GAUTENG 2055 – HUMAN SETTLEMENTS

Scenario Planning Project

FINAL REPORT – July 2010

Prepared by:
Mphathi Nyewe and Thembinkosi Semwayo

Contact Person: Mphathi Nyewe
B.Com(FH) B.Com (Hons) MPhil-Future Studies (SU)
Foresight Strategies (Pty)Ltd
mphathi@iafrica.com

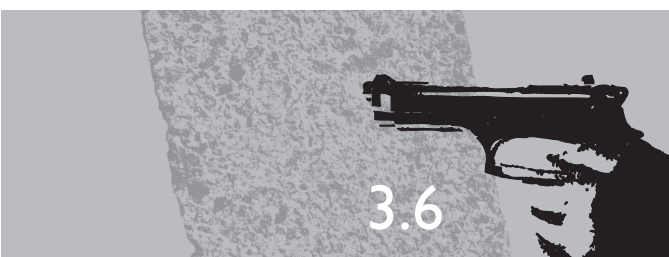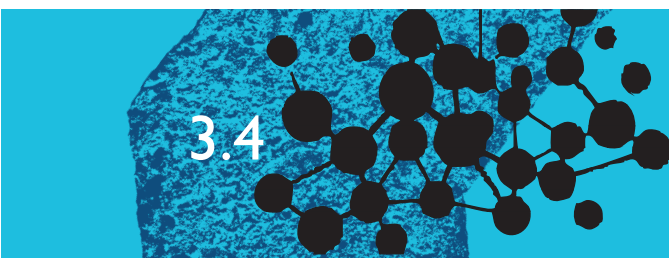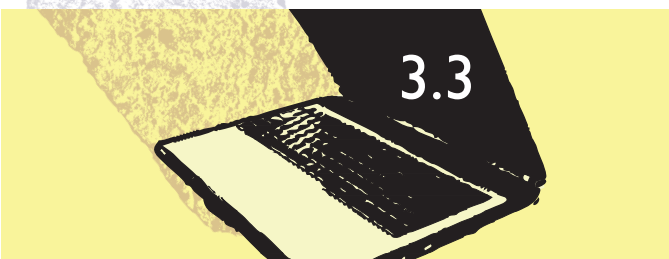1 Gauteng Knowledge Society
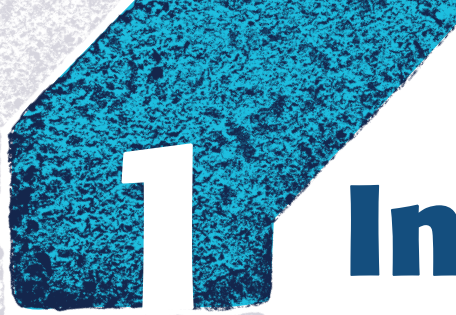
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1 Introduction

This document serves to convey the total outcome of the scenario planning project commissioned by the Gauteng Department of local Government and Housing. In an effort to employ long-range planning methodologies and strategies the Department embarked on the Gauteng 2055 Human Settlement Scenario Planning project at the beginning of 2009.

Extensive research and consultation with the widest variety of stakeholders, interviews with the Department's senior executives and input by experts from the wide range of sectors resulted in the determination of key drivers of change that would most certainly determine the courses and shape the future for Human Settlements in Gauteng by the year 2055.

A combination of scenario planning tools including Foresight, Morphological Analysis and Systems Thinking were used to draw on the experience, knowledge and expertise of all the participants and role players. Ultimately, the predetermined elements and critical uncertainties were identified, analysed and combined to create the forum scenarios presented in this document.

A scenario planning process, as a long-term planning tool was used to create a range of alternative plausible futures and to stimulate a strategic conversation about the future of human settlements in the Gauteng Province. We should always bear in mind that scenario planning is a process of painting pictures of the idealised future rather than a forecast of the future. It is a process in which possible world could unfold which are unimaginable, unthinkable and unpredictable. But the scenarios are based upon dissectible trends and a range of assumptions about the future.

It is with that frame of mind that we should understand and interpret the scenarios presented in this document. A separate document titled Strategic Implications of the scenarios is provided separately as an internal discussion document linking the scenario planning process to the strategic planning process of the Department of Local Government and Housing.

"A scenario planning process, as a long-term planning tool was used to create a range of alternative plausible futures..."

2 Factors shaping the future

2.1 What can we be more certain about?

Long range planning requires that we consider those trends which have already been established, the effects, of which may be felt only in the next decade or two, require that we plan and make policy changes and strategic interventions today. The facilitated workshop processes and expert input identified the following elements as key to the determination of the future of human settlements:

(a) Demographic trends

(b) Land scarcity

(c) Water scarcity

(d) Limited Financial Resources

(e) Demands of the Transportation Infrastructure

2.2 What are the critical uncertainities?

(a) How sustainable is the low-cost housing policy over the next ten to twenty years?
To what extent can the policy of providing free housing and guaranteed tenure be sustained in light of the growing number of the poor and indigent citizens of the province and financial resources? How can limited security of tenure be guaranteed against the reality of land scarcity?

(b) Can we achieve sustainable economic growth without environmental pollution and degradation?

(c) Can the trial of education, health and safety challenges be addressed in an integrated and effective manner to enable improved quality of life for the citizens of the Gauteng Province?

(d) Can technology be harnessed to improve not only the management of the housing delivery process but enhance the convergent real estate, eco-housing design and internet broadband technologies?

(e) Can we achieve car-less cities by redesigning the transportation systems?

(f) Can we transform and harness renewable energy sources to usher in a low-carbon economy as a level towards viable and sustainable communities?

(g) Can we achieve water security for both human consumption, agriculture and the sustenance of the ecosystem?

(h) Is it impossible that illiteracy can be reduced to zero level to achieve 100% literacy rate within the next twenty years?

(i) Can we design creative and productive immigration policies instead of fighting against inevitability of inward migration?

3 Building the scenarios

The scenario building process evolved from the use of a combination of scenario building tools including the 4 quadrant scenario tool, the causal layered analysis and ultimately the Morphological Analysis tool was used to deposit a range of three scenarios driven by twelve definitive drivers of change which rated as having the highest impact in shaping the future of human settlements. A brief description of the morphological analysis futures table is described followed by summaries of the three scenarios. The fourth scenario: "A Dream Deferred" is included to depict the consequences of failure to change current and distorted policies, value systems, behaviour tendencies and outdated political positions that hinder positive growth and development towards any of the desirable and preferred futures.

3.1 Summaries of the Four scenarios

Figure: 1

Scenario A	Scenario B
Knowledge Society	Cocoon Global City & Villages
Scenario C	**Scenario D**
Green Smart Living	A Dream Deferred
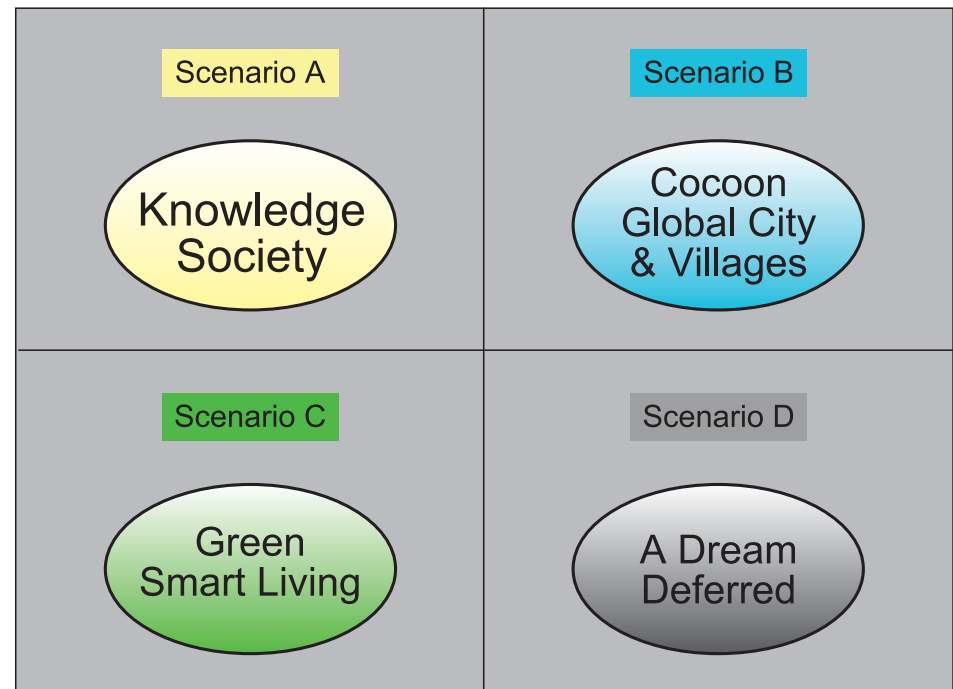
3.1.1 Summary of the Gauteng Knowledge Society

The scenario provides a positive future of a knowledge economy developed through well coordinated government policies and programmes, developed to take advantage of advances in information technology to foster rapid societal development and economic growth. Through targeted initiatives in education, knowledge access and learning become accessible. A bold policy move to make access to broadband internet and online material free, paves the way to rapid literacy and learning growth at all levels of society. Immigrant friendly policies enable the country to access the best human resources available globally and accelerates the development of local skills.

The creation of regional planning commissions and local futures planning committees in every district, the adoption of long range planning, and a systems thinking approach to address human systems problems dissolving mechanisms, are presented as some of the strategic interventions required in the present to lay the foundations for a knowledge society of the future. Effective collaborative governance with human settlements partners and stakeholders becomes a reality leading to the optimal harnessing of resources and the comprehensive resolution of housing, transportation, and water provision challenges. Through coordinated efforts and intensive knowledge application viable sustainable human settlements are realised.

3.1.2 Summary of the Cocoon Global City and Villages scenario

Cocoon Global City and Villages scenario depicts a typical community that has met all the criteria that defines viability and sustainability having managed to develop its citizens to be fully literate and technically skilled. Through dedicated focus on renewable energy technology, the use of the Internet online education delivery systems and radical innovation on social systems organisation, the concept of job dependency has been eliminated to be replaced by a robust entrepreneurial system at the community and individual levels. Business like planning and management discipline of command resources is adopted. Surplus energy and water is sold to earn revenue for the community/ the community pays taxes to the fiscus and distributes financial and material dividends to members of the community. Knowledge enterprises earn foreign currency for the community. Residential domains are not static but highly mobile using the tenure system.

