



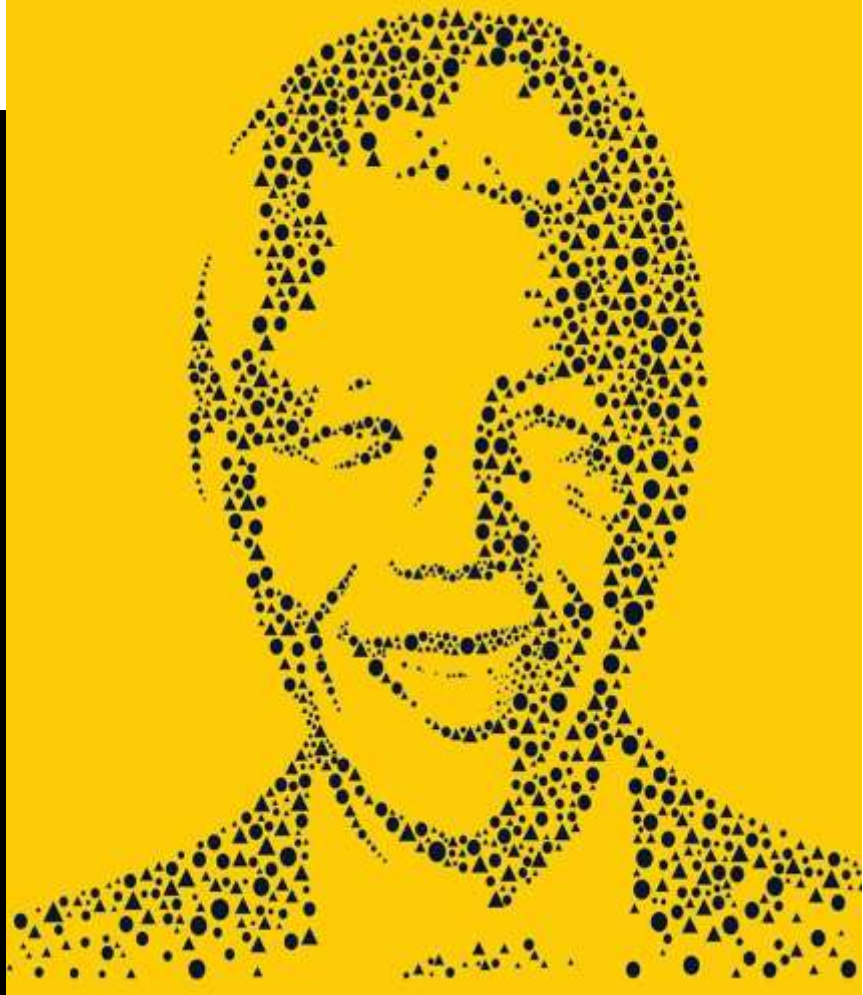
Book of Proceedings

2019

6 May 2019



NELSON MANDELA
UNIVERSITY



Conference Proceedings on

Sustainable Urbanisation

of the

South African Sweden University Forum

(SASUF) 2019 Symposium

Nelson Mandela University, in collaboration with,
South Africa Sweden Universities Forum (SASUF),
Department of Science and Technology, and
Department of Human Settlements

HOST
Nelson Mandela University

VENUE
North Campus
Goldfields Auditorium
Summerstrand
Port Elizabeth,
South Africa

6 May 2019

Symposium Theme:

**Sustainable urbanisation through research, innovation and
partnerships**

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Edited by Prof Sijekula Mbanga

Published in Port Elizabeth, South Africa.

ISBN No. 978-1-928472-12-4

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Notes about this Book:

This book includes the full papers accepted and presented at the SASUF2019 SYMPOSIUM, which were later subjected to a double blind peer review and approved for publication in the conference proceedings. This book was completed and posted to <https://sasuf2019.mandela.ac.za> NAME NEW DATE.

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CONFERENCE CHAIR

**Prof Sijekula
Mbanga**



Foreward and message from the Conference Chair

The Nelson Mandela University in collaboration with the South African – Sweden Universities Forum (SASUF), the Department of Science and Technology, and the Department of Human Settlements is convening a SASUF 2019 Symposium, a Satellite Event that is part of the 2019 SASUF Research and Innovation Week taking place on 6 to 10 May 2019. The Symposium is held on 6 May 2019 in the Nelson Mandela University, North Campus, Goldfields Auditorium, in Port Elizabeth, South Africa.

The Symposium presents a platform for researchers, professionals and general public to share multi-, inter- and trans-disciplinary research outputs and innovative case study projects aimed at systematically responding to the rapid urbanisation phenomenon. The event is convened under the Theme: '*Sustainable urbanization through research, innovations and partnerships*', with the subsidiary focus areas being: sustainable rural development interventions, urban renewal and re-design, peace and stability, citizen hope and universal happiness, urban economy and business development, nutrition and food security, public spaces and social inclusivity. Academic papers located within these topics have been subjected to a double-blind peer review process that will culminate in approved full papers for presentation in the Symposium, a Proceedings Publication (ISBN 978-1-928472-12-4). High quality papers will, at the cost off authors, be published, on negotiated page fees, in a Special Edition of the Journal for Public Administration. Case study innovative projects that are pursued through partnerships will be received. A portfolio of collaborative innovative projects will be assembled and their progress tracked in future SASUF Research and Innovation Seminars. A visit by Symposium delegates to an Enhanced Peoples Housing Process development in Walmer Airport Valley, Port Elizabeth, is planned as part of the Symposium Program. Under the guidance of a Scientific Committee, a multi-disciplinary ant internationally oriented Panel of Reviewers to consider academic contributions has been assembled. A total of 62 abstracts of between 150 and 300 words, responding to one or more of the selected topics have been received.

This Book of Proceedings of the Symposium provides diverse papers that have been submitted by authors, in response to the Call for Papers under the Symposium Theme: *Sustainable urbanisation through research, innovations and partnerships*. This Theme is an inter-disciplinary effort that investigates antecedents for transformation towards sustainable and environmentally friendly cities and human settlements. The theme invites immediate action from all role-players through providing tangible solutions to pressing questions that confront South African and Sweden cities, towns and villages. The Theme puts emphasis on the significance of partnerships in generating knowledge and innovations aimed at providing sustainable solutions that cities may explore in their endeavour to respond to rapid urbanisation and Climate Change. The Symposium is more inclined towards viewing the urbanisation phenomenon as presenting both challenges to be mitigated and opportunities to be explored by Cities of today to realise their medium and long-term prosperity and sustainability goals. Additional information about the Symposium can be accessed from the URL Link <https://sasuf2019.mandela.ac.za>.

We look forward to a successful SASUF 2019 Symposium.

Prof Sijekula Mbanga, PhD

Chairperson: SASUF 2019 Symposium Scientific Committee
Nelson Mandela University
PORT ELIZABETH
6001
Republic of South Africa

The Peer Review Process

Because of the need to maintain and assure the quality of the Symposium Proceedings, and to comply with the requirements for subsidy of the South African Department of Higher Education and Training, a rigorous two-stage double-blind peer review process was conducted by two acknowledged experts.

In this context, each abstract received was twice blind reviewed in terms of:

- relevance to Symposium theme and objectives;
- academic rigour;
- research methodology;
- whether the paper is based on empirical research or critical literature review;
- concise findings and their practical / policy value; and
- contribution to knowledge.

Authors whose abstracts were accepted after the stage one review process was completed were provided with anonymous reviewers' comments and requested to submit their full papers noting and addressing these comments. Authors who had submitted full papers were provided slots in the academic paper driven Symposium to present their papers in Parallel Sessions with further scholarly inputs being made. Authors were required to refine their papers taking into account the comments and suggestions that were made by delegates during the Symposium Parallel Sessions that were chaired by seasoned scholars and professionals. Resubmitted papers were double blind reviewed again in terms of:

- relevance to conference theme and objectives;
- originality of material;
- academic rigour;
- contribution to knowledge;
- research methodology and robustness of analysis of findings;
- empirical research findings; and
- critical literature review.

Authors whose papers were accepted after this second review were provided with additional anonymous reviewers' comments and requested to submit their full revised papers. These papers were assessed by the Editorial Committee to ascertain that reviewer comments were responded to. The role of the editors was to ensure that the final papers incorporated the reviewers' comments and to arrange the final sequence as captured in the table of contents.

Of the 69 abstracts originally received, 59 full papers were submitted by the authors for review. About 3 papers were withdrawn, and 18 papers needed major revisions and were not returned by authors at the time of concluding editing. Only 28 papers were accepted for inclusion in the proceedings, representing an overall rejection rate of 50%, including the papers that were not returned after reviews were sent to authors. While some papers were omitted at review stage, others were excluded during editing due to quality issues that were not fully addressed by authors as suggested by reviewers.

The Abstract and Paper submission was initially managed through an electronic conferencing and paper management system called EasyChair (<https://sasuf2019.org>). The system randomly selected papers and

allocated them to different reviewers. The final paper submission process was managed manually in order to keep track of reviewers' comments. At no stage was any member of the scientific committee or the editors/editorial board involved in the review process of their own authored or co-authored papers.

This process was managed by Prof Sijekula Mbanga of the Nelson Mandela University supported by a completing PhD Candidate Mr Ayo Ade Adeniran and Ms Charlene Dale. Any enquiries may be directed to Sijekula.mbanga@mandela.ac.za

Further details about the SASUF 2019 Symposium can be accessed from a specially designed university web-page <https://sasuf2019.mandela.ac.za>

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Session Chairs Biographies		SESSION CHAIRS	
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Venue: Goldfields Auditorium, North Campus Track 1: Citizen hope and universal happiness		TIME: 10:30	Peta De Jager CSIR
			PARALLEL SESSION 2
Venue: The Theatre, Conference Centre, North Campus Track 2: Technology and innovation projects driven through partnerships			Dr Jeffrey Mahachi University of Johannesburg
			PARALLEL SESSION 3
Venue: Venue 2, Conference Centre, North Campus Track 3: Sustainable peri-urban and rural development			Dr Sithembiso Myeni University of KwaZulu-Natal
		PARALLEL SESSION 4	
Venue: Senate Hall, North Campus Track 8: Nutrition and food security			Mr Thomas Stewart University of the Free State
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			PARALLEL SESSION 7
Venue: Venue 2, Conference Centre, North Campus Track 6: Urban economy and business development		TIME: 13:30	Prof Ronney Ncwadi Nelson Mandela University
			PARALLEL SESSION 8
Venue: Senate Hall, North Campus Track 7: Curriculum enhancement and system-wide capacity building			Dr Robert Mongwe University of the Fort Hare
		PARALLEL SESSION 9	
Venue: Goldfields Auditorium, North Campus Track A: Sustainable peri-urban and rural development			Dr Thomas Ramovha Department of Human Settlements
		PARALLEL SESSION 10	
Venue: The Theatre, Conference Centre Track B: Urban renewal and re-design			Dr Olufemi Ojo-Fajuru Nelson Mandela University
		PARALLEL SESSION 11	
Venue: Venue 2, Conference Centre, North Campus Track C: Public spaces and social inclusivity		TIME: 15:00	Mr. Pedro Mzileni Nelson Mandela University
			SPECIAL SESSION
Opening and Welcome			Dr Jeremy Gibberd
Purpose of the session			Council for Scientific and Industrial Research
Rad Map on STI4SHS Project			Academic Advisory Panel on the Road Map for Science Technology and Innovations for Sustainable Human Settlements in South Africa
Questions / Comments /Discussions			
A way forward			
Closure and Announcements			

PARALLEL SESSION 1

Peta De Jager
Council for Scientific and Industrial Research (CSIR)

Venue: Goldfields Auditorium, North Campus
Track 1: Citizen hope and universal happiness

Peta de Jager is a registered professional architect, and infrastructure innovation research group leader in the Smart Places cluster of the Council for Scientific and Industrial Research. The infrastructure innovation team focus on science and engineering in building infrastructure. It investigates and advocates the selection and use of appropriate technological innovation. The group seeks to promote context relevant and future-forward, efficient, effective, sustainable and resilient built environments which advance the safety, health, productivity, competitiveness, wellbeing and quality of life for South Africa’s citizens through the built environment. The research group’s scope of interest encompasses building physics, performance modelling, measuring, monitoring and assessment. It advocates capacitation for reduced ecological footprint, green and sustainable architecture, resource efficiency and waster, innovative building technologies, materials, systems and methods. The team has a healthy portfolio of active projects and a track record of successfully completed projects in residential, health, education, and services sector.



PARALLEL SESSION 2

Dr Jeffrey Mahachi
University of Johannesburg

Venue: The Theatre, Conference Centre, North Campus
Track 2: Technology and innovation projects driven through partnerships

Jeffrey Mahachi is a registered professional engineer and registered construction project manager. Jeffrey obtained his qualifications from Wits University (PhD), University of Surrey (MSc) and University of Zimbabwe (BS Eng). He is also a recipient of an M.IT degree from University of Pretoria. Jeffrey is currently the Head of School of Civil Engineering and the Built Environment at the University of Johannesburg and lectures structural engineering.



He has previously worked for the National Home Builders Registration Council, where he held several executive positions, worked for the Council for Scientific and Industrial Research (CSIR) as a Research Engineer and lectured at Wits University. Jeffrey has also been involved in a number of construction projects including sustainable human settlements and the roll-out of innovative building systems. Jeffrey has contributed to the development of standards and is passionate about developmental engineering and promoting innovation in the construction industry.

He is currently serving as a Board Member of Agrément South Africa, Council for GeoScience, the Engineering Council of South Africa and the Clay Brick Association. He has authored and co-authored two books in structural engineering and several journal and conference papers.

PARALLEL SESSION 3

Dr Sithembiso Myeni
University of KwaZulu-Natal

Venue: Venue 2, Conference Centre, North Campus
Track 3: Sustainable peri-urban and rural development

Sithembiso Myeni is a Lecturer in Housing and Planning at the University of KwaZulu-Natal (UKZN). Before this appointment, he was a former post-doctoral fellow with South African Research Chair Initiative in Applied Poverty Reduction Assessment at UKZN. Myeni is also a Cannon Collins Educational Trust and Ford Foundation Alumnus. He serves as a Principal Investigator for the Sustainable Human Settlements Decision Support Tools and the Municipal Innovation Maturity Index Research Projects. His research interests are gender and housing, Science, Technology and Innovation as well as rural development.



PARALLEL SESSION 4

Mr Thomas Stewart
University of the Free State

Venue: Senate Hall, North Campus
Track 8: Nutrition and food security



Thomas has been a housing practitioner since 1991. He developed a passion for human development and residential property development while studying towards his master’s degree in town- and regional planning at the University of the Free State. During his student years he was involved in various community development initiatives, facilitating

the engagement of students in the broader community, where he got exposure to the social dynamics of a developing South Africa.

Following his university studies, he spent time in Public Service as a Town Planner. He subsequently joined the Urban Foundations' Housing Policy Unit in 1991. The latter resulted in project managing one of the biggest (4000 units) Informal Settlement Upgrading projects in South Africa, i.e. Freedom Square in Bloemfontein.

His housing development involvement extended to various towns in the Northern Cape; Free State; and Eastern Cape, where a spread of Informal Settlement Upgrades; Greenfields Developments; Owner Managed (Peoples Housing Process); Social Housing Projects; and Retirement Villages has been structured and implemented by him, in his capacity as either development or project manager, employed by the New Housing Company (NewHco) and Inframax (1992 – 2007). He founded his own housing development management company, Hadedu Developments, in 2007. This allowed him an entrepreneurial space and exposed him to a wider range of opportunities and business initiatives.

On 1 August 2014, he joined the University of the Free State as lecturer in the Department of Urban and Regional Planning and is the main driver of an honours course in Spatial Planning, Specialising in Human Settlements. Other than teaching honours' and masters' students he also supervises several masters'-; mini-; and full research dissertations.

PARALLEL SESSION 5



Prof Janet Cherry
Nelson Mandela University

Venue: Goldfields Auditorium, North Campus
Track 4: Urban renewal and redesign

Janet Cherry is a South African social justice activist and academic. She is currently Professor and Head of the Department of Development Studies at the Nelson Mandela University in Port Elizabeth. She has a PhD in political sociology from Rhodes University. Her main areas of research are sustainable development, democratic participation, social and political history, labour, gender and human rights. She has published two books as well as a number of articles and chapters in books on South African history, labour and social movements, transitional justice and sustainable development.

PARALLEL SESSION 6



Dr Rosemary Hayangah
University of KwaZulu-Natal

Venue: The Theatre, Conference Centre
Track 5: Public spaces and social inclusivity

Rosemary Awuor Hayangah (Pr Pln) holds a Ph.D. in Planning (Wales); MA in Urban & Regional Planning BSc. (1st Class Hons) Nairobi. Dr. Hayangah is a renowned Urban & Regional Planner with over 20 years' experience in research and planning practice, Specialist in settlement planning, housing, place making and neighbourhood development with over 15 years' experience as a lecturer at the university level. She has supervised over 30 Masters and 4 PhD student research projects and published several papers.

She has a wide international urban and regional planning experience; has been team leader and project manager in a number of planning projects including long term and short term physical development plans; social surveys; data management and a Web enabled GIS project and was in charge of IT training for programme for staff members in a Town & Regional Planning Department.

Dr Hayangah has over 15 years working experience with local government both as a practicing planner and Technical Consultant on physical planning and infrastructure development. She is a former Head of School for Architecture, Planning & Housing at the University of KwaZulu-Natal. She is currently a Programme Delivery Facilitator with the National Department of Human Settlements (South Africa) and practising professional planner.

PARALLEL SESSION 7

Prof Ronney Ncwadi
Nelson Mandela University

Venue: Venue 2, Conference Centre, North Campus
Track 6: Urban economy and business development

Prof Ncwadi holds a PhD in Economics from Nelson Mandela Metropolitan University. His areas of specialization are Public Finance, Money & Banking, International Finance, Health Economics, Labour Markets, Macroeconomics, and Applied Econometrics. His research interest is in Public Finance, Policy Analysis and Entrepreneurship.



Professor Ncwadi is a former Deputy Dean of the Faculty of Management and Commerce at Fort Hare University and also a Director of Macroeconomic Analysis Unit at the Eastern Cape Provincial Treasury. He has also been a Head of Department of Economics at Nelson Mandela University. He is currently a Full Professor of Economics and a Director of the School of Economics, Development and Tourism at Nelson Mandela University. Prof Ncwadi is a co-chair of Pan African Entrepreneurship Research Council Editorial Committee in USA. He is a member of BRICS Academic Think-Tank and Athens Institute for Education and Research.

PARALLEL SESSION 8

Mr Robert Mongwe
University of Fort Hare



Venue: Senate Hall, North Campus
Track 7: Curriculum enhancement and system-wide capacity building

Robert Mongwe holds a Master’s Degree in Anthropology from the University of Stellenbosch (MPhil Anthropology), a BHons (Development Studies), and BA (Politics) from the University of the Western Cape. Robert’s interests are in the areas of Housing Studies, especially informal settlements upgrading, housing politics and citizenship, culture, development, and land.

In his current position Robert has supervised postgraduate (at Masters Level) in the areas identified above. Robert attends national and international conferences. Currently he is involved in a research project funded by the National Institute of Social Sciences & Humanities entitled “*Imagining the Future of Land Reform in Post-apartheid South Africa*”. Robert is also the Convenor and Head of department and part of team who developed the Bachelor of Social Science in Human Settlement at the University of Fort Hare.

PARALLEL SESSION 9



Dr Thomas Ramovha
Department of Human Settlement
Venue: Goldfields Auditorium, North Campus
Track A: Sustainable peri-urban and rural development

Dr Thomas Ramovha is currently the incumbent of the position of Director Technical Capacity Development in the National Department of Human Settlements of the Government of South Africa. His educational Qualifications are: (i) National Diploma in Organisation and Work Study (factories) from Technikon RSA; (ii) Diploma in Municipal Governance from Rand Afrikaans University; (iii) Bachelor of Technology degree in Management Services from Technikon Witwatersrand; (iv) Advanced Programme in Organisational Development from UNISA; (v) Master of Commerce degree in Leadership from University of KwaZulu-Natal; and (vi) Doctor of Philosophy (DPhil) in Engineering Management from University of Johannesburg.

He worked for organisations in private sector (i.e. AECL, Gencor Mining, and SAPPI), the public sector (i.e. Provincial department of Local Government & housing in Limpopo, Boksburg local Municipality, Ekurhuleni Metropolitan Municipality & the National Department of Human Settlements) and the State Owned Entity (i.e. ESKOM). His responsibilities were in the areas of Productivity Improvement, Organisational Effectiveness, Organisational Development, Change Management, Process Engineering and Capacity development.

PARALLEL SESSION 10



Dr Elufemi Ojo-Fajura
Nelson Mandela University
Venue: The Theatre, Conference Centre
Track B: Urban renewal and re-design

Dr. Ojo-Fajuru, Joseph Olufemi was born about 56 years ago in Ado-Ekiti, Ekiti State, Nigeria. He holds a Higher National Diploma in Town and Regional Planning (YCT, Yaba Lagos, 1987); Post Graduate Diploma in Urban and Regional Planning (FUT Akure, 2004); Master in Environmental Management (UNAD, Ado-Ekiti, 2005); Master of Technology in Urban and Regional Planning (FUT Akure, 2010); and Doctor of Philosophy in Town and Regional Planning (UKZN, Durban, 2018).

He joined Yaba College of Technology in 2005 and he is now a Senior Lecturer in Urban and Regional Planning Department of the Institution. His research areas cut across urban and rural landscape planning; green landscaping and green growth; urban design and development; environmental impact assessment; livelihood strategy and liveability enhancement; promotion of socio-economic and environmental sustainability, strengthening climate adaptation, disaster mitigation and vulnerability reduction, building resilience in communities; environmental planning, design and management for sustainable human settlement development. He has published articles in learned journals and chapter contributions to textbooks and has presented many papers at conferences. He is currently a Research Fellow in the Department of Building and Human Settlement of the Nelson Mandela University, Port Elizabeth, South Africa.

He is a member of the Nigerian Environment Society Nigerian Institute of Town Planners (NITP) and a registered Town Planner with the Town Planners Registration Council (TOPREC) in Nigeria. Haven acquired cognate academic and professional qualifications, he has been involved in various aspects of Urban and Regional Planning practice, consultancy and academia.

PARALLEL SESSION 11



Mr MZILENI Pedro
Nelson Mandela University
Venue: Venue 2, Conference Centre, North Campus
Track C: Public spaces and social inclusivity

Pedro Mzileni is a lecturer in the Department of Sociology at the Nelson Mandela University, a researcher in the Chair for Critical Studies in Higher Education Transformation, an Editor of the Perspectives Online Journal, a columnist for the Herald newspaper and the Mail and Guardian. Before his current job he was a Senior Manager of Living and Learning Programmes at the Premier Student Accommodation (Pty) Ltd. He is also the former Speaker of Student Parliament (2014), and a former SRC President (2016/17) at the Nelson Mandela University. He completed his Bachelor of Arts degree (2015), BA Honours in Sociology (2016) and Master of Arts in Sociology (2018) at Mandela University. He is currently enrolled for a PhD in Sociology with the Nelson Mandela University where he is examining the “Infrastructure responses of selected South African universities post the #FeesMsutFall protests.” His first book entitled “#FeesMust Fall in Mandela University” will be published in November 2019. He co-authors the book with Siyabulela Mandela who is also a a PhD candidate in Political Science at Nelson Mandela University, South Africa..

SPECIAL SESSION

Dr Jeremy Gibberd
Council for Scientific and Industrial Research, South Africa

- Opening and Welcome
- Purpose of the session
- Rad Map on STI4SHS Project
- Questions / Comments /Discussions
- A way forward
- Closure and Announcements



Dr Jeremy Gibberd is an Architect, Teacher and Research Scientist. He has worked on a wide range of innovative projects in the UK, the USA, South Africa, Botswana, Zambia, Tanzania and Sierra Leone that redefine how built environments are planned, designed, built and operated to become more inclusive and more sustainable.

These projects include inclusive schools and TVET colleges, self-build housing and sustainable neighbourhoods, high performance office buildings and PPP projects, master planning for eco estates and universities, design guidelines, policy, legislation and training, water resilience, climate change and building regulations research as well as sustainability policies and bylaws for African cities. This work has been distilled in a number of books, papers and tools which have been published.

Jeremy is currently working on digital ecosystems, water resilience, building regulations, circular economy and housing projects and is an editorial board member of Building Research and Information (BRI) journal and the Coordinator of the Smart and Sustainable Built Environment (SASBE) working group of the CIB

Creation of knowledge cities for South Africa. A case study of Nelson Mandela Bay Metropolitan Municipality

Roseline Tapuwa Karambakuwa and Ronney Ncwadi

Department of Economics, Faculty of Business and Economic Studies, Nelson Mandela
University, Port Elizabeth, South Africa, 6031

Abstract

The paper investigates the knowledge based development approaches for creative urban regions being adopted by successful cities worldwide in order to come up with recommendations for the development of South Africa's cities, with Nelson Mandela Bay as a case study. Knowledge-based economy has scaled up due to the rapid advances in information and communication technologies and the economy of a knowledge city creates high value-added products using research, technology, and brainpower. When a society is knowledge based, they form a future path in which all of the basic human needs can be met by future generations while maintaining a healthy, physically attractive and biologically productive environment. The present industrial capitalist model of development of urban regions is not sustainable and eventually the cities risk surpassing the manageable limits for superimposed growth which leads to collapse environmentally, socially, economically and psychologically. Knowledge societies emergence has multiplied the extent to which both productivity innovations and social transformations rely on knowledge capital, all citizens are involved, and they share responsibility for making appropriate decisions and choices that will enable the societal well-being. A review of literature and examination of global best practice experiences is carried out in this paper so as to determine how other cities are engineering their creative urban regions so as to establish a base for knowledge city formation in South Africa. The review shows that South African cities can promote knowledge based development hence create knowledge cities by developing technical knowledge for the innovation of products and services, developing diverse and highly skilled workforce, through research and development and utilising the international multi ethnic characteristics of its cities. The cities can promote start-up and entrepreneurial activities, utilise existing efficient urban transport system, create metropolitan industrial clusters, utilise the ocean economy and ensure low cost access to advanced communication networks.

Keywords - Urban development, Knowledge based management, Creative cities

1. Introduction

Knowledge based management is the process of creating value from the intangible assets. There is a consensus among researchers that the challenges facing modern societies call for development strategies that are knowledge-based (Ergazakis *et. al.*, 2006). When a society is knowledge based, they form a future path in which all of the basic human needs can be met by future generations while maintaining a healthy, physically attractive and biologically productive environment (Malone, 1995, Malone and Yohe, 2002). Knowledge city refers to all aspects of social,

economic and cultural life of a city and it is important for cities to invent and implement efficient and effective approaches so as to manage knowledge (Ergazakis et. al., 2006). A review of literature and examination of global best practice experiences is carried out in this paper so as to determine how other cities are engineering their creative urban regions so as to establish a base for knowledge city formation in South Africa.

The present industrial capitalist model of development of urban regions is not sustainable, cities that are developing based on this model, are becoming bigger and bigger, demanding increasingly greater inputs and generating greater outputs and waste. Eventually the cities risk surpassing the manageable limits for superimposed growth which leads to collapse environmentally, socially, economically and psychologically (Ergazakis et. al., 2006). Further, overcrowding in cities tends to increase violence, lack of social identity, vulnerability to terrorism and epidemics. Hence the capitalist model of cities' development is no longer functional (Carrillo, 2004). The knowledge based development approach on the contrary, is environmentally sustainable, economically equitable and socially responsible and by its nature, it can preserve a "local" character that respects and takes into account the history, particularities, mentalities and needs of the concerned region (Ergazakis et. al., 2006). However, general agreement has not yet been reached on which type of knowledge-based development strategy is the most advantageous and should be followed.

Carrillo (2004) argues that the emergence of knowledge cities is a breaking point in human evolution indicating the discontinuity of the current development models. According to Chatzkel (2004) knowledge cities have the unique advantage in that they are dynamic centres where new knowledge is created, brought into use and leveraged. By 2050 it is estimated that urban dwellers will account for 86 percent of the global population in the more developed and 67 percent in the less developed regions. Thus, the surge and concentration of human populations will not only put increased strain on the world's ecosystem, but also pose even greater challenges on quality of life (Cizelj and Bostjan Sinkovec 2012). Drucker (1998) suggests that "knowledge is now becoming the one factor of production, sidelining both capital and labour". OECD economies are moving towards a knowledge-based economy (Smith, 2000). With knowledge based economy, individuals and companies focus on maintaining and enhancing their knowledge capital in order to innovate thus knowledge societies emergence has multiplied the extent to which both productivity innovations and social transformations rely on knowledge capital (Carrillo, 1999, 2002).

According to Laszlo and Laszlo (2002), the unaddressed challenges that are addressed by knowledge based development policies include how to make development locally relevant and

globally attuned, how to ensure that development promotes higher quality of life, how to ensure that humans learn to live simply, meaningfully, and yet productively and to support participatory democracy. Ergazakis et al. (2005a), Montre´al Knowledge City Advisory Committee (2003) and Carrillo (2004) point that a knowledge city addresses the above challenges in various ways. The city is structured in such a way that contributes to the better functioning of democracy, allows knowledge-sharing among all the agents, has provision for inexpensive, real-time access to consistent, up-to-date information facilities and has support for online debates.

The processes through which knowledge is created, stored, shared and used are democratised and knowledge flows to all agents. It offers an environment where people can learn, understand and create meaning that will empower them to live in a way that fosters lifelong learning and sustainability (Carrillo, 2004). It offers to the citizens the social context for cooperation, the competencies to shape their present conditions and to influence their future, and the possibility to make informed and life-affirming choices. Information is ensured, all citizens have rights to education and training in order to effectively benefit from services and available knowledge and finally and they have right to a transparent public administration at all levels of decision making. In a participatory democracy, all citizens are involved and share responsibility for making appropriate decisions and choices that will enable the societal well-being (Ergazakis et al., 2005a, Montre´al Knowledge City Advisory Committee, 2003). There are some significant features that are necessary for designing, developing and operating successful knowledge cities, as shown on Table 1.

Table 1: Features necessary for successful knowledge cities

SUCCESSFUL KNOWLEDGE CITIES	
Design and development	Operation
Political and societal	Low cost access to advanced communication networks
Strategic vision and development plan	Research excellence
Financial support and strong investments	Existence of public libraries
Setting up agencies to promote the development of knowledge-based regions	
International, multi-ethnic character of the city	
Metropolitan website	
Value creation to citizens	
Creation of urban innovation regions	
Assurance of knowledge society rights of citizens	

Source Ezgazakis et. al (2005)

A new development paradigm of knowledge-based urban development (KBUD) is quickly finding

implementation ground in many parts of the world (Carrillo et al., 2014). This paradigm is about processes of knowledge production, and their reflection on the urban form and functions, which provides a new perspective for the development of creative urban regions (Yigitcanlar et al., 2008a, b). KBUD, considered as a new strategic development approach in tough global economic competition, involves contemporary understanding and management of value dynamics, capital systems, urban governance, development, and planning. Ultimately, it leads to sustainable urban and economic development (Yigitcanlar et al., 2008a). KBUD practical examples include the provision and development of infrastructures, improved financial systems, investments in social and human capital, the adoption of new state-of-the-art technologies, catering for the quality of life of city residents and the creation of attractive living places.

KBUD approach is based on the concepts of both sustainable urban development and economic prosperity. Cities are the engines of economic growth, as a large share of the innovations and entrepreneurship takes place in cities that foster economic growth (Pancholietal, 2014). KBUD strategy is aimed at promoting smart and sustainable cities through the operationalisation of a knowledge management integrated approach (Yigitcanlar and Lönnqvist 2013). During the last few decades, KBUD has been at the centre of policymaking in many global or world cities that seek to attain long-term competitiveness (Yigitcanlar 2009; Lonnqvist et al. 2014; Yigitcanlar & Bulu 2015). Yigitcanlar and Lonnqvist (2013) describes KBUD as a policy that targets building a 'place' to form perfect climates not only for business, but also for people, place, governance and their integration.

The main advantage of the knowledge-based economy is that the intangible asset that is managed, knowledge, does not depreciate the way material resources do through use, but rather becomes more valuable as it is used (Laszlo and Laszlo, 2007). However, to compete nationally and internationally cities need knowledge infrastructures (e.g. universities, R&D institutes); a concentration of well-educated people; technological, mainly electronic, infrastructure; and connections to global economy Yigitcanlar, (2009). Recent literature claims that the following factors are decisive in the development and growth of knowledge cities: government commitment, large corporations, small and start-up corporations, quality universities, public involvement; and quality of life and place (Landry, 2000; Yigitcanlar et al., 2008b, c).

Following Yigitcanlar, et al., (2015), the KBUD framework is applied qualitatively to assess the different development approaches for creative urban regions in South Africa with a case on Nelson Mandela Bay (for more info on the framework, see Carrillo et al., 2014 and Yigitcanlar, 2014c). The paper provides important insights for urban administrations planning for knowledge-based development of creative urban regions in South Africa and hence in other developing countries. As illustrated on Figure 1, the KBUD framework specifies that there are four development domains of

knowledge, namely economic, socio-cultural, enviro-urban, and institutional (Yigitcanlar 2011, 2014a). Economic development pertains knowledge economy where knowledge is the key to production hence prosperity.

Socio-cultural development pertains equity attained through educational and cultural strategies aimed at enhancing human and social capital and creating opportunities for people to develop their skills (Yigitcanlar 2011). The aim of socio-cultural development is to progress towards establishing a knowledge society where the generation, distribution, diffusion, use, integration and manipulation of knowledge and information is a significant economic, political, and cultural activity. Thus to achieve socio-cultural development, it is essential to work towards increasing the skills and knowledge base of residents as a mean for individual and community development (Gonzalez et. al., 2005).

