CHAPTER 2

Rethinking Urban Growth Boundaries: Following the Transportation Corridors

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Abstract

Modern urban areas are highly complex entities and constantly need to deal with interrelated processes of urban change. The forces of rapid urbanisation and increasing population growth initiated changes to the urban form of modern urban areas. The management of urban form was always placed at the forefront of urban planning, as it was evident that urban form determines the effectiveness of cities, the accessibility it offers and the integration between spheres. Various growth management tools were introduced to contain, control, direct or phase urban growth in this regard. Urban growth boundaries (UGBs) were soon to become one of the most popular urban growth management tools, supported by the smart growth approaches. However, recent development challenges suggest that the urban environments are becoming more complex and urban form is increasingly influenced by the growing economic sector, and especially the expanding transportation networks which operate across boundaries and between local jurisdictions. The one-dimensional approach of growth management and UGBs are questioned, especially within developing countries that are in no position to limit the much needed urban growth to support the local economy. It has furthermore become evident that transport plays a major catalytic role in achieving urban reform, and that land-use and transportation planning are highly interlinked urban determinants. Modern cities suggest of multi-nodal areas, characterised by transportation networks which are not bound to UGBs. The relevance and effectiveness of traditional growth management tools were evaluated within the urban space economy of the Gauteng City Region. The case study illustrated the challenges associated with growth management tools to structure urban form, against the background of increased economic development and expanding transportation networks.

Keywords: Urban growth boundary, transportation networks, urban form.
1 Introduction

The world’s population balance has shifted. In 2008, for the first time in history, more people lived in cities than in rural areas [1]. Urbanisation has accelerated from only 2% living in urban areas in 1800 to half the world’s population of 3 billion people, with two-thirds of the world expected to live in cities by 2050 [2]. As a city grows to absorb immigration and natural growth, the city expands beyond its defined boundaries into the sphere of influence of neighbouring cities, and urban and peri-urban areas [3].

These development trends are responsible for the changes in our current urban environments, for the increasing quantitative developments and decreasing qualitative environments.

It is widely accepted among urban restructuring advocacy groups and policy makers that the current local trends and the resulting spatial urban form have certain implications or consequences on the way in which our cities function. These consequences can be seen in settlement patterns that are grotesquely distorted, inconvenient and dysfunctional urban environments, the lack of efficient and viable public transportation, costly installation and maintenance of engineering services and the fact that cities have become hostile places to live in [4, 5]. Over the past couple of years, very little has been done to address the existing dispersed spatial pattern; it has rather been reinforced by existing spatial planning practices placing untold pressures on existing engineering infrastructure, bulk services and public transport.

The management of urban form was placed at the forefront of objectives for urban planners and managing authorities worldwide, as it was believed that the urban form determines the effectiveness of cities, the accessibility it offers, the integration between spheres, the land use and possible layout plans [6]. The realisation of the importance of urban form, and the management thereof, led to the creation of growth management tools such as the urban growth boundaries (UGBs).

Recent development challenges suggest that the urban environments are becoming more complex and urban form is now influenced by the growing economic sector, and especially the expanding transport networks which operate across boundaries and between local authorities. The transportation infrastructure is intimately linked to urban spatial planning and land use [7] and should, therefore, be incorporated when considering urban form.

Given not only the intense flow of people but also information, trade, finances and resources between cities, a traditional approach to planning and governance is increasingly untenable. A new approach to planning and managing these burgeoning urban areas is required [8]. This chapter will evaluate the relevance and effectiveness of growth management tools to structure urban form, against the background of modern urban environments, characterised by forces of rapid urbanisation, population growth, increased economic development and expanding transportation networks which are not bounded by urban development boundaries.
2 Urban Form

Urban form refers to the shape of urban environments, not simply in terms of appearance, but more importantly in terms of the defining characteristics, such as the design and structure, where development occurs, what type of developments are likely to realise, what types of public green spaces are available, and the inter-connection of these areas [4, 5]. Good urban form thus requires good, coordinated and integrated planning. For a decentralised system to work effectively, cooperation is required at the local level between formal governmental institutions and the range of less-formal, non-governmental organisations and community-based organisations [6].