> *"... the concept of job dependency has been eliminated to be replaced by a robust entrepreneurial system at the community and individual levels."*

3.1.3 Summary of the Green Smart Living

Green Smart Living depicts a successful Low Carbon Energy society supported by innovative water reclamation technology using nanotechnology for water purification and Water Theaters for water desalination.

Established green living habits are the ruling societies norm. Green Smart education is compulsory at primary and high school levels. Only renewable energy sources are acceptable as pure an there is a total ban on the use of fossil fuel energy sources. The concept of GAIA is fully understood and embraced as a guiding principle in infrastructure development. All the cities and selected parts of town are designed as car-less zone where only the people mover system is allowed as a means of transportation.

All buildings are certified as convergent real estate connected to the ubiquitous internal broadband. Green architecture confirms to established international norms and standards. The multi-purpose government buildings serve as accommodation spaces and hydroponic enterprises to augment traditional agriculture crop growing.

3.1.4 Summary of the - A Dream Deferred scenario

The Dream Deferred scenario sketches out the effects of a non-viable human system. A system that has all the good intensions, but still spirals out of control, and eventually collapses. The scenario provides an insight into the systems analysis management tools available right now to resolve human settlements issues comprehensively, due simply to lack of exposure to them. The impact of a siloed and inadequate approach to dealing with the issues of lack of adequate human settlement services: justice delivery, electricity, water, education and health are highlighted. The "hidden" connections between social and physical capital is explored. The scenario also shows the disastrous effect of protecting short-term vested interests by one sector.

A lack of foresight leads to the neglect of the driving social and economic forces that need eventually lead to a total collapse. While the scenario is meant for 2055, the system actually collapses just after 2025 illustrating that when the system spirals out of control the tipping point is reached sooner and collapse cannot be reversed.

3.2 Background to the Morphological Analysis tool

The Morphological Analysis futures tool was used as a means of conveying the message that the resultant scenarios are derived from a combination of drivers based on an understanding of the Pre-determined Elements (such as Population Growth) and Critical Uncertainties (such as Shortage of Land and Water for example) already identified during workshops 2 and 3. All these combined, in the Morphological Analysis schedule can be depicted together to portray a range of Key Drivers in different combinations across the three scenarios. These included enabling innovations such as those technologies or changes in policy that can be adopted gradually over time to enable the realisation of one or more scenarios to materialise. Figure 3 below represents the first schedule that was presented.

Although the Scenarios A, B and C are displayed at the bottom of the schedule, the elements above each do not yet correlate to any specific scenario. The next section in this report attempts to provide a more scenario specific Morphological Analysis Schedule.

Figure: 2 – Generic Schedule presented at the workshop

Scenario Building through Morphological Analysis

Relevant key Drivers	Most likely responses & breakthroughs			
Demography	22m	24m	28m	?
Land Scarcity	Highest Densification	No Land for Housing	No tenure guarantee	?
Water Scarcity	Infrastructure upgrade	Robust Infrastructure	Desalination Theaters	?
GDP Growth	8% pa	16.5% pa	5% pa	?
Technology	Broadband	Intelligent Buildings	Biometric	?
Typical Home	Virtual home	Eco-Building	Multi-purpose	?
Soc - Education	Free Tertiary Education	Free-online Education	100% Literacy	?
Soc - Health	Telemedicine (Trained Practitioners)	Online Medical Records	Free medical insurance	?
Soc - Crimes	Citizen Police	Biometric IDs	Genetic Profiling	?
Housing Policy	No Free (RDP) House	DIY Subsidy Only	Tenure Points	?
Envir. Degradation	Green Society	Energy from Waste	Energy from Solar	?
Transportation	Teleportation	Car less cities	People Mover Network	?
Coherent Scenarios	**Scenario A**	**Scenario B**	**Scenario C**	

Some breakthrough innovations, also not necessarily included in the schedule, can be any innovations, which demonstrate societies own ingenuity in solving problems or overcoming obstacles. Once again, these are not to be limited to technological or scientific inventions, innovations could even mean changing attitudes, values and norms. Delegates were reminded to exercise their minds liberally, free of any structural or policy constraints. Completed ACTVOD Tables served once again to provide a detailed illustration of the key elements that together make for a coherent scenario construct.

3.3 Gauteng Knowledge Society – Morphological Analysis

Figure: 3

Gauteng Knowledge Society

Relevant key Drivers	Most likely responses & breakthroughs			
Demography	22m	24m	28m	?
Land Scarcity	Highest Densification	No Land for Housing	No tenure guarantee	?
Water Scarcity	Infrastructure upgrade	Robust Infrastructure	Desalination Theaters	?
GDP Growth	8% pa	16.5% pa	5% pa	?
Technology	Broadband	Intelligent Buildings	Biometric	?
Typical Home	Virtual home	Eco-Building	Multi-purpose	?
Soc - Education	Free Tertiary Education	Free-online Education	100% Literacy	?
Soc - Health	Telemedicine (Trained Practitioners)	Online Medical Records	Free medical insurance	?
Soc - Crimes	Citizen Police	Biometric IDs	Genetic Profiling	?
Housing Policy	No Free (RDP) House	DIY Subsidy Only	Tenure Points	?
Envir. Degradation	Green Society	Energy from Waste	Energy from Solar	?
Transportation	Teleportation	Car less cities	People Mover Network	?
Coherent Scenarios	**Gauteng Knowledge Society**			

In this schedule the highlights in light yellow depict those key elements that contribute to the Knowledge Society scenario. The concept of a Knowledge Society in Gauteng was fully embraced by the delegates. It was felt that only under such a society is a 16,5 % GDP annual growth be attainable. The link between an information society and knowledge society was established.

The South African government, through dedicated organs of state is currently pursuing the establishment of Information Societies. These Information Societies, once established will evolve into fully functioning knowledge societies, changing lifestyle patterns, spatial planning processes and settlements.

In addition, it was felt that for many reasons advanced by the delegates, the Knowledge Society scenario was rated as the most ideal scenario for Gauteng Human Settlements. It was said to be accommodative of both the Cocoon Cities and Villages Society elements as well as those of the Smart Green Living scenario.

3.3.1 Gauteng Knowledge Society – ACTVOD Table

Theme	Immigrant friendly policies and High investment in education.
Drivers	Educational technology software. Reduction in state dependency of the poor. The quest for a knowledge based society.
Breakthrough Innovations	Broadband enabled online education delivery processes. Smart and Progressive immigrant policy. Tenure points policy in lieu of the FREE Housing Policy.
Enablers	Free tertiary education, Free broadband internet, intellectual harvest of foreigners.
Possible Obstacles	Inhibitive costs, broadband failure, lack of integrated planning, political interference. Failure to increase literacy levels.
Key Human Settlements Features	High density, multipurpose usage buildings, high technology wise community. Intelligent buildings. Biometric ID systems.

The one component of this Scenario that needed further explanation was that of Immigrant Friendly policies. The perception was that too much dependency on immigrants to fill the void for scare and critical skills undermines the potential inherent in South African society.

The reality though is that South Africa is currently experiencing acute shortages of scarce and critical skills as all SETAs can attest. The South African government has in fact adopted the policy of importing foreign skills such as medical doctors from Cuba and Mathematics and Science teachers from the northern African states. Immigrant friendly policies could be adopted to enhance the local skills base with the relevant provisions that allow for skills and knowledge transfer as much as we are currently doing with technology transfer programmes.

3.3.2 Knowledge Society Story

It's a cool winter's morning in Johannesburg on July 1, 2055 as Ntombi reflects on the fascinating ubiquitous knowledge society which she is part of. Knowledge on any subject of interest is now easily available at the flick of a finger. Virtually all educational material one requires on any subject is available on line and for free. Her genetic and medical profile, and medical history are now accessible over her mobile communication device.

She feels vindicated that what was considered then her pipe dream, a few years ago has come to life. The arrival of the broadband communications networks, fortuitously brought in by the country's hosting of the FIFA World Cup in 2010 made affordable internet access a reality. The advent of ubiquitous access to the internet made learning and access to knowledge a "no brainer". The INSPIRE programme whose vision was to develop progressive information societies across the country, had played a big role in making this happen. The Department of Education took advantage of this development, and by 2013 all schools had free access to broadband technology and teacher training became focused on online education delivery systems. A Free Education policy was put in place in 2014. Education was made free at all levels in order to develop a truly knowledge society in the same year. Free Online Education became widely available, recognised and accredited. By 2020, 98% literacy had been achieved and by 2025, 100 % literacy had become a reality.

She reflects on way back then when she used to spend 4 hours a day in traffic just to get to work at the Department of Housing. She remembers the ever occurring nightmare of having to face disgruntled clients asking why promises of free housing were taking forever to fulfil. She remembers how the policies on free housing, land tenure, and ownership had created a culture of entitlement amidst the fast growing population, (now standing at 28 million, fuelled by in-migration from the north of South Africa, and from other provinces) and dwindling land space to build housing estates in the Gauteng province. Her frustrations made it difficult to focus on her insurmountable work.

In 2012, the then Chief Director of the Department of Human Settlements and Local Government was asked to attend a Technology, Education, Safety, Health and Environment (TESHE) Innovation workshop in Cape Town. She considered this workshop as yet another talk shop which would produce nothing tangible. Ntombi was asked to attend the workshop on the Chief Director's behalf. Ntombi was only happy to get out of the drudgery of the office, and spend sometime in picturesque Cape Town. Little did she know that this workshop was going to change her life and the world she lived in forever.

At the workshop she learnt hand on how to use exciting concepts like: causal layered analysis, co-causation factor analysis, viable systems modelling, soft and hard systems, foresighting, and various

other innovation techniques and methodologies for problem analysis and ideal systems re-design. Ntombi was amazed at the promise these newly found techniques had at resolving most of the problems human settlements faced. While to her these approaches were revolutionary, she was pleasantly surprised that most of these ideas were not new, just that throughout her school and working days, these concepts had somehow passed her by.

In 2013 Ntombi joined the newly formed Regional Planning Commission (RPC), attracted by the long range futures planning approach the commission was taking. The mission of the RPC resonated with what she had learnt in Cape Town at the Innovation workshop. She had figured out then that much of the ills

associated with human settlements planning was a result of short term focus, siloed, and dysfunctional planning which characterised the way of doing business in the human settlements planning arena.