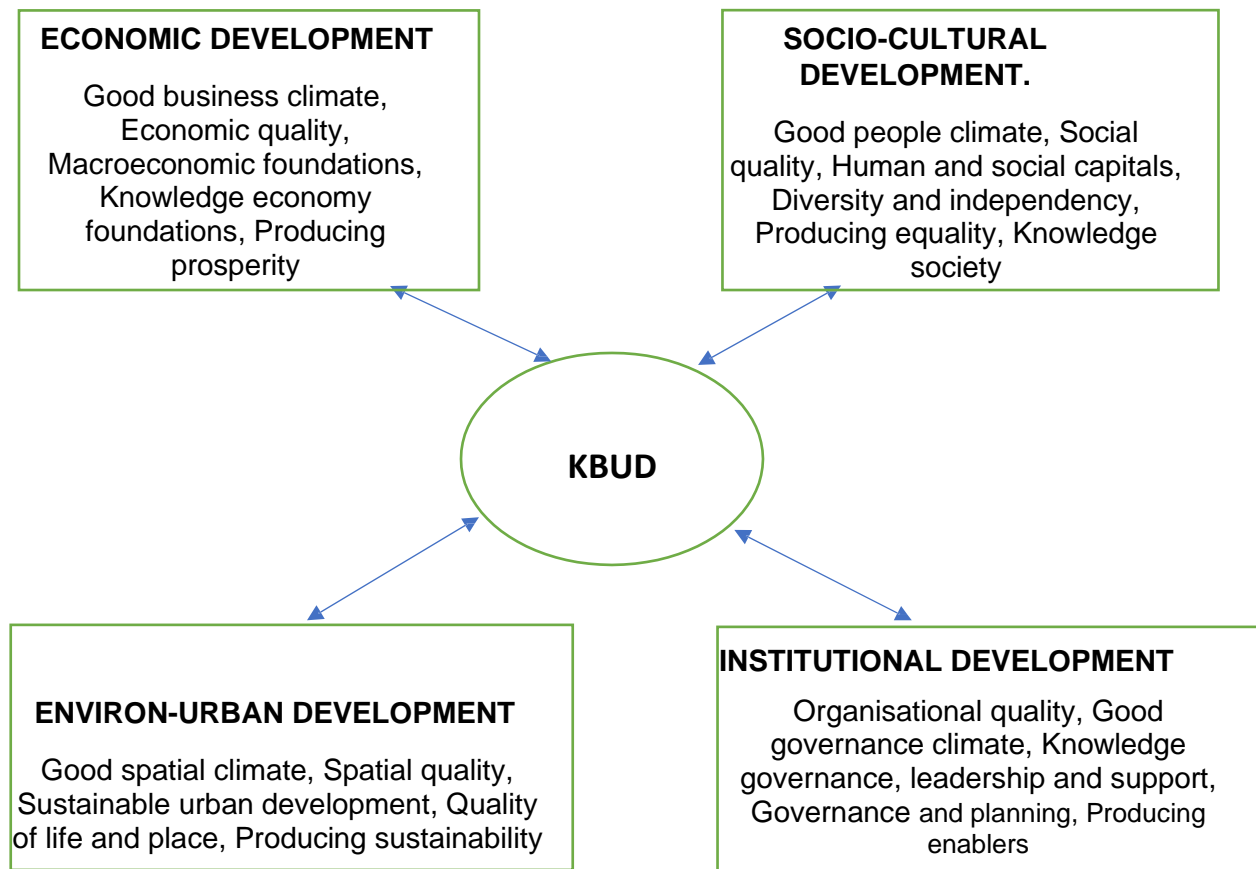


Figure 1: The KBUD Framework (Yigitcanlar and Lönnqvist 2013, p.359)

Enviro-urban development (development of both natural and built environments), aims to meet human needs while preserving the environment so that these needs can be met by both the present and future generations (Yigitcanlar 2011). Hence, enviro-urban development produces

sustainability where sustainable urban development and a better quality of life and place ensures that spatial quality is achieved.

Institutional development produces enablers of a knowledge governance that creates a good governance climate and eventually generates organisational quality. The aim is bring together all of the main actors and sources so that they are able to organise and facilitate necessary knowledge-intensive activities and plan strategically for knowledge city transformation (Yigitcanlar, 2009). Hence, for institutional development, it is critical to observe the principles of institutional leadership, good governance, strategic planning, targeting socio-economic and socio-politic equality, and branding the city as its promise of value in order to make a significant difference for the city in achieving its knowledge city status (Baum et al., 2009).

A knowledge-based economy creates, distributes, and uses knowledge to generate value and gives rise to “a network society, where the opportunity and capability to access and join knowledge and learning intensive relations determines the socio-economic position of individuals and firms” (Clarke, 2001, p. 189). Knowledge-based economy has scaled up due to the rapid advances in information and communication technologies (ICTs) during the last two decades that established the necessary infrastructure. In addition to possessing people and things necessary to produce knowledge, talent and innovation is also necessary (Winden and Berg, 2004). The economy of a knowledge city creates high value-added products using research, technology, and brainpower. The first step of development strategies for a city, region and/or country is to attract and sustain knowledge worker (Institute of Science and Technology, 2016). Talented workers, knowledge and high-tech industries have pivotal roles in boosting urban economic growth (Florida, 2005).

Because of advances in ICTs, societies and cities are increasingly knowledge-based, responsive and dynamic to answer to the needs of residents and to ensure their quality of lives. The effective use of ICTs offers opportunities for improved governance within a knowledge-based development context, because ICT use can help to reduce costs such as administration costs and service provision (Mansell, 2002a). ICTs can also create opportunities for promoting sustainable development and for deepening democratic processes as they support community information sharing, citizen’s access to local and global communities, education delivery and business entrepreneurship among others (Ergazakis et. al., 2006). However, the problem of ‘digital divide’ may exist where those without the capacities to access ICTs or to use them effectively are further marginalised. Thus, in such cases, the government, the private sector and members of civil society organisations and citizens need to eradicate this problem through ICT policies and strategies that are not detached from the reality of the way people live (Ergazakis et. al., 2006).

As emphasised by Yigitcanlar (2008) creative urban regions and knowledge cities are the first new urban formation tailored for the needs of a knowledge-based economy where ideas rule and there are infinite recipes for innovation and wealth creation. Their feature growth is based on the generation of value using common assets with the purpose of achieving sustainability. The advantages of a creative urban region or a knowledge city at global, national, regional and local scales cannot be ignored by the city authorities, policy-makers, private sector investors, and social organisations. Attempts to transform urban regions into creative urban regions and cities into knowledge cities need to be guided by sound strategic visions for success and these strategic visions should incorporate KBUD policies for attracting and retaining knowledge workers and industries and empowering citizens as knowledge creators and innovators.

KBUD was, to a larger extent initially triggered by the success of Silicon Valley and Cambridge Science Park in the 1970s (Castells and Hall, 1994) Major international organizations, such as the World Bank, European Commission, United Nations and Organisation for Economic Cooperation and Development (OECD) have adopted knowledge management frameworks in their strategic directions regarding global development (Morgan ,2007, Cooke and Leydesdorff, 2006). Yigitcanlar, (2009) reveals the common strategies for building successful creative urban regions and knowledge cities which are:

- political and societal will and good governance;
- strategic vision and dynamic long-term development plan;
- setting-up of agencies to promote KBUD;
- strong financial support, partnership and strategic investments;
- international and multi-cultural character of the city;
- creation of urban innovativeness engines;
- research excellence – universities, R&D institutions;
- metropolitan web-portal – E-government, E-democracy;
- value creation to citizens – skill development, employment, social outcomes;
- quality of place, life and affordable housing and urban services; and
- low-cost access to advanced communication networks.

However, planning abovementioned strategies and policies requires a broad intellectual team with

expertise in urban development, urban studies, planning and management, socio- economic development, models of intellectual capital and knowledge management. Planning for KBUD also requires understanding the diverse spatial forms of creative urban regions and knowledge cities Yigitcanlar, (2009). Some developing countries do not produce technical and scientific knowledge, and this creates limitations on KBUD implementation. KBUD strategies provides a comprehensive approach that does not only provide economic and urban goals; but also, requires social and institutional strategies (Institute of Science and Technology 2016).

Cities need to wary of the danger of successfully fulfilling the economic development purpose of KBUD for knowledge precincts by focusing on a technology or selecting a winning knowledge base occupation. Regulations may favour certain knowledge fields thereby hampering other forms of new knowledge. This results in a decline in knowledge attraction and may urge scientists to emigrate. A functional understanding of the dynamics of knowledge is necessary to form a knowledge society and foster knowledge and commercial innovations. Government policies, also at the local level, have a critical role to play in fostering the conditions and spatial relationships of urban development clusters.

2. Lessons from the international best practices

An increasing number of cities world-wide are benefiting from knowledge based urban management in the transformation of their cities. There are global perspectives and lessons from the international best practices that are discussed in this section, from Austin, Barcelona, Helsinki, Melbourne and Singapore.

The city of Austin in Texas, USA, had a reputation of being the human capital and the music capital of the world. Led by business organisations, the city developed a plan to attract large corporations by offering the relatively low cost of living and the quality of university graduates. Hence, the University of Texas at Austin has long been considered as an elite public university. Austin developed a vision for the future of the city and constantly updated its vision and strategic goals as changes occurred, giving the city a competitive edge in becoming a leader among the ambitious cities thriving for attracting and retaining investment and talent (Yigitcanlar 2009).

The success of the city was mainly driven by human centred strategic long term planning that involved public-private-academia cooperation (Yigitcanlar, 2009). Its achievements were that in the 1950s Austin was a leading city in electronics production sector, in 1960s it was a leading city in personal computing commodities sector, in 1970s it was a leading city in business and personal computing sector. In the 1980s the city was a leading city in technology and computer science research and development, in the 1990s it was a leading city in creative industries and in 2000s it

was a leading city in biotech, pharmaceutical sectors. Austin's success factors included dynamic vision and sound strategic planning, strong knowledge based economy, well connected university, industry, government relations. Success factors also included significant investment in human capital, high quality of life and place, efficient urban and transport system, including affordable housing, watching its competitors closely, investing on research and development and education and good governance (Yigitcanlar 2009).

Barcelona's reputation was that it is the culture and tourism capital of Europe. During the late 1990s, the city of Barcelona in Spain undertook a profound technological and cultural regeneration in order to position itself among the major metropolises of the global knowledge society. A strategic plan was developed for the knowledge-based development of the city with an aim of transforming Barcelona into a 'city of knowledge'. Emphasised was the necessity of the cultural sector to become the main driver of transformation and also expansion of ICT and tourism industries (Bontje et al., 2011). Both residents and public institutions were volunteered for the development and implementation of the knowledge city strategy.

The private sector played an important role mainly in the development of infrastructures and knowledge businesses of the KBUD process (Yigitcanlar, 2009). Barcelona's achievements included a new culture and knowledge oriented economy, a rich variety of cultural institutions and a strong creative class of knowledge workers. The achievements also included quality public amenity and services, conserved heritage built environments, conservation of natural surroundings and strong global ties for knowledge exchange. The success factors of the city included sound vision and planning, community involvement in urban transformation, full leadership of the local public initiatives, strategic urban marketing promotion and building on historical and cultural strengths of the city (Yigitcanlar, 2009).

In Finland, Helsinki's success is mainly originated from early strategic actions taken at the national level, the city being very strong in ICT, having a safe and well-functioning living environment, being strong in terms of its share of high-skilled people, being strong in research and development, and having a high level of social equality, which would help to facilitate networking (Bontje et al., 2011). Its achievements included being the first European country with explicit knowledge economy strategies. Helsinki had high level of educated population, high quality of life, high quality of place and high level of accessibility. The city had large investment in arts and culture, high level of social equity and regional focus on developing high quality infrastructure and services.

Helsinki was considered the telecommunication and technology capital of Europe with the presence of giant telecommunication company, Nokia which contributed significantly to the

development of Helsinki. Its success factors included a sound vision and strategic planning mechanism, targeting a dynamic world class centre for business and innovation and a strong, knowledge based economy. However, the city's economic structure was affected by recent global competition on the mobile technology. This caused a serious risk as Nokia started to lose its leading ground against competitor companies such as Apple, Samsung and HTC (Bontje et al., 2011). It is therefore important to diversify the economy and continuously be innovative in order to not to lose the competitive edge.

In Australia one of the strategy tools for the knowledge based development of Melbourne is the city plan that aims to shape its future as a prosperous, innovative, culturally vital, attractive, people focused, and sustainable knowledge city (Yigitcanlar, 2012). Melbourne had a reputation of being the art and culture capital of the Asia Pacific region and the ICT capital of Oceania. Its achievements included partnership between local government, private sector and community, skilled training program for young people, youth employment scheme and community jobs program. The city's achievements also included good governance, support and incentives for creative industry, international sports, art and cultural events and programs to boost tourism, sports art and cultural activities.

Melbourne's success factors included developing a gateway for biotechnology, developing affordable and high quality housing and educational centres, attracting strategic knowledge based and innovative start-up businesses and developing a place of business culture. It also included promoting growth in tertiary education, developing diverse and highly skilled workforce and enhancing liveability and lifestyles (Yigitcanlar, 2009).

Singapore's biggest knowledge based urban development project 'One-North knowledge community precinct' is a cutting-edge project that propels the city state into the knowledge era and establishes it as a regional centre of research and development. Singapore's success rests on its science and technology parks and knowledge precincts: for example, Singapore's Changi airport which is ranked among top international airports in the world. Further, Singapore is also recognised as having top quality eco-efficiency strategies in the world that has made the city- state a leader in the sustainable development area (Yigitcanlar, 2009). Singapore's achievements include being an icon for the knowledge based economy, a hub for knowledge and creative industries to merge and a comprehensive large scale knowledge community precinct development. The success factors for Singapore were government commitment, quality universities, research and development institutions and international large private companies. Success factors also included small and medium size companies, public enthusiasm, quality of life and place, attracting knowledge workers and becoming a city of constant change.

Brainport Eindhoven, Netherlands has created a successful creative urban region and knowledge city by offering a complete high tech infrastructure on a very small scale. This includes a wide diversity in technologies, world-class (technical) universities, international knowledge institutes, researchers, high R&D expenditure, start-ups, student teams, shared R&D and advanced manufacturing facilities. There are also opportunities to commercialise knowledge where high tech companies work closely together with high tech suppliers and knowledge institutes and innovation and technology spotting is achieved. The city offers stability, prosperity and international orientation (Brainport Eindhoven, 2019).

For Montréal, Canada, the economic decline and the flight of capital and financial institutions in the later decades of the twentieth century, including crumbling infrastructure caused by years of neglect and a systemic lack of public investment, a low population growth rate, and slow economic growth and recovery, was turned around using several initiatives. These included deliberate post-industrial transformation towards a knowledge economy and concentration of sector-specific expertise and capacity for innovation as the foundation of its new economic growth strategy. Montreal became a leader in education and research, awarding the highest number of university degrees in Canada each year.

Further, Montreal identified and developed metropolitan industrial ‘clusters’ that is, concentrations of interconnected companies and institutions in a particular field in order to encourage interaction among firms and support each industry's capacity for innovation and regional competitiveness. The city developed a metropolitan plan for Economic Development 2015–2020 to further attract talent and drive the growth of its clusters of knowledge economy activities. Montreal is incentivizing the relocation of international organizations (both governmental and non-governmental) and business investment internationally and markets Montréal as a gateway to the Americas for European trade and business. Further there is promotion of quality of life and cultural amenities (Montreal city, 2019).

3. Creation of a knowledge city for Nelson Mandela Bay

This section focuses on how Nelson Mandela Bay can create a knowledge city, using lessons from various cities around the world as discussed earlier. The city can promote knowledge economy where knowledge is taken as the key to production hence and prosperity. This pertains developing technical knowledge for the innovation of products and services, including urban services, market knowledge for understanding changes in the economy, financial knowledge to measure the inputs and outputs of production and development processes, and human knowledge in the form of skills

and creativity, within an economic model (Lever, 2002). In Nelson Mandela bay there are a number of universities and learning institutions including Nelson Mandela University, UNISA and training (TVET) colleges.

These universities can play a key role in promoting knowledge economy by developing diverse and highly skilled workforce. Promoting growth in universities offering tertiary education and research and development institutions is key towards becoming a knowledge city. Nelson Mandela Bay municipality can collaborate with these universities on research and development, so as to enhance the development of technical knowledge, market knowledge, financial knowledge and human knowledge

The city can expand its knowledge economy by positioning itself as a leader in education and research, ensuring research excellence while pursuing strategies to leverage its urban, demographic, and industry-specific assets (Turkina, 2018). Existing of public libraries can be utilised for this purpose. Further, the city can focus on retaining higher numbers of university graduates and skilled workers, overcoming real and perceived language barriers while leveraging cultural assets, and attracting international organizations and outside investment. The international, multi ethnic character of the city can aid its development as a knowledge city. The city can focus on initiatives to increase prospects and incentives for international students to remain in the city after graduating (Serebrin, 2017b). The city can further focus on attracting expertise to outcompete other cities in the region in specific areas of the knowledge economy, such as artificial intelligence (High, 2017).

Nelson Mandela Bay municipality can market itself as a gateway to Southern African trade and business and can conduct outbound 'investment missions' to foreign cities, provide regulatory and logistical support, and actively negotiate agreements around investment and job creation. Initiatives also include providing support for start-up and entrepreneurial activities (Serebrin, 2017b). Nelson Mandela Bay can make use of its existing efficient urban and transport system, and high quality infrastructure to position itself as a knowledge city. In all this, community involvement in urban transformation is critical. The promotion of quality of life and place and cultural amenities is also very important.

The development of metropolitan industrial 'clusters' that is, concentrations of interconnected companies and institutions in a particular field in order to encourage interaction among firms and support each industry's capacity for innovation and regional competitiveness is also important. Using the case of Montreal, Nelson Mandela Bay can form specialized research and industry clusters, for example a focus on artificial intelligence and life sciences research. Several types of

business clusters, based on different kinds of knowledge, can be formed. High- tech clusters are high technology-oriented, well adapted to the knowledge economy, and typically have as a core renowned universities and research centres. Historic know-how-based clusters are based on more traditional economic activities that maintain their advantage in know-how over the years, and for some of them, over many centuries. They are often industry- specific. Factor endowment clusters are created because a comparative advantage they might have linked to a geographical position.

Low-cost manufacturing clusters have typically emerged in developing countries within particular industries, such as automotive production, electronics, or textiles. Drivers of cluster emergence include availability of low-cost labour, geographical proximity to clients. Knowledge services clusters have emerged typically in developing countries. They have been characterized by the availability of lower-cost skills and expertise serving a growing global demand for increasingly commoditized (i.e. standardized, less firm-specific) knowledge services, e.g. software development, engineering support, analytical services. Multinational corporations have played an important role in "customizing" business conditions in these clusters. One example for this is the establishment of collaborative linkages with local universities to secure the supply of qualified, yet lower-cost engineers.

Also important is further diversification of the economy in the city, diversification within the manufacturing sector, diversification of markets for manufactured products and services, investment in the intellectual capital, creativity, public and private sector investment to accelerate the production of all economic sectors. There is enormous potential for the ocean economy in the city, as well as mineral and energy resources. It is important for the city to strengthen (and monitor) participation in multi-party large-scale ocean economy development initiatives such as the Waterfront development. Financial support and strong investments is critical. Low cost access to advanced communication networks can help to ensure sustainable development, deepening of the democratic processes in the city ensure improved governance (Mansell, 2002a),. However the problem of 'digital divide' need to be eradicated through ICT policies and strategies (Ergazakis et. al., 2006).

4. Conclusion

The knowledge based development approach is increasingly contributing to successful development of cities worldwide because of its numerous advantages over the industrial capitalist growth approach. The industrial capitalist model of development of urban regions is not sustainable and eventually the cities risk surpassing the manageable limits for superimposed growth which leads to collapse environmentally, socially, economically and psychologically. Knowledge based

development approach ensures that the basic human needs can be met by future generations while maintaining a healthy, physically attractive and biologically productive environment. A review of literature and examination of global best practice experiences is carried out to determine how other cities are engineering their creative urban regions and a base is established for knowledge city formation in South Africa with specific attention on Nelson Mandela Bay Municipality.

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“One tree one child project as a strategy towards contributing to household food and nutrition security: The case study of O.R Tambo District Municipality”.

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Abstract

This paper aims to raise awareness through research and innovation on how young school children contribute to food and nutrition security, climate change in their daily lives by understanding how their everyday actions are associated with nature, realizing greenhouse gases into the atmosphere. The paper further introduces the One Tree One Child project by the O.R Tambo District Municipality as a strategy towards contributing to household food and nutrition security, climate change and environmental conservation. The overall objective of the One Tree One Child Program is to make a valuable contribution to the improvement of global climate challenges for improved food security, livelihood and secure future generations in the district, using school children as the primary drivers of the tree planting campaign. In this paper, a descriptive study design was used with both primary and secondary sources as a means of data collection. The study population consisted of school children and the project coordinators from the randomly selected One Tree One Child Schools in the district. The findings of this paper reveal that there is a huge disconnection between children and nature and that the emergence of the One Tree One Child program had afforded opportunities to expose our children, students to the wonders of the natural world and helped to teach them of the inter-connectedness of all living things.

1. Introduction and background

Climate change has become a disturbing issue globally and warnings about its negative effects on humanity are becoming evident nowadays. Like in most parts of the world, South Africa is experiencing extreme weather events including storms, floods, cyclones, hailstorms, typhoons, heatwave and drought due to changes in rainfall patterns, increase in temperatures, sea-level rise, and a loss of biodiversity. High poverty levels, higher population growth, and fast-paced development are straining natural resources and the ability of environments to match these changes. This exposes especially rural Africa at high risks of negative climate change effects, worsening the pathetic rural livelihood situation. In some areas of South Africa including the Eastern Cape province, woodland has been exhausted and some poorly managed by the exploding population.

Cutting trees and shrubs within the natural environment has worsened the situation. Whereas the 70% of rural population in the Eastern Cape Province rely on Small-scale subsistence agriculture

as source of livelihood, its future is faced with high uncertainty, because South Africa is regarded a water-stressed country and less than 10% of the country receiving only 750 mm of rainfall per annum- regarded low compared to the world's minimum rainfall of 860 mm/annum (Hosu, 2015). According to Parliamentary Monitoring Group-SA (2009), the Assessment of forest cover was carried out to develop and integrate plans related to forestry and agriculture. The group lamented the major cause of deforestation in the country as those related to increased demand for land for agricultural and residential purposes. Among strategies of reducing the negative impacts of climate change was set aside at least 60,000 ha of land in Eastern Cape for afforestation, and a budget was established planned for over 5 years. However, based on observations by the authors of this article, a vast land size in OR Tambo District Municipality (ORTDM) is faced with low vegetation cover and barely any tree. This exposes established infrastructure, houses, and school buildings to storms which sweep off roofs and sometimes result in loss of human life. Destruction of school structures in such areas is seen as a huge loss not only to the school but also to the entire nation. According to Times live website dated 06th February 2011, under the headline "End of Mud Schools in Eastern Cape", the reporter indicated that there were several schools constructed with mud and these could hardly survive storms. All these natural disasters have contributed to low food production, high poverty levels, and increased government expenditures, and hence the poor quality of life especially in rural OR Tambo District Municipality. In quest to contribute to the improvement of quality of life more especially to food and nutrition security among rural communities, the O.R.Tambo DM initiated the "One Tree One Child" Project to promote tree planting campaign to promote tree planting campaign for commercial wood production, poles and pulp production, to curb the negative attributes of climate change, and fruit production for both selling and household consumption.

2. Legislation and policy background

In South Africa the Constitution is the supreme law of the country, therefore any law or conduct inconsistent with it is declared invalid. The constitution through the bill of rights upholds the principle of protecting the lives of the vulnerable groups. Section 27(1) (b) states that everyone has a right to access to sufficient food and water, whereas section 153(a) of the Constitution confers municipalities with the developmental duties of which among others include promoting the social and economic development of their communities. Various pieces of legislation attempt to promote and protect the lives of the poor through food and nutrition security and environmental conservation. These pieces of legislation include the South African Integrated Food Security Strategy of 2002 and the National Development Plan

The Government of South Africa, through the National Development Plan, committed itself to eradicate poverty and inequality among South Africans by 2030, thus food security is among the point of focus. In pursuing the NDP vision as well as fulfilling its constitutional mandate, the O.R Tambo District Municipality adopted and One Tree One Child program as one of its greatest strategies towards contributing to household and nutrition security. Specifically, the program was initiated by the office of the Honourable Executive Mayor Councillor Nomakhosazana Meth aimed at making a valuable contribution to the improvement of global climate challenges for improved food security, livelihood and secure future generations in the district.

The South African Integrated food security strategy of 2002 noted specific challenges about food security including weak institutional support and disaster management systems and inadequate and unstable household food production. The One Tree One Child Program is seen both as a food security and disaster risk reduction strategy. It is entrenched in the Integrated Development Plan (IDP) of the O.R Tambo District Municipality as a poverty relief program and is guided by the Service Delivery and Budget Implementation Plan, which state that the municipality must strive to distribute 400 fruit trees to 400 households every quarter of the financial year amounting to a total of 1600 fruit trees being distributed per financial year.

3. The need for planting trees for food security and securing future generations

The devastating effects of climate change on food security, environment and even the growth of a child can never be underestimated. As extreme weather events such as cyclones and heatwaves intensify in occurrence and ferocity, they threaten children's lives and destroy infrastructure that is critical to their well-being. Floods compromise water and sanitation facilities, leading to diseases such as cholera, to which children are particularly vulnerable (Unicef, 2019). Trees are an essential contribution to global agricultural practices and food security. Trees help to maintain the environmental conditions needed for agricultural production. They stabilize the soil, prevent erosion, enhance the land's capacity to store water, and moderate air and soil temperatures (Healthy Soils for a healthy life, 2015).

4. One tree one child project of ORTambo District Municipality

The ORTambo District Municipality is located in the eastern half of the Eastern Cape being one among the six district municipalities in the province. The O.R Tambo District is a rural district, characterized by high levels of unemployment and hugely poverty-stricken, thus the District deemed it prudent that the Executive Mayor should champion a program that addresses food security. One such program is the One Tree One Child Mayoral Project. This project was visualized by the Executive Mayor of ORTambo District Municipality as an innovative way of making a positive and

sustainable contribution towards our schools, climate change, and the environment, later it was developed into a project concept document to look for funds to assist the communities and schools, working hand in hand with the school principals, educators, learners as the primary drivers of this concept and the School Governing Bodies (SGBs), school administrators, involving chiefs, Councillors, Forest field officers, Commercial afforestation companies, environmental staffs, Local Economic Development officers, Local Municipal Councils and the Department of Education to utilize the existing opportunities such as land and consider school gardens, afforestation and greening projects within their school and Community.

This program was established in 2014 to fight against poverty and its associated evils, environmental issues and to restore the much needed endangered, degraded species in the district by providing fruit trees to households and planting indigenous trees at schools, old age homes and streets. The program target school children and schools as its primary drivers and beneficiaries.

4.1 Location and implementation of the One Tree One Child project

The One Tree One Child program is implemented throughout the O.R Tambo district, with both primary and secondary schools being the primary beneficiaries. The O.R Tambo District municipality is made up of five local municipalities, namely, Nyandeni LM, Port St Johns LM, Ingquza Hill LM, Mhlontlo LM, and King Sabatha Dalindyebo LM. When piloting the program, ten schools were selected in the 5 Local Municipalities that make-up OR Tambo District Municipality. Six schools benefited from the project in 2014 and the last Four (4) schools were completed in March 2015 and



Figure 1: O.R Tambo District Municipality Map (Source: Municipal Maps, 2019)

ten new schools were considered and selected. Since then, the program has enrolled thirty-four schools extracted across the five local municipalities in the O.R Tambo District. All these schools had undergone the three stages of the program. Figure 1 provides a picture of the ORTDM while Table 1 is a list of schools that have benefited from the program since its inception in 2014.

The program has three fundamental components which are; capacity building, distribution of fruit trees and planting of the indigenous trees. Key amongst these three components is capacity building where workshops are held on a quarterly basis in which all relevant stakeholders including children as the primary drivers of the project, traditional, religious and political leaders, teachers and parents are brought under one roof and are provided with theoretical and practical lessons relating to food security, project management, tree planting, and environmental conservation. According to Awopeso (2012:262), capacity building is a broad statement that encompasses two sets of beliefs. Firstly, it refers to actions that improve the effectiveness of individuals, organizations, networks or systems including organizational and financial stability, program service delivery program quality and growth. Secondly, capacity building is a long term process that improves an individual, group, and organization's ability to create a positive change and better improve performance results.

Table 1 describes areas where the project has been so far implemented.

Table 1: Areas where the project has been so far implemented

School	Local Municipality
1. Lapumikwezi SPS	Kings Sabatha Dalindyebo Local Municipality
2. Zimbane Valley SPS	Kings Sabatha Dalindyebo Local Municipality
3. Kwa Ntshale SSS	Kings Sabatha Dalindyebo Local Municipality
4. Menziwa SSS	Kings Sabatha Dalindyebo Local Municipality
5. Dudumayo SSS	Kings Sabatha Dalindyebo Local Municipality
6. Hlabatshana JSS	Kings Sabatha Dalindyebo Local Municipality
7. Nkalane JSS	Kings Sabatha Dalindyebo Local Municipality
8. Jongintaba SSS	Kings Sabatha Dalindyebo Local Municipality
9. Empa older persons project	Kings Sabatha Dalindyebo Local Municipality
10. Joubert Ludidi Comprehensive High Schl	Mhlontlo LM
11. Tsolo special School	Mhlontlo LM
12. Somagunya SSS	Mhlontlo LM
13. Thandanani JSS	Mhlontlo LM
14. Tsolo Residence JSS	Mhlontlo LM
15. Rueben Ntuli SSS	Mhlontlo LM
16. Ncumbe JSS	Mhlontlo LM

17. Dimanda SSS	Nyandeni LM
18. Dalisoka SPS	Nyandeni LM
19. Ntaphane J.S.S	Nyandeni LM
20. Gxaba S.S.S	Nyandeni LM
21. Smuts Ndamase SSS	Nyandeni LM
22. Mzomtsha Child and Youth Care Centre	Nyandeni LM
23. Thabatha SPS	Ingquza Hill LM
24. Goso Forest Secondary school	Ingquza Hill LM
25. Gwebinkumbi SPS	Ingquza Hill LM
26. Ntabezwe JSS	Ingquza Hill LM
27. Langa SSS	Ingquza Hill LM
28. Mqikela SSS	Ingquza Hill LM
29. Goqwana JSS	Port St Johns Local Municipality
30. Kwa-Msikwa SSS	Port St Johns Local Municipality
31. Ndevu JSS	Port St Johns Local Municipality
32. Khwezi JSS	Port St Johns Local Municipality
33. Toli SSS	Port St Johns Local Municipality
34. Mhlanganisweni SSS	Port St Johns Local Municipality

5. Design and methodology

This study adopted a descriptive study design using both primary and secondary sources as a means of data collection. Focus groups and observations were utilized to collect data from the stratified randomly sampled participants, whereas quarterly and annual performance reports were utilized as secondary data sources.

6. Findings on the implementation of the one tree one child program

Following numerous interactions and discussions with the beneficiaries of the program, numerous achievements have been noted. Out of these interactions, it has been noted that beneficiaries of this project do not only benefit from consumption, they also generate new knowledge and ideas on crop production and tree planting. Community members have not only acquired knowledge on tree planting, but they also learned about the importance of crop diversification. Also, beneficiaries are able to generate income by selling the surplus and purchase other commodities necessary for living. The implementation of the program has further fostered close relations between schools and parents, leading to increased participation of community members in school affairs. Children have

generated knowledge of agricultural practices out of this project and learner enrolment has gone high in many schools and below this is what learners and educators have to say ;

When asked how she had looked after her tree, Asonela Nontwana from Goso-Forest Junior Secondary School in Ingquza Hill Local Municipality said: "I had no clue about the value of planting trees until I planted my tree". Growing up a tree a fruit tree requires multiple strategies and I am happy that I eat oranges out of my efforts.

In the meantime, Noziphiwo Nqeketho confirmed that she has developed more interest in tree planting and that she would like to pursue her career in forestry. This all came after she was awarded an opportunity to grow a fruit tree and to take care of indigenous trees at her school.

Mrs. Bini who is the project coordinator in Kwa-Msikwa SPS in Port ST Johns said "When growing a tree you need to treat and love it a like a baby. I sometimes wake up in the morning and watch my school orchard and further speak to those orange trees as if I am speaking to my kids. Our school has been making a profit out of oranges. We sell oranges to the local market and other neighbouring schools and buy other commodities for needy school children like stationery and sanitary towels. In 2018 the school started harvesting oranges and made an income of R2400 while in 2014 the school made an income of R3400. Additionally, parents derive income through sold oranges from the trees that were given to school children.

Mr Nombanga from Thabatha SPS stated that they use their school orchard as a supplement to their school feeding scheme. In winter, they do not buy fruit instead they pick up oranges from their orchard. Also, 33 out-growers had emerged as a result of the One Tree One Child capacity building workshops including the study tour to Durban.

These findings are further complemented by the following achievements extracted from the municipal assessment reports on the progress and the impact made by the project.

- 34 schools have benefited from the program
- To date, the project has given out 17057 Fruit Trees and 2000 Indigenous trees of different species have been planted in homesteads, school compounds and streets
- 17 orchards have been established of which 5 of them have started harvesting.
- Employment opportunities have been created. Schools like Kwa-Msikwa JSS, Thabatha SPS, Ntabezwe SPS, Goqwana JSS have employed permanent people to look after their school orchards

- The program was profiled as the legacy project of South Africa and a legacy project of the United Nations Food for Agriculture as a result of South Africa hosting the World Forest Congress 2015 of which the One Tree One Child had showcased.

7. Challenges encountered

Since the inception of the One Tree One Child Project in 2014, there has been an increasing demand for tree planting across the O.R Tambo District Municipality. However, due to the capacity constraints including financial and material resources, the program has fallen short of achieving the target of planting 700,000 trees within a space of five years. When it started, the program used to distribute fruit trees to all children in any identified school, establish an orchard within the school and planting indigenous trees for greening. However, due to budget constraints and financial limitations, the total number of trees that must be distributed has been reduced. Currently, the One Tree One Child program is mandated to distribute only four hundred fruit trees (400) per quarter amounting to one thousand six hundred trees (1600) for the whole financial year which is the drop in the ocean according to the dangers facing the district in terms of tree distribution. As research shows that every one tree caters for four people in terms of distribution of oxygen.