The European vision considers the concept of compact cities as ideal places to live and experience the vitality and variety of urban life. The reasons offered for making cities more compact have changed in the last 150 years. First, it was for resource conservation, social interaction, waste minimisation and efficiency, but it has moved over to sustainable urban form, and economic, social and political issues. Contemporary compact city approaches are said to increase built-area and residential population densities, to intensify urban economic, social and cultural activities and to manipulate urban size, form, structure and settlement systems in pursuit of the environmental, social and global sustainability benefits derived from the concentration of urban functions [9].

Rogers [10] maintains that a sustainable urban form is based on a series of inter-linked compact nodes or neighbourhoods (refer to Fig. 1). These neighbourhoods

Figure 1: The compact sustainable urban form. Source: Rogers [11].
grow around centres of social and economic activities located at public transport nodes. This results in a compact city form, which can then be defined as a network of these neighbourhoods, each with its own parks and public spaces and accommodating a diversity of overlapping private and public activities [11] subject to the distance between the facilities.

In this sense, urban form is subject to two core forces that are responsible for this change in the urban environment: (1) force of containment, a centripetal force ensuring the compactness of the city, driven by accessibility, entertainment, social life and integration; and (2) force of sprawl, a centrifugal force resulting in the expansion of the city, driven by costs of land, individual privacy, open spaces, corridor developments and improving transportation means.

The reality in many developing countries illustrates fragmented and dispersed urban form, as a result of urban sprawl and uncontrolled development. The dispersed urban growth is believed to have many adverse financial, social and environmental impacts, and it is believed not to be sustainable in the medium to longer term [12]. Local authorities thus drive the compact-city approach, in search of the increased urban performance that will result from the compact-city urban form, not questioning the relevance of the European vision of compact urban form within developing countries, or the effectiveness thereof in the modern (technology and transport-orientated) urban environments. Urban form is still guided in most cities, by the compaction approach, implemented and managed by means of growth management tools to limited urban growth between set boundaries, with the objective of creating the ideal and sustainable urban form.

3 Growth Management and Smart Growth

In an attempt to contain urban growth and manage the existing and developing urban form, mechanisms and growth management tools were created, linked to the concept of smart growth, supported by policies intended to promote ‘sustainable urban form’. Accordingly, the role of growth management tools, specifically the UGBs, will be discussed, followed by the smart growth approach, as it currently manifests in various cities worldwide.

3.1 Urban growth boundaries

UGBs are defined as ‘a pro-active growth management tool that seeks to contain, control, direct or phase growth in order to promote more compact, contiguous urban development’ [13]. Since the first UGB was established in Lexington, Kentucky, USA, in 1958 [14], UGBs have become one of the most popular urban growth management tools. By 1999, more than 100 cities and counties in the USA had adopted UGBs [15].

Portland’s UGB is perhaps the most mentioned UGB in the urban planning literature, as it has been in the centre of controversy for the past two decades between the pro-marketeers and government intervention advocates [15]. On the one hand,
compaction was promoted, along with preserved open spaces and environmentally sensitive areas, and on the other hand, UGBs were criticised as they can easily yield undesirably draconian outcomes, because they are not directly linked to the underlying market failures [16]. In spite of numerous UGB studies conducted on the Portland UGB, there is no agreement about its effectiveness [15].

Recently, the effectiveness and relevance of UGBs were questioned. The ‘promised’ objective to manage growth and promote urban and environmental efficiency, effectiveness and economy in the interest of all [17] did not seem to realise as a direct result of the implementation of UGBs. This might be linked to problems associated with the actual implementation of the UGBs, which was regarded as a rigid legislative imperative, due to its stringent application as a cadastral line which determined delineation between urban areas and rural areas. Further concerns were raised about the practicality and functionality of the UGBs, especially in terms of their role in increasing the price of land, due to the restriction of land availability, resulting in land speculation. It has furthermore led to development applications being considered based on location [18], and not part of the overall rationale or \textit{ad hoc} status.

Research by McShane [13] strengthened the scepticism as it proved that the cities with the least affordable housing, the most congestion and the slowest growth rates are those which have adopted UGBs and the policies which go with them. It has since been understood that densification and compaction around public transport nodes is probably the most proactive mechanism to curtail unwanted growth and densify the city. This has redirected the focus of growth management to a broader spectrum of mechanisms where managing urban growth is about acting in line with the market, through bending and shaping it to achieve desirable outcomes [19], in line with the objectives of smart growth.