The establishment of the long-term National Planning Commission (NPC), followed by the RPC Local Futures Planning Committees in every district by 2015, helped instil Foresight and Systems Thinking across all sectors. Foresight and Systems Thinking Planning processes and tools improved radically the way local Integrated Development Plans (IDPs) were put together and implemented. Ntombi is proud that through the Regional Commission she had contributed her 2 cents worth in bringing about significant change in policy outlook on human settlements

planning. She is currently employed as a Futurist, where her job involves scanning the globe for new trends and technologies that make human livelihoods easier, and contributing insights to multi-sectoral / multi-stakeholder Foresighting activities. Human settlements were at last viewed as integrated wholes encompassing interacting economic, political, socio-cultural, ecological and legal dimensions.

Through the concerted efforts of the RPC stakeholder integration a number of far reaching policies and strategic interventions were put in place. Land banking became policy. Land tenure guarantee was abolished and replaced with a tenure points system in 2015. "No Free Housing Policy" moratorium was approved by cabinet in 2016, and "a Do It Yourself" policy was enacted to replace it. This culminated in no more state land available for low-cost housing. Further the green paper on extension or abolition of provincial boundaries wascirculated for discussion to discuss the possibly "artificial" land shortage. This culminated in the abolishment of provinces in favour of regions, whose boundaries were not political but economic planning areas. Access to knowledge on state of the art building and living spaces technology

resulted in the development of energy efficient, multi – high density multi-purpose usage intelligent buildings that brought work and residences close to each other.

Transportation was completely overhauled to bring in efficient people mover networks by 2020.

Car-less city centres with lots of open walking spaces have now become a reality. The breakthrough came from experiences and learnings from the 2010 FIFA World Cup on the effectiveness of Park and Ride approaches. By 2016, the first "People Mover Network" linked key regions, towns, cities, and townships. Research on teleportation gained ground post 2016, resulting in the development of sky trains, not quite the classical teleportation vehicle as envisaged, but super fast trains running on solar powered frictionless electromagnetism. The Sky trains made commuting a breeze. The Gauteng region Teleportation Mega Project which gave birth to the Sky train achieved world acclaim in 2020.

To keep up with the rapid infrastructural developments demanded by the fast growing economy, immigrant friendly policies were developed by the Department

"Transportation was completely overhauled to bring in efficient people mover networks by 2020."

of Home Affairs to attract artisans from across Africa, the Diaspora, China and India. Foreign artisans were brought in to facilitate this development and to grow the pool of local artisans for future sustained development.

The looming water shortages were averted through a number of linked strategic interventions. In 2012 a huge water infrastructure upgrade and maintenance project was put in place. This initiative resulted in addressing significantly the government's job creation priority. Through a fortuitous twist in technological developments and the now available environmental scanning expertise, South Africa was able to harness the latest water desalination technology in the form of "Water Theaters", air to water conversion structures and nano-technology water purification. A water theatre pilot project was set up in 2016 and by 2025 the Gauteng region and the rest of South Africa had a guaranteed renewable supply of water. Today, fresh cool water is now available from a "water from air" canister in her lounge, Thanks to the application of intense chemistry and nano- technology knowledge, the looming portable water shortages at the beginning of the century were laid to rest.

3.3.3 Initiatives embodied in the Knowledge Society Story

1. Free education policy

   Free education policy makes education accessible to everyone. Exclusions at tertiary institutions for financial reasons are a thing of the past.

2. Free internet access policy

   Free internet access makes access to knowledge on any subject easily available. This leads to rapid learning and skills development.

3. Government led aggressive information society development programmes

   Aggressive programmes to develop information and highly skilled knowledge societies gives rise to globally competitive societies. The INSPIRE programme whose vision was to develop progressive information societies across the country, makes a big impact and knowledge societies become ubiquitous

4. Establishment of Regional Planning Commissions

   The establishment of the long-term National Planning Commission followed by the Regional Planning Commissions and Local Futures Planning Committees give impetus to growth through Foresighting and development of focused knowledge intensive initiatives.

5. Intense use of knowledge to dissolve societal problems

   Systems approaches and techniques are applied to address looming water shortages, and the development of clean pedestrian friendly car-less cities. Access to knowledge on state of the art building and living spaces technology results in the development of energy efficient, high density multi-purpose usage intelligent buildings that brought work and residences close to each other.

6. Immigrant friendly policies

   Immigrant friendly policies leads to the transfer of knowledge intensive skills by skilled foreigners attracted to South Africa. A pool of local artisans is developed which provides for future sustained development.

3.4 Gauteng Cocoon Global City and Villages – Morphological Analysis

Figure: 4

Cocoon Global City and Villages

Relevant key Drivers	Most likely responses & breakthroughs			
Demography	22m	24m	28m	?
Land Scarcity	Highest Densification	No Land for Housing	No tenure guarantee	?
Water Scarcity	Infrastructure upgrade	Robust Infrastructure	Desalination Theaters	?
GDP Growth	8% pa	16.5% pa	5% pa	?
Technology	Broadband	Intelligent Buildings	Biometric	?
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Envir. Degradation	Green Society	Energy from Waste	Energy from Solar	?
Transportation	Teleportation	Car less cities	People Mover Network	?
Coherent Scenarios	**Cocoon Global City and Villages**			

Figure 4 depicts the combination of elements that together make up the Gauteng Cocoon Global City and Villages scenario. The scenario assumes a population growth of 28 million people in Gauteng with a GDP of about 8% per annum. The citizens are assumed to be technically advanced in terms of education and lifestyle, all having acquired education with a 100% literacy rate to support their claims to advance technological know how. Given the existence of ubiquitous Internet broadband much is possible in the manner in which the cities and smart villages are managed. This society earns revenue from selling solar energy to the local municipality. They have a fully functioning police service; all citizen records personal identity records are kept online with biometric technologies enabling access and identity profile all at the same time. A people mover system is in use as the main means of transportation.

The Cocoon Global City and Villages scenario is not to be mistaken for an exclusion of other communities but rather the emergence of self-sustainable communities that have the appropriate levels of education to enable adoption of new technologies, policy initiatives that allow for innovative means of collecting revenue from residents and using these to perform functions and services previously known to be in the exclusive domain of municipalities.

3.4.1 Gauteng Cocoon Global City and Villages Scenario – ACTVOD Table

Theme	Income generating, self servicing communities driven by renewable energy technical capabilities.
Drivers	Independence from municipal service delivery processes. Perfected use of Solar energy sources. Technically skilled and business-minded society.
Breakthrough Innovations	Solar energy sources technological capabilities. Eco-housing focus and delivery. Biometric security and access systems.
Enablers	High social capital. Investment in diverse technical skills. Business orientation.
Possible Obstacles	Restrictive government policies. Negative perceptions of elitist society. Lack of finance. Slow adoption of renewable energy sources and products.
Key Human Settlements Features	Renewable energy uses and knowledge. Eco-housing schemes and revenue earning communal living systems. Biometric security and health systems.

3.4.2 SAND-ALEX - Cocoon City's 50th dividend to its residents

Joyce Kubu is the kind of a person who should have been a political activist. From a very young age Joyce's grandmother maintained a tradition of taking her to political rallies in Tembisa, Soweto and even to Mangaung in Bloemfontein at one stage. Later she made her presence felt at the June 16th Youth Day Celebrations. This, she strongly believed was a way of making her connections with her late father who never returned from exile, his whereabouts are still unaccounted for. In 2024, Joyce was a twenty-six year old Wits University civil engineering graduate and headed the Meadowlands Infrastructure Development Committee under the umbrella of the Meadowlands Development Forum.

In 2050, Joyce became the City Manager of the Sand-Alex Global City Cocoon. The community is comprised of a mixture of high-density residential buildings with industrial establishments focused primarily at high technology information processing businesses and home-based techno-industries. In her position, Joyce is one of fifty such City Mangers who have emerged to manage and grow the now fasting-growing Gauteng City Region.

The Sand-Alex Cocoon City is generally regarded as a world-class community that is a major contributor to the growing tax-base of the Gauteng Province. Youth born into this community are highly sought after for their athletic, academic and social entrepreneurial prowess.

The Sand-Alex 2010 Poverty Museum is a major tourist attraction. The 70-meter high, 600-mega watt Water Theater is the eighth wonder of the world. The TSC Viable Cities concept, on which Sand-Alex is based, has now been replicated in all the nine provinces. "The Cocoon System is a very simple concept" Joyce insists, when asked how such a viable, sustainable community was achieved. "Common-sense, an understanding of Foresight and the application of Systems Thinking is all that is required. The rest is simple, diligent hard work, like anywhere else in the world. Corruption, we are told, is what caused the collapse of the previous communities".

Sand-Alex had solved the poverty problem in 2020. The community can no longer relate to the long forgotten problems of the past like housing backlogs, service delivery protests, HIV/AIDS pandemics, illiteracy and state dependency. All of which are stories told by elderly former residents of historically black township communities, now part of the museum exhibitions.

On this 30th day of June 2050, Joyce Kubu is presenting the Sand-Alex community Annual report at the MALBORO station Super Bowl. Those citizens, who could not attend the event, are glued to their television screens, expecting to hear news of the 20th dividend payout.

Gross Revenue is 50% up on the previous year. Net profit growth remains constant at 40% year-on-year. The major contributors to revenue growth are Electricity Sales to Eskom, City Power and the Gautrain. Electricity sales contribute 40% of the revenue, the Water Theater Centre contributes 15% and another 20% comes from tourisms. The remainder

> *"... "how we thought" rather than "what we thought" was what needed to change."*

is made up of local levies on home-based techno-industries together with dividend income from the local Sand-Alex TECHNO-PARK.

Residents of Sand-Alex have come to expect dividend payments in cash, in education grants and sports incentive schemes run by the Sand-Alex City Management Company. For more than twenty years now, the Sand-Alex TECH-PARK had produced the highest number of Artisans, Plumbers and Solar Energy Technicians in South Africa. It is these young graduates who are the highest salary earners in the entire Gauteng Province.

What brought Sand-Alex such fame and future?

This is a story that has been told multiple times but many can still not workout how the Sand-Alex community has achieved such a high level of Social Capital. The unquantifiable elusive concept of social cohesion is the invisible glue that has held the Sand-Alex community together.

2010 – 2015
Way back in 2010, Mrs. Mapula Kubu was the head of the Strategy Research Department at Wits University when she attended a 2055 - Human

Settlements Scenario Planning Workshop organized by the Gauteng Department Local Government and Housing. This workshop left a lasting impression on her and changed her outlook towards the future. She was already advanced in her PhD studies in Social development and Poverty Alleviation. She professed to her colleagues that the workshop provided valuable insights into the subject of Foresight and Systems Thinking being effective tools in mobilizing societies towards the achievement of common goals. As an active member of her Ward Committee in Alexander Township she realized that much of their challenges lay not so much in how much services were lacking or how many people needed housing or healthcare services, but much into how her entire society thought, behaved and the value system that informed their decisions. Therefore "how we thought" rather than "what we thought" was what needed to change.