The program has received overwhelming support at the household level. However, since its inception, the One Tree One Child program has never received any support from either the Provincial or the National Government, more especially from the Department of Rural Development and Agrarian Reform (DRDAR). The program has been noted as one of the legacy projects of South Africa in 2017 by the DAFF Minister, yet no formal Correspondence or Communication has ever been received as evidence-based of its status.

Also the project has never received any form of support to strengthen its program since "One Tree One Child "of ORTDM through this project we are members of the Eastern Cape Forest Forum Committee then it leaves the project in the Limbo relying on the Political leadership of the District Municipality which is not good in the language of Project Management Cycle. Apart from the political will and support but there are no indicators of its Sustainability if there is a change of leadership.

Though there has been some limited support from the Department of Agriculture, Forestry, and Fisheries (DAFF). One Forestry development officer has been quietly active in our One Tree One Child programs. His active participation, including selecting the best suitable schools to be offered fruit and indigenous trees, traveling around the district to conduct situation analysis from those schools and areas, capacitating communities on the role and the importance of planting both indigenous and fruit trees and also acquiring some indigenous trees that are planted at school.

However, due to this limited support, there some schools that have never received their indigenous trees which is not good on the side of the project implementers thus the doers coupled with the suitability of the project and sending wrong signals towards our communities as lack of uniformity in the process.

Lastly, the program has received a huge demand for trees from households, schools, community organizations, towns, and streets. There has been a call that the program should consider planting indigenous trees in sports grounds and landfill sites, particularly in rural areas. Another call was that at the household level, each fruit tree should be accompanied by an indigenous tree (Shade Tree). For example, Chief Mgwili from Ingquza Hill made a request that the program should move from One Tree One Child to One Tree One Household where all community members will benefit from the program, because there are those who are interested in tree planting yet cannot participate because they do not have kids or their kids have passed the stage of primary and secondary school's levels. It has been difficult to provide trees for some places because they are not properly fenced and the trees were considered vulnerable as they are exposed to animals.

8. Recommendations

The One Tree One Child is a big program and it requires active and collective participation and support from all angles of society including both public and private sector institutions. Since the role of the university is to teach, research and community engagement, universities need to engage more of their students in the tree planting campaigns, establishment of food gardens, orchards through research, innovation and career guidance which will result in skills development and job creation, thus curbing poverty and high levels of youth unemployment and preparing the future generations for the 4th Industrial Revolution.

9. Conclusion

The School community gardens, afforestation, and greening projects have provided many benefits to pupils, students, teachers, parents and the community at large. These spaces have afforded opportunities to expose our children, students to the wonders of the natural world and helped to teach them of the inter-connectedness of all living things. School gardens and green space have enhanced student's physical activity, ecological literacy, knowledge of natural cycles and offered increased protection from ultraviolet radiation. And lastly but not least the School children have demonstrated love for the environment.

Acknowledgement

Special thanks goes to the members of staff in the office of the Executive Mayor, the Supply Chain management staff of ORT DM, ORT DM truck drivers, Daff Management team of the Eastern Cape

Province, for allowing two Officials (Mr. Sijadu C and Mr. Katende L) to be part of the project since its initiation. Lastly, let me express my sincere gratitude to Sappi who has worked very hard around the clock to plant forests for our four schools enrolled in their program year 2015.

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Urban regeneration and renewal in African cities in the light of the sustainable development goal for cities: the case of Lagos, Nigeria.

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Abstract

The concepts of urban regeneration and renewal are tested, and are relatively successful means of addressing the urban problems or challenges that plague cities, including inadequate housing, urban decay, and inadequate infrastructure. They have also been applied in the resuscitation of declining urban socio-economic dynamics. The City of Lagos, the same as other African cities, is experiencing a high level of urbanisation due to the increase of people in the urban space. This is leading to more pressure on human settlements in terms of housing and basic infrastructure such as water, sanitation, hygiene, and power supply. The inability of most governments to deal with this challenge, has led to the rise of slums, informal settlements, poverty, and insufficiency of basic infrastructural and social services in urban centres. In the light of these challenges, it is necessary to continually measure government policies and actions against the sustainable development goal (SDG) of making cities safe, sustainable and inclusive. Therefore, the objective of this paper is to appraise the level of government's responsiveness in Lagos towards urban regeneration in line with SDGs to address housing, and infrastructural problems, as highlighted above. There are commendable efforts by the government through the various agencies and ministries to cater for housing, renewal, and regeneration. However, research carried out shows that much of the city's regenerative plans are geared to projecting the image of a 'world class city'. The city's regenerative approach is driven by the pursuit of economic interests and capitalism as against ensuring inclusivity, sustainability, and access to affordable housing, and basic infrastructure. This study aligns with Vanessa Watson's concept of conflicting rationalities between the yearnings for inclusive human settlements, and what is obtainable in the city.

Keywords: Urban regeneration, urban renewal, housing, infrastructure, sustainable cities.

1. Introduction to urbanisation in Africa and the imminent challenges

The concept of urban regeneration has been applied in addressing the challenges that plague cities, including inadequate housing, inadequate and inefficient infrastructure, and inefficient cities. This concept has also been applied in the resuscitation of declining urban socio-economic dynamics due to rapid urbanisation. According to Hardoy and Satterthwaite, (2014:301) cities and urban centres have become places where the majority of people struggle as they scramble

“for the most basic elements of life: for a room within reach of employment with an affordable rent, or vacant land on which a shelter can be erected; for places in schools; for medical treatment for health problems or injuries, or a bed in a hospital; for access to clean drinking water; for a place on a bus or train; quite apart from the enormous competition for jobs”.

The city space plays a significant role as an urban laboratory in testing urban dynamics, urban policies, responses from the populace, and it holds many promises of prosperity (Caprotti and Cowley, 2017). According to United Nations Human Settlements Programme (UN-Habitat) (2016:29), “cities have become a positive and potent force for addressing sustainable economic growth, development, and prosperity, and for driving innovation, consumption, and investment in both developed and developing countries”. The perception of the city as a place where the individual’s socio-economic goals and aspirations can be met has led to the increased influx of people into such areas and led to city officials grappling with providing urban services to its occupants in many areas. These services include healthcare, road networks to ease transportation, housing provision, power supply, water supply, sanitation, food availability, and a number of other supplementary services. These services also help the cities to balance the social, economic, physical and environmental dynamics affecting the populace.

According to a United Nations report, the percentage of the world’s population of people living in cities and urban settlements was put at 55%, and it is expected to go up to 70% by 2050, with considerable and rapid growth in Africa and Asia (UN-DESA, 2018). Table 1 below shows population projections for different continents, and what is worrisome in African cities is that the growth in population is not associated with economic, infrastructural or other forms of growth that can improve the lives of the urban dwellers (UN-Habitat, 2016; Potts, 2018). It is inferred and argued (that urbanisation ought to be accompanied by economic prosperity Potts (2018). This is as against what is obtainable in Africa, which largely has an agro-based economy, with few exceptions (Turok 2018). Fox *et al.* (2018) argue that the mortality rate factor in population growth and availability of healthcare has been a driver of urbanisation, and the growth of the cities in developing countries across Africa, including Nigeria. Hence, urban population growth in most African countries is driven by a high rate of procreation, “rural-urban migration, spatial expansion of urban settlements through the annexation, the reclassification of rural areas” as well as conflict and natural disasters (UN-Habitat, 2016:7). For instance, in Lagos, in addition to other factors, population increase is occasioned by the internal crises, and terrorist activities in North-eastern Nigeria. A major fall-out of the growing population within the city is the decrease in available resources, and infrastructure for all to share, and this necessitates the upgrading, renewal, regeneration or redevelopment of what

is available. From the 2017 world population prospect, Africa shows a geometric growth in population, while there is a decline in Europe and steady growth in other regions (see Table 1). The population prospect has serious implications for the African continent as it implies a rise in demand for housing and supporting infrastructure. While cities in industrialised and developed countries seem to have found a way of dealing with issues arising from urban decay, development and population growth increase in African cities has heightened demand for housing, supporting infrastructure, and ecological footprints (UN-Habitat, 2003; Daramola and Ibem, 2010).

Table 1: World and Region Populations for 2017, 2030, 2050, 2100

Year / Region	2017 Population (millions)	2030 Population (millions)	2050 Population (millions)	2100 Population (millions)	Percentage increase by 2100
World	7 550	8 551	9 772	11 184	48.1%
Africa	1 256	1 704	2 528	4 468	255.7%
Asia	4 504	4 947	5 257	4 780	6.1%
Europe	742	739	716	653	-12.0%
Latin America and the Caribbean	646	718	780	712	10.2%
Northern America	361	395	435	499	38.2%
Oceania now	41	48	57	72	43.1%

Source: Adapted from United Nations, Department of Economic and Social Affairs (2017).

This inability of most African governments to deal with such urban challenges has led to informal poor-quality housing without adequate or an absence of infrastructure, and can be attributed to many causes. These reasons include inadequate resources and technical know-how, corruption, and city development before proper urban and regional planning (Daramola and Ibem, 2010). Further, (Huchzermeyer, 2011) notes that most cities in Africa failed to apply modern planning techniques to address urban sprawl, prevalent informal activities, housing development, and the delivery of services.

Another major challenge in African cities is the continued reliance on urban planning, and practices still largely dominated by colonial policies without incorporating the indigenous principles of African urbanism and culture (Mabogunje, 1990; Coquery-Vidrovitch, 1991). While the globalised perception of urbanisation is a good thing for African cities, it places immense pressure on urban planners and state officials to adjust these inherited planning policies, and practices to address

peculiar local problems of urban deterioration and decay. Further, the inability to maintain existing infrastructure, and inadequate planning further aggravates the deterioration of infrastructure, especially in developing countries (Ayininuola, Ayininuola and Olalusi, 2004; Adejimi, 2005; Uma *et al.*, 2014).

2. The concept of urban regeneration and renewal

Urban regeneration, renewal, redevelopment, and revitalisation are clichés used by policy makers and officials when referring to efforts at addressing urban-related issues plaguing cities (Yau and Ling Chan, 2008; Granger, 2010). Even though these terms are different, they are sometimes used interchangeably. For most (growing) cities in the world, urban decay and deterioration cannot be wished away, but measures such as regeneration, renewal, redevelopment or rehabilitation if put in place can reduce or ameliorate the level of decay (K'Akumu, 2007; Yau and Ling Chan, 2008).

Roberts (2000:18) defines urban regeneration as the “comprehensive and integrated vision which seeks to resolve urban problems and bring about a lasting improvement in the economic, physical, social and environmental condition of an area” to improve opportunities. Granger (2010:9) refers to it as activities carried out in order to reverse ‘economic, social and physical decline’ in urban areas. Urban regeneration also refers to the process of improving urban areas already in existence for the purposes of upgrading the physical features, and making it more sustainable (ULI and Stanley (2014:2). In addition to the above, urban regeneration facilitates the improvement of the urban infrastructure, and the revitalisation of the economic climate. Urban regeneration can be seen as an offshoot of urban renewal, but Couch (1990) argues that urban regeneration transcends the aims of the renewal of urban centres.

According to von Hoffman (2008), urban renewal has taken various forms over the years, and is not susceptible to a particular definition (Engelbrecht, 2003). It may, however, be defined as the process of clearing slums, and replacing them with physical development. Urban renewal also has other considerations, such as social, cultural and economic factors (Zheng *et al.*, 2014). Urban renewal was used as a tool to address urban issues such as overcrowding and high-density challenges in places like France and London, and to rebuild other cities after the world wars, and industrial revolutions in the 18th and early 19th centuries. However, beyond concerns about modern forms of housing, urban renewal in Europe was underpinned by the need for a re-invention of the social aspect of urban life, as well as the influence the environment played in shaping members of the society (Zipp, 2013). As a planning tool, it aids the rectification of urban decay, and helps meet some of the government’s socio-economic objectives. It also enhances the social network, and the

inclusion of disadvantaged and vulnerable groups of people by reducing the negative impacts of unwholesome, and dilapidated living environments (Zheng *et al.*, 2014). It is also a means of effective land use and management and improving the quality of the environment within communities.

Hyra (2012) argues that urban renewal has the disadvantage of unfavourably affecting the poor members of society by uprooting them from places where they have developed social and cultural attachments, and significance. This is in addition to the fact that many of them are unable to properly settle into the areas where they are relocated because of the inadequacy or inappropriateness of government compensation (*ibid.*). For instance, Hyra (2012:499) noted that many of the people displaced during the 1949-1974 urban renewal wave in the US suffered “emotional and psychological trauma from having their networks and communities destroyed”. It is also argued that urban renewal only ends up creating more slums, as the resettlement plans for evicted people are usually situated in areas already predominantly occupied by the poor (*ibid.*). It is notable that what was termed urban renewal as at 1949, actually was urban redevelopment, which was based on slum clearance and the building of public housing for the inhabitants of the slums, and blighted areas. It was not until 1954 that the principle of urban renewal was established on the basis of the need for the “enforcement of building codes and the rehabilitation of substandard” houses (von Hoffman, 2008:281; Weber, 2002:528). However, because it emphasised the need for low-income privately built houses, it was difficult to implement the building codes, thus the implementation of the law failed (von Hoffman, 2008).

While urban renewal and regeneration are means of improving the urban centres and the living conditions, it is equally perceived as a capitalist agenda through neo-liberal policies to increase property value in urban centres in order to exclude the urban poor through gentrification (Uzun, 2003; Larsen and Hansen, 2008). Samara (2010) argues that urban renewal has been used as a neo-liberal development security strategy in the city of Cape Town to combat rising crime, and security challenges within the city. Urban regeneration projects also raise the issue of tenure security for displaced urban and slum dwellers, especially the urban poor, in cases of evictions and gentrification (Uwadiwegwu, 2015). Given the above definitions and contextual clarifications, it is argued in this paper that urban renewal tends more towards improving the social well-being of the urban poor, while urban regeneration tends more towards complete redevelopment, and economic improvement, disregarding the social well-being of the people.

3. Urban sustainable development goal for cities through the millennium development goals and urban renewal

Prior to the SDGs, there were the Millennium Development Goals (MDGs) set by the United Nations speaking to transnational aspirations and developmental practices with targets and indicators to measure how countries fare generally in relation to poverty, environmental sustainability, literacy, and other global concerns (United Nations, 2005). While some countries were "doing well" based on the indicators, especially the global north, the reverse was the case for nations of the global south owing to their population, level of development, which remains low, lack of political will, and infrastructural inadequacies (Parnell, 2016). The MDGs were greatly criticised on several grounds, including the non-universality of the goals with normative agendas (one size fits all), which favour the global north. The goals dealt less with social, economic, and environmental values as it relates to poverty and the populace as well as human capital, and were not region specific. There were more normative agendas without systemic or procedural strategies to achieve values (see Attaran, 2005; Easterly, 2009; Fehling, Nelson, and Venkatapuram, 2013; Parnell, 2016).

Goal 7 of the MDGs, addresses environmental sustainability, and Target 7d specifically speaks to the achievement of "a significant improvement in the lives of at least 100 million slum dwellers by 2020" (United Nations, 2005). Based on the need to actualise Target 7d, many cities in developing countries tried to mirror world-class cities and attempted to totally eradicate slums or any iota of informality (Huchzermeyer, 2008). It is argued that the Cities Alliance's slogan of "cities without slums" was wrongly interpreted and implemented to mean doing away with, and eradicating slums in cities (*ibid.*). However, this interpretation negatively affected the lives of slums dwellers since some were evicted or displaced, and others had to relocate permanently.

The MDGs #T7 resulted in creating an inclusive agenda for cities known as the SDG#11, which aims to make "cities and human settlements inclusive, safe, resilient and sustainable" (UN-Habitat, 2015:18). Targets 1 and 3 of the SDG#11 promote agendas on enhancing inclusive and sustainable urbanisation, as well as ensuring "access for all to adequate, safe and affordable housing and basic services and upgrade slums by 2030" (*ibid.*). It is crucial to continually measure government policies and actions against the SDG#11 as it relate to urban renewal and regeneration. It is notable that the SDG#11 was adopted at the Habitat III United Nations Conference on Housing and Sustainable Urban Development held in Quito, Ecuador in October 2016 as the New Urban Agenda (NUA) (UN-Habitat, 2016). However, despite the fusing of the SDG11 into the NUA, there is still a lot of uncertainty about the adaptation and localisation of the urban sustainable development goal for

cities at local city level (Parnell, 2016; Klopp and Petretta, 2017; Valencia *et al.*, 2019). Many southern cities and countries, including Lagos, Nigeria and Johannesburg, South Africa, are still trying to localise the NUA as pronounced on UN-Habitat platforms.

As noted earlier, urban renewal is a tool used by government to actualise social, economic and environmental well-being of society (Zheng *et al.*, 2014; Kleinhans (2004); von Hoffman, 2008; Hyra, 2012). Particularly, Gbadegesin and Aluko (2010) note that part of the purpose of urban renewal, among others, is to engender social inclusion, thereby promoting sustainable human well-being, and settlements. From the foregoing, it can be said that urban renewal entails elements of sustainable development, and that it is in line with the SDG#11 and MDG#7d. The importance of urban renewal to social and economic development is noted by Carmon (1999:154), who argues that urban renewal played and still plays a role in economic stability, and societal equality (by reducing the gaps between comfortable and poor members of the community), and the preservation of urban fabrics “for social, historical and aesthetic reasons”. Zheng *et al.* (2014) iterate this by arguing that the components of urban renewal such as housing, infrastructure, and land (in terms of land use) have implications for sustainable development. This is because both processes share common components, thus a synergy should be created where the benefits of one are used to advance the other in creating and recreating a sustainable human settlement.

4. Study area

Lagos has grown beyond being a metropolitan city to a city region with a population of about 23 million. As at the 2006 census, the population was 9 113 605 and the growth rate is exceptional for a city sitting on an area 3 577 km² or 358 864 ha with infrastructural inadequacy for addressing the needs of the teeming population. The city is experiencing rapid urbanisation at a rate of 6-8%, with population density put at about 6 000/km². This places a high demand and strain on housing, basic infrastructure, and transportation across the city (Gbolahon, 2017). As shown in **Error! Reference source not found.** below, Lagos state represents 0.4 per cent of the landmass in Nigeria, it is the state with the smallest land mass but has the highest population and urban density.

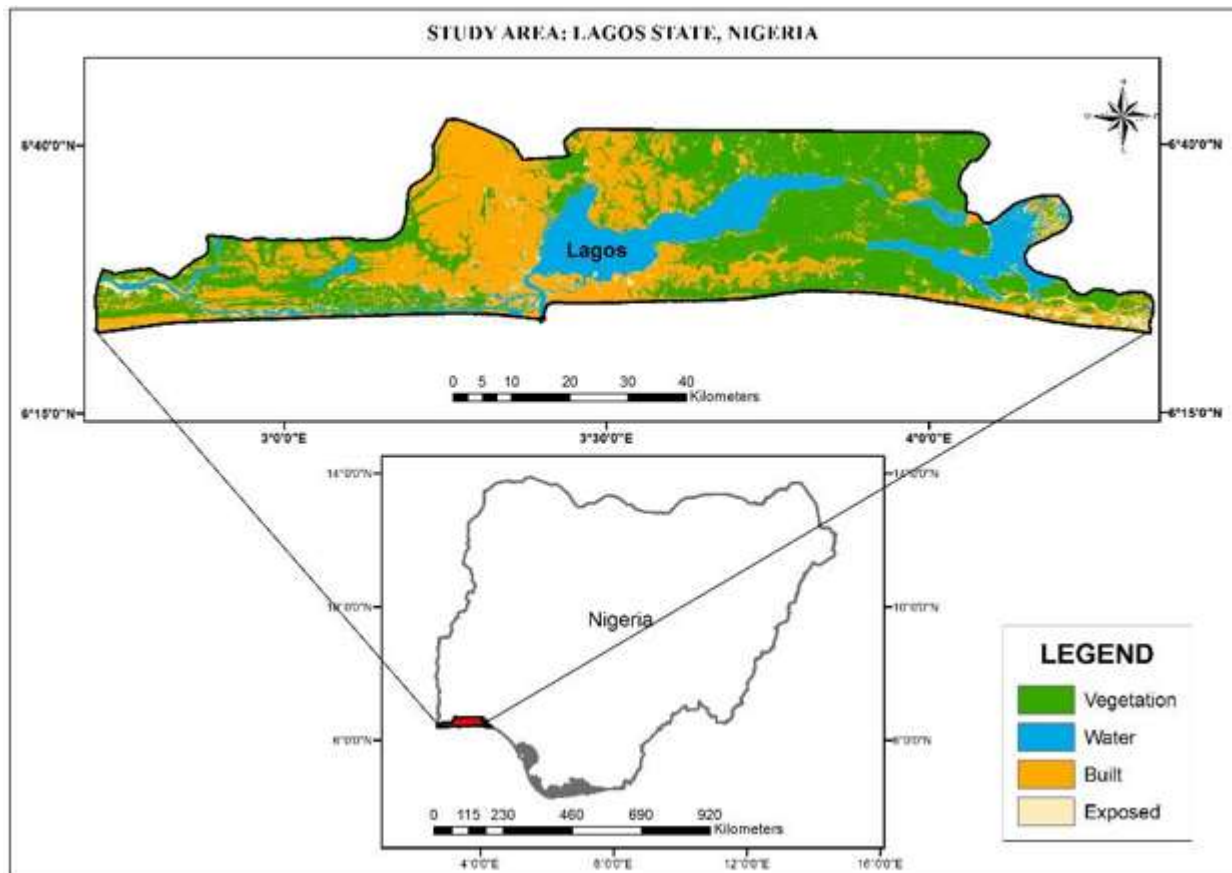


Figure 1: Map of Lagos in relation to Nigeria

Source: Adapted from Lansat 2014 Imagery.

Lagos, being a coastal city with a coastline of 180km, suffers significantly from its inability to expand horizontally due to the number of lagoons, creeks, waterways, and being bounded by the Atlantic Ocean in the south (*ibid.*). Lagos was the former capital of Nigeria and even though the Federal Capital City (F.C.T) Abuja is the present capital of Nigeria, Lagos remains the most vibrant, energetic and non-official economic capital of Nigeria. The city of Lagos boasts the majority of commercial banks in Nigeria, very busy air and seaports, and various institutions (Budgit, 2017). The city remains at the peak concentration of economic activities in Nigeria, where all the ethnic nationalities and the residents of the Economic Community of West African States are interested in doing business (Gbolahon, 2017). These and other factors increase the pressure of job seekers, and supply of housing, and infrastructure on the government. According to the 2018 Budget report, the state government had a fiscal budget of N1.046tn (\$29m) with capital expenditure of N699.08bn, recurrent expenditure N347.04bn, leaving the state with a deficit of N149bn (Okeowo and Budget Team, 2018). This is a good indicator in terms of economic performance compared to the economies of some other African countries. Despite the above, Lagos remains a city characterised by various

urban dynamics such as social inequalities, faith-based developments, urban poverty, and infrastructural inadequacy.

4.1 Nature of the problem in Lagos, Nigeria

The city of Lagos has suffered disproportionately in terms of infrastructural development since it stopped being the capital of Nigeria. According to Nelson (1988), the major reason for relocating the capital city to Abuja was because Lagos could no longer accommodate the future development due to the inadequacy of land, housing, and infrastructure to support the growth and population. The population growth has resulted in a decline of infrastructure in the human settlements. This decline in the city has given rise to slum proliferation, and informal settlements. Nigerian cities in general have consistently been rated as some of the least livable cities in the world, and this can be attributed largely to inadequate infrastructure to support the population and overburden of the existing ones. Olokesusi (2011) notes that the majority of Nigerian cities are characterised by slums and informal settlements, with about 70% of the populace living in unplanned settlements. Similarly, the 2012-2025 Lagos State Development Plan (LSDP) acknowledges that about “75% of Lagos populace live in substandard housing areas” (Ministry of Economic Planning and Budget (MEPB), 2013:7).

Of all the cities in Nigeria, Lagos seems to be the worst hit by rapid urbanisation due to its land size, population, grossly inadequate housing and infrastructure, and being a coastal city. Based on the LSDP, Lagos has witnessed rapid deterioration of infrastructure, giving rise to the proliferation of slums and informal settlements (MEPB, 2013:7). Consequently, the citizens, especially the urban poor, have limited access to adequate and basic infrastructure such as drinking water, sanitation, proper shelter, power supply, and waste management (Gilbert, 2000). Also, the living condition is worsened because of the coastal nature of Lagos which limits its ability to expand physical development, thereby increasing land value, leading to increased privatisation of land. Of the unverified figure of an 18 million housing deficit across Nigeria, Lagos alone is said to account for 5 million of the national figure (Opoko and Oluwatayo, 2014). These factors highlight the need for a general overhaul of housing provision, and basic infrastructure to support human existence in the city of Lagos in a sustainable manner in line with SDG target 1 of providing “access for all to adequate, safe and affordable housing and basic services and upgrade slums by 2030” (UN-Habitat, 2015:18).

5. Methodology

This research paper was carried out mainly through an explorative qualitative framework. According to Einstein (undated), "...not everything that can be counted counts, and not everything that counts can be counted..." thus, beyond the numbers, this method allows the researcher to employ and interact with various data, carry out analysis and come up with a conclusion. In determining the level of government's urban regenerative responsiveness, in-depth policy document analysis was carried out, semi-structured interviews were conducted through a purposeful sampling of participants, and an empirical urban renewal intervention was considered involving urban renewal, and housing provision in Lagos. In all, issues of ethical consideration were taken seriously, and the anonymity of all respondents was guaranteed during interviews, and personal communications. A total of 12 interviews were conducted across three major institutions, namely Lagos State Urban Renewal Agency (LASURA); Lagos State Ministry of Housing (MOH); and the Justice and Empowerment Initiative (JEI). Interviews were also conducted with two academics in the Built Environment from the University of Lagos.

LASURA is an agency of the state government responsible for implementing policies relating to renewal and slum upgrade within the boundary of Lagos state (LASURA, 2016). The Agency has the responsibility of "facilitating improved living conditions, the upgrade of infrastructure in slum areas, and the provision of decent housing for slum dwellers" (*ibid*). MOH is entrusted with the responsibility of delivering sufficient, affordable, and qualitative housing for all. JEI is a non-governmental and non-profit organisation in Lagos and Rivers state of Nigeria that "supports a coalition of slums and informal settlements in Nigeria called Federation" (JEI, 2017). JEI is involved in the day to day running of several slums profiled by them, with the aim of improving living conditions, and informally basic infrastructure.

The subject of the empirical urban renewal intervention by LASURA is Isale Gangan Towers and Gardens, and the research explored the extent of urban renewal and housing intervention project on the subject. The project was managed by LASURA under the Lagos State Government to address the challenge of slums and inadequate infrastructure in the Isale Gangan area within the Lagos Island (see Figure 2 and Figure 3 below). The project involved land pooling from 12 different families owning small portions of land in the neighbourhood, each sized about 200sqm. While the land initially belonged to all the families, they lacked the capacity to meaningfully develop the land and meet all planning permit obligations such as standard dwelling spaces, adequate set-backs, adequate parking, and infrastructural facilities.



Figure 2: Locational map of Isale Gangan Tower and Garden

Source: Google Map, 2017

LASURA decided to pool or aggregate all the individuals' plots together to amount to about 2 312sqm. Prior to the project a number of consultations were had with the families, and an agreement was reached. It is noteworthy that each family was resettled in a two-bedroom apartment and compensated in monetary terms while construction was going on. Also, each family was allocated one flat out of the 48 luxury flats, while the other flats were advertised for outright sale (LASURA respondents; LASURA library).



Figure 3: Image of Isale Gangan Towers and Gardens

Source: Mapcarta, 2017.

6. Discussion and findings

The urban morphology of Lagos has changed significantly from 1900 to the present day, and it is still evolving. Lefebvre (2003) talks about urban revolution, and how urban practitioners should perceive the urban space that is going through a transformation which might be a gradual process, or sudden. Lagos has also been a trade centre due to its coastal nature, particularly a slave trade centre in the mid-1800s, before the abolishment of the slave trade, and its annexure as a British colony in 1861. Figure 4 shows the urban development and growth of Metropolitan Lagos from 1900. The city attracts people from all over Nigeria and West Africa.

SNC Lavalin in conjunction with United Nations Development Programme (UNDP) carried out a full study of Lagos in early 1980, which was funded by World Bank (SNC-Lavalin, 1995; Agbola *et al.*, 2007; LASURA, 2016). The study identified 42 blighted areas in Metropolitan Lagos, and urban trends for slum growth as shown in Figure 5. The study culminated in recommendations on how to address slum growth, and urban decay. However, the recommendations and development guides from the SNC Lavalin study were disregarded (Respondents A2 and A3). The respondents also noted that the maiden 1980 Lagos State master plan for the next 20 years, which was meant to guide urban developments in Lagos, was not followed. The non-implementation and non-adherence to the master plans, and recommendations worsened urban planning and development in Lagos. A

respondent noted as follows: “we had neglects of urban planning processes; plans were not followed; we had indiscriminate development, and people took laws into their hands with the infringement of the shorelines and peri-urban areas until democracy came in 1999” (Respondents A3).

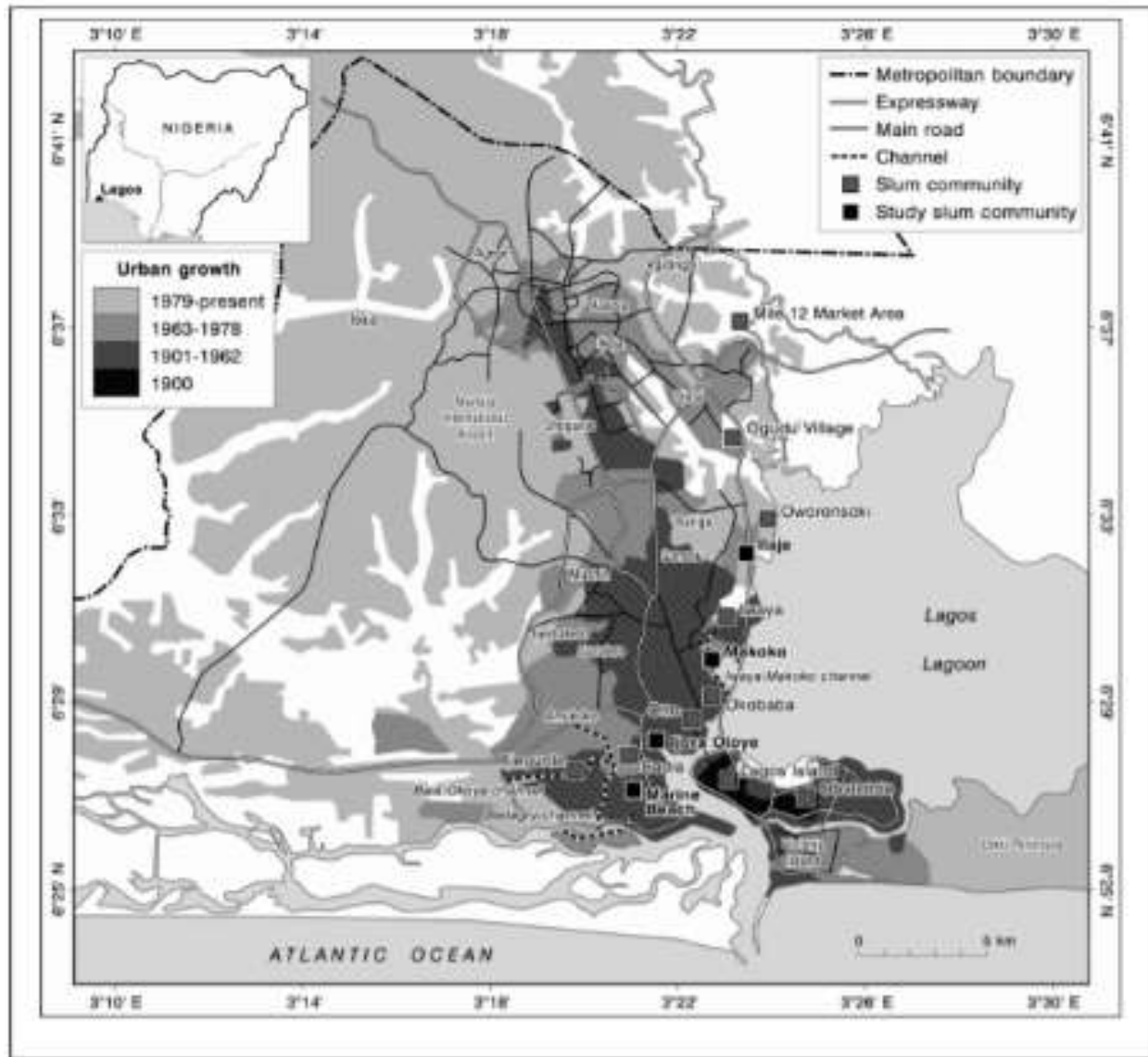


Figure 4: Urban growth of metropolitan Lagos from 1900

Source: Gandy (2006); Adelekan (2010).

Several respondents held the opinion that the non-execution and non-performance of planning guides were largely credited to several military incursions in the governance process, and such governments lacking the democratic competence necessary for urban planning, and development in Lagos. According to the respondents, one of the incidents of that era was the eviction that took

place in Maroko in 1990. The respondents highlighted the fact that despite interventions such as the 2007 World Bank-funded Lagos Metropolitan Development and Governance Project (LMDGP), based on the SNC-Lavelin Report, the number of slums within Lagos has continued to rise. The funds were meant to provide basic infrastructure for nine out of the then 42 identified slums. The number of slums in Lagos has since risen beyond 100, with Gandy (2006:372) describing Lagos as “the sprawling city ... which encompass a vast expanse of mostly low-rise developments including as many as 200 different slums ranging in size from clusters of shacks underneath highways to entire districts”.

