are close together. Such an approach requires significant cost, management and logistics to support the large network of services.

their settlement typology and population. This then informs and defines a minimum basket of services for each level of catchment under the assumption that all identified services can be met. The second analysis looked at how best to target investment by the optimal provision of service access to a basket of middle-order services. Middle-order services have an access reach of approximately 30km and the goal was to find the lowest number of optimal locations to service at least 80% of the population with a middle-order package of critical services. The latter approach is intended to support the development of sustainable service delivery networks in an environment full of pressures, relating to insufficient resources to deal with the extent of the development challenges and competing political and administrative priorities.

4.2 Creating the catchment hierarchy

To support the differentiated and appropriate provision of facilities for different contexts, the service catchment approach (Green et al. 2012a) was used to allocate and define all areas of the country into appropriate service catchments. After this, the hierarchical concept was used as the building block for drawing up facility provision packages and their allocation to the different levels of catchment.

Making use of advanced GIS spatial allocation models, it is possible to undertake, from a strategic perspective, a national/regional analysis of demand (population distribution) and potential supply points (town points) linked via the transport network. Such models are very useful for balancing and planning facility capacity within a region or area to achieve spatial equity and social justice. These tools were applied to demarcate service catchments for social facility provision for all areas outside the metropolitan areas using accessibility/central place principles. Service catchments for South Africa were developed around the 1 328 nodal places of different sizes and settlement morphology that had already been identified for South Africa (stepSA 2016). For this process, the country was divided into 1km2 grid cells and these units were used to allocate all areas, and by implication their population, to one of the classified settlements. A detail dwelling frame dataset was used for the purpose of assigning the population to each grid cell and then using this to aggregate the population to the defined catchments.

The classification and profiling of an extensive range of settlement and development contexts as they occur outside of the metros is critically important in understanding how much, where and how facilities should be distributed within catchments. The profiling identified a vast range of diverse settlement contexts which proved difficult to classify into a usable number of types; however, the profile of each catchment does provide significant detail to better inform the facility location within each catchment. The diversity of South African contexts also means that local adaptations are required in each instance. The profiles of the catchments cover a range of factors including population size, density, area, administrative role, economic production measured through Gross Value Addition (GVA), settlement morphology and topography, nodal level, and information on travel distances to other settlement levels. The settlement morphology within each catchment is considered to be a key informant to the final number, size and distribution of services within each catchment.

To ensure the sustainability of services and their effective provision, the location of services at key points of accessibility and centrality is critical. The first approach was to develop a 10-level hierarchy. The hierarchy has certain links and relationship to the CSIR/SACN typology of settlements for most of the higher order places, while the catchments of lower order places were mostly ranked according to population size. The reason for this is that population demand is the single major factor together with distance affecting the efficiency and viability of services.

The nodes of the first four catchment orders (1–4) are considered to be developed middle to higher order settlements or, in the case of some order 4 nodes, to at least be the most significant place within more remote/sparse regions. The classification of Levels 1 to 3 and most selected level 4 nodes is based on the SACN/CSIR Typology (stepSA, 2016). The aim was to ensure that in most areas of the country there is at least one level 4 (or above) catchment node within a reasonable distance at which to locate middle-order facilities. (The definition of reasonable is context specific given that in the more arid western regions of the Northern Cape 80km may be reasonable while the distance is seen as excessive in more densely populated parts of the country.) Catchments of Levels 5 to 10, in comparison to the higher catchment levels, have less economic functionality/concentration or contain fewer people.

The alignment of the different facility thresholds (the number of people or the size of a community to be supported by a facility) and the appropriate access distance to reach a facility was used as input to the development of the catchment hierarchy bands. Some of the key threshold values for selected