She felt that challenges that were discussed at the workshop could be resolved and even dissolved, through innovative thinking and a higher level of mutual cooperation. But, how was that to be achieved?

Challenges that had to be dealt with
Land availability was an issue that could not be resolved. The committee

agreed on putting forward Land banking proposals to the government.

The provision of free housing to children yet not born was viewed as historic legacy that mortgaged future generations to providing free houses for the rest of their lives. This was exactly why the housing backlog could not be dealt with effectively and permanently.

Continuous and endless water supply could not be guaranteed, what with the water infrastructure lacking maintenance and the ever-growing problem of Water pollution. Security of water supply was a serious threat.

In all this time, population growth was forecast at 57 million by the year 2050 and would reach 20 million by the year 2025. Gauteng would possibly be overrun by the legal entry of foreign immigrants particularly those from neighbouring states.

Dr. Kubu managed to convene a conference of the citizens of the Sandton community in Region 3 together with those of Alexander in Region 7. At this conference, agreement was reached to collapse the artificial boundaries between the two communities and adopt Sand-Alex as a single viable community whose

primary goal would be to end poverty and unemployment within a decade. The Sand-Alex Community would be defined as a Self-Sustaining Viable Cocoon City. The conceptual vision was premised on a belief that a community of highly educated, technically skilled and entrepreneurial citizens could never experience poverty, homelessness and joblessness. The Sand-Alex Cocoon City would then become like a business entity with citizens contributing to the local GDP growth while all civil servants would pledge allegiance only to the citizens and not to a political party. Corruption would be rooted out and replaced by total and ruthless transparency.

2015 – 2025

Working closely with the Gauteng Provincial Government Sand-Alex made substantial investments in 5 key areas:
(1) Online education delivery system
(2) Broadband Internal Access for all citizens
(3) Technology Transfer and Innovation
(4) Solar Power Technology
(5) Customer Service Culture and Tourism

A pact was made between the residential communities and the commerce industry that ensured substantial investments were made to secure Internet broadband access for every home and every school in the broader Sandton, Alexander, Tembisa and Diepsloot communities. A consortium comprised of Technology Experts, Educational Institutions, the Communities and the Government worked tirelessly to draw on the lessons that made the 2010 FIFA World Cup tournament one of the best ever experiences worldwide. This level of cooperation and commitment to a shared vision had never been achieved at a local community level. This was, thanks once again, to the Foresight, System Thinking and Social facilitation capabilities of the leaders, mobilized by the initiative of Dr. Kubu.

The value of basic education was recognized as the starting point in building viable sustainable communities. The insights gained from Professor Johannes Andria Watkins given at the Inaugural Conference of the Sand-Alex community in 2014, brought to light the difference (was there only one difference? Or should it be differences?) Between Soft-System Methodologies and Hard-System Methodologies. It was accepted that for far too long, land use planning, township development and housing delivery had always focused

on the hard-systems as the primary determinants of the social landscape. As a nation, we had succeeded in building hard infrastructure but were failing in building the soft-systems these "soft-elements" informed our attitudes, values, aspirations and impacted negatively on our behaviour as both civil servants, citizens and in our working lives.

Building on the backbone of the internet broadband education system which became available and accessible online to anyone who needed it, the teacher training colleges and universities complimented their teacher training curricula with Telematic Interactive Education modules enabling teachers to deliver educational content through online media channels.

As from 2018, all primary and high schools were equipped to receive and deliver online education. The Learners were equipped with learner-adapted iPads and could access these at home. A new cadre of teachers, well adapted to the online education system, was brought in into the schools to act as facilitators rather than teachers.

The Sand-Alex City Management secured technology transfer agreements with the Indian and Finnish

governments. The major technologies targeted were Solar Energy, Artisan training, Software development and Online Educational Content delivery technologies. The National Advisory Council on Innovation played a major role in the design and implementation of the online education content delivery system supported by the Departmental of Science and Technology.

In 2015 the Gauteng Department of Local Government and Housing launched a Programme called Soft Systems Human Settlements Initiatives (SSHSI). The primary goal was to bring into sharp focus, the elements that impacted on social capital formation to build social cohesion. The Department had realized that this element was the proverbial "Blind Spot" in the historic housing delivery schemes of the past.

The SSHSI was formed from recommendations made by the TESHE Systems Integration Commission, headed by Dr. Thembekile Magaqa a world-renowned futurist and System Thinking Practitioner. The essence of the Commission's recommendations was that the inter-governmental cooperation could only be achieved when both citizens and civil servants better understood Foresight, System Thinking and Systems Integration. The

integration of objects and people had to be preceded by integration of thought processes and the acknowledgment of system boundaries and systems dynamics. Therein lies the secret to the Sand-Alex Cocoon City's success, now a major revenue earner with practically no state dependents, but major tax revenue contributors.

In 2025, Sand-Alex pronounced poverty dead. One hundred percent literacy was the new standard, while knowledge and technology became the new 'Gold' as well as the ticket to wealth and prosperity. Housing shortages had been completely dissolved as all new citizens and young adults earned tenure points that allowed them to live and work from any where in the country and enjoyed special privileges in the new high residential domains at the top of all government buildings.

Joyce delighted her audience and Sand-Alex residents by announcing yet another 5000 cents per share dividend for the year 2050. In this community, everyone is a worker, not an employee and in this community, everyone is a winner. They are called TECHNO-SMART Citizens.

The lasting legacy left by the Sand-Alex Community is one where fifty other Cocoon Cities have now been established by simply adapting the Sand-Alex Cocoon City and Village Concept.

TESHE Multi-Stakeholder Forums exist in almost all communities that strive to be viable. The ultimate goal of every Cocoon City Village is to have TECHNO-SMART Citizens and achieve the highest accolade any city, village or township can earn, which is being awarded the TSC Viable City Award by the State President. Long established, the TESHE Institute earned consultancy fees by establishing viable and sustainable communities. The Institute has established policies and guidelines Systems Integration and collaborative innovation and provides training and development to any citizen who aspires to live in a cocoon city or village.

Joyce Kubu would always close her presentation by the quoting the philosophers who shaped her views and outlook in life:

Bertrand de Jouvenel, a French futurist and philosopher once said;

"Those who act with sustained and strong intention are the creators of the future."

The Art of Conjecture (1967)

She thanked everyone and proceeded to the media centre where local and foreign journalists were waiting to interview her. That evening, the SABC's headline news read;

"We at SAND-ALEX have realized our vision, not by focusing on sustainability but rather on viability as a self-sustaining organism, creating wealth, livelihoods and prosperity for future generations."

Ms. Joyce Kubu, Managing Director of the SAND-ALEX Cocoon City Management Company.

3.4.3 Initiatives embodied in the Cocoon Global Cities and Villages story

1. Use of the Internet online education delivery systems to accelerate the eradication of illiteracy and for skills development

   By embracing internet technology and providing free access to internet based content the Cocoon City Community accelerates the eradication of illiteracy, knowledge access and the development of skills in the renewable energy sector.

   Learner-adapted iPads are accessed by students at home. A new cadre of teachers, well adapted to the online education system, is brought in into the schools to act as facilitators rather than teachers.

2. Development of social capital and social cohesion through radical innovation on social systems organisation

   Efforts at influencing society thinking processes (mindsets), value system and behaviours that inform societal decisions led to new radical way of thinking from ''what we think to how we think''. This evokes a new understanding of the inter-connectedness of systems, and a realisation that affluence and poverty cannot sustainably co-exist without ever increasing social tensions. This thinking leads to the dissolution of boundaries between affluent and poor areas.

   A new entity Sand-Alex run by multi-stakeholder forums that seeks to develop social capital through collective foresighting, application of soft systems methodologies, education and training is created. Dedicated focus on skills development in renewable energy technologies and entrepreneurship. Techo-Smart Citizens that add tremendous developmental value to their cohesive community are created.

3. Development of a Viable City System that turns technology into viable businesses

   A viable Cocoon City built around the Viable City System concept and run on solid business principles is built. A technopark comprising a mixture of high-density residential buildings with industrial establishments focusing primarily on high technology information processing businesses and home-based techno-industries is developed. Residential domains reorganised as highly mobile units using the tenure points system.

   Renewable energy technologies are turned into viable businesses run by trained highly skilled local community members. Income for individuals and the community as a whole is generated from selling solar powered electricity and water created through Water theatre purification technologies. Sand Alex becomes a model sustainable, affluent city region attracting tourist to see for themselves how such a transformation took place.

   The newly formed Sand-Alex model is replicated in all the nine South African provinces.
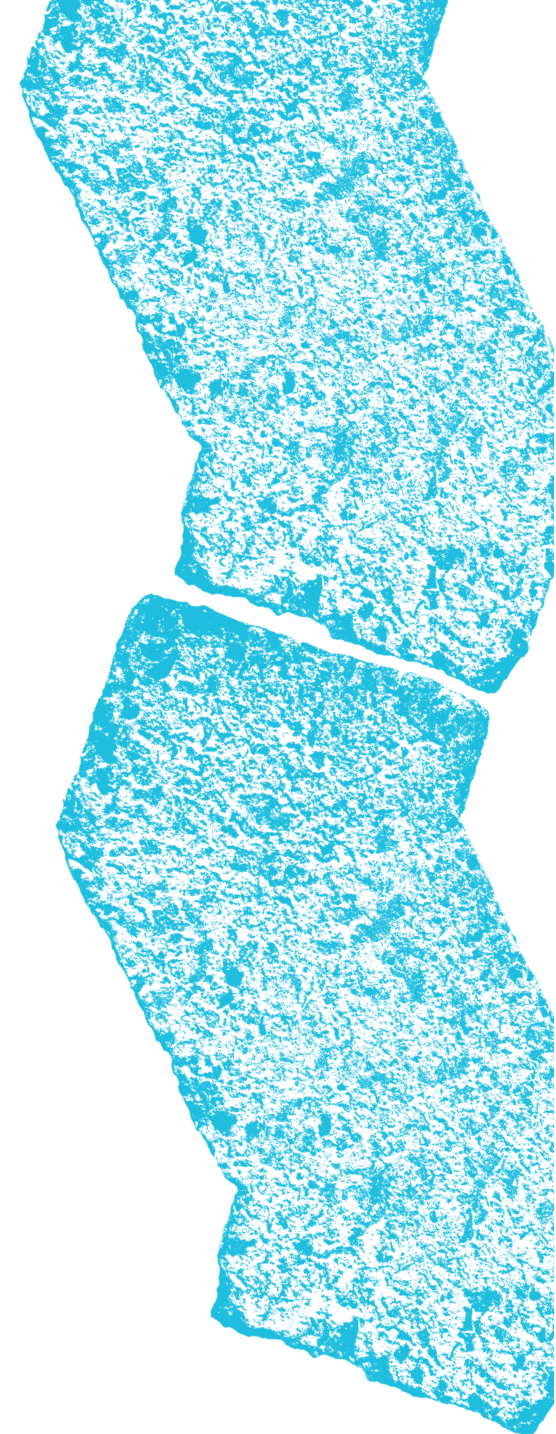
3.5 Green Smart Living Scenario – Morphological Analysis