### 3.2 Smart growth

The smart growth concept supports the compact-city approach, and prioritises densification and growth management. The smart growth concept presumes that if the urban form is uncontrolled, the boundaries will be misshapen, intermittent, \textit{ad hoc} or out of control [13]. This concept offers an alternative to sprawl [20], by referring to a set of planning principles intended to increase land use and transportation system efficiency [20].

Smart growth emphasises compact development and accessibility [21, 22], while sprawl emphasises mobility (physical movement) and auto-mobility (movement by vehicles) [20]. The smart growth approach is aimed at higher-density urban development and clustered activities within a mixed land use. It focuses on the human scale and promotes facilities within walking distance, thus emphasising the public realm. On the other hand, various criticisms of smart growth include the claims that it harms consumers, infringes on freedom, increases traffic congestion and air pollution, reduces housing affordability, causes social problems, increases public service costs, requires wasteful transit subsidies and is unjustified [20].
Major differences between compact land-use patterns (driven by smart growth) and urban sprawl patterns are compared in Table 1.

The core problem of urban sprawl, which the smart growth approach intended to address, does not turn out to be problematic after all, but rather a reflection of the decisions made by many people who like the amenities of suburbia, and therefore has no rationale as to why smart growth values should be preferred over the values of those who like suburbia [24]. This questions the effectiveness and relevance of the smart growth concept in general.

### 3.3 Comparison of growth management and smart growth approaches

Table 2 presents a summary of the comparison between growth management and smart growth approaches in terms of the similarities, advantages and disadvantages of the two approaches.

As the growth management concepts were developed in first-world countries, another issue to consider is the relevance and effectiveness of the growth management concepts (and smart growth approach) in areas characterised by urban sprawl and fragmented urban areas, such as most of the cities in developing countries. While planning a new urban area, the smart growth approach can be implemented, but can the same be said for an already established area, which emerged spontaneously, without any densification strategies?

### 4 Growth Management in Developing Countries

The European vision that compact cities are the ideal urban form and can contribute to the attainment of sustainable cities [25] is supported by concepts of
structured and integrated planning approaches. The reality in developing countries, however, suggests that most urban areas have not been planned and lack prescient ground design. The compactness of these urban areas (in the few cases where it does exist) has emerged spontaneously, if not chaotically [9].

The idea of a compact city therefore has serious obstacles in developing countries. These obstacles include the current survival strategies of the poor that necessitate lower building densities, the freedom and power afforded to private landowners and developers within the capitalist market system, the lack of development-control measures to ensure that development takes place at higher densities at central localities and with mixed uses and the anti-urban mindset of both rich and poor. The combination of these forces has resulted in the three spatial characteristics of low density, fragmentation and separation. Furthermore, urban economists around the world are virtually of one mind in their conviction that the first and most important step in improving housing affordability in cities around the world is the removal of unnecessary restraints on the supply of land, and, in particular, the removal of UGBs [13]. In this sense, arguments in favour of UGBs were questioned when considering the practicality and implementation of these growth management tools in developing countries. Arguments include, but are not limited to, the following:

- Aesthetic and green-planning arguments deem UGBs ‘necessary’ because it marks a clear boundary line between urban and rural areas: This line does not, however, guarantee a qualitative environment, but often results in developed

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Growth management</th>
<th>Smart growth</th>
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<tr>
<td>Similarities</td>
<td>Compact development</td>
<td>High-density, clustered activities</td>
</tr>
<tr>
<td></td>
<td>Contain and limit urban sprawl</td>
<td>Manage land use and urban sprawl</td>
</tr>
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<td></td>
<td>Proactive management tool</td>
<td>Proactive management tool</td>
</tr>
<tr>
<td>Advantages</td>
<td>Division between urban and rural areas</td>
<td>Mixed land-use development</td>
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<td></td>
<td>Strict enforcement</td>
<td>Human scale development</td>
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<td></td>
<td>Preserved open spaces</td>
<td>Land-use efficiency</td>
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<td>Node development</td>
<td>Transportation system efficiency</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Development applications based on rigid line and location</td>
<td>Needs strict zoning controls to ensure successful implementation</td>
</tr>
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<td></td>
<td>Implementation difficulties</td>
<td>Infringes freedom of development</td>
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<td></td>
<td>Restrict land availability</td>
<td>Reduces housing affordability</td>
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<td></td>
<td>Increase speculation and land prices</td>
<td>Causes social problems</td>
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<td></td>
<td>Not in line with market demand</td>
<td>Increases public service costs</td>
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Table 2: Comparison of growth management and smart growth approaches.
and undeveloped (neglected) areas [13]. The developing countries are in need of a developmental approach, not a conservation approach [4, 5].