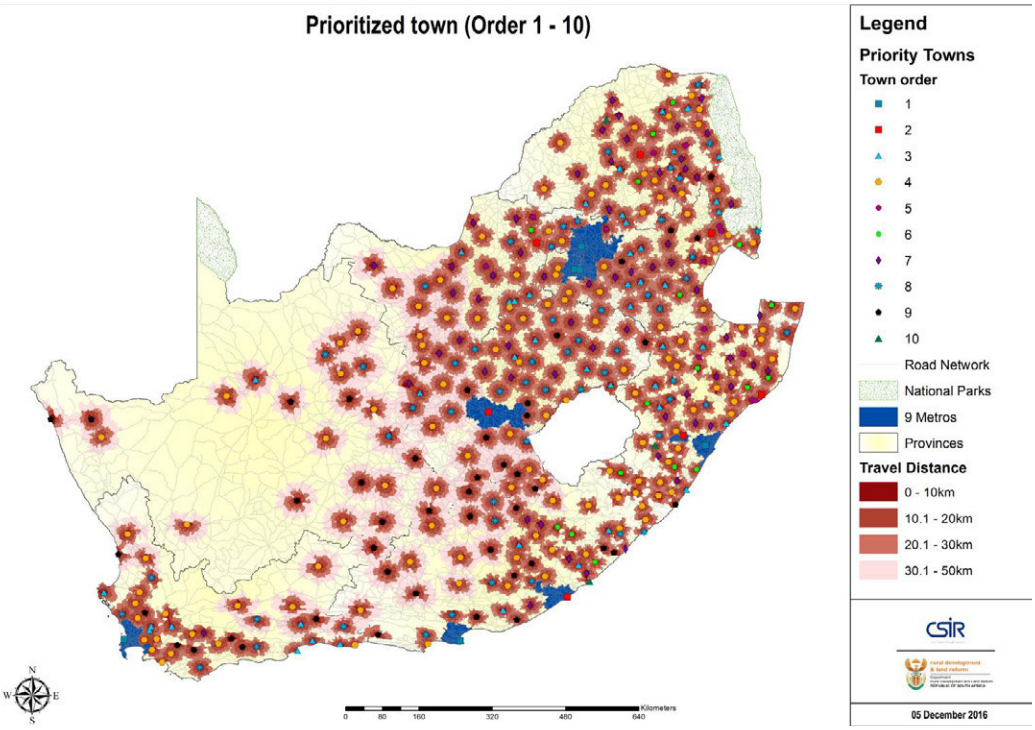


Figure 1: Prioritised towns and orders and surrounding travel distance bands (Source: Authors, 2016)

The catchment and travel distance analysis results revealed that, if the catchment level is the only criteria considered in the allocation of middle order services, there is a problem of potential service redundancy due to the overlapping and competing nature of catchments. This could result in low population thresholds at some places, thus potentially limiting the positive agglomeration effects through too much competition within the travel range.

This led to the approach of testing spatial optimisation analysis techniques to select catchment node points with non-overlapping service areas within a specific distance range and with minimum threshold levels. Thus, the most central places from each of the catchment levels were selected. The purpose was to achieve more cost-efficiency in service distribution but to still maintain equity in the location of typical middle-order services. Using the goal of service efficiency in conjunction with accessibility as the departure point, an optimisation analysis of all 1 328 node centroids in South Africa was done to identify optimum locations for social facility 'service malls' from the existing catchment centroid points (towns). The goal was to select the least number of service points from which to service the maximum number of citizens.

Since, the access range of this group of social services is generally between 20km and 30km for most areas, with a 50km range being acceptable in the very sparse western parts, these parameters were used as input distances for the optimisation analysis. (The distance is based on the road network rather than simply on a straight line distance). The use of GIS and the concept of a maximum travel distance addresses the issue of spatial quantification and fairness and enables analysis across space such that it is not limited by service ratios within administrative or other spatial units. This approach allows for measurement across boundaries, more closely reflecting the travel choices of citizens who are generally not aware of the demarcation lines between areas such as those for education or health districts.

The optimisation was applied to all areas of South Africa outside the boundaries of the metropolitan areas. A key assumption was that based on the regional importance or size of the Level 1 to 4's, analysis should by default include all these nodes and then select the most spatially optimally located towns from the remainder, irrespective of the catchment level in which the town is located. The starting point of the analysis was thus to demarcate a 30km/50km catchment around each of these nodal towns based on the network distance. Following this, an optimisation analysis algorithm was applied to all areas more than 30km/50km from a Level 1 to 4's to identify the remaining most optimal locations in the Level 5 to 10 catchment nodes to act as middle-order service provision centres. Owing to computational limitations, the analysis was done using a 50km2 spatial unit (cells).

The catchment optimisation model sequentially and iteratively identified the cells which were the most

optimal and densely populated within the distance parameter. Once all suitable cells were identified, they were assigned to the nearest towns serving as catchment centroids. This process was completed though a manual check and a catchment analysis in competition with all other towns was used to generate the final service statistics. The minimum population required was at least 5 000 people living within 30km/50km from such a centroid for it be included as a so-called priority node.

5.2 Findings

The outcome of the final catchment analysis, which took into consideration competition between catchments, was impressive. Service coverage of 91.8% of the total population within the 30km/50km range was possible from 378 central points. When only considering the non-metro population, 86.3% of people can be served from 369 points. This is a major reduction from the 805 places required to reach 96% of the population if using the catchment level approach (the first approach)) as opposed to applying a spatially targeted approach. The prioritised town locations and the respective travel distances covered around the priority towns are shown in Figure 1.