Figure: 5

Gauteng Green Smart Living

Relevant key Drivers	Most likely responses & breakthroughs			
Demography	22m	24m	28m	?
Land Scarcity	Highest Densification	No Land for Housing	No tenure guarantee	?
Water Scarcity	Infrastructure upgrade	Robust Infrastructure	Desalination Theaters	?
GDP Growth	8% pa	16.5% pa	5% pa	?
Technology	Broadband	Intelligent Buildings	Biometric	?
Typical Home	Virtual home	Eco-Building	Multi-purpose	?
Soc - Education	Free Tertiary Education	Free-online Education	100% Literacy	?
Soc - Health	Telemedicine (Trained Practitioners)	Online Medical Records	Free medical insurance	?
Soc - Crimes	Citizen Police	Biometric IDs	Genetic Profiling	?
Housing Policy	No Free (RDP) House	DIY Subsidy Only	Tenure Points	?
Envir. Degradation	Green Society	Energy from Waste	Energy from Solar	?
Transportation	Teleportation	Car less cities	People Mover Network	?
Coherent Scenarios	**Gauteng Green Smart Living**			

Figure 5 depicts the combination of elements that together make up the Gauteng Green Smart Living society scenario. The scenario assumes a population increase of between 22 million and 28 million people in Gauteng with a GDP of about 8% per annum. While this scenario was seen as plausible, the idea of a DIY (Do-it-yourself) Subsidy Only policy was seen as contradicting the "No Land for Housing" element.

Water scarcity was highlighted as an essential driver across all the scenarios. The reason advanced being that though water may be available, the province will need to adopt more stringent measures to ensure the preservation of water resources and infrastructure, amongst others.

3.5.1 Gauteng Green Smart Living Scenario – ACTVOD Table

Theme	Established green living habits, entrenched green living education supported by punitive legislation. Green architecture.
Drivers	Sustainable healthy living and waste recycling. Dedication to ecological and sustainable practices for the built environment.
Breakthrough Innovations	Wide usage of renewable energy sources and recyclable materials. Car-less city centers. Solar battery powered mass transportation.
Enablers	Primary education on greening living. Total ban on fossil fuel energy sources. High yield on carbon credits.
Possible Obstacles	Failure to meet international protocols on climate change and global warming. Vested interests and lack of coordinated government initiatives. Sanction-busting activities by people still using fossil fuel energy.
Key Human Settlements Features	Green buildings, clean green environments. Adoption of hydroponics (climate controlled) farming technologies. Eco-friendly homes in eco villages.

3.5.2 Gauteng Green Smart Living

On this cold winter morning Zoleka van Wyk wakes up to the sound of the Indian Bird singing on the rooftop of her 50 story residential apartment overlooking the Mine Reclamation Plains to the west of the Johannesburg City Centre. It is 6am and she has to get ready to attend the World Reclamation Day celebrations in Randfontein. This is the 10th event out of 31 scheduled for the month of July, the celebration marks the day South Africa reduced CO2 Emissions to Zero and the day that all abandoned gold mine property was reclaimed by the state to create more land for human settlements. Each District celebrated this day differently, taking into account its own progress towards the achievement of sustained Smart-Green-Living in the Province.

Zoleka takes a shower and hurriedly puts on her organic clothes. She does not need much to keep warm as she can always pick-up an organic coat or socks at the flea markets nearby. The People Mover Network train station can be found on the 30th floor of the building, she has enough time to catch breakfast on the 32nd floor after a short stint at the gym at the far-end of her apartment floor. At 7am, Zoleka's Eco-clock beeps to give her the overnight report on her health status. Pleased that all her health indicators are still showing green she knows that eco-health data monitor in her room is still functioning.

Zoleka punches her DNA code to permit electronic transmission of her health status data through to the Central Health Data-monitoring Centre across town. All done and settled, Zoleka reads through her prepared speech as the now packed People Mover jets her off to Randfontein. It is a 15 minutes journey over the Gauteng skyline, clear, as crystal the sky looks the colour of clear seawaters of the Atlantic Ocean. She is proud to have inherited the Smart Green Lifestyle of the Gauteng Global City Region.

As the Head of the Gauteng Chapter Earth Reclamation Institute, Zoleka had played her part in the realization of a Smart-Green Living vision inspired by her fellow-citizens way back in 2010. At that time, Zoleka was an intern at the Gauteng Department of Local Government and Housing. The 2055 Human Settlement Scenario Planning Workshop processes fascinated her and though not senior enough to attend all the workshops, she followed diligently the progress and read emerging scenario with deep interest. She was sceptical about the possibility of such scenarios materializing in her lifetime.

The successful hosting of the 2010 FIFA Soccer World Cup tournament changed her outlook in life, she believed then, more than ever that, no dream could not be realized so long as there was a common vision, a future goal yet to be achieved inspired the nation. But then, major challenges seemed insurmountable, she recounted in her mind.

Population growth projections by the Wits Centre for Forced Migration pointed to the doubling of the population from 10.8 million in 2010 to 28 million in 2050. Land scarcity was a reality, homelessness; informal settlements proliferated every empty

space and threatened even the highly esteemed golf clubs. Worst of all, the deteriorating water infrastructure and doomsday prophesies of the berated Dr. Anthony Turton were fast becoming self-fulfilling prophesies. Without security of water, guaranteed and continuous energy supply and widespread homelessness nature seemed to have conspired to spoil the post 2010 FIFA World Cup spirit of camaraderie and patriotism. Zoleka's department held the hopes of many indigent and poorer citizens of the Gauteng Province, unemployment stood at 25.2% nationally and at 27.1% within the Province.

In 2050, Zoleka and her two children only worry about getting preparations ready for the next Green Smart

Living Festival held annually in Randfontein. These celebrations mark the successful transformation of the barren wastelands, which were the by product of the age of the mining resource driven economy that gave Gauteng its name from centuries gone by.

The remarkable achievements of the Gauteng Province could be attributed to six momentous events and policy decisions that took bravery, foresight and genuine concern for future generation.

In 2011, Gauteng Department of Local Government and Housing launched the Gauteng "TESHE" Global City Region Initiative. The primary goal was to achieve an unprecedented level if inter-

government cooperation and build social cohesion at community level. TESHE was an acronym for Technology, Education, Safety, Health and Environment. Even though the Department had embraced its mission to be "   "

…There was always something amiss as all resources were applied in efforts to build brick and mortar structures, called Low-Cost Housing, but the waiting list for government sponsored housing schemes were not making satisfactory progress to alleviate the backlog, unemployment grew amid calls by trade unions for decent jobs, the tax base was shrinking and the burden getting heavier on the shoulders of both government and citizens.

The Eight Great Initiatives, embodied in the TESHE Global City Initiatives were:

(1) The adoption of Foresight, Soft Systems Methodologies and Systems Dynamics as thinking and planning tools to bring together diverse stakeholders who together could now understand the challenges of Human Settlements in a new light, project forward and embrace a desired and preferred common future. Until that time, inter-governmental, inter-sectional and multi-stakeholder cooperation was an illusive dream. The problem could be traced back to the none-existence of a common value system and the lack of a holistic view of the different settlements as systems that needed to be viable before becoming sustainable.

(2) The acceptance of GAIA (Mother Earth) as the mother of all people on Planet Earth. South Africa having rated at the 13th, amongst countries emitting carbon dioxide into the atmosphere, thus contributing Global Warning and Climate Change by the (OEDC) Organisation of Economic Development Country

"The goal of futuring is not to predict the future but to improve it. We want to anticipate possible or likely future conditions so that we can prepare for them. We especially want to know about opportunities and risks that we should be ready for."

Edward Cornish, author of Futuring: The Exploration of the Future and founder of the World Future Society

2009 Report. The nation was caught up in a dilemma of being amongst the worst polluters of planet earth. How to continue to secure energy supply to fuel its growing economy without digging more coal to feed the fossil fuel hungry growth economy, was the question. GAIA is a concept for understanding the Earth's Control System. There are limits to growth especially in the context of limited natural material and financial resources. Agreement and acceptance of this concept as the common frame of reference gave impetus to the establishment of the Earth Reclamation campaign. The Department of Environment became the custodian of Earth's natural Resources Control Mechanism. From this day on, Smart Green Living was woven into the fabric of social culture, norms and values that informed all policy and strategy decisions.

(3) Broadband Internet and Online Education Delivery System

The Broadband Internet network was already in place, waiting to be brought to life with access tools and shear ingenuity of the leadership of that time.

Mass awareness and public education campaigns inspired by pure political will amongst local government officials and councillors, was all that was need to open the gateways into cyberspace. The education system moved online, teacher training transformed from chalk and talk classroom settings to click and type telemetric interactive teaching methods. Bricks and mortar classrooms gave way to foresight, systems thinking and green lifestyle habits training workshops, seminars and local events. Huge savings were realised in teacher and learner materials development and production, saving a million trees in the process. Logistical learner material distribution challenges dissolved along the way superseded by online access to free education and instantaneous curriculum content changes at a click of a button. Electronic handheld iPads were standard issue amongst learners and replaced the paper notebook. The best mathematics and science teachers taught the nation, not the classroom, literacy levels grew as Adult Basic Education followed the trend.

(4) Artisan Training and Water Resource Infrastructure Upgrade and Maintenance

The Gauteng province, being the engine of economic growth could not be allowed to grow dry and stagnate. The water infrastructure needed serious upgrade, growth and maintenance. The import of Indian, Cuban and Chinese criticism met no resistance from the labour unions who recognized their role in providing resources for the growth of the economy. Plumbers, welders, engineers from foreign countries moved into Gauteng bringing creativity, technical ingenuity and high productivity levels and different work ethic. The Water Sector became the major area of focus as part of the Infrastructure Growth and Maintenance Programme.