- Economic arguments claim that UGBs provide developers with best-location options and prevent speculation in land: The reality is that speculation is beginning to increase within the borders of the UGB as vacant land within the UGB is becoming more scarce and valuable [13].

- Sustainable urban form arguments state that UGBs provide structure and form to urban environments: Forcing people into such patterns requires coercion and it is not long before the people start moving out of these ‘control zones’ to where they can more freely express their individual choices. In developing countries, many have to move because the scarcity of land prises them out of the local housing market and, in many instances, spatial disparities are widening [26]. Instead of accommodating the inward migration of people from rural surroundings using densification techniques, the urban expansion was enhanced by making more, less-expensive land available for development on the periphery of the city, strengthening affordability in developing countries.

- Promoting inner-city redevelopment arguments claim that UGBs are necessary to promote the revitalisation of inner cities: Ironically, the enthusiasm for density at any price has allowed over-development and a glut of sub-standard apartment blocks [13].

Apart from these arguments, the implementation of growth management and UGBs in developing countries is questioned from the broader economic perspective and transportation network perspective. First, developing countries are in no situation to ‘restrict’ or ‘prevent’ urban development, as they are dependent on the economic development and growth to sustain themselves and ensure food and livelihood to their residents. Second, transportation considerations have also brought along a new dimension to urban planning, as transportation and land use are (and being increasingly more) interconnected. Transportation provision was not (and will never be) subjective to municipal boundaries, but rather enhanced the crossing of boundaries and linking of the various nodes.

5 Transportation and Its Impact on UGBs

Modern urban areas are highly complex entities and constantly need to deal with interrelated processes of urban change. The most popular types of models used to illustrate urban change have been those dealing with the relationship between transportation network growth and changes in land use and the location of economic activity, embodied in the concept of accessibility [27]. Transportation networks and the spatial patterns of land use they serve are assumed to mutually influence each other over time. Changes to transportation networks, such as the construction of a new link or expansion of an existing one, eventually influence the location of investment in land, which in turn influences the demand for travel to and from a particular location. This relationship is
sometimes referred to as the transportation–land-use ‘link’ or ‘cycle’, emphasising a feedback relationship [28]. The promoters of smart growth believed that, by increasing compaction and congestion and forcing people to live at high densities in mixed-use neighbourhoods, people would abandon their cars and walk, cycle or ride on buses and trains. However, behaviour patterns and consumer trends revealed that more than 90% of people in large cities want other people to use public transport [13], but are not willing to sacrifice personal convenience and luxury.

Reality reveals that modern cities suggest of typically multi-nodal areas, characterised by transportation and transport routes which are not subjective to the UGBs. If an urban area restricts the use of private motor vehicles, residents abandon the city and move somewhere else, as modern societies are car-dependant, and it is no longer negotiable to plan for adequate transportation provision within cities.

It has become evident that transport has a major catalytic role to play to achieve urban reform, and that land-use and transportation planning are highly interlinked urban determinants [19]. However, opportunities to create sustainable, environmentally friendly communities are being missed because transport provision and funding are still too dislocated from the overall planning process [10]. Spatial planning and transportation planning should in this sense be more integrated and planned holistically as transportation not only stimulates economic development but also helps structure space, and thus urban form. The relationship between transport and spatial organisation can be considered from three major geographical scales, namely global scale, regional scale and local scale [29]. Global spatial organisation seeks to explain global differences in growth and accessibility, assuming that the global spatial organisation favours a few core areas that grow faster than the periphery, thus identifying poles based on favoured geographical concentration. Regional spatial organisation is based on the central place model, which tries to find the relationships between the size and the geographic distribution of cities in a region. Transportation is particularly important as the organisation of central places is based on minimising the friction of distance, and transportation is regarded as a factor of accessibility that reinforces the importance of poles. Local spatial organisation is focused on important elements which shape the local urban spatial organisation, such as employment zones and attraction zones. The growing disassociation between the workplace and the residence is believed to be largely due to the success of motorised transport, notably the private automobile [29]. The impact of transportation on urban form and growth management was evaluated from the case study of the Gauteng City Region (GCR), as presented accordingly.