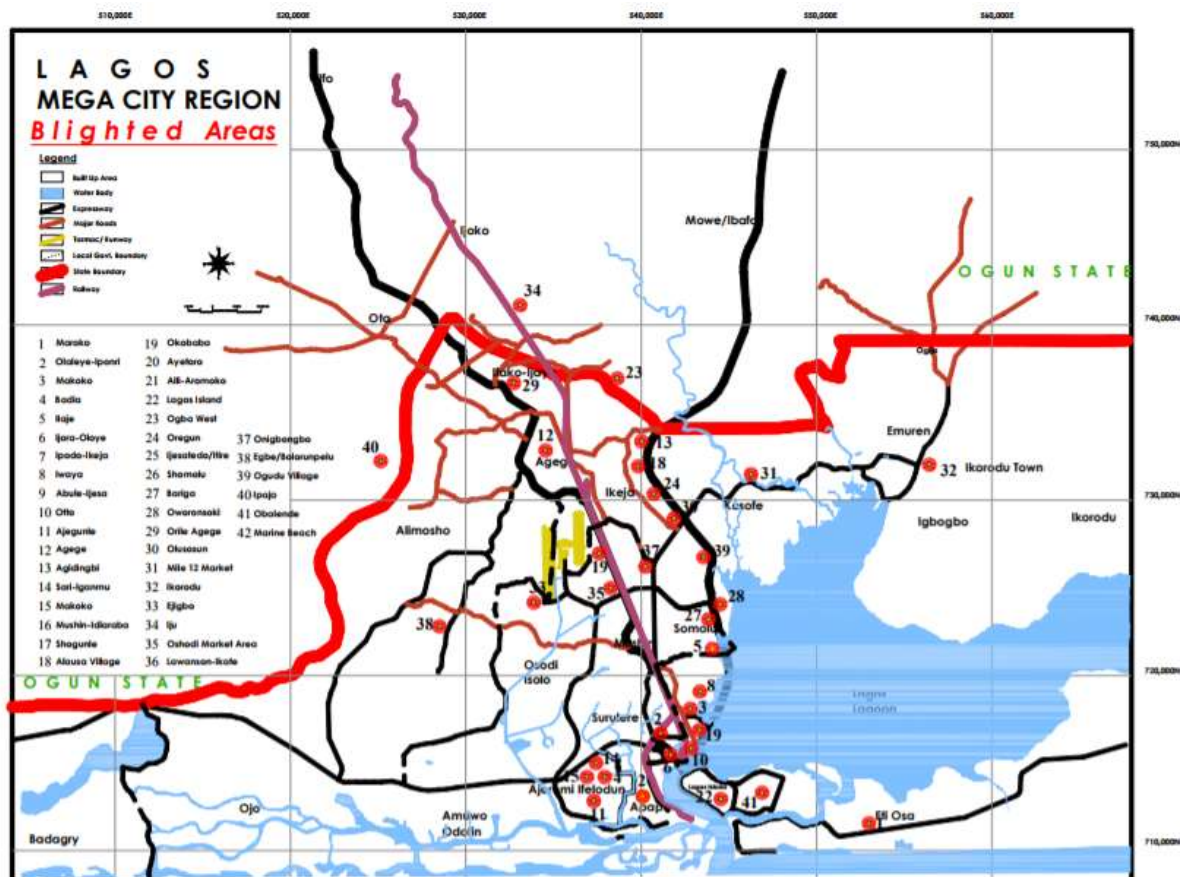


Figure 5: Map showing blighted areas/slums in Lagos

Source: SNC-Lavalin (1995).

The study identified several issues hampering the operations of LASURA, the agency responsible for urban renewal in Lagos state. Funding for urban renewal projects, and the perception of government agencies by the slum dwellers seem to be the most prevalent challenges. Apart from the fully funded World Bank LMDGP, and a few other projects supported by the international community, the Agency is grossly underfunded for meeting the challenges faced by communities.

Respondents noted the restrictions occasioned by government structures, as the Agency can only function within the ambit of the law, and execute projects captured within the budget.

Also, slum dwellers do not trust the government's motive for carrying out urban renewal. This is based on earlier experiences, where the government took over land under the guise of renewal and regeneration. Gotham (2001) argues that urban renewal policies of the government in the past often were elitist, while poor citizens are negatively affected by displacement as their neighbourhoods are transformed for commercial and industrial uses. This is a reflection of the negative impact that of many urban renewal and regeneration projects, in that they have left the poor worse off. Another challenge identified by the respondents, is the security of tenure, land issues and the Land Use Act of 1978 of Nigeria (LUA), which vests all urban lands in the state governor, except for government-owned lands. The (LUA) and the bureaucratic process of acquiring title to land and certificates of occupancy is a constraint to housing development and home-ownership, and this limits the possibilities of intervention by LASURA within communities (Akeju, 2007). Many of the urban poor do not have titles recognised by the LUA, or have insufficient evidence of their title to land, thus giving up their land for urban renewal might imply a complete forfeiture. Lastly, there is a paucity of data collection by the government, and the NGOs seem to have more information about slum communities than the Agency. This was observed by the researcher at a focussed group meeting between LASURA and civil society. This lack of data on the part of the government highlights the need for a closely-knit working relationship with civil societies to solve urban issues in Lagos.

There are a lot of infrastructural, housing and other developmental projects going on across the state, and it is acknowledged that these are responses to the NUA and SDGs pertaining especially to housing, and infrastructural problems. Some of these projects are the Eko Atlantic City, the Lekki Free Trade Zone, the Bus Rapid Transport project across the city, housing projects by different actors (government, private sector, and individuals) and the ongoing construction of Blue and Red Rail lines. However, the bulk of these projects are urban regeneration drives to improve the economic status, as against the social well-being of the populace. Specific reactions from respondents in this regard are as follows:

“slums have been on the increase because housing ownership has been through an incremental mode of building for years in areas without infrastructure ...as long as the mode of housing procurement is promoted through an incremental building without government providing infrastructure and mass housing production for the citizens, slums will continue to increase” (respondent C2).

“until the city vision includes catering to the needs and the potentials within that demographic majority, then our processes and policies will continue to be skewed” because of our peculiarity and teeming population (Respondent C1).

“, the only approach we have seen government taking in Lagos when it comes to slums and informal settlements is to demolish or ignore them, even though there seem to be some changes in that regards” (Respondent D1).

“government’s policy reflection on the housing situation in Lagos State which is inadequate, as it were, consists more in unending stories of regeneration, lacks historical data on planning and development, lacks disaggregated data on communities in Lagos, regeneration is not based on the principles of integration and inclusion, ...(which) lacks a housing delivery structure to accommodate the low-income groups” (Oshodi, 2016).

What is most prevalent across the interviews is that while LASURA and MOH are trying to improve the living condition of the populace, the general body language from the state government is towards making the city look attractive for foreign investors. Generally, the state government pays more attention to the mega-projects that will portray the city as a potential ‘world class city’. Through these projects, there is an attempt to address years of disregard for urban planning and development, but there is no actual positive impact on the urban poor. Notable efforts by LASURA include the preparation of developments guides based on contemporary urban issues, the use of urban growth boundaries to curb slums, and the land pooling system exemplified in the empirical urban renewal intervention of Isale-Gangan. Notable efforts by the MOH include the promotion of home-ownership through the ‘rent to own’ schemes, the partnership with the private sector to finance housing estates, and the initiative to redevelop to increase densities, and to provide infrastructure in old government estates built in the 1970s and 1980s (Respondent B1, B2, B5). However, it is noted that even civil servants earning the national minimum wage cannot comfortably afford the cheapest house within the ‘rent to own’ scheme.

7. Conclusion

This study reflects a conflict in rationality between economic improvement in the state and the social well-being of the populace. This study echoes Watson (2009:151) that urban planning processes adopted in the global South sometimes “serve to promote social and spatial exclusion, are anti-poor, and are doing little to secure environmental sustainability”. Again, when the overall effort of

the government in urban regenerative drive is weighed in line with the urban sustainable goal for cities, there is a conflict of rationalities between the state and its citizens (Watson, 2003). Agbibo (2018) criticises the state government for its urban regeneration projects, arguing that there is a gross disjuncture between state neo-liberal urban policies in wanting to be a 'world class city', and the reality for improving the lives of the populace. His argument is based on the manner in which the government is curbing and doing away with informal means of transportation.

The government's idea of urban regeneration portrays a continuation of "cities without slums" initiatives; this is based on the vision to make Lagos state "Africa's Model Mega City and Global Economic and Financial Hub". This vision is being implemented in phases through regenerative plans across the state. These plans are, however, not inclusive as they do not take cognisance of the plight of the urban poor, and people living in slums. In line with SDG11, there is a need for the government to accept slums and informal settlements as part of the city, and to cater for the needs of everyone within the demographic majority. There is also the need for co-production in solving urban-related issues to promote inclusivity, and the protection of livelihoods for the urban poor. In the final analysis, the city space plays a significant role as an urban laboratory in testing urban dynamics, urban policies, and responses from the populace, and it holds many promises of prosperity (Caprotti and Cowley, 2017). In this regard, the urban regeneration plans in the city of Lagos seem to fall short of the SDGs requirements for a safe and inclusive space characterised by the availability of both housing and basic infrastructure.

Acknowledgement

This paper was presented at the African Centre for Cities International Urban Conference, Cape Town and the content of this paper is the first extract of my Research Report for the award of Master of the Built Environment in the field of Housing at the University of Witwatersrand, under the Wits-TUB Urban Lab, which was supported and funded by the German Academic Exchange Network (DAAD) and Federal Ministry for Economic Cooperation and Development (BMZ).

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Modelling the household unit size with respect to time – A critical literature review output

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Abstract

This research is part of an on-going wider research at PhD level. The purpose of the research was to provide a comprehensive identification of all the possible factors that influence the household unit size with respect to time, and the inter-relationships that exist between these factors. The research will then provide a systematic technique of modelling likely changes in household sizes per given age ranges with respect to time. The household will be treated as a unique entity which is born at a certain point in time, and dies after a given period. The household unit is also subject to emigration, immigration, and mortality effects at each age group for any year or period of analysis. The design was based on reviewing of existing literature that is relevant to household size prediction with respect to time, including micro-simulation literature. Using the R environment, a limited analysis of the effectiveness and sensitivity of the implemented model in comparison to existing household population prediction packages like the R- based “Rramas” package was done. The results show that the proposed model is a good predictor of household unit sizes, is simpler to understand than its “Rramas” counterpart, and its sensitivity to any slight parameter changes, though significant, is appreciably low compared to the sensitivity of the “Rramas” package. This would make it a good candidate for household unit size predictions.

Keywords: Household unit, Household Size, Microsimulation, Population stochasticity, Environmental stochasticity.

1. Background

Housing affordability and tenure change prediction and forecasting is very important for urban economists, because urban areas are quite complex with unique problems. Central to this cause is the big challenge of modelling the changes in the household unit, whose characteristics with respect to time lie at the core of any kind of meaningful analysis of the general affordability and tenure status trends of an entire urban area. This is important, given the fact that South Africa is already highly urbanized, with the rate of urbanization still increasing.

In the field of population studies or sciences, various techniques have been developed that simulate population sizes with respect to periodic intervals such as seasons. These seasons can also be set to correspond to time frames such as years. The best methods so far available are those making use of transition matrices such as the Leslie and the Lekovitch models. An example of a package using these techniques is the “Rramas” package. There is quite a lot of literature dealing with these models.

However when tested, it was found out that these methods need careful attention because the elements of the transition matrices have to be carefully chosen according to the expected behavior of the population of the unit under consideration. During the process of testing, the researcher tried to apply these methods to individual human households and it was found out that the sensitivity of the matrix elements to household population changes both in terms of total population or population across individual ages is quite high. These kinds of methods are often used and are suitable for analyzing animal species' growth, or even human population species' growth of a certain area, instead of individual household's growth.

However, sometimes in some fields of urban economics, such as housing research (for example, housing affordability and tenure change prediction), there is a need to model how an individual household unit family size will vary, both in terms of overall family size, and also in terms of the sizes across each age value with respect to time.

Take for example if we want to evaluate more accurately the non-housing expenses of individual households. The non-housing expenses of a toddler are much different from those of a 30 year old, even if both are in the same household. In addition, twelve years later the toddler will have grown up, and probably it is a teenager, while the 30 year old individual, say the parent, will be 42 years at that time. Both their non-housing expenses will be different then compared to what they were 12 years back. In addition, as each year passes by, an individual has a probability of survival into the next year or a probability of dying and hence reducing the family size. This probability may vary across ages since older people may have a higher mortality rate than younger ones. Still, each passing year there is a likelihood of new babies being born in the family or household. There is also a very strong likelihood that, when children come of age they will leave the family and set up their own households.

This implies that modelling Housing unit sizes with respect to time cannot be separated or divorced from modelling the number of households in a given area with respect to time, because reduction in household sizes due to older children leaving their parents implies formation of new households while if the age of a household goes beyond a certain limit implies the death or disappearance of an entire household.

It was therefore necessary to come up with a new approach to household unit size modelling with respect to time, which would capture all the above events or processes that affect the household unit size.

Thus the aims and objectives of this research were:

- To identify all the factors that affect household unit size and model the relationships that exists among them.
- To identify at least 1 alternative method of modelling household unit size and carry out an effective analysis of the performance of the proposed model as compared to the existing alternative method of household unit size prediction.

2. Satisfying the aims and objectives

In order to meet the aims of the research, relevant literature that dealt with factors influencing household unit size and their relationships was reviewed. This included literature dealing with micro-simulation. Of particular concern also was finding an alternative way of determining household unit size taking into consideration changes in age of household members with time, likelihood of newborns joining the household with time, likelihood of immigration into the household with time, likelihood of emigration and hence new household formation with time, likelihood of differing degrees of mortality at each age range with time, differing degrees of fertility at each age range with time, and the death of entire households after reaching a certain limit of household age.

One (1) other population size estimating R based package was also identified, and relevant literature dealing with it was reviewed. This packages is the “Rramas” R package. This package together with the new proposed household unit size estimating model were tested on simulated or randomly generated household data with varying parameters to determine the effectiveness in predicting household size with time and the sensitivity of each package to changes in the varying parameters. A comparison was then done for these two (2) methods based on:

- Ability to predict household sizes per given age ranges
- Effectiveness in predicting total household sizes
- Sensitivity to varying parameter values
- Speed of performing computation

The results obtained were limited to the assumptions made concerning the applicable (chosen) probability distributions that were used to model the uncertainties or likelihoods of event occurrences stochastically.

3. Outline of the findings

The findings show that the nature of their designs allowed both the new model and the “Rramas” package to model households populations based on age ranges and eventually give the total household population per given period of analysis.

The findings also show that the new model's prediction pattern for household sizes is consistent with the observed patterns of household size variations with time. The fact is that no two households may have exactly the same trajectory path regarding the size per given age range per given year of analysis because the events (birth, death, emigration, immigration, and household formation) that happen along the timeline for each individual household at each age range are triggered or depend on stochastic processes. Given the nature of the problem at hand, the occurrence of these events, is highly dependent on random effects. The new model correctly reflects this kind of pattern in its estimation of individual household size with time.

The findings also showed that compared to "Rramas", the new model is less sensitive to varying parameter changes that lie at the core of controlling the kind of trajectory path that a household size per given age range per given period of analysis will follow. This implies that the fine-tuning of the parameters to produce the desired effects is easier under the new model as compared to the "Rramas" package.

The 2 models were compared in terms of speed of computation. The "Rramas" package was far much slower (slow almost up to 20 times compared to the new model) in producing the desired results compared to the new model.

4. Household population projections

4.1 *Household population projection model*

i. Introduction

This sub-section will deal with the theory behind the developed household population projection model developed by the researcher to predict age-structured household populations with respect to time. The model is an open discrete microsimulation household population model (Morand et al, 2010:5-6)

ii. Rationale behind the model

The rationale behind is based on population microsimulation literature from authors such as Geard et al, (2013: 8-9) & Morand et al, (2010:13-15). While the models discussed in that literature are more detailed in household states because of their intended purpose, the model discussed here is much simplified because its purpose is to determine household sizes across age ranges with respect to time. A brief description is given below.

- Basically as years pass by, for each year there is a probability of individuals being born in a household (if there are adults who are of age to give birth). This will increase the household population. The number of children born to a woman within a period of their reproductive life (Say Age 15 to 45 years) is called the **fertility rate** (Ofusuhene, 2009: 20)
- Each passing year there is a probability attached to each household member of dying. This will reduce the household population. The process whereby deaths occur is called mortality, hence the **mortality rates** (Ofusuhene, 2009: 14)
- Each passing year implies an increase in age of an individual by one year. This means that the household age structure will change.
- As the children increase in age, they become more and more likely to leave the home and set up a home themselves. Hence, they become more likely to **emigrate** out of the household.
- Those children who emigrate out of their family households are therefore assumed to form households themselves. They will require their own dwelling places, and probably raise families themselves (Thus no longer being taken as children, but as parents or adults).
- In addition there may be individuals who can become part of a household through the so called process of “Immigration” into the household. For example young ones (whose parents are dead) of whom the household under consideration are relatives may be cared for by the current household. This is a characteristic of a population in an area (in this case a household) that can be expressed as the number of individuals per 1000 members of the population that come from outside the population to become members of the population in a given year. Immigration increases a household size. If young adults are more likely to emigrate when they are say 18 years and above, it follows that Immigration will most likely happen when individuals are below 18 years because they still need to be cared for.
- As individuals pass through different ages, these probabilities vary and hence their fertility, mortality, emigration and immigration rates of the households also vary. This implies that there are certain age ranges when each individual is most likely to be subjected to the effects of fertility, mortality, emigration or immigration and vice versa.

Efforts are being made to align the model design according to validation recommendations, such as those outlined by Harding et al, (2010). Improvements are therefore still being made to this effect.

iii. *Functions to compute corresponding household population rates*

Four (4) functions were as a result created to compute the fertility, mortality, emigration or immigration rates of the households. These functions were based on the theoretical treatment of

how to compute these rates available in literature dealing with population studies. In particular, fertility rates were computed using the Hadwiger mixture model (Peristera and Kostaki, 2007). Mortality rates were computed using the Gompertz model (Nguimkeu, 2013).

iv. *Random Deviates using the uniform Distribution*

A uniform distribution is then applied 4 times for all households for the entire possible lifespan of each household (Which lifespan was assumed to be 120 years) to generate 4 sets of random deviates using the uniform distribution (Becker et al, 1988). Each set of random deviates corresponds to each set of the 4 population parameters under discussion, namely fertility, emigration, mortality and immigration rates. These values will differ from household to household since they are random deviates.

v. *Determination of the occurrence of an event at a certain age.*

Once the random deviates are generated (which vary with the household and the age), then an event regarding birth, or emigration, or immigration, or death in a household at a certain age will be considered only to occur if the function value for each of these parameters (Fertility, emigration, immigration, mortality) computed at a certain age for that household (section 2.1.2) is greater than the random deviate (Also computed at the same age for the same household) corresponding to that parameter (Section 2.1.3). This process is also modeled using a set of 4 equations whose sum is the total change in household size (births + immigration – deaths - emigration) at a certain time (age of household). This process takes care of the uncertainty in events occurring in each household that will influence the household state with respect to time.

For example, in the case of mortality,

Let m =mortality rate at certain age;

Let M be the corresponding random deviate

Let E represent the occurrence of the death event (Death occurs when $E=1$, Death does not occur when $E=0$)

$$\text{If } m > M \text{ then } E = 1 \quad (1)$$

$$\text{If } m \leq M \text{ then } E = 0 \quad (2)$$

The final output if the initial household population is added to these population changes with respect to time is the population of individual households. The outputs are grouped into different age ranges

and are summarized in as a list in different formats. The list holds different data frames each of which represents the summary (R Core Team, 2014).

$$\Delta h_{ij} = bt_{ij} + im_{ij} - dt_{ij} - em_{ij} \quad (3)$$

$$h_{ij} = h_{(i-1),j} + \Delta h_{ij} \quad (4)$$

Where

Δh_{ij} is the total change in household size for household “ j ” that will be used to compute the household size in period “ i ”

im_{ij} are the total immigrations in household “ j ” for a period leading up to period “ i ”

bt_{ij} are the total births in household “ j ” for a period leading up to period “ i ”

dt_{ij} are the total deaths in household “ j ” for a period leading up to period “ i ”

em_{ij} are the total emigrations in household “ j ” for a period leading up to period “ i ”

h_{ij} are the total size of household “ j ” for period “ i ”

Figure1 illustrates the population flow diagram on the basis of which the proposed model was developed.

5. The “Rramas” Matrix population projection model

The “Rramas” model is a population prediction model by use of matrices. More detailed information about it can be obtained from De la Cruz (2015).

The initial vector of stage abundancies must be supplied (for this research, it is the initial household sizes for the different age ranges). Thus if the number of age ranges used are say 14 ranges, then the vector will be of length 14. If there are 50 households under analysis, then there will be 50 initial vectors. Each vector corresponds to each household.

A transition matrix representing the probabilities of an individual transiting from one age range to another, for each passing time interval, must be provided.

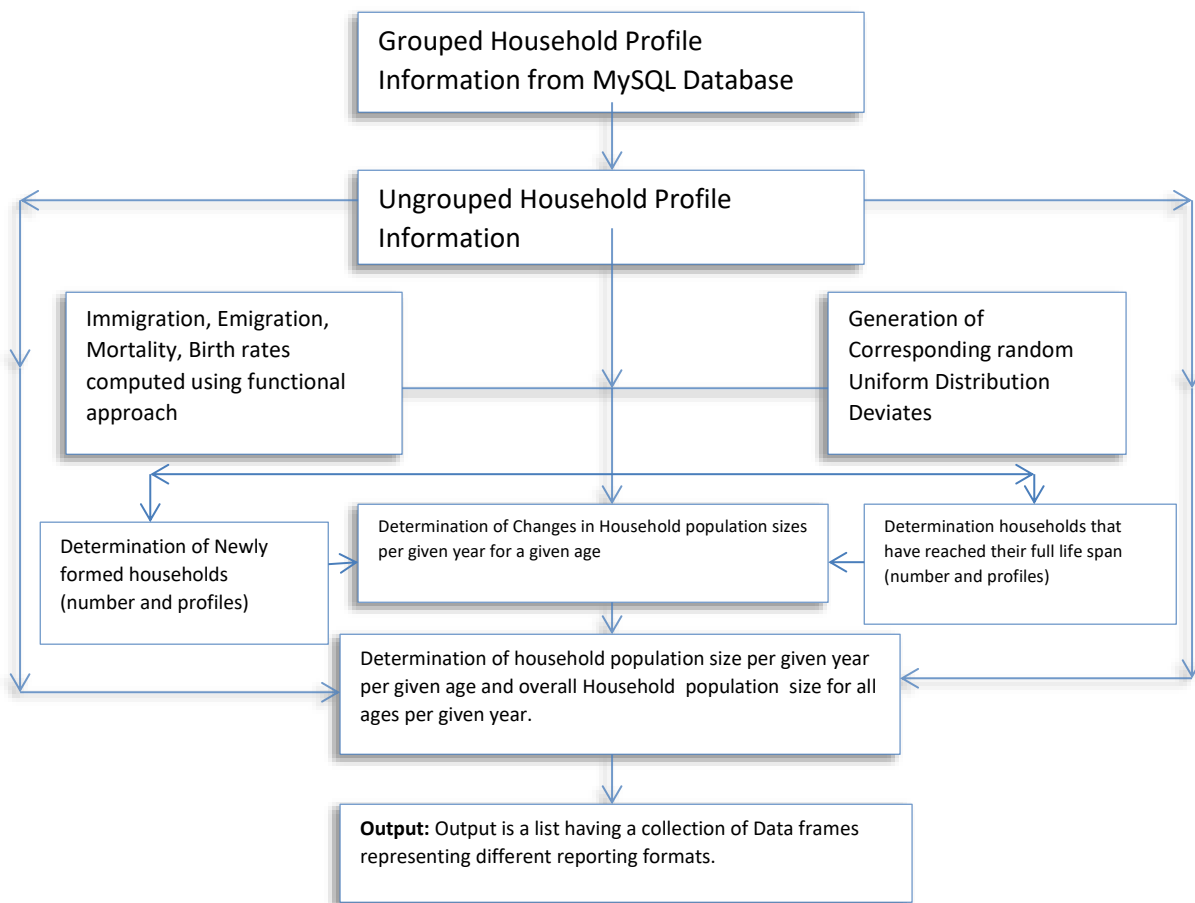


Figure 1: Population Projection Flow Diagram for the proposed model

The primary sub-functions used in this package are “projectn” function and its accompanying summarizing function called “summary”. The ideas used are borrowed from Ackakaya et al (1999) and Caswell (2003).

The “projectn” function will itself repeatedly call the “project1” function for each applicable time interval until all the time intervals of population prediction are completed. In order to determine the household population abundancies for a given stage (say for the year 2015), the “project1” function will multiply the stage abundancies for the previous year (2014) by the transition matrix, assuming there is no population or environmental uncertainty.

However if there are population and environmental uncertainties or stochasticity, then “project1” will call another function called “estdemo” that will assign abundancies for each stage by sampling from either the binomial or Poisson distributions. The sampling probabilities will be the elements of the transition matrix that was supplied earlier (De la Cruz, 2015).

The output of “estdemo” function when binomial distribution is used are survival chances for each individual accounted for in the previous matrix of stage abundancies, while if the Poisson distribution is used, then the output are the number of offspring at that stage, spread across the different age ranges for each household (De la Cruz, 2015).

Therefore to get actual stage abundancies if the binomial distribution is used, the survival chances must be multiplied by the previous stage abundancies in order to obtain the current stage abundancies.

6. Research Methodology

The research methodology that was used mainly involved the collecting of information on various population projection models in order to find out if they are suitable for projecting household sizes with respect to time according to individual age ranges. The “Rramas” model was the one that was found suitable for this purpose. It was practically tested in the R environment by applying it to hypothetical data representing initial household abundancies at the different age ranges, in order to determine future household abundancies.

The proposed population estimation model was then developed based on the theory outlined in the previous section. The R programming language was used for the coding together with “Rstudio” Integrated development environment (R Core team, 2014). Hypothetical initial household abundancies according to age ranges were then also used as an input into this model in order to determine future household abundancies.

The “microbenchmark” routine was then applied in order to compute and compare the execution times for these 2 functions (Mersmann, 2018; R Core team, 2014). A summary of the results was then presented.

The sensitivity of the function outputs for each of the 2 functions with respect to the input parameters was also evaluated and a summary of the results was also presented.

7. Findings and discussion

i. Ability to estimate future household sizes per given age ranges

Both methods have the ability to predict household sizes by making predictions based on household size age ranges. The vector of initial abundancies in the “Rramas” model is the basic unit that allows for this kind of prediction using “Rramas”. This functionality is incorporated into the proposed model using looping procedures. These procedures loop across the number of households, the period of analysis, and the age ranges. Thus they are 3 dimensional loops. Although the use of loops generally slows down the code execution time, it was still adopted since direct vectorization was not possible.

ii. Effectiveness in predicting total Household size

Both methods are effective in predicting total household sizes (Each household has been assigned a unique ID in the tables) with respect to time, and creating graphs to this effect. The “summary” function in “Rramas” both graphs and implements this functionality of total household size computation per analysis period unit. The outputs shown in Table1, Table2, and Table3 illustrate the pattern of growth and decline. They apply to the same households, and so can be compared side by side. As can be seen, the initial state of the 2 groups of households in 2010 was the same.

The proposed model can also both graph and perform the total household size computation with respect to time by summing the household sizes across age ranges. As indicated by both tables corresponding to each of the 2 models, households typically go through a process of initial household growth, and later decline in size due to children leaving the family or increasing mortality rates with age. This is more pronounced in the “Rramas” table (Table2, that includes both population and environmental stochasticity), but an equally pronounced effect can be created with the proposed model by increasing the mortality rates and/ or emigration rates of households. This pattern of household size decline becomes more pronounced in the later stages of the projection period. A longer the projection period leads to a magnified household size declining the effect especially in the later stages of the projection period.

Table1: Predicted household population sizes for various years using the proposed model

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID										
A	2	2	2	2	2	2	2	2	2	3
B	5	5	5	5	6	6	6	6	6	6
C	4	4	4	4	4	4	4	4	4	4
D	8	8	9	9	10	10	10	11	12	12
E	9	9	9	9	10	10	10	10	10	10

Table 2: Predicted household population sizes over various years using “Rramas” with both population and environmental stochasticity included

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID										
A	2	2	3	3	3	4	4	4	4	4
B	5	7	6	7	8	7	7	8	7	6
C	4	4	3	3	4	4	4	3	3	4
D	8	8	8	9	9	8	9	10	9	9
E	9	7	7	8	9	10	11	10	9	9

Table 3: Predicted household population sizes over various years using “Rramas” without considering population stochasticity.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ID										
A	2	2	2	3	3	3	3	3	3	3
B	5	6	6	6	7	7	7	7	7	7
C	4	4	4	4	4	4	4	4	4	4
D	8	8	8	8	9	9	11	12	13	13
E	9	8	9	9	9	9	9	9	9	9

Wilcoxon signed rank test for similarity of results

A Wilcoxon signed rank test with pairing was done twice to test for the similarity of the output results from both “Rramas” and the proposed new model. The new model results were tested against the “Rramas” output results that were obtained after considering both environmental and population stochasticity. The testing was then repeated using “Rramas” output results that never included population stochasticity. The method used was a “Signed Wilcoxon rank test with continuity correction”. Both tests were done at 5% or 0.05 level of significance.

Null Hypothesis 1: The predicted household sizes from the proposed model and the predicted household sizes from “Rramas” model with both environmental and population stochasticity being considered, are from identical populations

Null Hypothesis 2: The predicted household sizes from the proposed model and the predicted household sizes from “Rramas” without population stochasticity being considered are from identical populations

Since the p-values for both test1 and 2 (according to Table4) are all greater than 0.05 level of significance, both null hypotheses are accepted at the 5% level of significance. This indicates that at the 5% level of significance, there is no significant difference between the household population projections from “Rramas” and the household population projections from the new model.

However since the p-value for test1 is much greater than the p-value for test 2, it indicates that the household size population predictions from the new proposed model are much more similar to those from the “Rramas” model that takes into consideration both population and environmental stochasticity than to those from the “Rramas” model that does not have population stochasticity considerations.

Table4: Summary of the test results that indicate the ability of the new model to predict household sizes compare to the “Rramas” model at the 5% level of significance.

Test specifications	W-stat	p-value	null-value	Alternative Hypothesis
test1(population and environmental stochasticity in “Rramas”)	280	0.764	0	two-sided
test2 (no population stochasticity in “Rramas”)	170.5	0.147	0	two-sided

Speed of computations

When population and environmental stochasticity are not taken into account, the “Rramas” model is much faster (about 8 times faster) than the proposed model (Table 5). However when population and environmental stochasticity are taken into account, the proposed model is much faster (about 17 times as fast) than the “Rramas” model (Table 6). Reducing the number of repetitions per function model computation in “Rramas” directly reduces the time taken to perform evaluations. Table 6 and Table 7 show that a 10 fold reduction in the number of repetitions in “Rramas” makes the computations run almost 10 times faster under “Rramas”. However it has to be noted that environmental and population stochastic considerations need to be included into the “Rramas” model to make its computations more realistic to the usual household size behavioural patterns. Making stochastic considerations will require using several repetitions per functional run in order to

get both the best estimates of household sizes per given age ranges, and the uncertainties in household size estimation. These however will unavoidably come at the cost of significantly reducing the “Rramas” model computation time as shown in the tables. If “Rramas” is say 17 times slower, it will imply that a computation task that normally will be done by the proposed model in 1 second, will be completed by “Rramas” in 17 seconds. The computational time factor is especially very important, because household population predictions are normally just part of the overall solution to the housing problems being investigated. Minimizing computational time at each stage is very important, especially in situations where many functional runs have to be made, with the goal of optimization. Where an optimization requires 300 functional runs, it implies that the proposed model would take 300 seconds (5 minutes), the “Rramas” model would take 85 minutes (1 hour and 35 minutes). The tables below illustrate the 2 functions whose computation times are evaluated under 3 different scenarios. The minimum (min), mean, median, and maximum (max) times taken are indicated in *milliseconds*. The functional evaluations done to determine the computational speed are run over a 6 year period in both models (2010 to 2015). “Rramas” is an approved R-package kept online in the repository of approved packages. Its computations are assumed to be based on properly recognized and widely accepted mathematical and stochastic models. The number of functional evaluations or repetitions done by the “microbenchmark” function in R is indicated as “neval”.

Table5: With No environmental and population stochasticity considerations and 10 repetitions per function evaluation to estimate uncertainty

method	min	mean	median	max	neval
Proposed model	1005.577	1005.577	1005.577	1005.577	1
Rramas	145.4837	145.4837	145.4837	145.4837	1

Table6: With environmental and population stochasticity considerations and 10 repetitions per function evaluation to estimate uncertainty

expr	min	mean	median	max	neval
Proposed model	994.4235	1152.684	1080.098	2802.906	100
Rramas	16390.97	17582.80	17084.20	29876.23	100

Table7: With environmental and population stochasticity considerations and 1 repetition per function evaluation to estimate uncertainty

method	min	mean	median	max	neval
Proposed model	976.9271	1076.278	1028.725	1342.680	100
Rramas	1594.6291	1751.338	1710.765	2328.953	100

Sensitivity to varying parameter values

The sensitivity of the 2 models also differs. Table1 and Table2 illustrate this fact. If the year of analysis is considered as the varying parameter, the “Rramas” model with both population and environmental stochasticity considerations is quite more sensitive to changes in year of analysis compared to the proposed model. There are more frequent changes in household sizes with respect to year of analysis in the “Rramas” model compared to the proposed new model. Though not indicated in the tables, the likelihood of the Rramas model to produce changes by amounts ranging from 0 to 3 people across consecutive years is high. On the other hand there is a high likelihood of the proposed new model to produce household population changes by amounts as low as 0 or even 1 person across consecutive years. The “Rramas” model’s sensitivity is quite higher compared to the proposed model. Therefore fine tuning the parameters entered in order to produce the desired output is more difficult with the “Rramas” model. This idea also applies to other parameters like the parameters of the transition matrix for “Rramas”.

Summary of effectiveness of the proposed new model in household population estimation

Compared to the “Rramas” model, an evaluation of the proposed new model is therefore presented below:

At the 5% level of significance the household population projections of the proposed new model and of the “Rramas” model are not different.

The proposed new model takes a shorter computation period for household population sizes compared to the “Rramas” model

The sensitivity of the proposed new model to input parameter changes is lower compared to the “Ramas” model.