(5) Free Housing Policy Burden

It was agreed that there being no more state land on which to provide free housing the policy could not be sustained. A moratorium on free housing was declared in 2012, allowing only the living children above the age of ten to remain eligible, not for free housing assistance but for financial in a Do-it-Yourself Housing Scheme that had a limited lifespan. The question that bothered everyone was "how can today's generation commit future generations to an unsustainable policy? Education, a value system based on a work-ethic never experience before in South Africa and a patriotic outlook to nation building would ensure that every child is taught to be creative, self-sustainable and futuristic in outlook. Foresight for the Youth Programmes, Entrepreneurship Education Programmes and International Technical Innovation Programmes were introduced into the schooling system. India, Brazil, Finland and China became the Youth Techno-Education Exchange programme partners.

The Housing challenge, could not be resolved using conventional wisdom, new insight, new knowledge and innovative lifestyle and work habits had to be inculcated to build the viable and sustainable human settlements of the future.

(6) Green Building Technology and ICT (converged real estate)

Green building technologies were declared a standard practice to be monitored using remote data collection sensors built into the structure of every home. Intelligent building became the norm. The interior movement sensing wireless network system enabled residential and commercial properties to recognize and actually communicate with each individual occupant of the property. Home based-wireless network access points were to be a standard feature in each home. Health data could be collected using biometric systems embedded in the tissue of every person. This provided the benefit of free medical insurance granted on all citizens who registered on the online medical records system in its each neighbourhood. A biometric personal identity system allowed access only to the person registered all those he allowed access to using a private PIN code. Health Management, Safety and Security as well as online education content delivery could be administrated from a central point in every community.

Converged real estate was a major enabler in enhancing cooperation and integration of citizen and property data processing. This ICT and Green Building technology offered triple bottom-line benefits.

(7) Low-Carbon to Renewable Energy Sources

Energy security was to be guaranteed through the rollout of massive solar panel retrofits in every home in Gauteng. No new buildings including industrial establishments could draw electricity from the Eskom grid. The goals set for the observance and maintenance of GAIA had been embrace by all. Independent power producers rendered services to neighbourhood industries and local communities. Water Theaters established to reclaim water from the atmosphere were used to draw hydraulic electrical power, a development that materialized in 2025.

Gauteng took fervently to efforts towards contributing to the country's effort to reduce carbon dioxide emissions from the energy sector by 54% in 2050.

This was made possible by significant efforts to fully exploit the large potential for energy efficiency, hence the focus on cost-effective renewable energy sources for both heat and electricity generation.

By 2030, South Africa had dropped from a ranking of 13 amongst countries with high CO_2 emissions to 50, having succeeded in growing the share of electricity generation from renewable sources from 10.7% in 2010 to 50% in 2030.

As of 2050, as much as 75% of electricity energy comes from renewable sources. The high temperature reactor (HTR) built by the Pebble Bed Modular Reactor Company now earns Gauteng much needed foreign currency. Thanks to concerted efforts by both industry and global nuclear organizations, the HTR technology was rescued from near extinction in 2011.

"Health data could be collected using biometric systems embedded in the tissue of every person."

(8) Home-Building and Shelter

All government buildings including transportation infrastructure assets were transformed to serve as hydroponic agricultural sites on the rooftops. New building standards dictated that new building plans make provision for the installation of hydroponics or climate controlled agricultural initiatives and report annually on these initiatives to earn a property rates rebate.

As from 2015, all new residential properties on remaining government owned land had to comply with multi-purpose usage prescriptions and standards. The energy efficiency and remote health data collection systems had to be functional at all times.

These initiatives shaped all future land-use and town planning processes. The Department of Local Government and Housing ceased to be the provider or even facilitator of housing provision to the indigent communities. This mandate expired officially in 2020. Social Systems Integration (SSI) and Hard System Design (HSD) were now central to the mission of the department. Green Smart

Living, as a concept was not limited to the growing of plants and edible vegetables. It became a way of life. The TESHE Global City Initiative was extended to every sector and segment of society.

At school level, learners had to pass the TESHE System Integration subject to proceed to the next level. All communities in each ward, municipality and district had to submit their Foresight Plans directly and online to the Gauteng Province's Social System Integration Department.

Zoleka had spent the next ten years as a role player in the Provincial Planning Committee, promoting the Soft System Integration vision and her Department worked closely with local communities to generate Foresight plans using Foresight and Systems Thinking and System Dynamics as key enabling tools to change the mind-set of the citizens, local councillors and municipal officials.

Life in Gauteng had never seemed so bright, the World Health Organisation rated Gauteng as a developed Global City Region where life expectancy amongst

both males and females had improved by an extra 20 years to 75 for males and 85 for females. Proactive measures were used to eliminate preventable diseases; child mortality dropped to 10 per 1000 all deaths being due to genetically transmitted diseases. The major cause of death was natural causes especially amongst the geriatrics of 2030 and 2050.

The Happiness Index of the United Nations ranked Gauteng higher than South African residents at 92%.

The Randfontein based Water Theater desalination plant, is modelled on one designed by Chrisoph Keissling in Siam Park, Canary Islands. Because the Water Theater, a super structure is both visually stunning and eminently practical, it is a major tourist attraction. It uses nanotechnology based water purification processes developed by the Nanotechnology Institute of South Africa. The Water Theater is testament to Gauteng's foresight and courage in persuading the mining companies to fund its development from both CSI and Social Plan funding budgets. The entire structure

and adjacent park is a visual, yet practical display of commitment to environmental sustainability. This desalination plant built in the park processes 700 cubic meters of underground mining wastewater every day. The processed water is used in the rides and then recycled to water the park's plants.
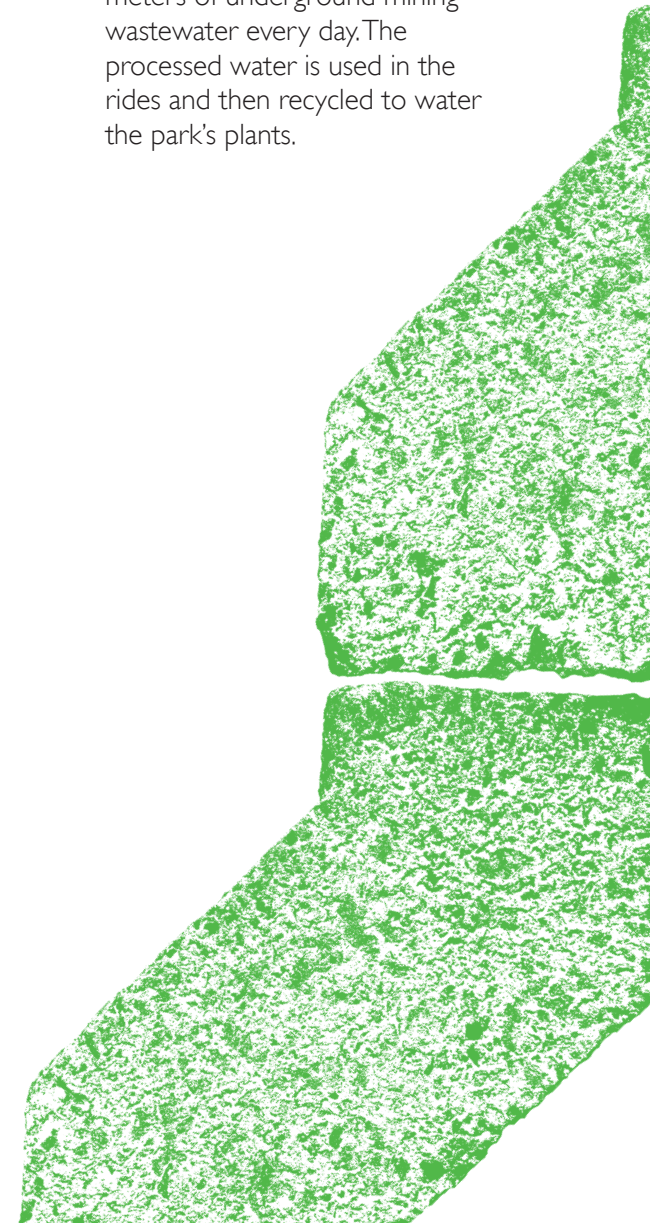
3.6 Disaster story

A Dream Deferred

The year is 2055 May 15, and Jim Grootboom is released from Pretoria Central prison. As he collects his few belongings from the warden he paints the picture of a broken man. He recalls distinctly the day he was incarcerated in this hellhole. He remembers the heart wrenching words of the judge when the judge said:

"I understand the mental anguish associated with knowing that another man, your neighbour, ruthlessly raped your daughter. Much as I empathise with the reason why you subsequently shot that wretched man, and being a father myself, we all have to remember that no one, I repeat no one is above the law. Our laws are enshrined in our sacred constitution and we fought long and hard to have the best constitution in the world. We cannot as a nation, have any individual, for whatever reason; desecrate it by taking the law into their own hands. The laws of this country are meant to protect us all. Take away that constitution, violate those laws with impunity, and what will we be left with? Total anarchy. We will have another Somalia on our hands, with gun-totting warlords reigning havoc on our society.

As long as I am the presiding judge in this court, and as long as I am still breathing, I will personally see to it that this beautiful country of ours does not descend into such chaos".

"Having considered all the evidence before me, I find the defendant guilty of manslaughter. Taking into account the obvious extenuating circumstances of this case, I have decided to excise some leniency and sentence you to the minimum allowable by law for manslaughter. Jim Grootboom, I hereby sentence you to 20 years in prison, with an option for parole after 15 years."

As Jim walks out of Pretoria Central prison and heads towards the car park where his eldest daughter, Puleng is waiting, he cannot fully believe that he is at last a free man. He had actually spent 15 years in prison, let off earlier for good behaviour.

As Jim Grootboom and daughter drive through the streets of Pretoria Jim is shocked at the decay that confronts them. There is rubbish everywhere; the roads have more potholes than the actual road surface.

The street lights are no more, what remains are the street light poles, the electric copper wires and light bulbs have all been pilfered and the authorities long gave up replacing them. Traffic lights are relics of a bygone past, road rules have disappeared and replaced by survival of the biggest and most daring. There is general sense of decay and despondence in the air. Jim had heard rumours of the reigning chaos that was the reality beyond the prison walls. Of course electricity supply disappeared from the prison 10 years ago, and water access was intermittent and a well known healthy hazard, but Jim assumed this was because of the authorities' disdain towards prisoners and considered part of their punishment.