6 The GCR Case Study

Current urban settlement formation in the developing urban areas of South Africa tends to be very poor in terms of quality, service provision and standards. These environments have very little chance of developing into vibrant, enriching and efficient urban environments [30]. While the reasons for poor environmental quality are undoubtedly diverse and complex, having political, economic and social
dimensions, it is argued that the prevailing approach to layout planning in South Africa is part of the problem.

Settlement characteristics of Gauteng are similar to those of most South African cities, including a multi-nodal and spatially fragmented urban structure, attendant decentralisation and decline of the inner-city and low-density sprawl, separation of functions and a motorcar-dominated road network, ribbon development along highways, unbalanced city growth with most of the economic activity in the centre and south-east, over-emphasis on low-density housing provision often peripherally located and segregation and inequality [4]. The urban nodes developed spontaneously and were not a result of detailed planning. These nodes, although mono-functional, soon became mixed in terms of use [31].

Gauteng was (and is still) the most densely populated province in South Africa, with the highest gross geographic product (GGP) and highest GGP per capita. Despite being the economic heart of South Africa, extensive research carried out by the Gauteng Department of Finance and Economic Affairs in 1997 revealed that the economic performance of the province was worsening, specifically, from 1985 to 1995 when unemployment was steadily rising, labour absorption rates were below 1%, standard of living had been decreasing and the economic growth was at an average of 1.4% a year [32]. It was found that Gauteng’s poor economic performance was a result of the prevalence of the mining resource-exploiting industries and low value-added manufacturing. An alternative path of economic development was proposed, focusing on high-tech industries, transportation and high value-added manufacturing and tourism [33].

In 2001, the Gauteng province in South Africa devised and implemented an initiative called ‘Blue IQ’ to stimulate economic growth in the province through public investment in strategic economic infrastructure [32]. The Gauteng Legislature confirmed Blue IQ’s institutional beginnings as an infrastructure investment vehicle in October 2003 [33]. Blue IQ comprised 11 projects from the four target sectors, including tourism, technology, transport and high value-added manufacturing.

Gauteng’s ‘urban space economy’ (economic activity in space, considering how the spatial form of cities is structured by dynamic changes in economic activity; how economic opportunities and constraints are structured by spatial form; and the changing nature of economic space itself) [34] was dramatically influenced by the introduction of the Blue IQ projects. ‘Projects initiated by Blue IQ changed the face of the province and unlocked potential in key growth and development areas’ [33].

Development in Gauteng, as well as the economic footprint, increased radically since Gauteng was officially declared a Global City Region on 31 August 2006, set to become the world’s 12th largest City Region by 2015 [35]. This economic heartland of South Africa now contributes to more than 50% of South Africa’s economic output [8]. The current GCR economic footprint extends beyond the borders of Gauteng into three other provinces, within a radius of some 150 km from the Johannesburg city centre [8]. However, the rapid growth of the GCR and its ever-expanding urban boundary is a key concern for transportation infrastructure development within the region [36].
In an attempt to structure the (expanding) urban form, the Gauteng Spatial Development Framework of 2007 identified four key regional anchors (refer to Fig. 2), agglomerated areas of intensive economic concentration, which in the sense of growth management play an important role in regional structuring [19]. The Gauteng Spatial Development Framework furthermore identified four key regional corridors. The north–south and east–west corridors manifested as dual-serviced transport spines, including both road and rail infrastructure, as illustrated in Fig. 2 (right).

The primary economic forces were also identified, as captured in the Gauteng Spatial Development Perspective (2006) (refer to Fig. 3), where the highest intensity of economic activity was found to occur in the central areas of the province, following the spatial distribution of the identified anchors and corridors in the province.

Economic development, along with transportation networks and Blue IQ projects, was not within specific local municipality boundaries and local authority jurisdiction, but revealed cross-boundary development throughout the entire province. Although local municipality boundaries still existed, the GCR operated as one entity, and development initiatives, urban nodes and urban corridors were managed accordingly.