8. Conclusion and further research

This research has highlighted the importance of computation of household sizes with respect to time for some researches that deal with housing studies. Very few models exist that can compute household sizes across age ranges. Most models are tailored to computation of population of species in general and so do not yield the expected trajectory paths of household population changes, which are usually a mixture of early growth and later decline in sizes, coupled with stochastic or uncertainty effects. The “Ramas” package was the best available package on hand to do these computations. However to be effective, population and environmental stochasticity have to be incorporated into it, which eventually makes it very slow in terms of execution time. This, together with its high sensitivity to input parameters necessitated the development of an alternative model. The proposed model makes a good attempt to address the shortfalls of the “Ramas” model for the task at hand.

Proposed further research can deal with:

How to further improve the speed of the proposed model, especially if it is to be applied in optimization routines.

Testing the performance of the model if the binomial distribution was used in the model instead of the uniform distribution.

Acknowledgements

The research is part of a larger research project being done at PhD level at the Nelson Mandela University. The authors wish to thank the Nelson Mandela University, Department of Construction Management for the guidance they are offering in development of the research.

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The review on sustainable development trade-offs in metropolitan areas: New Urbanism Perspective

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Abstract

Sustainable Development Goal number eleven calls for the formation of inclusive and sustainable cities in terms of the provision of quality and resilient housing, safe and adequate basic services, upgrading of slums, accessible transport systems, and reducing adverse environmental impact. In order to realize this goal, a balanced and comprehensive approach in terms of environmental, social and economic development is critically important. Ironically, the agenda towards the realization of sustainable development in large cities, particular in developing countries, has been hampered by the trade-offs in favour of economic growth over the social wellbeing and ecological viability aspects. Against this background, this paper seeks to highlight the plight in relation to social and environmental development in the context of sustainable development in the metropolitan cities of South Africa. Methodologically, this paper applies a Descriptive Statistical Analysis on a secondary data which is based on social and ecological development factors published by the Statistics South Africa in 2017. The paper further applies the principles of New Urbanism to discuss the findings thereof. The key finding of the study is that a noticeable proportion of households in the metropolitan cities of South Africa are still living in informal dwellings; have poor quality of the subsidised housing; have substandard sanitation facilities; and are experiencing environmental problems such as littering, water and air pollution, land degradation, and excessive noise. These results suggest that most of the metropolitan cities in developing countries, South Africa in particular, have a backlog in terms of delivering on the social wellbeing and ecological viability aspects of inclusive and sustainable cities. Thus, development planning in the metropolitan cities should equally pay attention on the social and environmental aspects of sustainable development in order to improve the quality of life of the people comprehensively.

Keywords: Sustainable Development, Metropolitan Cities, New Urbanism, South Africa

1. Introduction

Metropolitan areas are generally known to be the concentrated centres of economic activities and economic growth engines for many countries in the world (Coetzee, Waldeck, Le Roux, Meiklejohn, Van Niekerk & Leuta, 2014; Moyo, 2015; Gupta & Vegelin, 2016; Bartkowiak & Koszel, 2017). According to the Global Metro Monitor (GMM) (2018) Report, the 300 largest metropolitan areas in the world account for 36% of global employment growth, and 67% of the global Growth Domestic Product (GDP) growth. The report also indicate that more than half of the world's population is now living in cities and metropolitan areas in particular. In the face of the increasing population in the metropolitan areas as a result of economic opportunities, the accomplishment of inclusive and

sustainable cities in terms of safe and resilient human settlements, sustainable transport systems, improved air quality and waste management system is dubious. The literature on sustainable development and politics reveals that achieving a balanced sustainability in cities, which implies no compromises between the economic, social and ecological goals, is very rare (Leach, Fairhead, & Fraser, 2012; Lorek, & Spangenberg, 2014; Gupta & Vegelin, 2016). In practice, politics tend to make trade-offs in favour of the economic growth goal, at the expense of the social and ecological goals (Lorek & Spangenberg 2014; Majam & Uwizeyimana, 2018). In this regard, the constructors of the Sustainable Development Goals (SDG) are being criticized for not articulating how, in practice, the different issues would be addressed to reach overarching goals, and how the competing goals and trade-offs would be managed (International Council for Science & International Social Science Council (ICSISS), 2015) in order to achieve a comprehensive quality of life of the people. Against this background, the article seeks to highlight and illustrate the social and environmental plight in the South African metropolitan areas which are cities that are overwhelmingly being portrayed as the leading role players in realizing the inclusive and sustainable form of development in the African continent. Most studies in the field of development have primarily focused on the economic growth of the metropolitan areas, and neglected the social and environmental aspects. This article, therefore uses a secondary data on social and environmental development factors in the South African metropolitan areas to highlight the neglected issues of social and environmental development in the cities of the country. The data is then explained from the principles of new urbanism development approach which echoes the ambitions of the SDG: 11 in terms of the formation of inclusive and sustainable cities. Understanding the prevalence of the adverse social and environmental conditions in the metropolitan areas is important, not only for redressing the skewed development practices in the metropolitan areas, but also to highlight the concerning serious threats of environmental public health risks to which the residents in the cities are exposed. The first section of the article addresses the key dimensions of sustainable development

2. Key Dimensions of Sustainable Development

Theoretically, sustainable development refers to economic development that takes economic, social, and environmental dimensions into equally consideration (Gupta & Vegelin, 2016). Therefore, in order to achieve sustainable development, there should be no compromise between the economic, social and environmental goals (Leach *et al*, 2012). However, in practice, the economic dimension often takes precedence over the other dimensions.

i. Economic dimension

The economic dimension of sustainable development primarily focus on the improvement of the economic growth of a particular country or region. From the economic dimension perspective, the cities' development is measured in terms of the GDP and employment growth rates (Moyo, 2015; Global Metro Monitor, 2018). With the economic dimension, the focus is to verify which countries or cities are generating a certain level of added value and income distribution within its locality (Mignaqui, 2014). The obsessed emphasis on economic growth eventually result to exhaustive use of natural resource and environmental degradation (Gupta *et al*, 2016), which as a result undermines the social wellbeing and the ecological viability aspects of sustainable development.

ii. Environmental dimension

The environmental dimension of sustainable development seeks to promote economic development that is considerate of the environmental viability. This include supporting development initiatives such as the use of low-carbon technologies (Moyo, 2015), cleaner energy-driven vehicles (Dill, 2006), green buildings industries (Mason & Fredericksen, 2011), generation of energy from waste (Lorek & Spangenberg, 2014), low carbon or non-carbon emitting renewable energies (Fujii, Iwata, Chapman, Kagawa & Managi, 2018), and conservation of biodiversity (Leach, Fairhead & Fraser, 2012). Such development initiatives are referred to as green development, and are generally commended for having positive benefits to the economy as well as on the social wellness of the people in the cities.

iii. Social dimension

The social dimension of sustainable development refers to the state in which people in their social life enjoy a sufficiently high quality of life resulting from a combination of various specific factors (Rydzewski, 2019). These factors can include satisfaction with health and education services, public safety, employment, earnings and income, housing condition, family stability, and equality (Wallece & Lu, 2018). On the same note, Mignaqui (2014) adds that the social dimension of sustainable development may also refers to guaranteeing a certain level of basic need fulfilment for the general population in terms of access to provision of water and sanitation, and access to sociocultural facilities. In essence, the mandatory responsibility of the provision of basic services by the metropolitan municipalities is critical in enhancing the quality of life of the people in the metropolitan areas. Equally, the improved quality of life is one of the underlying principles of the New Urbanism development approach, as it is reflected in the next section.

3. Theoretical Framework: New Urbanism Approach

The New Urbanism is one of the most influential planning approach since the late 20th century (Joseph, Chaskin & Webber, 2007; Liu, 2012; Rahn timer, Roshani, Hassani & Hossienpour 2012). The New Urbanism approach has been introduced to influence the urban planning practice in terms of improving environmental sustainability and the general quality of life of the people in regions, cities and neighbourhoods. To this extent, proponents of the new urbanism maintain that this approach is ideal to creating appropriate urban environment in humanistic scale in response to the need for improvements in the framework for urban sustainable developmental goals (Rahn timer et al, 2012). Therefore, in the face of the deteriorating environment and social qualities in urban areas, the new urbanism planning is commended for creating liveable neighbourhood, housing and friendly atmosphere for pedestrians (Rahn timer et al, 2012), enhancing the provision of high quality basic services (Joseph, Chaskin & Webber, 2007), remedying the rapid urban sprawl (Mason & Fredericksen, 2011), and ultimately improving the urban living conditions (Liu, 2012). In essence, the new urbanism planning approach is often proposed as a more sustainable form of urban growth at both the neighbourhood and regional scale (Dill, 2006). The new urbanism provides set of principles (Table 1) which its outcomes are consistent with the fundamentals of sustainable development in terms of environment, economy, and social (Congress for the New Urbanism, 2005) wellness and viability.

Table 1: New Urbanism principles and implications thereof

New Urbanism Principles	Implications
Walkability	Most of facilities should locate in distances suitable for walking; ideally ten minutes walking distance from home to work.
Connectivity	Connect street networks that distribute traffic and make walking more easily and satisfying.
Mixed Use & Diversity	Mixing socioeconomic facilities such as shops, offices, apartments and houses for a diverse range of people from different ages, classes, cultures and races
Mixed Housing	Provision of a range of housing types, sizes, tenure and prices in close proximity to each other.
Quality Architecture & Urban Design	Emphasis on beauty, aesthetic, resilient built environment such as housing and public facilities in order to make human spirit convenient
Traditional Neighbourhood Structure	Provide public open spaces for communal use and design public realm and open space quality such as civic art. Including a variety of uses and congestions in walking distance.
Transect Planning	The most and least densities in city centre and gradual reduction of densities toward suburbs

Increased Density	More buildings, residence, shops, and services clustered together for ease of walking as well as to enhance efficient use of resources and services.
Smart Transportation	Provision of high quality network of railway systems that connect cities, towns and neighbourhoods. Design road networks which support pedestrian and emphasis on walking as a way for daily use.
Sustainability	Eliminate environmental side effects, and use environment friendly technologies that respect environments and natural systems values. Promote energy efficiency, less use of fuel, more walking, and less automobile.
Quality of life	Taken together these add up to a high quality of life well worth living, and create places that enrich, uplift and inspire the human spirit.

Source: Congress for the New Urbanism,(2005)

These principles cover three broad intended outcomes: namely, (1) reduced automobile use and more walking and cycling; (2) increased diversity of land uses and people; and (3) increased social capital, through citizens taking responsibility and strengthened personal and civic bonds (Dill, 2006). Beyond the afore mentioned outcomes, the principles also seek to realize high quality and aesthetic of the built environment such as housing; close proximity between homes, schools, and place of workplaces; efficient transport system in terms of time and costs; environmentally friendly lifestyle; better services to improve the quality of life of the people. As such, the new urbanism approach can be used as a perspective through which sustainable development success or lack thereof in developing countries could be understood, mainly because the new urbanism thinking is increasingly having an influence on how and where metropolitan regions choose to grow (Joseph, Chaskin & Webber, 2007; Mason & Fredericksen, 2011; Landman, 2012) in such regions, with reference to South Africa in particular.

4. Sustainability in Metropolitan Areas

While metropolitan areas are generally known to be the engine of economic growth for many countries in the world (Glaeser, 2008; Coetze *et al*, 2014; Bartkowiak & Koszel, 2017), there is an increasing concern globally about the sustainability of metropolitan areas in terms of social and environmental development. Numerical studies have begun to examine the social and environmental adverse effects in the metropolitan areas. For example, Dadashpoor, Azizi and Moghadasi (2019), has studied the land use change, urbanization, and change in landscape pattern in a metropolitan area. In their study they revealed that that most ecological lands such as grasslands have been converted into bare and urban lands over the past two decades. On the same note, Wallace and Wu (2018) published a study on immigration and the quality of life in metropolitan areas in the United States of America, wherein the quality of life is measured in terms of

socioeconomic factors including health, public safety, education, employment, earnings and income, poverty, housing, family stability, and equality. They found that immigrant concentration tends to have negative effects on urban quality of life in terms of economic well-being, social wellbeing, healthy living, and urban mobility. Another study conducted by Yudhistiraa, Indriyanib, Pratamaa, Sofiyandia and Kurniawana (2018) on transportation network and changes in urban structure in Jakarta Metropolitan area reveals that improvements in highway and railway access promote population growth in city suburbs and non-city suburbs, respectively confirming the process of transportation-led suburbanization. Shockingly, a study on environmental public health risks in European metropolitan areas highlights that air pollution is the highest environmental public health risk, and as a result the associated number of deaths in Athens, Barcelona and London collectively, ranged between 800 and 2300 attributable deaths per year (Mitsakou, Dimitroulopoulou, Heaviside, Katsouyanni & Vardoulak, 2019). Similarly, another study investigated the relationship between urban carbon dioxide emissions and economic growth with reference to transport, energy, residential and industry sectors in metropolitan areas (Fujii, Iwata, Chapman, Kagawa & Managi, 2018). The results of their study demonstrate a positive relationship between urban carbon dioxide emissions and urban economic growth in the metropolitan areas. Evidently, there is a growing concern on the social and environmental wellness in the expense of economic growth in metropolitan areas, which remains a critical issue towards the realization of sustainable and inclusive cities, particular in developing countries such as South Africa.

4.1 *The context of metropolitan areas in South Africa*

In the South African context, metropolitan areas are designated as part of the local government sphere, which is also known as municipalities. In term of the White Paper on Local Government, the metropolitan areas in South Africa are classified as the A category of municipalities, and its metropolitan council is vested with exclusive municipal executive and legislative authority in its area (Republic of South Africa (RSA), 1998; South African Institute of Race Relation (SAIRR), 2014). Accordingly, the metropolitan municipalities have a constitutional mandate to ensure the provision of services to its communities in a sustainable manner; promote social and economic development; and promote a safe and healthy environment (Republic of South Africa (RSA), 1996). In this regard, the metropolitan municipalities have a mandate to administer and enforce its by-laws in relation to issues such as air pollution, building regulations, electricity and gas regulation, municipal public transport, water and sanitation services, domestic waste-water and sewage disposal systems; and solid waste disposal (Local Government, 2014). Geographically, metropolitan areas are characterized by large urban conglomerations, which often consists of multiple towns and cities, and as a result, the metropolitan areas in South Africa are the key contributors to the national Gross

Domestic Product (GDP) given that they consist of industrial hubs/districts as well as extensive commercial activities (Moyo, 2015). South Africa has eight metropolitan municipalities which are based in six provinces (Figure 1), with over 20 million people, equivalent to 38% of the total country's population (Statistics South Africa (Stats SA), 2013).



Figure 1: Map of South Africa showing the 8 metropolitan municipalities

Source: (Adapted from Wikipedia, 2019)

Collectively, the provinces with metropolitan areas have an average contribution of 77% to the country's GDP annually (Stats SA, 2018), hence, the metropolitan areas in South Africa are referred to as the eight largest urbanised and industrialised centres in the country (Moyo, 2014). Apart from the economic agglomeration, metropolitan areas are also characterised by high density forms in term of population and built environment. To this extent, the White Paper on Local Government outlines that "metropolitan areas are large urban settlements with high population densities, complex and diversified economies, and a high degree of functional integration across a larger geographic area than the normal jurisdiction of a municipality" (RSA, 1998; 51) (Table 2). In summary, a metropolitan area can be generally characterised by five components, namely economics, political, environmental, social, and health and education (Wallace and Wu, 2018) factors.

Table 2: Demographics of the metropolitan areas in South Africa

Municipality/Area	Province	Area Size	Population	Population density
Buffalo City	Eastern Cape	2 750km ²	834,997	303.6
City of Cape Town	Western Cape	2 446km ²	4,005,016	1,637.6
City of Johannesburg	Gauteng	1 645km ²	4,949,347	3,008.8
City of Tshwane	Gauteng	6 298km ²	3,275,152	520.0
Ekurhuleni	Gauteng	1 975km ²	3,379,104	1,710.6
eThekweni	KwaZulu-Natal	2 556km ²	3,702,231	1,448.5
Mangaung	Free State	9 886km ²	787,803	79.7
Nelson Mandela Bay	Eastern Cape	1 957km ²	1,263,051	645.4

Source: (Adapted from Stats SA, 2018 and Wikipedia, 2019)

The White Paper on Local Government outlines three compelling reasons for the establishment of metropolitan government in South Africa. These reasons are in accordance with the aspirations of the realization of sustainable and inclusive cities. Firstly, metropolitan government creates a basis for equitable and socially just metropolitan governance given that the urban poor are pushed to the metropolitan peripheries or into spatial pockets of poverty, which are expensive to service and far from job opportunities and recreational and social amenities. Secondly, metropolitan government promotes strategic land-use planning, and coordinated public investment in physical and social infrastructure to avoid the common mismatch between the scale of municipal boundaries and the scale of economic and social activity in the metropolitan area which often happen as a result of irrational land-use planning decisions. Lastly, metropolitan government is able to develop a city-wide framework for economic and social development, and enhance the economic competitiveness and well-being of the city. That is metropolitan government creates the basis for metropolitan development that is socially just and equitable, as well as spatially and economically integrated across the metropolitan area (RSA, 1998). The rationale behind the formation of the metropolitan areas in South Africa suggests that the metropolitan municipalities are entrusted with a catalysts role to lead the agenda of a comprehensive development in terms of environmental, social and economic development. To this extent, the manifestation of Sustainable Development Goal (SDG) eleven in terms of the formation of inclusive and sustainable cities that provide quality and resilient housing, safe and adequate basic services, efficient transport systems, and advanced solid waste management services, is certain in metropolitan areas. Ironically, though metropolitan areas in South Africa, may be seen as the concentrated centres of economic activities and the engine for the country's GDP, the metropolitan areas are also homes to a large (and increasing) number of

population who live in severe poverty, often lacking secure and decent housing, and with no access to basic services (Coetzee *et al*, 2014; Moyo, 2014; Marks, 2017) such as water and sanitation, and electricity provision as it revealed in the following section of the article.

5. Methodology and design

This article uses a secondary statistical data which provides a variety of social and environmental development factors in the context of the metropolitan areas in South African in the year 2018. These data was obtained from Statistic South Africa, a credible and reliable institution of statistics in South Africa. For analysis purpose, the statistical data was converted into histograms and tables through the use of the Microsoft Excel Software. Then, a descriptive analysis of each data set was made. Eventually a deductive discussion is presented based on the data, and the New Urbanism approach is applied as a perspective to explain the findings in the article.

6. Data and findings

The article consists of data and findings in relation to social and environmental development factors which also serves as the measures of the dimensions of sustainable development in terms of social wellness and environmental viability. In this regard, the social development dimension is measured in terms of the proximity to socioeconomic facilities, households' monthly spending on transport service, the nature and quality of the housing infrastructure, access to sanitation facilities, equal access to health services, and the adequacy of food access at household level in the metropolitan areas of South Africa. In relation to the factor of proximity to socioeconomic facilities, the article reveals that there is a wide proximity between where the majority of the people stay and their socioeconomic facilities such as schools and places of work in the metropolitan areas. In this context the proximity to schools is far when assessing the responds for people who walk and those who travel to the nearest school. In the City of Tshwane (21.1%), City of Johannesburg (18.9%), and Buffalo City (16.6%) respectively, a significant number of children travel more than 30 minutes to the nearest school (Figure 2). On one hand, the results also shows that there are very few residents who walk less than 30 minutes to the nearest school in all the metropolitan areas respectively.

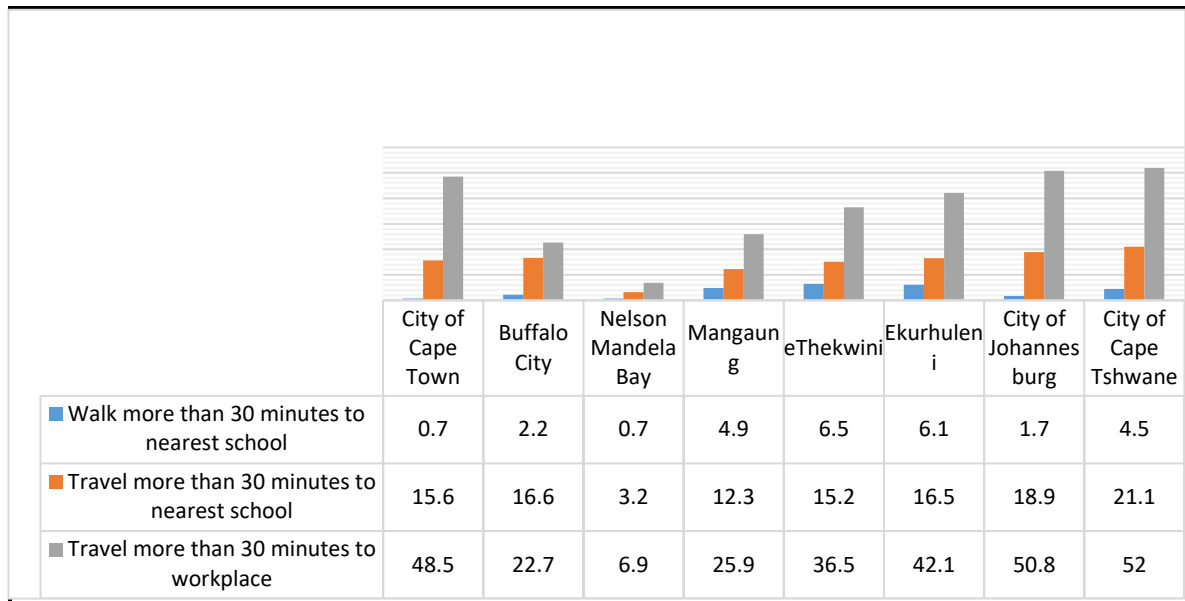


Figure 2: Proximity to socioeconomic facilities

Noticeable, about half of the residents in most of the metropolitan areas indicate that they travel more than 30 minutes to their work places. In the City of Tshwane (52%), the City of Johannesburg (50.8%), the City of Cape Town (48.5%), Ekurhuleni (42.1%), and eThekweni (36.5%) respectively, most of the residents in these metropolitan areas travel more than 30 minutes to their places of work every day. This findings suggest that most of the residents in the metropolitan areas of South Africa are residing in far proximity to their places of work. This assumption could be supported by the level of households' monthly expenditure on transport services as shown in Figure 3.

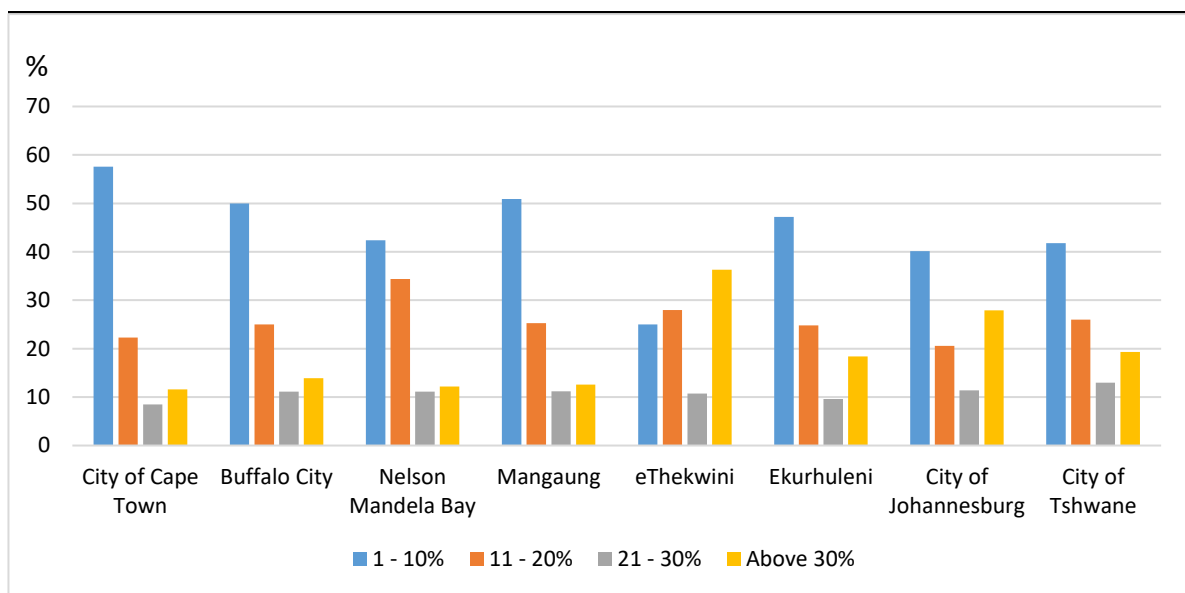


Figure 3: Amount of households' income spent on transport service per month

While most of the residents in the metropolitan areas in the country indicate that they spend less than 10% of their monthly income on transport services, there is a noticeable proportion of residents who indicated that they spend between 11% and 20%, and those who spend above 30% of their monthly income on transport service respectively. In the eThekweni (36%), Ekurhuleni (18%), City of Johannesburg (28%) and City of Tshwane (19%) metropolitan areas respectively, the residents spend more than 30% of the monthly income on the transport service.

There are several residents in the metropolitan areas of South Africa who still lack decent houses. The Buffalo City (27%), City of Johannesburg (21%), Ekurhuleni (20%), and City of Cape Town (19%) have the highest number of residents who live in informal dwellings respectively (Figure 4).

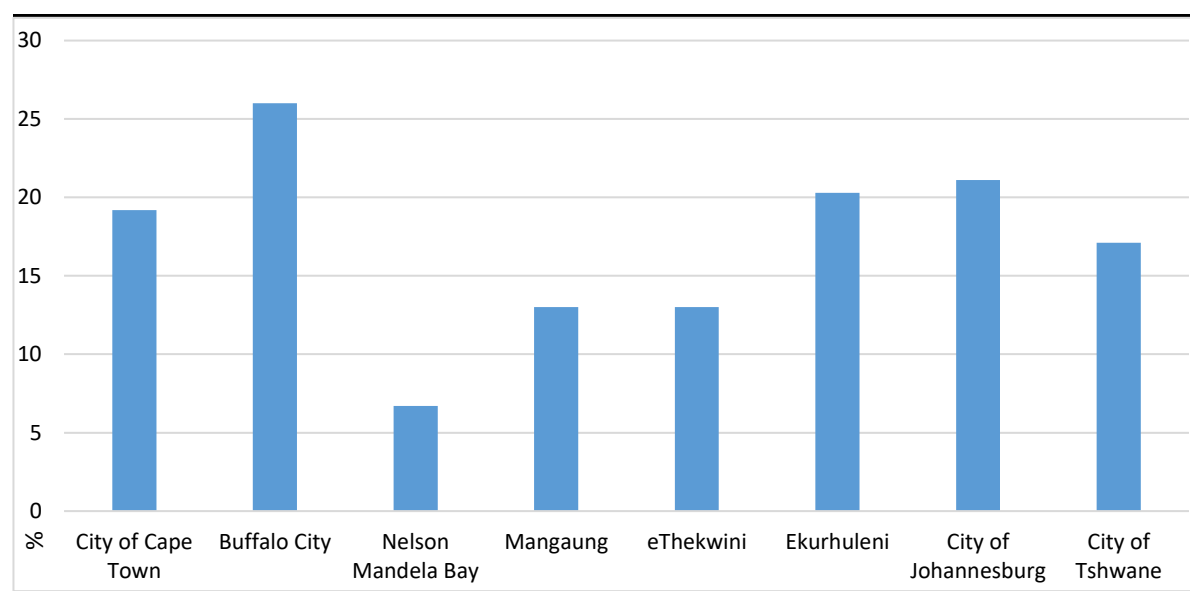


Figure 4: Informal dwellings in the metropolitan areas

The lack of decent dwellings plight in the metropolitan areas is also coupled by the challenge of substandard and poor quality of the state provided housing infrastructure across the metropolitan areas in the country. In all the metropolitan areas, more than 10% of the residents indicated that they have received a government housing subsidy, wherein the Nelson Mandela Bay (29.1%) as well as the Mangaung (24.7%) metropolitan areas have reported the highest number of housing beneficiaries provided by the state (Figure 5).

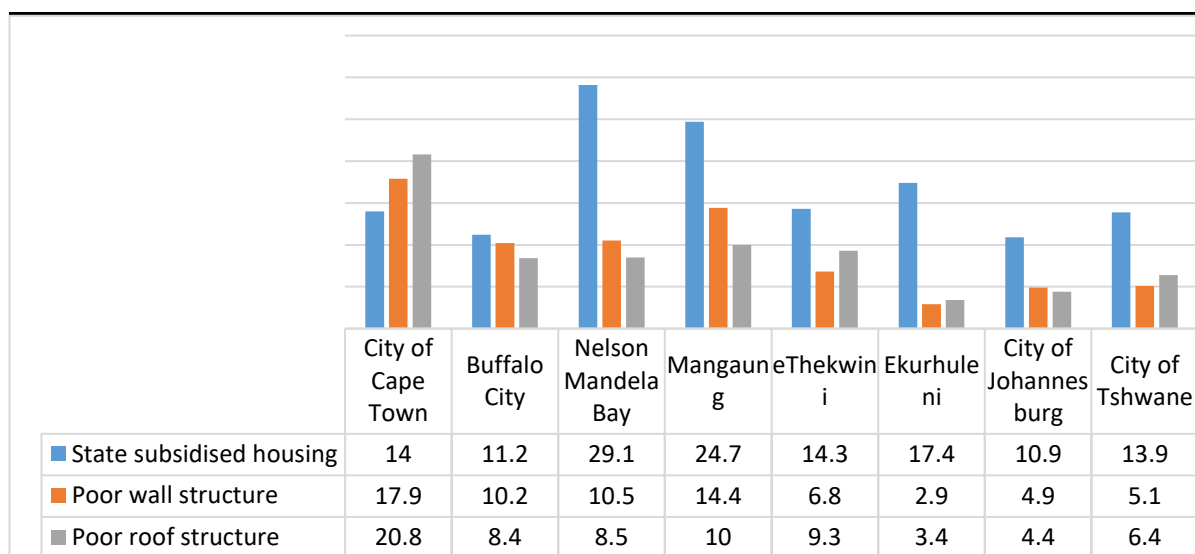


Figure 5: Percentages of state subsidised housing and houses with poor quality

A significant proportion of the beneficiaries of government housing subsidy claim that their housing infrastructure have poor walls and roofs structures in all the metropolitan areas in the country. In the City of Cape Town about 20.8% and 17.9% of the residents have indicated that their houses have poor roofs and wall structures respectively.

While the majority of the residents in the metropolitan areas have indicated to have access to improved sanitation services in their home, a meagre number of residents in the metropolitan areas are still either using substandard toilets, and or bucket toilets or not have a toilet at all. Noticeable, the City of Tshwane (17.2%), eThekwini (13.8%), Ekurhuleni (9.4%) have the relatively higher number of residents who use substandard sanitation facilities respectively (Figure 6).

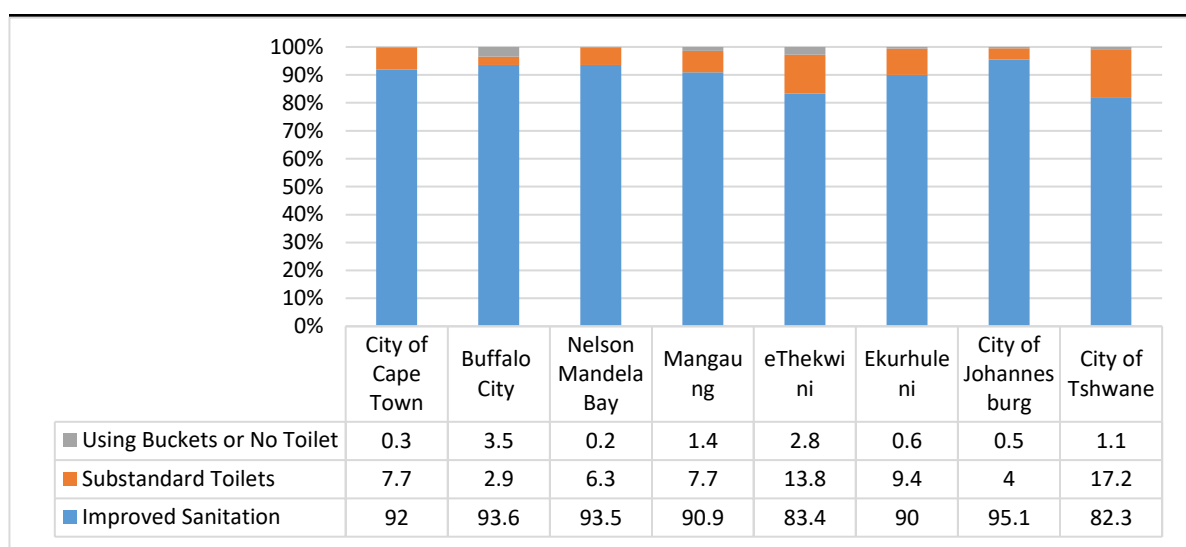


Figure 6: Quality of sanitation facilities

Worryingly, there pockets of residents in all the metropolitan areas who are still using the bucket system or have no access to toilet facilities. The Buffalo City (3.5%) has the highest number followed by the eThekwini (2.8%) metropolitan area.

The plight of the lack of proper sanitation facilities can cause health risk for the residents in the metropolitan areas. When looking on access to health care services, the majority of the residents in the metropolitan areas indicated that they consult with the public health care services.