As they enter Mamelodi, Jim sees a stream of raw sewerage cutting across what used to be decent roads, the pride of South Africa, way back then. The stench is nauseating. Informal settlements are all over, surrounding the infamous RDP houses built post apartheid. Roads are hardly navigable. The two are forced to park the car

2kms away from where their house, once the pride and joy of the family which Jim got when he was still working as a technician at Eskom in 2015. Jim had subsequently lost his job after participating in a so-called "illegal strike". How could a strike be "illegal", he had protested, when he was suspended and then retrenched in 2020? Those "blood sucking capitalists" had conspired with the CCMA to get rid of him. There was no doubt in his mind that the corrupt management had bribed the CCMA officials.

They walked past narrow pathways strewn by under nourished children with very little energy to do anything but sit on stoeps outside their shacks. Buildings that used to be schools, community halls, malls, are all standing empty, victims of vandalism. Jim does not miss the irony of it all. The judge's sworn statement to uphold the constitution and the rule of law and the total chaos that confronts him 15 years on. He asks his daughter, "How did we get here?"

How did we get here?

Puleng reflects on his father's question and comes up with one phrase for an answer, "Systems failure". His father is perplexed, "systems, what systems", and Puleng responds, "the interwoven hard and soft systems that make up human nature, natural ecological systems, and man-made artefacts like roads, electricity and cities". Puleng then goes on to fully explain herself using a number of tools to illustrate the point.

### The golden age of promise, 2010 - 2015

This was the golden age of promise characterised by hope and euphoria. While civil unrest was evident, and violent protests were commonplace, the FIFA world cup had brought in and left a sense of national pride and can do attitude. Hadn't the country pulled off the hosting of the biggest world event, and all without a glitch in the face of global cynics? Puleng uses the co-causal factor analysis tool after, [Dorstal 2008] to illustrate the status quo of the disastrous under-currents that already existed in the human settlements arena in 2010. At this point, she explains, there were political, social, and economic drivers of change, like growing populations from immigration, fragmented planning, slow growing economy, and civil unrest (see figure 6 for a comprehensive picture).

Puleng explains that the co-casual analysis shows that, much as society tends to look at problems in isolation, the reality is that problems tend to co-cause each other and have feedback loops. For example lack of adequate education for individuals in a community meant limited economic opportunities for those individuals, which in turn caused increased poverty. This in turn increased the demand for free housing, and less human settlement infrastructure investment like schools, hospitals and so forth.

> *"... lack of adequate education for individuals in a community meant limited economic opportunities for those individuals, ..."*

Figure: 6 Co-causal analysis after...
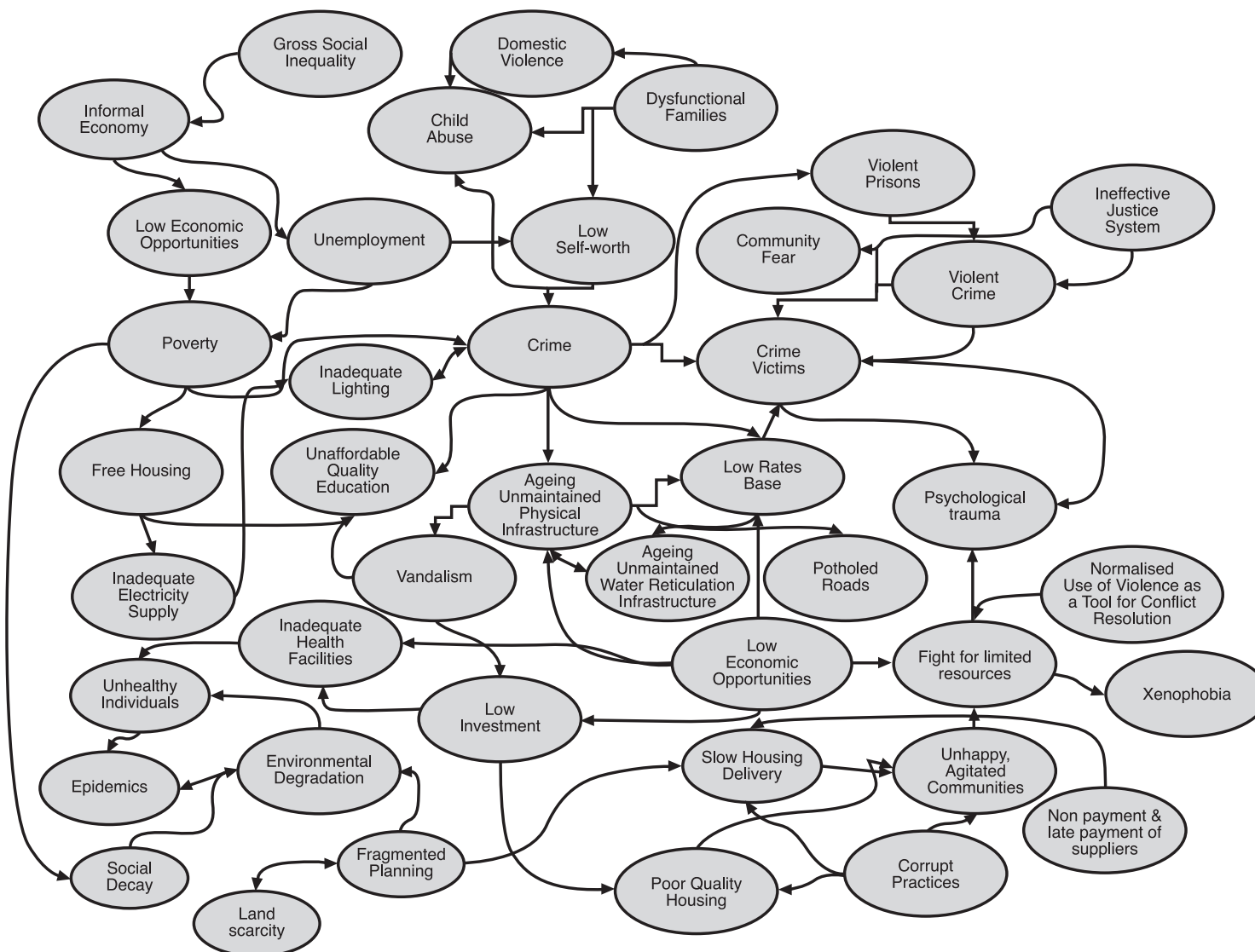
The series of inter-connected factors co-caused each other to create a complex "messy" web. This shows that human settlement problems are of inter-connected; social, political, ecological, and economic systems. Puleng explained to her father that contrary to traditional analysis and understanding, there are no simple linear cause effect relationships. She argues that there is need for a deeper understanding of the nature of complexity. She explains that the universe is one huge complex system made up of inter-connected sub-systems; social, political, ecological, and economic systems.

To further explain the systemic nature of the issues identified using the co-causal analysis Puleng pulls out another analytical framework tool that illustrates the multi-level and multi-dimensional nature of the key elements that make up human settlement systems, and how these interplayed to set out a series of disastrous events.

The Biomatrix System Table

	Political	**Social**	**Ecological**	**Technological**	**Economic**	**Legal**
Universe	• Free housing policy • No free education policies • Unfriendly Immigration policies	• Rising population (28m by 2055)	• Land scarcity		• Recession	
Society	• Intolerance	• No systems thinking • Focus on current futures • Housing supply backlog • Social strife – violent protests	• High carbon footprint • Sickness & disease	• Ageing water reticulation infrastructure • Inadequate electricity supply		• Ineffective justice system
Organisation	• Non payment & late payment of suppliers • Corrupt practices	• Trade union wage demands • Adversarial culture between managers and employees	• Use of non renewable polluting resources	• Use of obsolete technologies	• Inefficiently run parastatals & govt depts.	• Non compliance with the law • Abuse of the law
Institutions	• Active trade unions	• Under resourced hospitals & clinics • Under resourced educational system • Prison violence		• Low quality housing • Poor quality, potholed roads	• Flight of suppliers • Skills shortages	
Community		• Slow housing delivery • Poor quality residencies • Unhappy, Agitated Communities • Instability • Social decay • Xenophobia • Prostitution • Gangsterism • Petty crime	• Environmental degradation	• Inadequate lighting	• Low rates revenue	• Inadequate legal protection of victims

The Biomatrix System Table *(continued)*

	Political	**Social**	**Ecological**	**Technological**	**Economic**	**Legal**
Community *(continued)*		• Violence • Reversal of TB treatment gains • Poverty				
Individual	• Political immaturity • Disempowerment	• Single parents • Prostitutes • Gangsters • Criminals • Unhealthy individuals			• Impecunious	• Survival of the fittest
Cellular		• Immunity compromised – HIV/AIDS • H1N1 Flu • Cholera, dysentery	• Polluted waters • Poor soil quality • Reduced agricultural yields	• Obsolete technology		

Puleng explains that by placing the identified issues at the correct level and dimension one can have a clearer understanding of which systems are relevant, and which sector of society is affected. She tells her father that while the issues were known they were typically handled in isolation ignoring their systemic connectedness. Further, a cursory look at the bio matrix indicates that most of the key issues are social issues (soft systems) as opposed to hard systems, (technological), housing quality issues, and physical infrastructure. Focus was on hard systems at the expense of the soft systems.

Looking at the biomatrix chart, as explained by Puleng, a lot of things start to make sense to Jim. His mother, Gogo Grootboom, may the lord rest her soul, had been the victim of a slow housing delivery process grounded in a free housing policy which could not possibly continue to deliver in the face of an ever growing population and rampant corruption and low capacity at the municipal level. She had passed away while waiting for her RDP house to be delivered to her. The house was only delivered long after she had died, the house Jim and his wife Patience moved into in 2015. While there had been efforts to stamp out corruption in at municipal level, with a number of corrupt officials being fired, the

slow construction of houses and land shortage meant the bribes housing officials were being offered were very high and too tempting to ignore. The corruption methods just got more sophisticated.

It also explains the *how* and *why* of Jim being fired for participating in an illegal strike in 2015, and armed with his good technical skills could not get a job elsewhere. Jim had been employed as a coal fire powered electricity technician at one of the Eskom plants in the Mpumalanga province. No one seemed to be interested in his obsolete skills set.

It was during this period when he came back home from a job hunting expedition that he discovered that his neighbour, a notorious repeat male offender aged 25 years old had brutally raped his daughter who was only 6 years old. There had been one of the notorious Eskom power outages when Malaika, who was playing at the neighbour's house, was raped. The neighbour, whose children Malaika had been playing with, was asked by their father to go to a spaza shop to buy candles. While the children were gone, the heinous crime was committed. Patience, Jim's wife was at the time still making her way from across town where she worked as a high school teacher.

On hearing what had happened Jim lost it, somehow managed to get an unlicensed firearm from the neighbourhood, and shot dead the perpetrator. He ended up in prison for the next 15 years.