Figure 2 below shows the number of identified prioritised towns in relation to the total number of catchment centroids/ town points.

The implication of this is highlighted in Figure 3, which shows that by spatially targeting prioritised towns that optimally reach areas of 30km (50km in sparse areas) or less with no overlap, it is possible to achieve high service coverage whilst minimising the number of service points.

6. RESEARCH CONTRIBUTION

The analysis has implications for service provision throughout the country. The prioritized locations specifically identified for middle-order service location means that service providers can achieve high service reach levels using fewer locations rather than trying to roll out services to every corner of the country. These prioritized towns can potentially provide middle-order services to 92% of the country's population within 30/50km of 378 selected towns. If this spatially targeted investment strategy is used to locate middle-order services as described above, it reduces the number of potential points to be serviced by over 50% while still being within an acceptable travel distance of over 90% of citizens, including those in rural areas.

With this information, service providers have a clear understanding of which locations can yield the optimal service reach levels in the most efficient manner. This information can also be used to support a range of other investment decisions, both public and private, in a more cohesive manner.

This could have a major impact on the rationalisation of services and more efficient allocation of resources to areas of greatest impact, potentially allowing for a greater emphasis on quality and operational efficiency. This is especially relevant given the expected increased demand on the South African fiscus within the medium term.

7. RESEARCH LIMITATIONS

The successful implementation of the research outputs will depend largely on government's investment policies and the availability of resources.

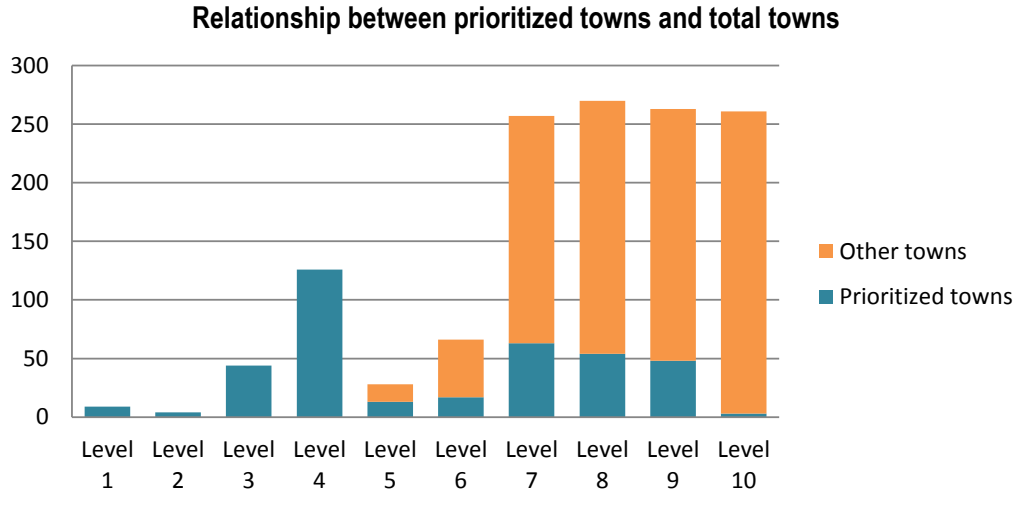


Figure 2: Relationship between prioritised towns and total towns (Source: Authors, 2016)

Town Category	Towns by Orders (Cumulative Values)										
	Order 1 (9 cities)	Order 2	Order 3	Order 4	Order 5	Order 6	Order 7	Order 8	Order 9	Order 10	*Total*
All towns (No prioritisation)											
Number of towns	9	13	57	184	212	278	535	805	1 067	1 328	***1 328***
% population reached in 30/50km	40.5%	42.3%	55.7%	74.4%	80.6%	83.6%	91.3%	95.9%	98.3%	99.2%	99.2%
Prioritized towns – including the 9 cities											
Number of towns	9	13	57	184	197	214	276	330	375	378	***378***
% population reached in 30/50km	40.4%	42.3%	55.7%	74.5%	77.8%	80.6%	87.0%	90.3%	91.7%	91.8%	91.8%
Prioritized towns – excluding the 9 cities											
Number of towns	-	4	48	175	188	205	267	321	366	369	***369***
% population reached in 30/50km	0%	3.0%	25.6%	57.1%	62.7%	67.5%	78.2%	83.6%	86.0%	86.3%	86.3%

Figure 3. Number of towns and population per order

For instance, it is stressed that as far as possible facilities should be clustered and that the selection of nodes where there is already existing development or infrastructure should be a key consideration in locating facilities. Resource constraints, particularly around budgets and staffing, mean that a roll-out of service provision (especially in the case of the more specialised and larger facilities) may be required such that the most needy and largest populations are served first and choices may have to be made between two similar locations. In this regard, the use of the prioritised town hierarchy which has been developed will be critical.