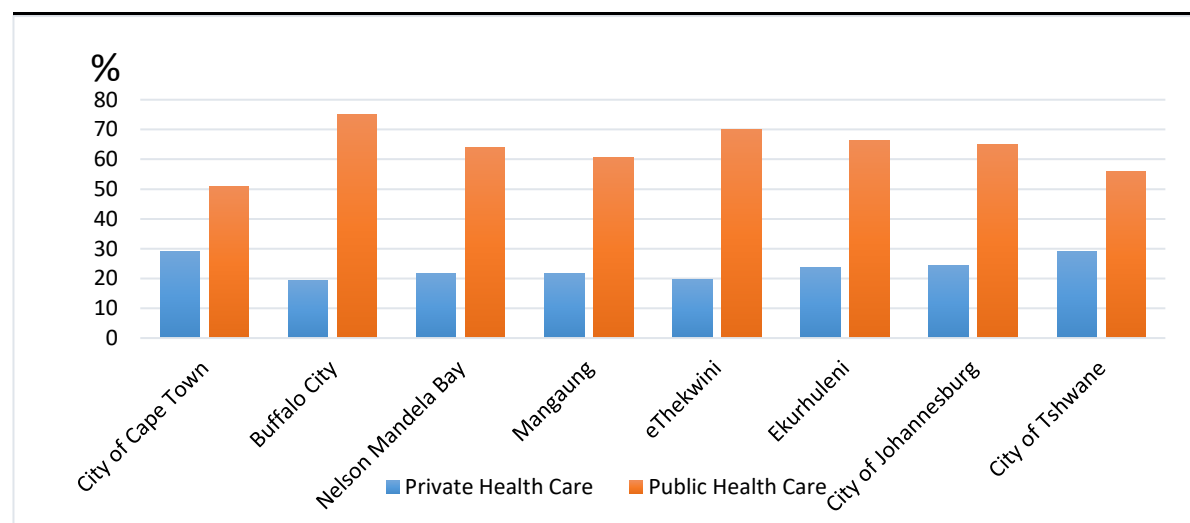


Figure 7: Access to public and private health care services

In all the metropolitan areas in the country, more than 50% of the residents use public health facilities. In the Buffalo City (75%), eThekwini (70%), City of Johannesburg (65%), and Ekurhuleni (66%) metropolitan areas, the figures are relatively higher, respectively (Figure 7). In contrary, there are very few residents in the metropolitan areas who have access to private health care service. In the Buffalo City (19%), eThekwini (20%), Mangaung (22%), and Nelson Mandela Bay (22%), access to the private health services is very limited.

The level of food access in most of the metropolitan areas in the country is reported to be at adequate level. In the Buffalo City (95%), eThekwini (92%), and City of Tshwane (91%) the level of access to adequate food is very high when compared with other metropolitan areas in the country (Figure 8). However, there are other households in the metropolitan areas who have inadequate food security, especially in the Nelson Mandela Bay (22%), City of Cape Town (22%), and City of Johannesburg (18%) respectively.

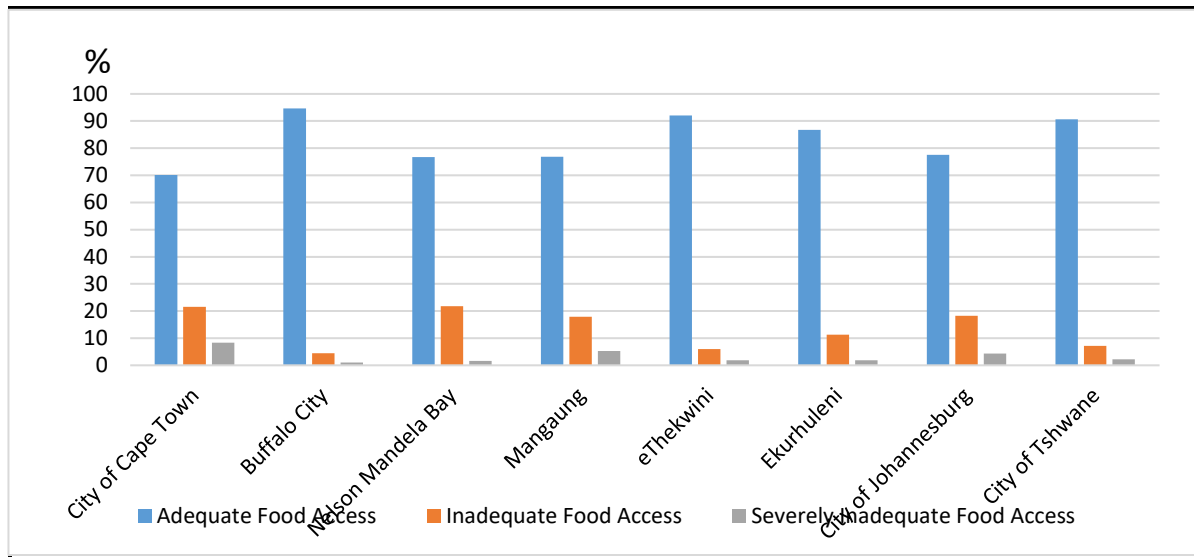


Figure 8: Households' levels of food access

Worryingly, other households in the metropolitan areas their level of food access is severely inadequate. Noticeable, the City of Cape Town (8%), Mangaung (5%), and the City of Johannesburg (4%) respectively have a relative high number of residents whose level of food access is severely inadequate. The severely inadequate food access goes with the environmental problems in the metropolitan areas.

In relation to the environmental dimension of sustainable development, factors including the residents' experience of pollution, solid waste removal service, the use of brown energy, the level of pesticides and herbicides use, and access to water and sanitation are used to measure the sustainability in the metropolitan areas.

In relation to exposure to pollution in the metropolitan areas of South Africa, the residents indicate that they are suffering from multiple forms of pollution, including littering, water and air pollution, land degradation and noise pollution. In this regard, littering and land degradation seem to be the common and prevalent form of pollution in the metropolitan areas of the country. The high level of littering is noticeable in the eThekweni (47.1%), Mangaung (39.1%), the City of Johannesburg (38.6%), the City of Tshwane (33.5%), and the Nelson Mandela Bay (30.6%) metropolitan areas, respectively (Figure 9).

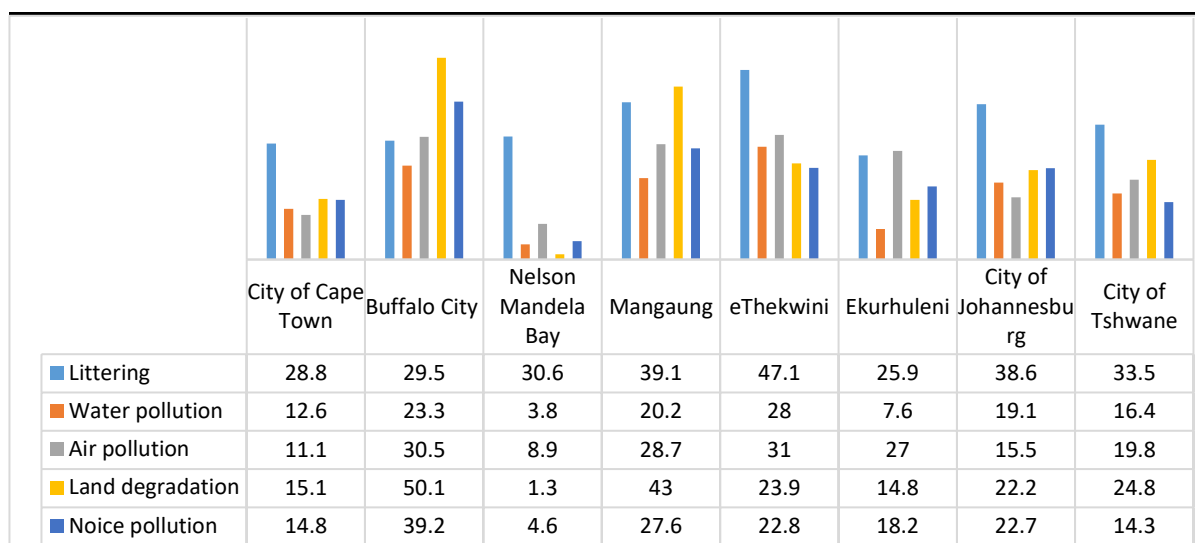


Figure 9: Experiences of the different forms of pollution

On the other hand, the experiences of land degradation is relatively high in the Buffalo City (50.1%), and the Mangaung (43%) metropolitan areas respectively. A relatively high level of air pollution is reported in the Buffalo City (30.5%), eThekweni (31%), Mangaung (28.7%), and Ekurhuleni (27%) metropolitan areas, respectively. A significant number of residents who suffered from noise pollution is indicated in the Buffalo City (39.2%), in Mangaung (37.6%), in eThekweni (22.8%), and in the City of Johannesburg (22.7%) metropolitan areas, respectively. The residents who suffered water pollution are relatively high in the Buffalo City (39%), in Mangaung (28%), in eThekweni (28%), and in the City of Johannesburg (19.1%). The littering pollution can be related to the level of the provision of solid waste management services in the metropolitan areas.

The provision of the solid waste removal service does not reach all the households in the metropolitan areas of the country. There are only three metropolitan areas wherein the provision of solid waste removal service is above 90%. That is, in Mangaung (96%), in the City of Johannesburg (95%), and in Ekurhuleni (92%) metropolitan areas, respectively (Figure 10).

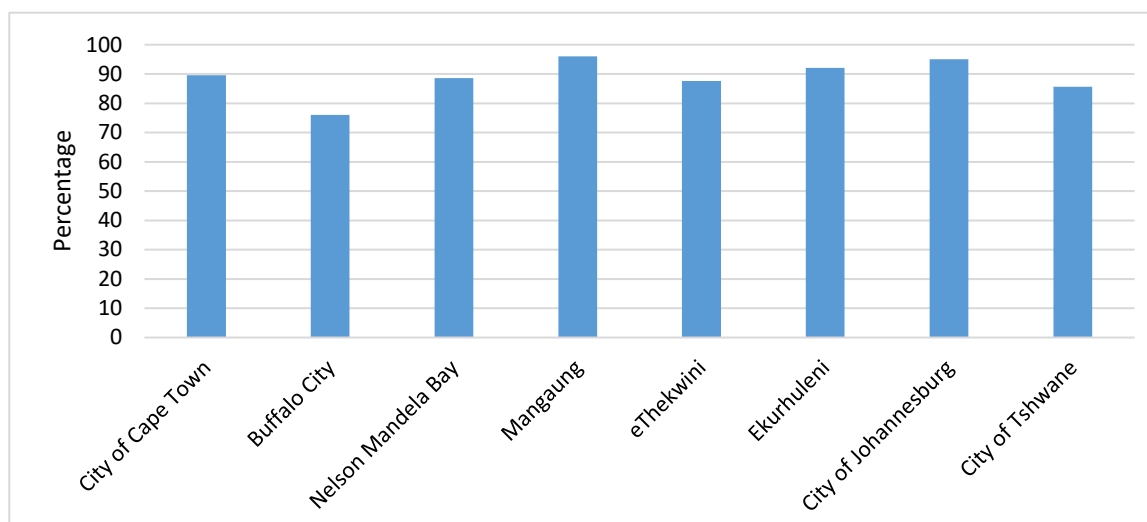


Figure 10: Provision of solid waste removal service

The metropolitan areas with the relatively low number of residents who receive the service of solid waste removal is the Buffalo City (76%), and the City of Tshwane (86%), respectively.

There is a disturbing number of households who still use wood and coal as the source of energy for cooking. A figure of twenty thousand and ten thousand for households who use wood and coal for cooking is recorded in Ekurhuleni and in the City of Tshwane respectively (Table 3).

Table 3: Number of households using wood and coal for cooking

Brown Energy	City of Cape Town	Buffalo City	Nelson Mandela Bay	Mangaung	eThekweni	Ekurhuleni	City of Johannesburg	City of Tshwane
Number of households using wood/coal for cooking	1 000	7 000	0	0	8 000	20 000	4 000	10 000

In contrary, there are no households who have indicated to be using wood and coal for cooking in the Nelson Mandela Bay and in the Mangaung metropolitan areas respectively.

The use of environmentally harmful substances is common in residences of the people in the metropolitan areas of the country. The excessive use of harmful substances such as pesticides and herbicide for domestic purpose is reported in the City of Johannesburg (58%), Ekurhuleni (56%),

eThekwini (55%), the City of Tshwane (55%), and the Nelson Mandela Bay (53%) metropolitan areas, respectively (Figure 11).

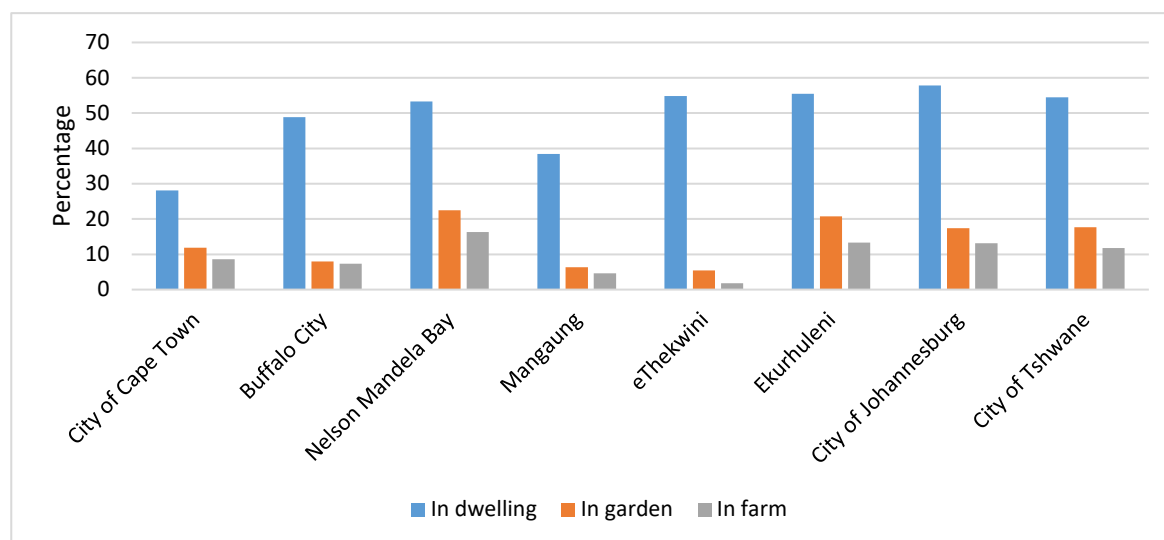


Figure 11: The use of pesticides and herbicides

There is a relatively high number of residents who reported to be using the pesticides and herbicides in their gardens in the Nelson Mandela Bay (23%), Ekurhuleni (21%), and the City of Tshwane (18%) metropolitan areas, respectively. In the same metropolitan areas, the residents have also indicated to be using the toxic substances for farming purposes. The excessive use of such substances may have adverse effects on the environment, particular in the water resources.

While there is a significant proportion of households who receive free basic water and sanitation services as indigents in the metropolitan areas, the number of households who have no supply of in-house water infrastructure and those without toilets or using buckets is an issue of concern in terms of health and environment in the metropolitan areas.

Table 4: Households' access to water and sanitation services

Access to Water and Sanitation Services in the Metropolitan areas	City of Cape	Buffalo City	Nelson Mandela	Mangaung	eThekweni	Ekurhuleni	City of Johannesburg	City of Tshwane	All metros
% of poor households receiving free basic sewerage and sanitation	59,0	48,6	74,2	79,6	61,1	55,6	83,4	39,3	65,1
Number of households with no water supply infrastructure	8 000	6 000	0	15 000	39 000	19 000	24 000	57 000	168 000
Number of households using bucket or no toilets	89 000	7 000	17 000	4 000	23 000	48 000	32 000	13 000	233 000

The proportion indigent households in the City of Johannesburg (83%), Mangaung (78%), and the Nelson Mandela Bay (74%) metropolitan areas is comparatively very high, respectively (Table 4). This figures may be the indication of the scourge of poverty in the metropolitan areas. The number of households with no water supply infrastructure is reported to be one hundred and sixty eight thousand (168 000) across the metropolitan areas in the country. The City of Tshwane (57 000) and eThekweni (39 000) metropolitan areas have a relative high number of households without in-house water connections. Another worrying situation is the use of buckets or no toilets in some households in the metropolitan areas, as it is indicated that a total of two hundred and thirty three thousand households in the metropolitan areas of the country are using buckets for toilets and or have no toilets at all. The City of Cape Town (89 000), Ekurhuleni (48 000), and the City of Johannesburg (32 000) have an alarming rate of households using buckets or without toilets at all.

7. Discussion

The goal towards the realization of sustainable cities is being hampered by the dilemma and trade-offs resulting to bias to economic growth in the expense of the social wellbeing and ecological viability development aspects. In the metropolitan areas where most of the bigger cities are located, the prevalence of social and environmental dreadful conditions is increasingly affecting the quality of life of the people in the metropolitan areas. While metropolitan areas are generally known to be

the engine of economic growth for many countries in the world (Glaeser, 2008; Coetze *et al*, 2014; Bartkowiak & Koszel, 2017), there is an increasing concern about the persistent carbon emission from transport and industry (Fujii *et al*, 2018); environmental public health (Mitsakou *et al*, 2019); poverty and inequality (Wallace & Wu, 2018); ecological degradation (Dadashpoor *et al*, 2019); and inefficient transport system (Coetzee, Waldeck, Roux, 2014). Though one of the fundamental principle of the new urbanism approach is the formation of close proximity between homes and essential facilities such as workplaces and schools, residents in the metropolitan areas, particular in developing countries are spending more time and money for travelling to their places of work and to their nearest schools. Again, in contrary to the new urbanism principle in relation to aesthetic and resilient housing, a significant number of residents in the metropolitan areas are staying in the informal dwellings, housing with poor walls and roof structures, and some have no access to standard sanitation facilities. This poverty condition is also coupled with the experience of inadequate food access and inequality access to health services in the household level. With regard to the health services, the majority of the residents in the metropolitan areas depend on the public health service, which is often criticised for poor provision of health services. Notwithstanding, the new urbanism principle of promoting sustainability and quality of life in the cities (Dill, 2006; Rahnama *et al*, 2012; Marks, 2017), poverty and inequality is rife in metropolitan areas, particular in developing countries. Notwithstanding the consensus that metropolitan municipalities in many countries are entrusted as catalysts role players to lead the agenda of a comprehensive and sustainable development in terms of economic, social, environmental viability (RSA, 1998; Moyo, 2015; Bartkowiak & Koszel, 2017), evidence shows that the environmental viability is neglected in the metropolitan areas. To this extent, the residents in the metropolitan areas are still experiencing different forms of pollution in their neighbourhood. These forms of pollution includes littering, water and air pollution, land degradation, and noise pollution. Moreover, the solid waste removal service is not provided to all the households in the metropolitan areas. The prevalence of pollution may result to environmental public health risks, and eventually lead to number of incidents of deaths in the metropolitan areas (Mitsakou *et al*, 2019). In addition, the use of brown energy such as coal and wood, as well as the use of harmful substances such as pesticides and herbicides, as it is the case, for some residents in the metropolitan areas of South Africa, may also have adverse environmental effects in the long term. The extent to which the country uses the brown energy is outlined by Moyo (2015) when stating that due to South Africa's heavy reliance on fossil fuels such as coal and oil, and also because of its relatively larger industrial base when compared with other African countries, the country is among the world's top 15 most energy intensive economies. As a result, South Africa is reported to "emit about 1% of the global annual carbon dioxide emissions (Industrial Development Corporation)" (IDC, 2013:14). Again, the excessive use of fossil fuel may also suggest that though

the South African government is investing in public transport infrastructure such as the Bus Rapid Transit for example, such transport system does not necessarily generate the required densities to make such public transportation infrastructure viable and sustainable (Coetzee, Waldeck, Le Roux, Meiklejohn, Van Niekerk & Leuta, 2014) in the metropolitan areas of the country. The metropolitan areas of the country still lack the smart transport system in terms of high quality network of railway systems that connect cities, towns and neighbourhoods (Rahnama *et al*, 2012), as it is projected in the new urbanism planning approach. Therefore, the social and the environmental dimensions of sustainable development remain a stagnant problem in the metropolitan areas of developing countries such as South Africa. A high and escalating numbers of people live in poverty and densely informal settlements, and also lives in increasingly vulnerable areas on the periphery of the cities (Coetzee *et al*, 2014), places wherein they are subject to travel for more than 30 minutes to their places of work and nearest school.

8. Conclusion

The goal towards the realization of sustainable development in large cities, particular in developing countries, has been hampered by the dilemma and trade-offs in favour of economic growth in the expense of the social wellbeing and ecological viability aspects of sustainable development. Though metropolitan areas in developing countries such as South Africa may be seen as the concentrated centres of economic activities and the engine for the country's GDP, the metropolitan areas are also homes to a large and increasing number of people who live in abject poverty, often lacking secure and decent housing and with no access to basic services (Coetzee *et al*, 2014; Moyo, 2014; Marks, 2017) such as water and sanitation, and electricity provisions. The residents in the metropolitan areas still use brown energy sources such as coal and wood for cooking, as well as the use of harmful substances such as pesticides and herbicides for domestic and gardening purposes. The prevalence of these adverse social and environmental conditions is not only a great concern towards the realization of inclusive and sustainable cities, but also a serious threat to the environmental public health risks, particular in the developing countries such as South Africa. Further studies should be conducted to measure and quantify the impact of the adverse social and environmental conditions on the environmental public health risks for the residents in the cities, particular in the developing countries.

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Community-driven upgrading for self-reliance in South Africa: the ISULABANTU project in Durban

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Abstract

Spontaneous and self-built neighbourhoods, often called informal settlements, represent one of the most complex challenges worldwide, mostly due to migration and rapid urbanization in developing countries. Characterised by lack of basic services and infrastructure, poorly performing building materials and often located on illegal and hazardous land, unplanned settlements are home to over half the urban poor in African cities (UN-Habitat, 2013).

This paper presents preliminary lessons learned from an ongoing collaborative project entitled ISULabantu¹, which focuses on community led upgrading for self-reliance in South Africa. The overarching aim is to uncover the benefits and challenges of moving towards a participatory, incremental approach focusing on construction management and integrated environmental management systems in the Durban metropolitan area, which can enhance quality of life, livelihoods and, ultimately, community resilience and self-reliance. ISULabantu seeks to enhance skills, explore indigenous knowledge and share lessons between communities and local/national authorities and research institutions. The core vision is to re-examine informal settlements through the lenses of the community by co-producing inclusive approaches for the upgrading of informal settlements. To meet the research goals, an action research based methodology is employed to 'co-produce' knowledge with residents and community researchers in three selected case studies in the Durban metropolitan area. The research identifies grassroots approaches as key strategies to build sustainable and resilient cities. The findings seek to build capacity for both local communities seeking to improve their quality of life and for local authorities seeking to enhance their upgrading planning programmes, plans and policies.

Keywords: informal settlements, self-building, self-organisation, co-production, grassroots approaches, Durban.

1. Introduction

It has been estimated that informal settlements are home to over half of the urban poor in developing nations, with a figure of 61, 7% in the African cities (UN-Habitat, 2015). Despite the global experience of the informal settlement phenomenon, the UN-Habitat (2013) acknowledged that the

¹ The ISULabantu project (<http://www.isulabantu.org/>) is funded by the Economic and Social Research Council (UK) and the National Research Foundation (SA). The project is led jointly by the University of Westminster (UK), the University of KwaZulu-Natal (SA) and, together with University College London (UK), an NGO uTshani Fund (SA) and the eThekweni Municipality (SA).

phenomenon is not adequately addressed. As a consequence of rapid urbanisation and population growth, informal settlements form a major part of the urban landscape globally and therefore constitute a major challenge (UN-Habitat, 2015; Marutlulle, 2017). At the same time, more than half of the global population already lives already in urban areas with a significant increase in projections by 2050; this is likely to increase the impact of issues related to, which is inevitably linked to issues of poverty, inadequate infrastructure, housing and poor living conditions (Majale, 2008; Menshawy et al., 2011).

In South Africa, informal settlements are complex, popular and spontaneous neighbourhoods offering an immediate response to housing and with their location critical for the socio-economic activities of the involved community (Huchzermeyer, 2011). This paper aims to present preliminary findings and lessons learned from an ongoing collaborative project called ISULabaNtu focused on community led upgrading for self-reliance in South Africa. The project – which unfolds through six phases –is currently implementing Phase 5, which focuses on developing an integrated “Collaborative environmental and construction management Toolkit” to enhance community self-reliance in informal settlements. ISULabaNtu² is framed around the holistic view that informal settlement upgrading is not about physical housing per se but rather a socio-technical approach that delivers social capital, livelihood development, empowerment and skills to local inhabitants. The research seeks to support communities by strengthening their capacity to drive urban development themselves. With a focus on Durban Metropolitan Area, South Africa, the study is looking at informal settlements through the lenses of their residents and is co-producing upgrading solutions to feed into the creation of an integrated environmental and construction management toolkit. This paper presents preliminary lessons learned from the extensive fieldwork activities over the last three years of the project (2016-2019).

2. Defining informal settlements

Informal settlements have been defined and interpreted very differently across the Global South. The meaning and connotations behind this concept vary considerably with the context and other specific parameters. According to Srinivas (1991) informal settlements may be defined as residential areas which developed without formal legal standing or claim to land. They have some common features such as inadequate services and infrastructure (Klug & Vawda, 2009). Informal settlements are characterised by self-help efforts, often illegal, and considered *‘informal’* as they do not align

² The name “ISU” has a twofold meaning: it is an acronym for Informal Settlement Upgrading and also means a ‘great idea’ or a ‘vision’ in isiZulu. LabaNtu instead, stands for people in Isizulu and it is an acknowledgement of the community engagement as community researchers are co-investigators in this project.

with prevailing regulations. In the self-help efforts residents make use of the limited resources available to them for the purposes of erecting shelter on interstitial or marginal land (Ojo-Aromokudu & Loggia, 2017) often close to economic, social or survival benefits. Dovey and King (2011) record that informal settlements often form small pockets of irregular, unconventional, substandard, unregulated human settlements, with few instances where informal settlements take up larger geographical area as in the case of Dharavi in Mumbai, Rocinha in Rio de Janeiro, Kibera in Nairobi, and Ezbet el-Haggana in Cairo.

Unplanned settlements may be defined by certain characteristics: physical, social and legal. Physical characteristics refer to poor services of networks (water, sanitation, electricity, and roads) and inadequate physical infrastructure constructed from a variety of materials including corrugated iron, plastic, clay, timber and metal sheeting (Marx & Charlton, 2003). Some literature attempts to distinguish between 'slums' and 'informal settlements'. Slums often refer to physical aspects; i.e. buildings, facilities and services (particularly sanitation and waste management) in inner cities that gradually deteriorate into slummed conditions, due to overcrowding. Informal settlements are related mostly to the legal standing of the scheme; namely, settlements that mushroom on vacant land, within and around places of opportunities, without proper planning, building regulations or standard construction methods (Khalifa, 2015). In South Africa, however, a clear departure from Apartheid terminology included the term 'slum' being mainly replaced in policy by 'informal settlements' (Huchzermeyer, 2011).

Most of the definitions emphasize the dwelling type as a dominant feature of informal settlements (e.g. shacks built of temporary and poor materials) (The Housing Development Agency, 2013). Moreover, several definitions refer to ownership of the land, the nature of land tenure and formal demarcation. The SA Department of Human Settlements (DoHS, 2009) defines informal settlements on the basis of the following characteristics:

- illegality and informality;
- inappropriate locations;
- restricted public and private sector investment;
- poverty and vulnerability; and
- social stress

According to Huchzermeyer (2011:112) "*Shacks, that are the visible dimension of informal settlement, remained an embarrassment to the newly elected democratic state (after apartheid) and thus they decided to replace them by neat estate of pitched roof houses*".

Roy (2011) suggests a more progressive interpretation of informal settlements as spaces of habitation, livelihood, self-organisation and politics. This concept moves away from the pathology of Informal settlements that need to be fixed and envisages their huge potential in terms of dynamic places of living for those who cannot afford formal housing. In fact, these settlements grant the households an entry point into the city, allowing them to participate in the economies where migrants can acquire valuable information, job contact and skills to grant the access to employment. These reception areas (informal settlements) also assist the households to reduce their costs of living, more specifically for those with low paying, entry-level jobs. Most informal settlements are in fact cleverly well located in relation to employment and job opportunities, as this plays a vital part in cutting down the transport costs (Huchzermeyer, 2002).

3. Approaches to informal settlements upgrading

Physical upgrading of informal settlements takes two general approaches: demolition and relocation or in-situ development. Demolition and relocation is the process of moving inhabitants from their settlements to another 'greenfield' site. However, in-situ upgrading is generally preferred as this involves the formalisation of informal settlements in their original location (Del Mistro and Hensher, 2009; Huchzermeyer, 2006; Massey, 2014). One of the main critiques of demolition and relocation is that this approach is motivated by the macro-economic target of the government to meet the housing shortage and not the improvement of poor living conditions. This has led to conflicts and significant socio-economic disruption with little regard to displacement, poverty, vulnerability and the impact of these actions on social inclusion. In-situ upgrading is the process undertaken to improve the conditions of an informal settlement in its current location through the provision of basic services and secure tenure to people. This model recognises three conditions: *"the property rights, the property values and the physical attributes of the underlying assets, and the impact on each other"* (Mukhija, 2002:554). In-situ projects can be wide-ranging, from simply dealing with land tenure to incremental housing improvement and/or the provision of site-and-services associated with formal settlements.

In South Africa, the democratic government, since 1994, has applied different strategies. They range from the *Roll-over* upgrading, which involves the removal of residents from their informal settlement shelter into temporary accommodation called transit camps to the *Partial relocation*, for dense settlements where some removal is necessary to make way for access and services. Lastly, the most effective strategy is the in-situ upgrading, which aims to reduce the interruption of social and economic networks by decreasing the number of households relocated to another site or elsewhere on the site (Del Mistro and Hensher, 2009).

3.1 Community-driven upgrading

Self-help can be seen as consequence of what Pugh (2001) relates to the inadequate supply of government driven housing. According to Ntema (2011), this concept involves practices in which poor low-income communities address their housing needs incrementally through their own resources and at their own pace. It presents an opportunity for community-led upgrading to be achieved, with the communities being the drivers of their own upgrading projects with the government as a support structure – that is the so-called *dweller control*.

In South Africa, this type of approach has been firstly implemented through the People Housing Process (PHP), followed by the Enhanced People's Housing Process (EPHP). The PHP approach to housing provision was approved in 1998 as a self-help housing scheme inspired by the work of the homeless people's federation and saving schemes from around the globe. The PHP has been a feature of the National policy; nevertheless, many provinces resisted it in favour of private sector delivery (Napier, 2003).

For the past two decades the housing policies have been promoting the laissez-faire self-help housing concept and freedom to build when the state delivery system has failed to meet the housing demands of the people. Therefore, community and NGO led initiatives became a convenient alternative for the state, where there is full dweller control and room for innovation. In this instance beneficiaries who have been involved in community led projects have a better housing product than of those under the RDP and state led upgrading projects (Ntema, 2011).

However, in most cases, government-led initiatives have a tendency to downplay the progressive nature of self-help housing and its potential benefits. Tissington (2010) argues that this is apparent due to the government policies being framed around certain paradigms that emphasise acceleration of delivery, reduction of backlog and reduction of informal settlements which translates to quantity over quality. The above contradicts Turner's initial self-help ideologies that believe that government should be enablers rather than providers. The World Bank definition of community participation has three dimensions; the first being the contribution in decision-making about what should be done and how, for all those affected, the second is mass involvement to the development effort and the third is sharing the benefits of the programme (White, 2011). Community participation stems from self-help upgrading linked to planning processes on grassroots level where the power of decision is left to the local populations on the future of their own settlement (Lizarralde and Massyn, 2008).

The existing housing framework supports the active community participation as a key tool in project life cycle of in-situ upgrading programs (DoHS, 2004). The concept of community participation is

becoming very popular; however, in reality, is very difficult to translate into practice. In fact, it often becomes (Jordhus-Lier & de Wet, 2013) “formal, legalized, and politicized”. Moreover, it is common that in participatory upgrading projects most details and plans are actually defined by officials, whereas residents are merely “informed” (not engaged) at a later stage during implementation phases.

4. Methodological approach

i. Co-producing solutions with local residents: The three case studies in Durban

The present study proposes a concept of community-driven upgrading that goes beyond the mere participation and refers to a *meaningful* community participation, where the community takes the lead of the upgrading process and prioritise the interventions. According to some NGO officials interviewed, community led upgrading is:

“...where the community itself chooses which projects need to be priorities for the upgrade through the enumeration of the informal settlements, where the control of the projects is fully in the hands of the community ranging decision making, design of the layout through the consultation with professionals within the SDI.”

The communities themselves, in many cases, approach the municipality to get help with, and they establish a partnership that is beneficial for both the parties. The community-led approach is when ‘people come first and they drive initiatives’.

The research adopted a participatory action research method, applying ‘co-production of knowledge’ (Ostrom, 1996; Mitlin, 2008; Watson, 2014) as the process through which residents in selected case study areas in the Durban metropolitan area. A key objective was to engage in knowledge transfer between the UK and South Africa on how informal settlements can be transformed into sustainable and self-reliant settlements through a meaningful participation of the local residents. The research involved a multidisciplinary team of academics, students, housing experts, NGO groups and community-based researchers. The project applied a novel action research methodology, which involved the co-production of knowledge with local people, community organisations, South African policy makers and practitioners. It is expected that community members will benefit from access to the finalised toolkit and training to improve technical, management and communication skills.

ISULabaNtu offered to the research team the opportunity to engage with the community establishing a collaborative learning environment, in such a way that they learned from and also impart know-how to improve the living conditions in the settlements. For this purpose, the research team has

organised a range of community events, such as in-field training sessions, called *critical conversations* to get feedback from the community and discuss important issues, participatory workshops, and also awareness raising events just before the beginning of fieldwork sessions in a specific area. Since the inception of the project, in February 2016, the ISULabantu team has been supported by the local NGO uTshani Fund in organising these community events and facilitating the meetings and the research activities conducted.

Fieldwork in three case studies, Namibia Stop 8 (Phase 1), Piesang River and Havelock, was conducted to assess the best available practice in community-led upgrading of informal settlements in the Durban metropolitan area. The case study selection criteria involved community leadership, presence of an active support organisation, community self-organisation practices (e.g. saving groups), good documentation of historical development and upgrading models used in the past.



Figure 1. An example of a self-build house in Namibia Stop 8 (Inanda, Durban)

The first case study is Namibia Stop 8 (phase 1) located in the northern region of eThekweni on the outskirts of Durban, and part of the Inanda township. It was built in 2010-2014 by community contractors who delivered 2,500 dwellings providing homes for 10,000 people (SDI South African Alliance, 2012). Residents had been moved there from two settlements: Namibia and Stop 8. The housing provided was a mixture of subsidised houses (RDP) which were 40sqm and FEDUP provided houses which were larger at 56sqm. Namibia Stop 8 has water supply, a sewage system, and access to electricity.

The second case study, Piesang River, is also part of the Inanda Township, 25 km north of Durban city centre. Incrementally upgraded with formal structures in the early 1990's a variety of building types were constructed, such as two-story flats, cottages, and single-story houses. Houses have access to water supply, sewage system and electricity.