2015 – 2025
Economists who had promised the end of the recession and an economic boom by 2015, based on the assumption that history would always repeat itself, were revising their projections and were now talking of a double dip recession. The physical infrastructure boom of the years preceding and after the 2010 FIFA World Cup was now creaking from neglect as maintenance was suffering from a dwindling tax base. The labour force of the era had not been trained to participate in other sectors of the economy and unemployment was rampant. The unions did the best they could to fight retrenchments but there simply were no jobs in the construction industry.
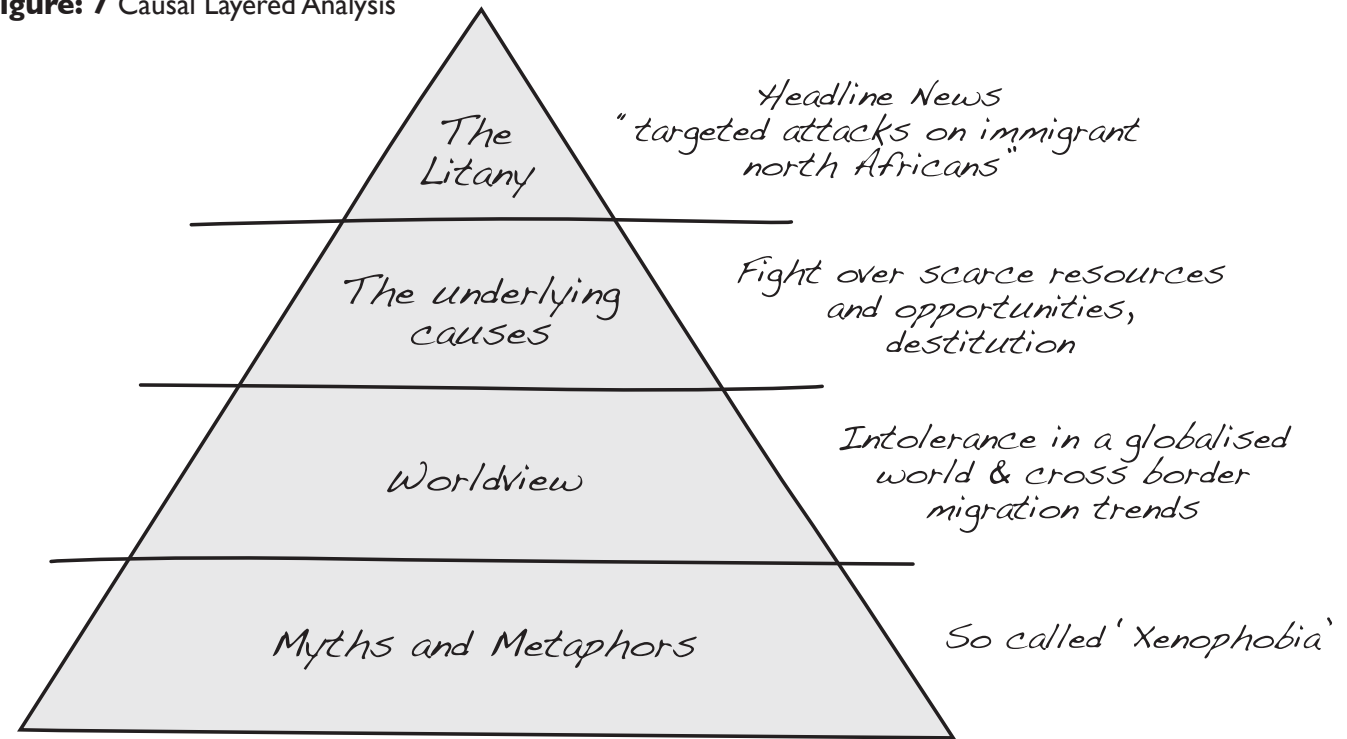
While opportunities existed in the renewable sector, particularly in the growing green housing and solar energy electricity for lighting and heating, there had not been any foresight in understanding that re-training should be carried out of the existing and new labour force, targeting emerging technologies. The crop of leadership then, focused on short-term gains and sacrificed the future opportunities in the process.

With deteriorating human settlements infrastructure, the already restive civil society became increasingly violent, demanding ever loudly that politicians deliver on the promises of human settlement products and services like housing, roads, schools, health facilities, and affordable electricity. Attacks on foreigners intensified. Jim, whose wife Patience was from Zimbabwe was chased out of her house and her household effects were looted while Jim was in prison. Puleng was shipped off to her aunt who lived in Cape Town for protection. Her mother and sister Malaika moved across the border to Namibia where they were happily welcomed by a state eager to boost it's low human capital. Puleng's only brother, Sipho's where-abouts are still unknown. It is rumoured that he joined a gang of car jackers plying their trade in central Johannesburg.

Jim could not understand how and why people who had lived as neighbours could suddenly turn on each other based on some previously unheard of phenomena called xenophobia. Puleng who had received an excellent education in Futures and Systems Studies, paid for by Jim's sister in Cape Town, again broke down the issue to bring clarity through the use of what she called the causal layered analysis. She sketched a diagram to illustrate her point. (Figure 7)

Puleng explained that what is seen out there in the public, as the problem is targeted attack on African foreigners, which is the tip of the iceberg. The attacks are caused by competition for scarce resources. To explain this metaphor / myth, xenophobia was assigned to the phenomena. By definition xenophobia refers to the prejudicial dislike of foreigners. The competition for scarce resources was the root cause not xenophobia. This explained why neighbours who had lived together for decades would suddenly turn against each other, and also explained why only black African foreigners were targeted. Black African foreigners lived in the same neighbourhoods as their South African counterparts.

Figure: 7 Causal Layered Analysis

The Litany — Headline News "targeted attacks on immigrant north Africans"

The underlying causes — Fight over scarce resources and opportunities, destitution

Worldview — Intolerance in a globalised world & cross border migration trends

Myths and Metaphors — So called 'Xenophobia'

Adapted from CLA, Sohail Inayatullah – 1998

2025 and beyond, total collapse

By 2025 the under currents (drivers) at play were now powering at full steam. Water became a very scarce resource both in quantity and quality and could not meet the needs of the population. With a collapsed health system and degraded water and other resources, cholera, dysentery and other water borne diseases wrecked havoc.

Social unrest, corruption and a culture of violence made the country un-governable. It was a free for all, citizens fighting for the meagre services that were still available in their degraded state. Jim did not miss the irony; he remembered the words of the judge that had sentenced him, words to do with the upholding of the sacred constitution and maintenance of the rule of law.

Jim wondered out loud how with sharp, smart people like his daughter, the state of affairs had come to this. Puleng sighed resignedly and stated, *"Good foresight and systems thinking was sacrificed at the altar of ignorance and vested myopic short term interests."*

4. Gauteng 2055 Human Settlements Trendline

Trendline extrapolation is a very specialised discipline combining mathematical modelling techniques for forecasting economic quantifiable variables and standard forecasting models with pure subjective judgement by a selected panel of experts.

The trendline extrapolation depicted in Figure 8 is based purely on established, global trend analysis sources such as the Futures Society, Shaping Tomorrow and the 2008 State of the Future Index published by the Millennium Project. Subjective judgements were then applied to take account of the plausibility of specific events and breakthrough developments that may shape the future towards different elements of the proposed scenarios. At the least, this graphic trendline can serve as a useful tool around which to create meaningful stakeholder engagements processes and discussions of the scenario.

4.1 Gauteng 2055 Human Settlements Trendline Extrapolation

Figure: 8

Time Zones
- Zone 1: 2009 – 2014
- Zone 2: 2015 – 2025
- Zone 3: 2026 – 2055

Legend:
- Demography
- Land scarcity
- Economic growth
- Technology
- Typical home
- Soc – Education
- Soc – Health
- Soc – Crime
- Housing policy
- Enviro degradation
- Transportation

Icon Legend:
- Mega trend
- Weak signals
- Prediction
- Trend

Trend/signal labels: Green Society, 16.5% GDP, No land for housing, Energy from waste, Population 15m, Population 28m, 5% GDP, 8% GDP, No tenure guarantee, Energy from solar, Virtual home, Population 10.8m, Intelli buildings, Multi-purpose buildings, Densification, Telemedicine, Free medical insurance, Online medical records, Advanced biometrics, No free housing, Citizen policing, Broad band, Biometric Id, Eco-buildings, DIY Housing only, Free online education, Genetic profiling, Free tertiary education, 100% Literacy, People mover networks, Green Society, Car less city centers, Teleportation

5 Conclusions

The FOUR scenarios outlined in this report are the product of facilitated interaction and discussion amongst various stakeholder groups, individuals and sector experts within the Gauteng Province who have each provided valuable input from a specific and particular perspective.

It is important to emphasise that no single individual has an accurate knowledge of the future. The use of Foresight and Scenario planning tools in a scenario planning process allows us to challenge our own assumptions, attitudes and perceptions about the challenges facing us. We now have the opportunity to use the scenarios to determine whether we have been able to identify the key factors that serve as drivers of the future of human settlements in Gauteng to the year 2055. We can also look to see whether we are equipped well enough to plan and operate in a climate of growing and increasing complexity.

The realisation of the Gauteng Knowledge society, as the preferred scenario will dependent largely on the audacious decisions and policy initiatives that the current leadership will be able and willing to take in a conscious departure from the conventional approach to strategic planning that extends the current future in a linear trajectory into the foreseeable and predictable future.

The story line depicting each of the four scenarios may change in terms of the scenario plot or the cast of characters, but central to the realisation of any of the 2055 Human Settlements Scenario is the need to embrace technology as the key driver of change, the need to embrace the GAIA concept as a central driving value in the protection and usage of limited natural resources, education and the development of technical skills are critical enablers in a society that seeks to reduce dependency by individual citizens on the state. Rapid urbanisation is recognised as an irreversible worldwide trend, inward migration and immigration are both unstoppable forces that are sure to put pressure on the limited resources required to sustain livelihoods threatening the viability and sustainability of existing and future human settlements. Emergence of convergent real estate, the challenge to review and replace the concepts of guaranteed land tenure in the light of diminishing land resources and the need to review the "Free Housing" policy are some of the low hanging fruit around which debate and can be initiated to dissolved current challenges while embracing new opportunities.

A separate but complimentary document provides a detailed analysis of the Strategic Implications of the scenarios presented here. It goes further to provide reflections on new innovative approaches to long-term planning incorporating foresight, systems thinking and other critical thinking and planning tools leading to convergence in strategic thinking and planning approaches already embraced by the National Planning Commission.