The economic initiatives (Blue IQ) acted as a catalyst for market-driven growth and thus also impacted on the urban form of the area. The Gautrain Rapid Rail Link (Gautrans Project) was the Blue IQ project that claimed the most interest from authorities in terms of spatial planning, impact and transformation of the urban environment, as it brought along even more changes in terms of urban spatial form within the GCR.

6.1 Transportation impact on urban form

Sustainable urban growth is dependent on efficient public transport [37]. At the same time, the provision of public transport networks influences urban growth and urban form. Transportation provision in Gauteng adopted the ‘predict and provide’ method by which important decisions regarding the design and upgrade of transportation networks were made [36]. This ‘predict and provide’ process utilises data collected from various surveys to conduct a general analysis of travel patterns and transportation usage in the region. The results of the analysis are then employed to create various situational models for the possible future transportation requirements and infrastructural development in the region. These situational models are based on the transportation land-use planning model, which comprises of four steps: (1) trip generation, (2) trip distribution, (3) modal split, and (4) traffic assignment [36].

As stated, the Gautrain Rapid Rail Link (Blue IQ) project had a significant impact on the spatial planning, urban form and urban transformation of the area. The purpose of the Gautrain Rapid Rail Link was to allow Johannesburg, Pretoria, Johannesburg International Airport and the corridors between these nodes to continue to grow and develop without being hindered by access problems and traffic
Figure 2: Key regional anchors (left) and key regional corridors (right). Source: Gauteng Provincial Government [19].
congestion in future years. Besides the tangible benefits of reducing congestion, improving accessibility and mobility, assisting tourism, promoting the use of public transport and reducing pollution in economic terms, the Gautrain was considered a key element in improving economies of urbanisation, increasing total factor productivity and improving the conduciveness of the local economic environment [38].

Passenger Rail Agency of South Africa (PRASA) recently published a strategic plan for the development of passage rail in South Africa, enabling alignment of current and future services, facilities and technology applications with development objectives, illustrating impacts on the urban form and future urban development patterns [39].

The Gautrain Development Node Study [40] found the Gautrain Rapid Rail link to be relatively well located to serve the existing development nodes in Gauteng, and strategically positioned to enable these nodes to grow to their full potential. It strengthened the greater polycentric development plan of Gauteng, supported by the Bus Rapid Transport (BRT) systems, and national and regional road corridors, as illustrated in Fig. 4.

This ‘originally economic initiative’ transformed the transport and movement system in Gauteng, and simultaneously transformed the urban form of the greater Gauteng area. It had a great impact on the UGBs and urban containment of the area, as transport networks were not bound to the urban development boundary [41]. In this sense, the relevance and implementation of UGBs within the modern GCR
were questioned, as the economic development within this area could not be limited by growth boundaries, and the development followed the transportation corridors, crossing boundaries in order to link nodes.

Transportation planners believe that the transportation challenge of the GCR lies in the character of the cities and towns located within the boundaries of the region, as low-density urban sprawl is the norm. Mixed land use should therefore become the future norm if the negative effects of high transport costs and congestion are to be reduced [36] and urban growth is to be managed in a more effective manner. The implementation of UGBs that was proven unsuccessful in this complex environment could rather be replaced by integrative land-use planning, along with detailed zoning controls, not restricted by development boundaries.

7 Proposed Approach to Urban Land-Use Planning

Simpson et al. [36] has demonstrated that the negative consequences of poor urban planning in the past continue to haunt the GCR. Poor land-use decisions now strongly determine transport demand and traffic flows. Transport provision is a long-term consideration, while land use is a temporary one, and emphasis usually goes to transport, rather than land use. In order to address the current complexities and challenges (urban sprawl, fragmentation and segregation), the GCR would need to develop the transportation network around current land use and established urban structure.

Growth management in Gauteng must strike a balance between growth and development, on the one hand, and social responsibility and upliftment, on the other. In terms of managing growth, the secondary and intervention areas need to be shaped (in terms of establishing appropriate densities and prioritising public transport), and the primary areas need to provide opportunities for infill and densification [4, 5].
Development application and future land-use planning should no longer be subject to one-dimensional urban edges and UGBs limiting outward expansion of the urban area, but be considered according to the actual merits of the specific development proposal. The focus needs to be wider and the approach more integrated and holistic.