Figure 2. Self-built houses in Piesang River (Inanda, Durban)

The last case study is Havelock (in Durban north) an informal settlement with more than 200 dwellings and approximately 400 people living in the settlement (Slum Dwellers International, 2012).

The settlement sits on privately owned and municipality owned land. This area has various hazards such as: illegal electrical connections, dangerous electrical cables sprawled across paths, fire



Figure 3. Self-built dwellings in Havelock (Durban North)

hazards and flooding. The municipality have installed ablution blocks and a detail enumeration has been conducted for the proposed re-blocking of the settlement.

ii. Towards an integrated construction and environmental management resource framework

Extensive fieldwork activities have been carried out by the ISULabaNtu team through four discrete phases, namely phase one (local context & gap analysis), Phase two (mapping urban transitions through community participation) phase three (Integrated closed loop environmental management systems) and phase four (project management and skills enhancement in construction).

Phase I defined the barriers and drivers for bottom-up upgrading in Durban Metropolitan area by undertaking an overview of the status quo of informal settlements, a comprehensive policy review and stakeholder analysis and engaging the various stakeholder practices driving current upgrading processes in the city. In addition, during Phase I, a community engagement strategy was developed and endorsed by the project team members and three case studies have been selected as the best available practices for informal settlement upgrading in the eThekweni area.

Phase II used participatory action research methods to co-produce knowledge with communities and various stakeholders on bottom up construction processes, environmental management and the potential synergies for integrated approaches for slum upgrading. During this phase, the team mapped urban transitions through community participation and identified a set of barriers and drivers to community self-organisation that have informed the Phases 3 and 4.

Phase III worked with households and different stakeholders to investigate the processes, partnership and business models required to promote user-centric and resilient infrastructure provision in informal settlements. The potential for closed-loop environmental systems for settlement upgrading has been assessed together with acceptability for residents and potential linkages between sustainable environments with respect to appropriate sanitation technologies and improved livelihoods, job creation and food security.

Phase IV mapped the tasks and outputs required to build and manage each construction phase and the hard and soft skills required to meet specific project requirements within in-situ participatory upgrading processes. This phase has identified critical success factors in managing self-build upgrading projects, discussing the crucial roles of stakeholder management and project governance, while understanding the balance between formal and informal forms of procurement.

Current estimates in eThekweni municipality indicate that there are about 327,615 households in 476 informal settlements, without any clear plans for upgrading or signs of a participatory process (eThekweni Municipality, 2015). An innovative participatory action planning approach was proposed by the Housing Development Agency (2015) and has been endorsed during the focus group discussions with external stakeholders.

The research showed that full upgrading with services and subsidised housing is not a viable option for South Africa in general, and Durban metropolitan area, in particular. This approach also underpins that the challenge to upgrading is not just housing but a manifestation of structural social change and political endurance. In this context, key principles of a *new approach* to informal settlement upgrading involve (EThekweni Municipality, 2017):

- *city wide*: inclusive of all the informal settlements;
- *incremental*: with a range of different improvement as opposed to the traditional housing delivery;
- *in-situ*: considering relocation as a last resort;
- *partnership-based*: instead of purely state-service oriented);
- *participatory and more community driven*: collaborative informal settlement action, co-management to develop acceptable solutions;
- *programmatic and area-based*: instead of project delivery focused;
- *context related*: differentiated, situationally responsive (as opposed to the 'one-size-fits-all');
- *statutory and regulatory flexible*: working with and not against informality.

The above approach has been consolidated and adopted in the form of the Durban's resilience strategy (eThekweni Municipality, 2017) by the 100 Resilient Cities Programme (100RC) for the city of Durban³. The Durban's strategy recognised the need to rethink new perspectives on informality and accepting it as part of the city. Informal settlement is such a dynamic space that changes continuously and requires appropriate planning strategies that involve (in a meaningful way) the residents. Currently, the housing targets (performance goals) are reducing the approach to informal settlements to a mere set of numbers (delivery target). The key strategy to address this challenge is represented by collaboration and partnership between the local Government and all the other main participants. There is a lack of understanding about the dynamics of informal settlements and there is need for coordinating all the interventions from the different departments of the Municipality. Moreover, the involvement of communities in the planning is generally poor and that implies a high level of mistrust between Municipality and community. Communities are very different and thus responses need to be diversified. Progressive and integrated human settlement policies can be undermined by a focus on numbers (housing targets).

³ The '100 Resilient Cities' (100RC) Programme, pioneered by the Rockefeller Foundation was dedicated to helping cities around the world become more resilient to the physical, social and economic challenges facing urban communities in the 21st century.

5. Conclusion & recommendations

South Africa has an agenda for slum management and response, particularly under the post 2015 UN Sustainable Development Goals (e.g. SDG11) and the Habitat III New Urban Agenda. This paper sought to provide recommendations on how the above experiences and lessons learned from ‘good available practice’ in community-led approaches could be effectively incorporated into the existing upgrading programmes, such as the new Integrated Urban Development Framework and the efforts for city-wide participatory upgrading of informal settlements as part of the 100 Resilient Cities initiative in Durban.

EThekweni municipality has currently ambitious targets to achieve due an increasing backlog on housing delivery. Focus group participants claimed that there are currently about 535 informal settlements, which translate to 25% of population in the KwaZulu-Natal province. Most informal settlements are upgradeable and are already part of the urban form. The government perspective on informal settlement demographics and policy suggests that conventional upgrading (i.e. state funded housing with a full package of services) with tenure security and formal town planning is an unviable solution due to: the increasing backlog; cost; complex land schemes; higher density; and long-time scales. This is why an incremental, city-wide, partnership-based participatory upgrading approach is proposed with lessons learned from communities that have undertaken (even partially) aspects of community-led upgrading.

The ISULabaNtu project is currently under phase 5, which focuses on developing an integrated “Collaborative environmental and construction management Toolkit” to enhance community self-reliance in informal settlements. A review of the existing toolkits for informal settlement upgrading showed two key gaps, namely the missing focus on community-led approaches and the need for an integrated approach to housing and environmental management and gender. In fact, there is a significant amount of discourse on participatory planning approaches and the importance of including communities in the upgrading process. However, none of the toolkits proved to be geared exclusively towards communities.

The vision is to develop a toolkit that seeks to go beyond participation and emphasises community leadership. The idea is that the toolkit could assist communities define the process themselves and then use bespoke tools to meet their unique needs. For example, an idea would be to create a platform where communities involved in the ISULabaNtu project share their experiences with other communities outside the scope of the project.

Finally, it is important to note that the level of a successful upgrading project is measured differently between local authorities and communities. This is potentially why the government-led upgrading of informal settlements is not providing the results intended. For eThekweni municipality, it refers mainly to successful delivery of infrastructure and services. Empirical data from the two communities, instead, revealed that a successful project is about full ownership of the upgrading, social cohesion, livelihood development and tenure security (ultimately by obtaining the title deeds). This means that upgrading is not just housing delivery but consideration and development of social fabric, such as access to job opportunities, health facilities, schools, and public transport. EThekweni municipality has practiced limited community led approaches and currently acts as a mere housing *provider*, instead of being an *enabler*. It is therefore essential to build capacity and invest in further training in both communities and local authorities by understanding the minimum preconditions that unlock community participation in an upgrading project.

ACKNOWLEDGEMENTS

This work is based on two ongoing research funded projects; namely: a Royal Society Newton Advanced Fellowship (NA150082) and an Economic and Social Research Council (ESRC) award as part of the Newton Fund, in collaboration with the National Research Foundation (NRF) in South Africa (www.isulabantu.org). The authors would like to thank all the project team, the officers of uTshani Fund and particularly Mr Jeff Thomas for his precious assistance and support; Mrs Bashintshile (Sibongile) Buthelezi and Mrs Duduzile (MaDudu) Khumalo from the University of KwaZulu-Natal, and the community researchers from Namibia Stop 8, Piesang River and Havelock communities for providing support with data collection and translation during fieldwork in Durban.

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Dimensions of informal sector activities and public space contestation in downtown areas of cities: The Paradox in Ado-Ekiti, Nigeria and Port Elizabeth, South Africa

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Abstract

The rapid rate of urbanization and population growth resulting from rural-urban migration in developing countries are the banes of cities challenged with increasing spatial requirements for human activities, which exert pressure on limited land resources. In Ado-Ekiti, Ekiti State capital, Nigeria and Port Elizabeth, a major city in the Eastern Province, South Africa, people's response to livelihood strategies culminate into public space contestation in downtown areas. The study utilizes a research methodology hinged on secondary data sourcing to build literature, and compliment multi-stage sampling technique of digital socio-economic baseline data gathering and observation from the field. Findings reveal that the cities developed from different socio-political settings, and there are quantitative and qualitative inadequacies of public spaces in Ado-Ekiti, compared to the abuse of some public spaces in Port Elizabeth. It was established that while the people meet their livelihood needs, the high level of space contestation undermines the inclusivity of public spaces, depletes green infrastructure and degrades the environment in the city cores. The study reproduced for Port Elizabeth, the Urban Greenery Intervention Model developed for Ado-Ekiti (Ojo-Fajuru, 2018). These models form the basis for the formulation of public space reclamation and greenery revitalisation programs geared towards urban re-naturalisation to attain conducive and inclusive CBDs in the cities. The paper concludes that people's participation is germane to the meaningful socio-economic integration of the informal sector into the greening program to strengthen green growth, propagate biodiversity, guarantee urban comfort and inclusivity. The paper argues that the Model can be replicated in Global South cities having similar socio-economic challenges, to provide cutting-edge solutions to sustainable human settlements.

Keywords: informal sector; space contestation; central business district; livelihood strategy; green landscaping; urban inclusivity; sustainable settlements

1. Introduction

Urbanization is a global phenomenon of various dimensions. It has led to population explosion and rapid growth of cities. According to World Bank (2018), currently over 4 billion people or more than 50% of the global population live in cities, and by 2050, it projected that the *urban population* will double its current size, and nearly 70% of the world population will live in *cities*. The accumulation of people and the agglomeration of physical and capital developments in cities, particularly in the

Global South, led to ever increasing space demand for human activities, contestation of public spaces and resultant socio-economic and environmental problems, most noticeable in the cities' core areas. It is paradoxical that while the people engage in space contestation for livelihood sustenance, the cityscape is negatively impacted and rendered unlivable. Touray (2014) observes that much pressure on the immediate environment for daily livelihood lead to more poverty and environmental related problems such as draughts, famine, air and water pollution, deforestation, land encroachment and poor sanitation. This study is intended to investigate the causes and effects of informal sector claims to public spaces, and issues arising from such space conflicts in central area of cities, using Ado-Ekiti, Ekiti State, Nigeria, and Port Elizabeth in the Eastern Province, South Africa as the case studies.

The context of this research comprises the identification and impact analysis of the socio-economic and environmental effects of space contestation and informal sector activities in the central areas of the cities. The study focuses on the lack of, or inadequacy, or misuse of open spaces meant for green infrastructure in the environment and examines the physical impacts that the dearth of green landscaping, or the excessive use of hard landscaping exert on the general environment in the downtown areas. It also includes the survey of the existing situation to generate some socio-economic baseline data, provide insight into peoples' livelihood strategy, and evaluate the impacts on environmental quality, given the inequitable space usage in the core areas of the two cities. It is on these premises that the Urban Greenery Intervention Model developed for Ado-Ekiti (Ojo-Fajuru, 2018), was replicated for Port Elizabeth. The formulation of policies for public space reclamation and programs for greenery revitalisation are derived from the models. These intervention programs for the restoration of greenery in the CBDs are aimed at curtailing informal space contestation and degradation, and thereby promote livability and inclusiveness in the cities.

2. Methodological framework

This research is a cross-continental qualitative comparative study, which was carried out in successive stages of problem identification, statement of research problems, research questions and objectives, formulation of hypotheses, data collection with research instruments, data analysis with the aid of statistical techniques, drawing of inferences, development of models, policy recommendations and conclusion. The case study cities are Ado-Ekiti located in the West African Region, and Port Elizabeth in the South African Region as shown in Figure 1 and Figure 2 respectively. These cities have divers socio-cultural, political, economic and environmental attributes and trajectories, but their common denominator in this study is the informal sector

contestation and abuse of public spaces, which impact negatively on urban livability and the environment. The study utilised research methodology hinged on secondary data sourcing to build literature on the key issues and compliment multi-stage sampling technique of digital socio-economic baseline data gathering and observation from field studies in the central areas of both cities.

In Ado-Ekiti core or old traditional areas, Mathew, Odo-Ado, Orereowu, Ogbon Oba, and Igbehin Streets were selected for the study. On the other hand, Russell, Govan Mbeki, Parliament and Pearson Streets were selected from the Central District of Port Elizabeth's city center. Some digitized maps and empirical baseline data, socio-economic attributes and the existing state of the environment in Ado-Ekiti were extracted from Ojo-Fajuru (2018). Satellite images of Port Elizabeth were derived from the Internet and digitized to aid data gathering, analysis and presentation. Relevant information was collected from Ado-Ekiti Local Government Area, Nelson Mandela Bay Municipality, and other relevant published and unpublished sources.

Hence, the research dealt with the spatial structure of the study areas, the proportion of the land use devoted to open space development in the city centers, livelihood and survival strategies as the major causes of public space encroachment in the CBDs, effects of space contestation on public spaces and the extent to which statutory provisions and extant rules have influenced this development. Others include the assessment of government efforts in controlling encroachment and reclaiming contested spaces for greening, and the establishment of any significant variation in these phenomena in the downtown areas of the two cities. Research findings enabled the encapsulation of the Intervention Model and the formulation of recommendations targeted at reclaiming encroached spaces and



Figure 1: The geographical location of Ado-Ekiti, indicated with red arrow, in the West African Region

Source: Extracts from Google Earth imagery (2019).



Figure 2: The geographical location of Port Elizabeth, indicated with red arrow, in the South African Region.

Source: Extracts from Google Earth imagery (2019).

revitalisation of existing ones, and devoting them to greening and incorporation of socio-economic activities to promote equity and inclusivity, particularly in the core areas, and in the cities generally.

3. Conceptual underpinning

The informal sector activity is peculiar to Africa and the Global South. Roever (2016) posits that street vendors are accorded the informal status as they are normally perceived to be operating on public spaces contrary to state regulatory legislations. Since the Organisation for Economic Co-operation and Development concluded that informal is normal (OECD, 2009), and the World Bank declared that “a global agenda for jobs is needed” (World Bank, 2013, p. 38), the informal sector activities have increased significantly. While informal employment accounts for over 50 percent of total non-agricultural employment in most developing regions, rising to 66 percent in sub-Saharan Africa and 82 percent in South Asia (ILO & WIEGO, 2013), more than half of informal workers in most regions are self-employed (Vanek et al., 2014) as means of livelihood strategy. Roever (2016) links street vending to poverty alleviation and suggests how cities can more effectively balance the right to livelihood with the need to govern public spaces. This necessitates the new paradigm shift for the integration of the informal sector into the mainstream development to promote the inclusiveness and economic empowerment in human settlements. Since this view has been established in a previous study (Ojo-Fajuru, 2018), the current study is intended to create liveable cities by eliminating the negative aspects and ensuring that the livelihood of the informal sector is safeguarded. The issues of inclusive green places, climate change mitigation and adaptation, livelihood strategy, socio-economic integration, segregation and protection of pedestrians and free flow of traffic along movement corridors and public places in downtown areas to attain liveable African cities are central to this study.

Public spaces occur in various types, sizes, categories, functions and spheres of influence. Chiu (2009) points out that the type, function, operational rules and regulations, and the prevailing social norms determine people’s perception and usage of the public spaces. The Future of Places (2014) views public space as a generic term used to refer to areas in the ‘public realm’ or ‘the commons’, such as streets, squares, parks, open spaces/places and public facilities, among others. A public space is where all citizens, regardless of their income and personal circumstances, can feel equal and cared for, which underscore the need to adoption a public-space oriented urban strategy for the achievement of the equitable city (Garau 2014). The availability of adequate quality public open spaces in average quantity in the spatial structure of the human settlement is deemed important to

the attainment of the Sustainable Development Goals to the extent that the UN Habitat adopts the existence of ample open spaces as an indicator. In so doing, the Organization acknowledges the collective roles of private and public spaces in enhancing the functionality and identity of cities. This forms one of the indicators for Goal 11 focusing on how to make 'cities and human settlements inclusive, safe, resilient and sustainable', while Target 11.7 states that by 2030, parties should 'provide universal access to safe, inclusive and accessible, green and public spaces, particularly for women and children, older persons and persons with disabilities' (UN Habitat, 2015, pp. 1-2). These policy directives are targeted at providing inclusive, green open spaces for the people. Ojo-Fajuru and Adebayo (2016) concord that a public space or open space becomes a social space when it is available and accessible to the entire citizenry, irrespective of age, race, gender, class or creed. Hence, a public space is construed as a facility that should be inclusive of all and sundry, rather than being misused by one or few individuals or group to the exclusion of the majority of the populace. This argument exposes the act of public space contestation, notwithstanding the citizen's right to the city. The need therefore arises to restore public spaces that promote welfare, equality, social inclusion and meaningful landscape development in the ideal city. This forms the basis for this study that is intended to examine the trend, threat and strength of informal sector activities in relation to space contestation in the city centers and restore inclusive green places as platforms for strengthening economic empowerment, aesthetic quality, social cohesion and environmental sustainability in Ado-Ekiti and Port Elizabeth.

The central area of the city often constitutes the central business district within the oldest part of its physical form and structure (Ojo, 1983). Many Nigerian traditional settlements, exemplified by Yoruba cities such as Ado-Ekiti, exhibit this characteristic morphological pattern of the King's palace and market forming the core area with other developments radiating in different directions (Ojo, 1966a; Ojo, 1966b; Dmochowski, 1990). Olujimi (2011) observes that these city centers, typified by the presence of the traditional institutions, are surrounded by communal land to promote proximity and effective interaction at reduced cost of transportation. In the South African context, ethnic and racial segregation have ever been underlying attributes for the organization of physical, social, and economic spaces in South African cities, which led to elements of race and ethnic spatial segregation in the residential structure, and all facets of urban living. (Davis, 1981)

As the focal point of a city and usually situated at the center point for accessible transportation network, the CBD is the commercial, office, retail, and cultural center of the city. The modern CBD is a diverse region of the metropolis combining residential, commercial, educational, medical, entertainment, cultural and public uses, and providing workplaces and institutions for government workers, doctors, lawyers, directors, academics, bureaucrats, entertainers, and financiers. The CBD

is what people perceive when they think of a city's downtown area (Rosenberg, 2018). Designing Building Wiki (2019) describes the CBD as the commercial and business centre of a city, otherwise called the financial district, and has some distinctive attributes such as high daytime population, high density development, high concentration of offices, financial institutions, high land values, and the lack of, or the misuse public green spaces. CBDs are prone to the menace of public space contestation, mostly for informal commercial and retail activities, taking advantage the daytime large population and heavy traffic in this zone. The paradox is that while the informal sector engages in various activities in public spaces to strengthen their livelihood strategies, their exclusive occupation of these public spaces debars other people of their rights of access to the spaces, including movement paths, have negative effect on the people and the environment. This study is aimed at examining these effects and advocate for the reversal of the trend of inequitable public space usage in the downtown areas of Ado-Ekiti and Port Elizabeth.

Livelihood strategies are the range of activities and choices available for the people to attain their life goals. According to the Department for International Development, these include, but not limited to, productive activities, investment strategies, and reproductive choices (DFID 1999), as well as the totality of resources usage, intended actions and activities involved to make a living (DFID 2000). Ellis (2000) views livelihood strategies as consisting of planned activities that men and women undertake to build their livelihoods, which culminate to household survival. Succinctly put, the totality of organized lifestyle choices, goals, values, and activities, which are shaped by the prevailing physical, biological, economic, socio-cultural, political, legal, and psychological components form livelihood strategies (Walker, Mitchell and Wismer, 2001). Eneyew & Bekele (2007) corroborate that livelihood strategies are the various activities that households carry out to earn a living. The concept of livelihood strategy is central to this study as it provides the lens through which the social setting, patterns of behaviour and the *modus operandi* of the informal sector in public spaces in the central business districts of Ado-Ekiti and Port Elizabeth can be critically evaluated. It provides the yardstick for the analysis of the paradox that the city centers are negatively impacted by environmental pollution, vegetal depletion, landscape degradation and carbon footprints through activities bordering on the livelihood strategies of the informal sector on contested spaces. This concurs with the findings of Ojo-Fajuru, Adebayo and Adebayo (2018b) that the selective integration and effective control of informal sector activities in public spaces are guaranteed to strengthen the attainment of livelihood strategies while promoting economic empowerment, urban inclusivity and livability, social cohesion, and environmental sustainability in the cities.

Green landscaping is the propagation, utilization or preservation of natural vegetative elements on the earthscape. The natural vegetative aspect is referred to as the green landscape. Such naturally occurring soft landscaping elements are trees, shrubs, hedges, flowers, grasses, ground cover, climbers, prostrates, woodland, forests, vegetation, recreational or organised open spaces, gardens, parks, water bodies, swamps, watersheds and catchment areas (Ojo-Fajuru, Adebayo and Adebayo, 2018a). The common attribute is that they all exhibit characteristic cooling effect on the environment and constitute an important indicator in the assessment of the green city. The green city development encompasses the strategies that protects, restores, and maintains nature and ecological balance within urban communities. Williams (2000) describes the green city as the intermingling of nature with urbanism to create civic, urbane, healthy, and inclusive living places. Hence, the green city is a habitable place governed, not only by legislature but largely by nature to emerge as a sustainable human settlement based on ecological balance, community self-reliance, and participatory democracy. Olokesusi (2009) submits that green cities have generous landscaped open spaces, parks, nature trails and reserves. Apart from the ecological services performed by vegetation, nature also contributes to a happy and fulfilled life. Green spaces play crucial roles in city sustainability through erosion and flooding control, purification of the atmosphere, and microclimate modification (Oduwaye, 2014). Given the submission that a green city is synonymous with a clean city, which boosts clean and efficient energy derived from renewable sources like solar and wind, complemented by clean and accessible modes of public transport such as biking, hiking and walking (Ojo-Fajuru, 2018), it is implied that the green city should be a healthy and inclusive place. Such a city also has effective waste management, transport and building infrastructure. This study is targeted at attaining the qualities of a green city that is not only richly endowed with beautiful natural landscape, green spaces, clean, garbage- and litter-free streets, clean and unpolluted air, clean potable water, effective solid waste and sewage management but also with ample and inclusive public spaces for all. It is a truism that green landscaping, and green city concepts are the bedrock on which this study is grounded.

In simplistic terms, inclusion means the state of a person or thing that is included, while inclusive is the adjectival derivation that translates to including a wide range of people, things, ideas, and entities (Oxford Advanced Learner's Dictionary, 2000). An inclusive city can thus be viewed as a place that exhibits a high level of inclusiveness, where the needs and aspirations of all citizens are satisfactorily accommodated. The Collaborative for Inclusive Urbanism (CIU, 2014) views an inclusive city as one in which all citizens are deemed important and are involved in a diverse range of developmental activities, leaving no room for marginalization, which may undermine robust interrelationships and scuttle innovative and meaningful development. The CIU believes that inclusive cities are "more affluent and socially just"; affluent in the sense that they harness the

potential and capabilities of all and sundry to create wealth, and socially just as they embrace the interests of the otherwise marginalized, and offer equal opportunities for socio-economic attainment. Rhonda Douglas, the Global Projects Director for Women in Informal Employment: Globalising and Organising (WIEGO), and the Coordinating Partner for the Inclusive Cities Project (ICP), a partnership of membership-based organizations (MBOs) of the working poor, submits that:

[a]n inclusive city is the one that values all people and their needs equally. It is the one in which all residents - including the most marginalized poor worker - have a representative voice in governance, planning, and budgeting processes, and have access to sustainable livelihoods, legal housing and affordable basic services such as water/sanitation, and electricity supply...cities like these, however, are not achievable until informal workers can take their rightful place at the decision table, voice their demands and be heard...[t]he partners share a belief that to reduce urban poverty, we must reverse the current exclusionary trend taking place in so many modernizing cities and instead foster (as the project's name insists) inclusive cities. (WIEGO/ICP, 2014, p.5)

The CIU notes that inclusiveness checkmates socio-economic exclusion and resultant effects such as urban decay, and militates against the partitioning of the city into “ghettos of despair without opportunities for upward economic mobility”. Rather than placing an embargo on growth or debarring avenues for redevelopment, inclusiveness promotes meaningful growth and sustainable development, and shuns exclusivity and dislocation and the heavy financial burden that often accompanies them. The inclusive city therefore eliminates exclusion and brings otherwise marginalized activities into the center to join seemingly privileged activities, sharing mutual urban space cheek by jowl (CIU, 2014). Harvey (2008) cited in Yan (2016) emphasizes that the right to the city transcends the individualistic tendency or his accessibility to urban resources, but embraces the collective citizens’ right to change themselves and as well be free to transform the cities. The concept of urban inclusivity is relevant to this study as it seeks to ensure people’s right to the city and redress inequality to pave way for sustainable settlement development.

The concepts of sustainable development and sustainable city form the cornerstone of this study. It is widely accepted that unplanned urban physical development has undesirable implications, especially in urban settlements. The issue of sustainable human settlement has become so paramount that its principles were entrenched in the Millennium Development Goals (MDGs) adopted by world leaders in 2000, and revisited at the World Summit on Sustainable Development

in 2002, and currently repackaged as the Sustainable Development Goals (SDGs), targeted at 2030 (UN Habitat, 2015). In the planning of a sustainable city or eco-city, the impacts that it will have on the environment are considered from the inception. Its inhabitants are dedicated to minimizing energy, water and food inputs, as well as reduce waste outputs such as heat generation, gaseous emissions, and liquid discharge into the environment.

With the application of industrial ecology in its planning, the sustainable city is designed to be self-reliant less dependent and self-sufficient in food supply and renewable energy sources. The sustainable city aims at making minimal input into the climate change syndrome by lessening its ecological footprints through land use efficiency, pollution abatement, waste reduction, recycling and conversion to energy. The concept of the sustainable city is central to this study as it seeks to strike a balance between all sectors of the city, using its social, economic and environmental attributes to provide and ensure healthy, equitable, efficient and inclusive living for present and future residents in Ado-Ekiti and Port Elizabeth.

Unplanned urban physical development is having undesirable socio-economic and environmental impacts, especially in the urban settlements of developing countries. Given its definition as development that caters for the survival requirements of the present generation while safeguarding the interests and needs of future generations (WCED, 1987), sustainability embraces cultural, social, economic, political and ecological issues of human survival in an enduring global environment. The blunt implication of sustainability is that the world and its sensitive nature should be enjoyed and conserved by mankind, and passed on from generation to generation. The concept of sustainable development could be applied to curtail these challenging problems and to guarantee a secure future in Ado-Ekiti and Port Elizabeth.

4. Research results analysis and findings

Out of the 660 questionnaires administered in the core area of Ado-Ekiti, 652 were collected. These were sorted and only 585 questionnaires were accepted for SPSS collation and analysis, translating to a response rate of 88.64%. In 1996, following the creation of Ekiti State from the old Ondo State in Nigeria, Ado-Ekiti assumed the dual role of headquarters of Ado-Ekiti Local Government and the state capital. The city experienced unprecedented concentration of land use activities that stimulate population growth and generate a high volume of vehicular and pedestrian traffic. Economic

activities in Ado-Ekiti fall within primary production like farming, fishing, and hunting; secondary production like manufacturing and processing; and tertiary employment such as the civil service and professional service. The fourth category is the informal sector dominated by the self-employed engaged in trading and service activities as survival strategies in response to widespread youth unemployment and economic downturn. Many economic activities are concentrated in the CBD and other major streets and hierarchies of roads. The space required for human activities and movement puts pressure on land resources, and in the face of ineffective policy enforcement, leads to encroachment and contestation on public spaces in the fledging capital city (Ojo-Fajuru, 2018).

The observation and unstructured interview methods were used to gather information about the availability, existing state and usage of public open spaces in the selected streets in the central area of Port Elizabeth Metropolitan City, the nodal city in the Nelson Mandela Bay Municipality. The city is located on the Sunshine Coast and boasts of the busiest port as well as bathing and surfing beaches in the Eastern Cape Province of South Africa. Bainbridge et al (2009) observe that the downtown area of the city was almost run down resulting to the relocation of some important commercials, catering and hospitality establishments to suburban shopping precincts such as the Broadwalk and Dolphin's Leap. The construction of the Nelson Mandela Stadium at the northern part of the city center for the 2010 Soccer World Cup provided a facelift for the derelict North End and Central.

4.1 Spatial structure and availability of public open spaces in the cities

The study examined the spatial structure in Ado-Ekiti and Port Elizabeth and assessed the availability, existing situation and usage of public open spaces in the city. Findings revealed the dominance of residential land use in the spatial structure of Ado-Ekiti, whereby three distinctive morphological zones were identified. These are the core or old areas (COAs) in the city center, the new development areas (NDA) and the planned residential areas (PREs) as shown in Figure 3. The lack of planning in the core and new development areas contrasts sharply with the PREs on the peri-

urban fringes of the city. Beyond this, the city expands uncontrollably into the surrounding region with attendant vegetal destruction and no conscious replacement, resulting in insufficient green spaces. The study established that the central area of Ado-Ekiti lacks adequate public spaces and sufficient greenery in the urban web as shown in the 3D satellite imagery in Figure 4.

On the other hand, Port Elizabeth is a well-planned city with three geographic areas, viz: the downtown areas called Central, the new development areas (NDAs) and the extensive coastal area as depicted in Figure 5. Unlike the central area of Ado-Ekiti, the research shows that Port Elizabeth Central is endowed with ample green spaces, adequate public spaces and functional green infrastructure within the city morphology as depicted in the 3D satellite imagery in Figure 6. However, ethnic and racial segregation have ever been underlying attributes for the organization of physical, social, and economic spaces in South African cities, which led to elements of race and ethnic spatial segregation in the residential structure and all facets of urban living (Davis, 1981). Port Elizabeth is not an exception to this phenomenon that has shaped the morphology and characters of South African cities along racial lines.

The baseline survey that examined the socio-economic attributes of residents in the study area found more males than females in the sampled districts of Ado-Ekiti. Moreover, since household heads were preferred as study respondents, more male than female residents participated in the study. The majority of the respondents fell within the 30 to 59 years age group constituting 63.03% of the sample in the COAs, 70.41% in the NDAs, and 83.54% in the PREs. This is the economically productive group. More respondents in the core areas than in the PREs fell into the older age group; older people tend to be more conservative in their outlook. Married people made up 69.43% of the respondents; this is likely to lead to a steady natural population increase in the study area. Similarly, in Port Elizabeth, the study reveals more males than females in the selected areas of the city. This is obvious in the gender of persons using the parks, open spaces and streets in Central, who are mostly males of colored and Afrikaans ethnic group.



Figure 5: Map of Port Elizabeth showing the city center and the planned surrounding suburbs and coastlines.

Source: RoomsForAfrica.com 2019



Figure 6: 3D satellite imagery revealing the intricate spatial structure of Port Elizabeth Central.

Source: Extracts from Google Earth imagery (2019).

4.2 The dimensions of informal sector encroachment and contestation on public spaces in the cities

The study revealed that at a rate of 55.21%, there is a high tendency to encroach on or develop public spaces into makeshift or permanent structures, mainly for commercial purposes, without permission in the downtown area of Ado-Ekiti. Informal commercial activities along major roads, minor roads and access points, including sidewalks and even roadways were recorded in 61.02% of the core area, which is the highest compared to other zones of the city. Other uses which the encroached setbacks

and open spaces are put are residential purposes (15.17%), informal, illegal workshops, light industrial activities and services (9.44%), and religious use (8.56%). Furthermore, 5.12% of encroached setbacks and open spaces are used as refuse heaps, while sundry uses account for 6.5%. On the other hand, informal traders operate in public spaces in the central area of Port Elizabeth, while parks and green spaces are littered or defaced with uncollected refuse, and are often dominated by youth, mostly men within the age range of 18-35 years.

Furthermore, greenery, circulation spaces, pedestrian movement and recreation areas are steadily reduced at the expense of environmental sustainability. As stated in the literature, the development conflict between equity and ecology, the property conflict between equity and economy, and the resource conflict between ecology and economy in the sustainability triangle (Campbell 1996) are evident in these cities.

4.3 Factors responsible for encroachment and contestation on public spaces and the effects on the environment in Ado-Ekiti and Port Elizabeth

The study found that 92.24% of encroachment on setbacks and open space resources in Ado-Ekiti is illegal. The reasons identified by the respondents included ignorance (34.65%), while nearly a third (31.77%) blamed it on the failure of government organs to ensure compliance with development regulations. Other factors identified were people's desire to engage in productive activities to improve their financial situation and circumvent livelihood and survival challenges (15.19%) as shown in Figure 7, increasing human activities that requiring space (13.16%), and the nefarious activities of land speculators (4.48%). The study established that illegal and substandard developments hinder pedestrian movement and vehicular traffic flow, endanger lives and property while degrading the environment in Ado-Ekiti.



Figure 7: Informal trading activities contesting and commercialising building frontages, setbacks space earmarked for greenery as well as the roadway along Igbehin Street is a common sight in the core area of the capital city.

Source: Field survey, July 2015.

Field study reveals that in Port Elizabeth, the misuse and abuse of available open spaces and parks are illegal, while majority of respondents hold service providers responsible for inefficiency. A handful of respondents blamed it on the failure of the Municipal Government to monitor the public spaces and forestall the perpetration of illegal occupation and degradation. Research findings established dereliction of service duties in the areas of waste collection and management as well as park monitoring and maintenance.

Asked to describe the effects of the high magnitude contestation of public spaces on the general structure of the city environment, 24.80% of the respondents in Ado-Ekiti were of the opinion that there were negative consequences, while 22.70% agreed that encroachment hinders the segregation and free flow of pedestrian and vehicular traffic along traffic corridors in the city. Furthermore, 22.00% of the respondents linked encroachment on setbacks and open spaces to the downgrading of health and living standards, and 17.37% felt that it poses serious threats to the security and safety of lives and property as the makeshift structures inhibit clear views and provide havens for criminals. However, only 8.11% of respondents linked such encroachment to the hindrance of relaxation and recreational opportunities in the city. The research established that

public space contestation subtracts greenery, degrades the cityscape, and inhibits free circulation along movement paths, while impacting negatively on health, wellbeing, security, livability and inclusivity in the State capital.