The lack of well-maintained datasets on current facilities means that additional local planning is required to avoid the duplication of services. The analysis was not able to consider the availability of public transport and route networks as this information is not readily available in a usable format.

8. DISCUSSION & CONCLUDING REMARKS

A multi-pronged approach has been taken. Firstly, to demarcate the country into service catchment regions and to profile these with parameters relevant to social service delivery and defined social facility service packages for each catchment. (Please see www.socialfacilityprovisiontoolkit.co.za.) This data can also be supportive of a range of other planning activities. Secondly, a non-overlapping hierarchy of central places/nodes where middle to higher order services can be sustainably provided at central and accessible places was developed. This structure can provide a basis for incrementally extending services to as many people as possible over the longer term.

Middle-order services that are essential for citizens to transact fully in society should firstly be directed to the prioritised nodes before they are provided to any other places with sufficient demand for such services. (Provision of low-order services provided by local facilities such as schools, social grant pay points and small health facilities would be required by all nodes.)

It is in the provision of clustered middle-order services that the opportunity exists to direct investment optimally outside the metros. This targeted approach can best serve non-metro citizens by using the prioritised town points in order to serve the maximum number of citizens in the surrounding communities from the least number of points.

REFERENCES

Amer, S. 2007. Towards spatial justice in urban health services planning. University of Utrecht: Enschede, The Netherlands.

Christaller, W. 1933. Static Relations. In Christaller, W. Central Places of Southern Germany, pp.27–81. Baskin, C.W. Englewood Cliffs, N.J.: Prentice-Hall.

COGTA (Department of Cooperative Governance and Traditional Affairs). 2016. The Integrated Urban Development Framework, A new deal for South African cities and towns. Accessed on: 6 December 2016, Accessed from: http://www.cogta.gov.za/?programmes=the-integrated-urban-development-framework-iud

Green, C.A., Breetzke, K. & Argue, T. 2008. Standards for improved governance and performance measurement in the eradication of backlogs and delivery of public facilities. Winelands 11th International Conference on Public & Development Management. 17–18 April 2008. Stellenbosch.

Green, C.A. and Argue, T.C. 2012. CSIR Guidelines for the Provisions of Social Facilities in South African Settlements. August 2012: ISBN 978-0-7988-5603-4. Pretoria: CSIR.

Smith, D.M. 1995. Geography, social justice and the new South Africa. South African Geographical Journal 77(1):1-5.

Green, C,A,, Mc Kelly, D., & Mans, G.G. 2010a. eThekwini accessibility mapping and optimisation of community social services 2010. Section 18 (Vol. 3) – Node Hierarchy Catchment Analysis. Phase 3 optimising. Report No. CSIR/BE/PSS/ER/2010/0046/B. Pretoria: CSIR.

Green, C.A., Mans, G.G. & Spocter, M. 2010b. Evaluation of community social facilities and recreational space in the City of Cape Town: current and future provision for 2016 and optimal location of new facilities. Report No. CSIR/BE/PSS/ER/2010/0041/B. Pretoria: CSIR.

Green, C., Mans, G., Le Roux, A., Zietsman, L. and Ngidi, M. 2012a. Providing government services in an equitable and uncontested manner through geographic accessibility processes. Paper at Planning Africa 2012, eThekwini, 17–19 September 2012.

Green, C.A., Mans, G., Le Roux, A., Schmitz, P., Mokgalaka, M., McKelly, D., Ngidi, M., Badenhorst, W., Zietsman, H.L. 2012b. Geographic accessibility study of social facility and government service points for the metropolitan cities of Johannesburg and eThekwini 2011/12. Report No. CSIR/BE/SPS/ER/2012/0061/B. ISBN 978-0-7988-5608-9. Pretoria: CSIR.

NPC (National Planning Commission) 2012. National Development Plan 2030: Our future-make it work. Pretoria: NPC the Presidency, p260.

stepSA. 2016. Functional City, Town and Settlement Typology [online]. Available from: http://stepsa.org/settlement_typology.html [Accessed 14 April 2016].

Sogoni, Z., Ngidi, M., Green, C.A. & McKelly, D. 2016. The Morphological / Settlement Pattern Classification of South African Settlements, Based on a Settlement Catchment Approach, to Inform Facility Allocation or Service Delivery. Unpublished conference paper presented at Planning Africa 2016, 3–6 July 2016, Johannesburg.