Structuring initiatives were proposed for the Gauteng area with the objective to guide the spatial plan, land use and urban form towards efficiency. The structuring initiatives are illustrated in Fig. 5, and included the following:

- The movement system: Creating new transport corridors (roads and activity spines) and ensuring that the movement system directly links with nodes and contributes to the economics of urbanisation.
- Nodal development: Strengthening of urban nodes (intensified development initiatives and integrated housing initiatives) to cluster activity, and ensuring accessibility.

Figure 5: Gauteng urban structuring initiatives. Source: Adapted from Gauteng Provincial Government [40].
Table 3: Transport and land-use planning paradigm.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Old approach</th>
<th>New approach</th>
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<tbody>
<tr>
<td>Progress</td>
<td>Growth</td>
<td>Development</td>
</tr>
<tr>
<td>Scope</td>
<td>Expanding, getting bigger</td>
<td>Improving, more efficient</td>
</tr>
<tr>
<td>Transport goal</td>
<td>Mobility</td>
<td>Accessibility</td>
</tr>
<tr>
<td>Approach</td>
<td>Reductionist</td>
<td>Integrated</td>
</tr>
<tr>
<td>Road network</td>
<td>Traffic flow</td>
<td>Multi-functional</td>
</tr>
<tr>
<td>Users</td>
<td>Vehicular traffic</td>
<td>Streets for people</td>
</tr>
</tbody>
</table>

Source: Litman [20].

- Design guidelines: Land-use zoning (urban integration of peripheral townships, urban consolidation) to support synergy between spaces and between buildings, and it takes on a definite form that adds to urban characteristics.

The new proposed approach to urban land-use planning within the GCR is summarised in Table 3, focusing on improving development and making it more efficient, enhancing transportation accessibility, creating multi-functional road networks and streets for people, by means of an integrated approach. This approach was realised in terms of the polycentric development pattern (Fig. 6), structured by the identified nodes, economic initiatives, transportation corridors and networks and structuring initiatives.

This polycentric development approach calls for a strategic decision-making framework, such as the framework illustrated in Fig. 7, as development applications are no longer subject to a one-dimensional legislative line, but are subject to the contribution of sustainability and feasibility of the greater development area. First, it should be determined whether the application is applicable to an urban node (illustrated as A) or a rural node (illustrated as B). Second, it should be determined whether the development approach is development-orientated (illustrated by C) or conservation-orientated (illustrated by D).

If the application is conservation-orientated and falls within a rural node, it would be appropriate, as it will enhance the green area. This is illustrated by sector BD. If the application is development-orientated and falls within an urban node, it would be appropriate, as it will enhance urban development. This is illustrated by sector AC. Development applications falling in sectors AD and BC would be inappropriate as these areas are sensitive areas and would thus be immediately disapproved by the provincial authorities. The development application is therefore evaluated based on development potential and merit, and not by a rigid legislative line on a map.

Table 4 captures the GCR case study findings, illustrating the comparison among the (1) current reality in the GCR, (2) the outcome if UGBs were to be implemented in this area and (3) the outcome if a polycentric development pattern was to be implemented, such as the approaches illustrated in Fig. 6.

Currently, there are no (or limited) environmental protection measures implemented in the Gauteng area as pro-developmental approaches are prioritised. The
UGB will not necessarily assist in environmental protection within this area, as it focuses more on the division between urban and rural areas, and containment of the greater urban area. The polycentric development approach will, however, provide green linkages within the area, focussing on planned open spaces, and no-go areas, managed by strict zoning control measures. The current dispersed, social
Table 4: Comparison of the proposed development initiatives.

<table>
<thead>
<tr>
<th>Spatial planning</th>
<th>Current reality</th>
<th>GCR Polycentric development</th>
<th>UGB</th>
</tr>
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<tbody>
<tr>
<td>Environment</td>
<td>No protection measures, degrading of the urban core</td>
<td>Green linkages, planned open spaces</td>
<td>Open areas outside contained nodes</td>
</tr>
<tr>
<td>Development prioritised</td>
<td>No-go areas protect environmental areas from development</td>
<td>Boundary divides urban and rural areas</td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>Dispersed social nodes</td>
<td>Smaller neighbourhood nodes with social function</td>
<td>Urban core with social functions</td>
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<tr>
<td></td>
<td>Increasing distances</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>Transport ignores development boundaries</td>
<td>Planned transportation network for holistic area</td>
<td>Transport corridors cross boundaries</td>
</tr>
<tr>
<td>Development</td>
<td>Urban sprawl</td>
<td>Economic network across area</td>
<td>Compaction</td>
</tr>
<tr>
<td>Limited controlled development</td>
<td>Guide urban form</td>
<td>Restrict development outside the boundary inside boundary applicable</td>
<td></td>
</tr>
<tr>
<td>Land use</td>
<td>Not implemented effectively</td>
<td>Requirement</td>
<td>Inside boundary applicable</td>
</tr>
<tr>
<td>Regulations</td>
<td>Town planning schemes</td>
<td>Integrated framework and zoning controls</td>
<td>Urban edge policies and acts</td>
</tr>
<tr>
<td>Management</td>
<td>Local and district municipalities</td>
<td>Integrated metropolitan authorities</td>
<td>Local municipalities</td>
</tr>
<tr>
<td>Approach</td>
<td>Ad hoc</td>
<td>Development management</td>
<td>Development control</td>
</tr>
</tbody>
</table>

Source: Own creation (2013).

Nodes would be better structured by the polycentric development approach, creating smaller neighbourhood nodes with social functions. The current transport systems ignore the development boundaries. Transport corridors cross the urban boundaries. The polycentric development approach considers a planned, holistic transportation network, strengthening the urban form and functions.

The development, currently characterised by urban sprawl and limited growth management, can be better managed by means of the polycentric development approach, providing an economic network across the entire area and structuring the urban form. Land-use management is, however, a crucial requirement in this sense, regulated by integrated development frameworks and zoning controls. The
polycentric development approach will thus focus on development-management, in comparison to the development-control approach of the UGBs and the ad hoc approach currently enforced. The development-management approach would require integrated management, including all (local, district and metropolitan) management authorities.

8 Conclusions

There is a need for a new approach to growth management, as traditional growth management boundaries and tools were not proven to be successful. Authorities have various other (and adequate) tools at their disposal to manage the environmental effects of growth and development and to plan those genuine public goods such as roads and certain infrastructure [13]. In this sense, the UGB concept should be re-thinked in the modern urban environment, in comparison to flexible zoning tools [42] and land-use approaches.

The modern urban environments are more complex than the urban models of prehistoric cities. As urban areas grow and expand, the number of urban nodes and corridors also increases. This leads to a transformation in urban areas, from a mono-centric development pattern to a polycentric development pattern where the various urban nodes are interlinked, as illustrated in Fig. 8.

Traditional growth management tools and UGBs played a significant role in containing urban form of the mono-centric urban areas, but the modern polycentric development pattern calls for a new approach to growth management. As economic development cannot be limited within urban boundaries, and transport networks enhance cross-boundary developments, the relevance and effectiveness

Figure 8: Spatial impact of polycentric development. Source: Own creation (2008).
of traditional UGBs are no longer significant, as illustrated in the GCR case. The polycentric development pattern that characterises the GCR rather relied on growth management in terms of detailed zoning and land-use considerations to accommodate the drivers of sprawl, and be a catalyst to the drivers of compactness, enhancing the functionality of the identified and developed nodes.

The issue of development applications being evaluated on merit also proved to be more successful in the absence of UGBs, as applications were no longer subject to a one-dimensional legislative line, but were subject to the contribution they could bring to the greater area, the actual sustainability and actual feasibility of the development self. The strategic decision-making framework (refer to Fig. 7) can assist in the decision-making process, ranking development applications based on environmental sensitivity based on location and development-orientated versus conservation-orientated approaches.

Tomorrow’s governments cannot deliver the policy outcomes that society expects if they continue to hold onto yesterday’s monolithic-leadership model [43]. In this sense, the current approaches of growth management (UGBs in specific) are one-dimensional and the implementation thereof is ineffective. Growth management should rather be subject to good governance and simplistic implementation measures, such as detailed zoning controls and land-use management. The polycentric development pattern, supported by detailed zoning and land-use considerations, is a possible solution for managing growth and development in modern urban areas.

This approach guides urban development, following the transport corridors, linking smaller development nodes. It addresses the challenges of modern cities, characterised by multi-nodal areas and transportation networks which are not bound to UGBs.

References


[38] Dutt, 2006.