Figure 8: Green space strewn with litter and uncollected refuse along Parliament Road, near the Donkin Reserve and Pyramid, Central, Port Elizabeth.

Source: Field survey, April 2019

In Port Elizabeth, majority of the respondents agree that space contestation and misuse constitute major environmental problems and hindrance to relaxation and recreational opportunities in the Central district as shown along Parliament Road in Figure 8. The study established that contestation and abuse of public spaces aggravates carbon footprints, impacts negatively on the environment and residents' quality of life in the heart of the port city.

Findings show that in terms of the ineffectiveness of government action to curb encroachment in Ado-Ekiti, 14.95% of the respondents felt that the government lacks the willpower and enthusiasm to prosecute proven offenders. This inertia encourages further encroachment on setbacks and open spaces. Only 24.06% of the respondents confirmed that structures that encroach on setbacks and open spaces are demolished. As depicted in Figure 9, this exposes the failure of the Ekiti State Development Control Agency to prevent or promptly remove illegal or encroaching structures or development as soon as they appear. It sends the wrong signal to residents; the result is commercial

activities that have spilled over setbacks and drainage channels onto the roadways in busy streets. The implication is that the lack of sufficient greenery to protect the environment against solar radiation and absorb carbon, aggravates the heat island syndrome in the hot tropical climate in the



city.

Figure 9: Marked for demolition along Matthew Street in the central area of Ado-Ekiti since November 2013, this makeshift illegal structure is still standing and in use nearly six years after.

Source: Field Survey, July 2015



Figure 10: Typical illegal occupation tantamount to contestation, misuse, abuse, and degradation of public green space, hindering recreational opportunities and inclusive usage of Horse Memorial Park at Cape Road and Rink Street Junction, Central Port Elizabeth, and remains unchallenged by the Nelson Mandela Bay Municipal Authority.

5. Summary of findings

The study established that the central area of Ado-Ekiti is dominated by unplanned residential districts in the spatial structure that lacks adequate public green spaces and sufficient green infrastructure in the urban web. In contrast, the research shows that Port Elizabeth is generally well-planned with extensive coastlines, and Central, the downtown area is endowed with ample green spaces, adequate public spaces and functional green infrastructure within the city morphology. Findings reveal that illegally built structures were used for informal activities mostly commercial, and resulted in the heavy commercialization and degradation of contested public spaces in Ado-Ekiti. The research shows that informal traders operate in public spaces in the central area of Port Elizabeth, while streets, green spaces and parks are littered or defaced with uncollected refuse. It was revealed that the predominant users of most of the parks in Central are male youth of the black and colored ethnical background, which have implications on inclusivity, recreation and livability in the city center. The study argued that the people engaged in space contestation and encroachment as a means of livelihood and survival, while the informal sector is largely unorganized and virtually neglected by government. It was established that public space contestation and encroachment may provide avenues for livelihood strategies, the impact on the environment is degrading with negative effect on social inclusion and landscape sustainability in the cities. The research established the incapability of development control organs to resist or redress numerous cases of public space contestation and encroachment, which subtract greenery from the city landscape and reduce urban livability and inclusiveness. The study made it clear that government needs to redouble its efforts to achieve zero tolerance of encroachment, re-establish lost spaces and greenery in the environment and make the cities great liveable and inclusive places.

5.1 A Model for Comprehensive Greening and Urban Spatial Intervention

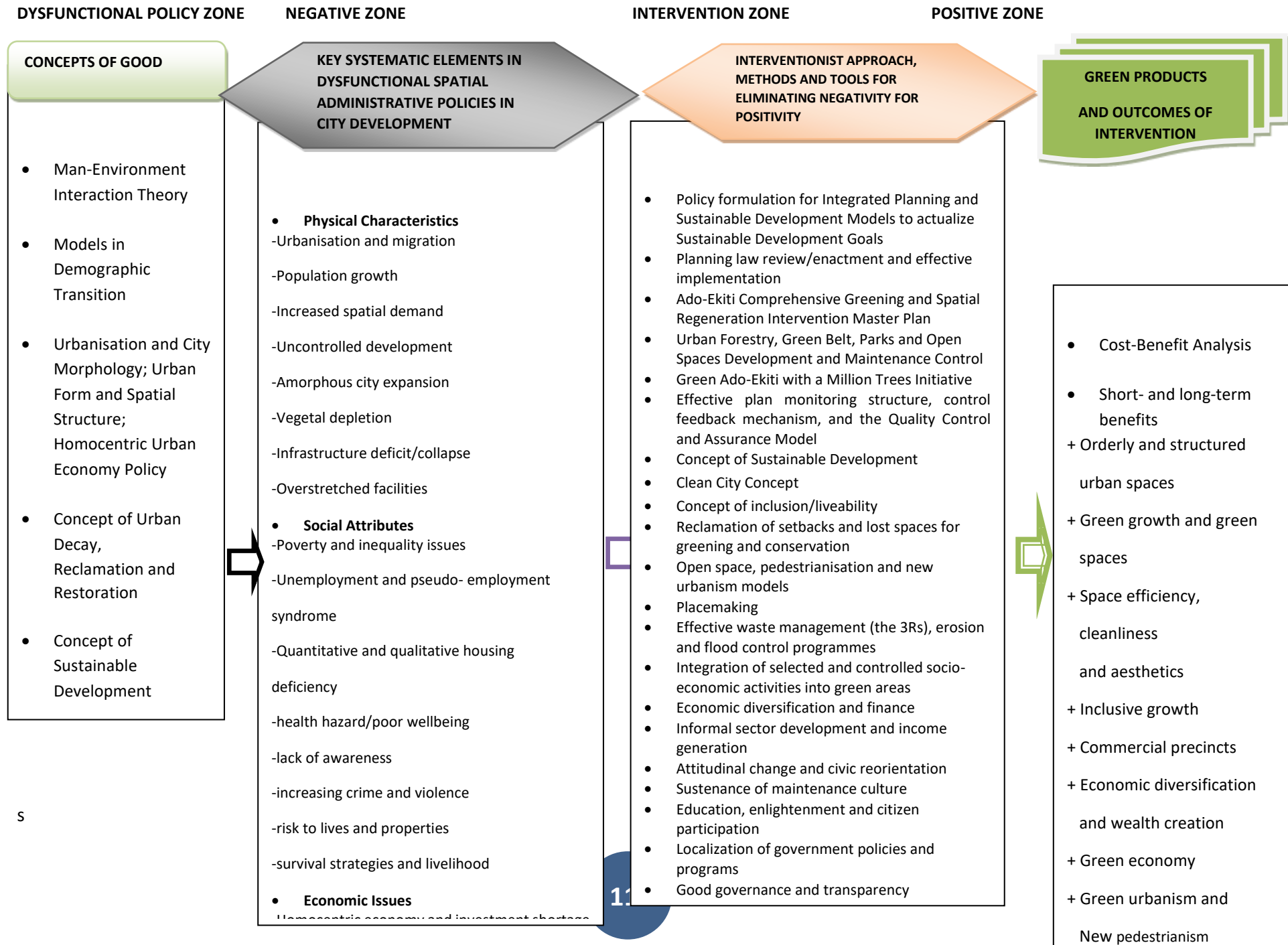
African green cities.

The concepts of green city, smart city, inclusivity, livability and sustainable development are crucial to this research, which entail the application of smart growth approach to promote efficient use of resources, inclusive growth and green growth to attain the liveable, clean and green cities for all. The operationalization of these and other relevant concepts necessitates the adoption of peculiar spatial planning models that would reorder the trend of inequitable space usage and unwholesome state of landscape in Ado-Ekiti and Port Elizabeth without undermining socio-cultural values. This

is departure from earlier practices of adopting foreign spatial models in Africa, which have not yielded

Figure11: Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability in Ado-Ekiti Green City.

(Source: Ojo-Fajuru (2018), p. 388.)



appreciable results as they were state-centered and foreign driven (Akinola, 2014). The argument is that communities and cultures vary from place to place, and according to Tocqueville (1966) cited in Akinola (2014), people always bear some marks of their origin, and the fact that a model worked in the Western World is not a guarantee that it will work exactly the same way elsewhere (Akinola, 2008). It was on this basis that a strategic urban greening intervention Model was developed for Ado-Ekiti to evaluate dysfunctional policies, their negative fallouts and the interventionist approach, tools and methods devised to eliminate negativity for positivity and generate green products and outcomes (Ojo-Fajuru, 2018).

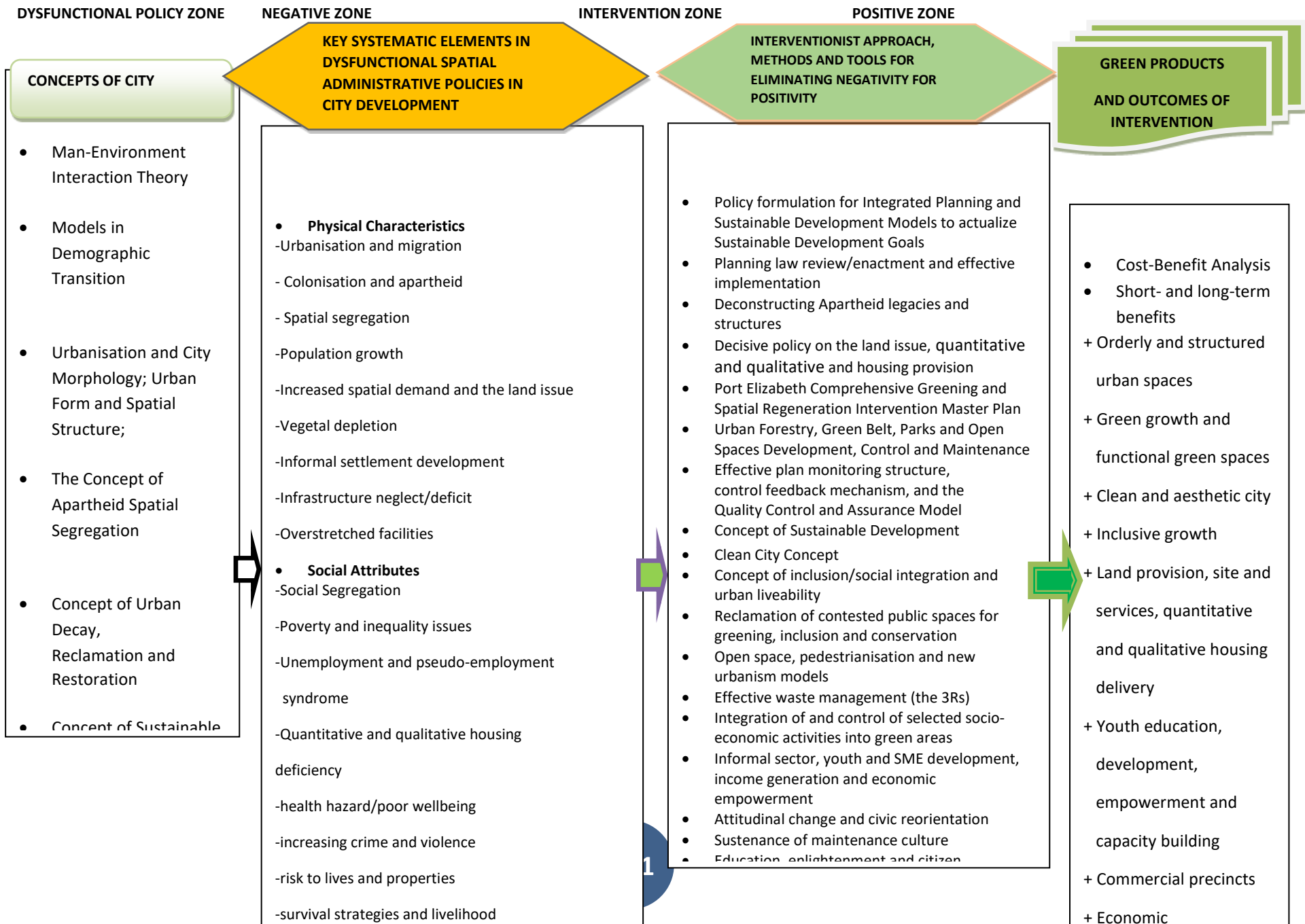
5.1.1 The Ado-Ekiti model of comprehensive greening and urban spatial intervention

The Ado-Ekiti model of urban greening is anchored on some elements of the green city model. It is through its guidance that the City Greening Masterplan is drawn. The model addresses the need to see the physical existence of man in the realms of economy, livelihood and survival strategy as important factors militating against sustainable green landscape within the context of the city environment. While it is pertinent to make man comfortable in his natural habitat, it is equally important to ensure that the environment is safeguarded from misuse and abuse that are capable of disrupting natural processes thereby undermining inclusivity and social cohesion. This underscores the indispensability of proper planning, control and maintenance to ensure checks and balances toward the attainment of a clean and liveable environment in the city.

This culminates to the development of the Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability in Ado-Ekiti Green City as shown in Figure 11). It is a localized but adaptive spatial and administrative model that recognizes human livelihood, poverty, survival strategies, citizen's culture, values and aspirations. Other relevant issues are health, space usage, the informal sector, economic impacts, ecological settings, environmental issues such as climate change, water, flooding, greenery, as well as government policy and administration in relation to land use, overall landscape and environment of Ado-Ekiti and its metropolitan region. The Model is structured into successive zones such as the dysfunctional policy zone, the negative zone, the intervention zone, and the positive zone. It is based on this intervention Model that the comprehensive urban greening masterplan for Ado-Ekiti was formulated to encapsulate policy directives and programs for attaining overall socio-economic and environmental sustainability in the capital city of Ekiti State.

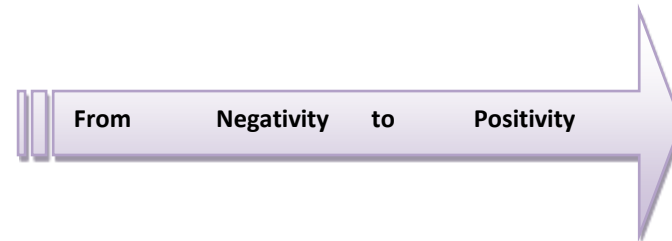
Figure12: Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability in Port Elizabeth Green City.

(Source: Adapted from Ojo-Fajuru (2018), p. 388.)





Apartheid policy,
administrative laxity,
functional inefficiency,
model failure, misplaced
priorities and negligence



Replication of the Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability in Ado-Ekiti Green City for Port Elizabeth

The Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability developed for Ado-Ekiti Green City is versatile as it can be replicated, not only in other cities in sub-Saharan Africa, but also in the Global South, given that there is similarity in nature of activities and phenomena inherent in the cities (Ojo-Fajuru, 2018). The research established the common occurrence of public space contestation and encroachment with similar attributes in the core area of Ado-Ekiti and Central Port Elizabeth. It was revealed that people usurp public spaces to meet livelihood and survival strategies, which culminate to environment degradation, social divide and exclusion of various magnitude in the cities. Given the similarity in the nature of the problems identified by the research in the two cities, the Ado-Ekiti Model was adapted for Port Elizabeth to redress issues militating against social inclusion, livability and landscape sustainability in the city.

5.1.2 The Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability in Port Elizabeth Green City

The typical succeeding stages of the Model are the dysfunctional policy zone, the negative zone, the intervention zone, and the positive zone as shown in Figure 12. The dysfunctional policy and the negative zones of the Model take cognizance of apartheid background and effects on the physical and social fabrics, among other attributes of the city. These provide insight into the underlying factors affecting the attainment of socio-economic and environmental sustainability in the city, which culminate into the intervention and positive zones of transformative green growth and green economy to promote urban livability, social cohesion and integration.

5.1.3 Recommendations for the implementation of the Ado-Ekiti Comprehensive Greening and Spatial Regeneration Intervention Plan: with reference to the Central Area of the City

The reclamation of encroached setbacks and open spaces, and their utilization for green landscaping and the incorporation of socio-economic activities to create great places that promote livability, inclusiveness and a sustainable landscape in Ado-Ekiti was the main thrust of this research study. With appropriate public support and participation, the ugly state of the

environment could be addressed and reclaimed spaces could be re-established and maintained as green places in the capital city.

It is against this background that recommendations and policy directives are made to achieve the main goal of the Ado-Ekiti Green City Masterplan, within which the city center is considered. It is aimed to adopt green landscaping as a tool to transform recovered setbacks and open spaces to create parks, squares, gardens green spaces, greenways and promenades that enhance environmental quality and promote aesthetics, livability and inclusiveness in the city center as shown in Figure 13. The concept of catchment area was used to locate newly created squares within the sphere of influence of the city center, given the centrality and wider array of high-level services offered.

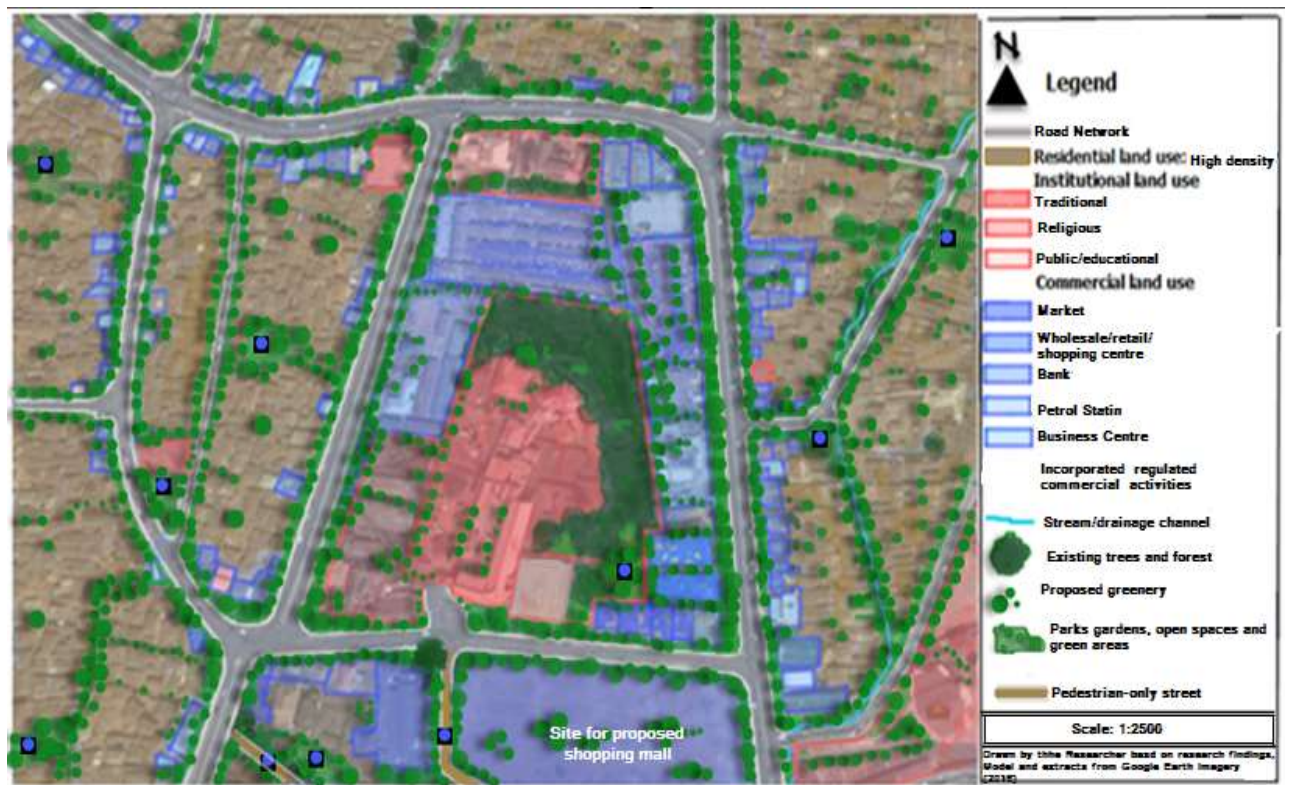


Figure 13: The structural greening plan with proposed squares and nodal points in the core area of Ado-Ekiti.

Source: Ojo-Fajuru, 2018, p. 399.

The entire informal commercial activities and services previously operating on reclaimed setbacks and open spaces along the linear corridors, defacing the city, are relocated and organised at nodal points associated with the squares. The determining factor for the location of the nodal points also took cognizance of the minimum walking distance between 300m to 500m, which can be covered by foot within three to ten minutes. The nodal points will be accessed by major roads and serviced by public transport system. This addresses the challenges of transportation by ensuring unhindered ingress and egress to enable the people carry out commercial and shopping activities within the vicinity of their homes. This is to ensure convenient access, shared use and variety of services in the squares and parks to accommodate the informal activities taken away from the roadsides and streets in the green layout. The longer the distance to the facilities, the greater is the tendency for the people to return to the streets. In Africa, socio-economic aspect and livelihood strategy cannot be divorced from the success of any planning instrument and regulation, failing which the people will resort to open space encroachment along the streets and activity areas with the byproducts of environmental pollution. The informal sector inclusion will ensure the restructuring of the typical African system from a negative hindrance to be a contributing factor to the functionality of the built environment. This will discourage the phenomena of motivated linkages inherent in the recurrence of public space contestation, encroachment and degradation in the city. It will prove the sanctity of the people's opinion that greenery alone is incomplete without the socio-economic aspects and livelihood, which are very important to the success of a smart city that maintains the green setbacks and open spaces in accordance with building regulations and bye-laws. These proposals will ensure convenient transportation, reduce carbon footprints, inculcate effective environmental protection, enhance inclusivity and livability, promote sustainable socio-economic development and guarantee the reinvention of the city center and the entire Ado-Ekiti municipality as great place.

5.1.4 Recommendations for the implementation of the Port Elizabeth Comprehensive Greening and Public Space Monitoring Intervention Plan: with reference to the Central Area of the City

While the research established the availability of public green spaces in Port Elizabeth, it exposed associated social exclusion occasioned by the misuse and abuse of these spaces, particularly in Central. In order to achieve the research goal targeted at equitable public space usage to promote livability, inclusion and sustainable landscape in Port Elizabeth, recommendations were made in form of a Comprehensive Greening and Public Space Monitoring Intervention Plan, putting into context the Central Area of the City. The Plan was

based on the Strategic Urban Greening Intervention Model for Socio-Economic and Environmental Sustainability in Port Elizabeth Green City, developed from this study. The targeted outcome of the greening and public space monitoring intervention programs are green growth and green economy; functional, orderly and structured green spaces; clean and aesthetic city; green urbanism, new pedestrianism and green infrastructure, as well as inclusive growth and liveable environment. Other crucial outcomes that indicate the success of the Comprehensive Greening and Public Space Monitoring Intervention Plan through the eradication of public space contestation include land provision for housing, agricultural and industrial uses, affordable site and service schemes, low income/low cost housing projects, quantitative and qualitative housing delivery, as well as the upgrading or redevelopment of informal settlements to fill the housing gap in the city. Youth education, literacy, development, empowerment and capacity building, integrated with urban agriculture, gardening and equitable wetland usage would generate employment and create wealth for improved living standards. The development of commercial precincts provides vital urban basic support services and products, which is guaranteed to strengthen the value chain of infrastructural facility development and economic diversification. The successful implementation of this Intervention Model and Plan, backed by enabling legislation, will eradicate space contestation and informality, enhance inclusivity and livability, inculcate effective environmental monitoring and protection and promote socio-economic development. The development of extensive green spaces will boost carbon sequestration and, in turn, abate global warming and climate change, and ensure sustainable landscape to reinvent Central in particular, and the totality of Port Elizabeth municipality as Clean and Green City.

6. Conclusion

The argument for public space contestation is that the space belongs to all, hence those that usurp or trade in public spaces should be allowed the right to the city. The need thus arises to provide accessible space to integrate the informal sector as part of the organic entity of the city to protect greenery, alleviate poverty and inequality, strengthen social cohesion and boost economic empowerment. This research investigated the factors that contribute to the various dimensions of public space contestation, and proffer meaningful recommendations to ensure green growth, equitable space usage and improve livelihood strategy, urban livability, social cohesion and inclusion, urban landscape and aesthetic quality, and climate resilience in Ado-Ekiti and Port Elizabeth. It is highly expected that an inclusive greening and effective monitoring and maintenance programs will maximize equitable space utilization, ensure proper monitoring, enhance the local economy, and upgrade the status of the cities to green

and great places. There is a need to ensure and maintain effective public participation based on the readiness of the people to take active part in inclusive greening programs to achieve an overall sustainable landscape development. This bodes well for successful transformation and reinvention of Ado-Ekiti and Port Elizabeth as great green cities of the future.

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Planning for co-production through innovative technology in informal and 'city-edge' human settlements in the global south: The case of Hopley Farm, Harare, Zimbabwe

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Abstract

This study uses the Hopley Farm Settlement in Harare, Zimbabwe, to explore the dynamics in planning for co-production through innovative technology for accessing water and sanitation in informal and city-edge settlements. Specifically, we investigated ways in which innovative technology can be mainstreamed through the development of an understanding regarding the strategies employed and the gaps filled by residents in the planning and development of informal and city-edge settlements. Based on the phenomenological research design guiding the study, data were collected through document reviews. Key informant interviews, triangulated with in-depth interviews with residents, while focus-group discussions with residents from Hopley were also conducted. Emerging from the study are the dynamism and complexity associated with city-edge and informal human habitat systems. Such complexity manifests in emerging settlements that are thriving, yet disconnected from the existing formal and collapsing water and sanitation infrastructure. Therefore, the community has employed technologies and strategies to access water and sanitation, thereby showing that people are not just spectators of development. It seems that the government is reluctant, or is not willing to tap into the opportunities presented by innovative technologies employed by the residents in working towards facilitating access to adequate water and sanitation. The paper argues that adequate water and sanitation provision may be achieved through co-production mechanisms, as well as the transformation and reform in the political will and legislation guiding the planning of human settlements.

Keywords: Hopley Farm, Co-production, Innovative Technology, Human Settlement, City-edge settlement

1. INTRODUCTION

Over the past decades, there has been increasing emphasis on embracing innovative technologies to achieve sustainable development in different areas of development (Mulder, Ferrer & Van Lente, 2011:2; United Nations, 2013). Likewise, innovative technologies are adopted in the context of human settlements, especially when settlements lack basic services and are disconnected from the formal grids and networks of services such as water, electricity, and sanitation (Morato et al., 2011). Innovative technology is defined as technology that is

new, advanced and creative. The Centre for Development and Enterprise (2013:2) argues, “innovative practices in urban development can help improve access to the cities and address informal settlements”. Therefore, innovative technology proves to be a pathway through which informal settlements may be planned and developed to promote human well-being, as espoused in Sustainable Development Goal 11 and the New Urban Agenda (Parnell, 2016). Ironically, little attention is paid to embracing innovative technologies aimed at promoting residents’ access to water and sanitation in informal settlements of the Global South (Morato et al., 2011). For example, the guidelines for mainstreaming innovative technologies to promote the functioning of informal settlements seem to be missing from the urban planning discourse and human settlement policy in Zimbabwe.

This paper explores the strategies that have been employed by residents in the Hopley Farm Settlement (hereafter ‘Hopley’), drawing lessons from the nature of these innovations and how they can be upscaled to effect sustainable development. The paper further argues that planning for co-production through innovative technologies contributes significantly to the sustainability of human settlements. However, there are barriers to this success, such as lack of political will, funding mechanisms and planning ideologies that inform human settlement planning within a particular context.

2. Characterising informal and city-edge settlements

An informal settlement is an unplanned settlement. It has informal or insecure property tenure; lacks infrastructure, services and registration, making it unrecognised by government; and has a vulnerability for the inhabitants who are the most marginalised (UN-Habitat, 2015). In this paper, city-edge settlements refer to settlements outside the city boundary demarcated by the local authority as the area wherein they provide infrastructure and services. City-edge settlements are also associated with sprawling forms and located far from the city core, which makes it expensive to connect to the infrastructure networks. City-edge settlements may not necessarily be informal, but even when they are planned they may be lacking services, which then make them informal settlements.

2.1 *Water supply and innovative technology in informal and city-edge settlements*

Water supply is essential to sustain any settlement and has to be accessed from improved sources, which include piped water, boreholes or tube wells, protected wells, protected springs, and packaged or delivered water (WHO/UNICEF, 2017:8). Informal and city-edge settlements are usually not connected to formal water systems and residents resort to alternative water sources that are usually unsafe and compromise their well-being (Kwizera,

2014). Introducing and adopting new approaches to water supply in informal settlements have become crucial (Brown, Leder & Wong, 2017).

Button (2017) illustrates how residents in the middle-class areas of the city of Mumbai secured water supplies through rainwater harvesting technologies. Similarly, Enniful (2013) demonstrates how rainwater harvesting is a sustainable water supply strategy capable of alleviating water problems for low-income housing in South Africa. Rainwater harvesting is favoured due to the ability to collect rainwater, thereby reducing the strain on conventional infrastructure, such as the rainwater harvesting solar pasteurisation treatment systems used in an informal settlement in Stellenbosch (Reyneke et al., 2017).

Local authorities are increasingly exploring other alternative sources such as groundwater. The cities of Johannesburg, Tshwane, Durban and Cape Town have introduced groundwater as a valuable resource, although the use of groundwater remains unregulated (Armitage et al., 2015). The extraction of groundwater requires innovation; for example, Kenya uses solar energy to activate a pump that extracts groundwater and distributes it through a payment system that is managed locally (United Nations, 2013).

Groundwater is the major source of water in informal and city-edge settlements; yet it is usually polluted and not safe to drink. For example, the groundwater in Cape Town is alleged to be polluted by cemeteries, wastewater treatment works, landfill sites and informal settlements (Kretzmann, 2019). This polluted water fails to augment the water needs of the community. The community should adopt innovative technologies to cleanse and purify such water for use. Ecosystems such as wetlands that act as natural filters may be used to purify groundwater (Ahn & Schmidt, 2019). Furthermore, the solar-powered water purification technology invented by the Massachusetts Institute of Technology (MIT) and used in a Mexican village to purify drinking water (Matroos, 2018), may also be put to use to purify drinking water.

2.2 Sanitation and innovative technology in informal and city-edge settlements

The most preferred sanitation facilities and systems should not be shared with other households. Excreta should be treated and disposed of in situ, stored temporarily and then emptied, transported and treated off-site, or transported through a sewer with wastewater and then treated off-site (WHO/UNICEF 2017:8). However, the large and dense concentrations of people in urban areas make it difficult to decentralise sanitation systems. To empty the septic tanks when they are full may lead to human exposure and contact with faecal matter; hence, centralised sanitation systems are ideal in urban areas (Satterthwaite, 2016:100; Satterthwaite, Mitlin & Bartlett, 2015).

Informal and city-edge settlements are usually located far from the reticulated water systems, which makes it difficult to operate conventional sewerage systems. In this regard, some proponents have advocated decentralised sanitation facilities, but acceptance remains low. This remains an area to be explored with regard to human settlements (Chirisa et al., 2016). Another issue concerning the provision of sanitation services in urban settlements is the tension of funding that confronts local authorities and, ultimately, the need to uphold certain standards. These standards usually exacerbate the dilemmas in sanitation provision (Banana et al., 2015).

Nevertheless, innovative technologies such as dry or waterless toilets may be employed to enable the decentralisation of sanitation facilities in informal and city-edge settlements. The waterless toilets popularised by the Bill & Melinda Gates Foundation (2019) provide an alternative where water is limited.

Another alternative innovative technology is composting toilets that operate independently of water supply and sewerage connections while providing safe and hygienic sanitation (Berger, 2009). This works like a pre-treatment system where bacteria and chemicals decompose the faecal matter through an aerobic biodegrading process with, minimum environmental pollution (Zavala, Funamizu & Takakuwa, 2005).

Incinerating toilets uses different sources of fuel, from electricity, gas or fossil fuels to incinerate the excreta into ash (about a tablespoon of ash per sitting). This waterless system may be more expensive, but it is odourless and does not require any additional chemicals (Trulli, Torretta, Raboni & Masi, 2013).

3. *Co-production mechanisms*

The success of innovative technologies is best achieved through engagement with and among different players through co-production, including both individuals and organisations collaborating with government agencies in the design, production, use and management of public services (Alford, 1998:128; Poocharoen & Ting, 2015). Watson (2014) considers this as state-society interaction, which has received little attention in the discourse of urban planning. Watson argues that recently, cases from the Global South contexts offered possibilities for adding to planning debates and shifting planning theory from the Global North to become truly international. Resource constraints usually suppress the success of adoption, introduction and management of innovative technologies. Such constraints may be overcome through co-production where non-governmental institutions (NGOs) and the private sector may contribute to service delivery by means of innovative resource mobilisation, financial or personnel assistance. Furthermore, partnerships between universities and research

institutions, such as the MIT and Stellenbosch University, who collaborate with local authorities in innovative technologies, have become critical.

The success of co-production depends on the government. Mehta (2014) highlighted that inasmuch as policy rhetoric focuses on rights and equity; the reality is that utility and efficiency are largely dominant which in most cases sideline the interests of the marginalised communities. The result is what Harvey (2018) refers to as 'alienation', which occurs where the private sector sees no incentive in investing in water supply in areas where the poor reside. Such areas are thus referred to as unprofitable markets (Marson & Savin, 2015:27). In the end, they remain unserved, and residents normally resort to the use of alternative water sources, which include rainwater harvesting, shallow wells or water vendors (Matamanda, Dzvimbo & Kadebu, 2017:96).

4. Methodology

This study adopted a phenomenological research design that is concerned with the exploration of the lived experiences of the respondents (Creswell, 2014). The phenomenological research design enables a description of the realities as experienced by the respondents. In this way, this research design enabled us to explore the experiences of the residents in Hopley farm with regard to water sources and the challenges they face. Data were collected through observing and photographing the state of the infrastructure and how residents accessed water and sanitation. Key-informant interviews were held with purposively selected officials from the City of Harare, Department of Physical Planning, five private planners, and three representatives from NGOs. In-depth interviews were conducted with 15 randomly selected residents, while the questionnaire was also administered among 450 residents from Hopley. Ethical consideration was maintained through informed consent, the anonymity of the respondents, and free will of participation without coercion. Various Acts and the Constitution of Zimbabwe were reviewed. Content and thematic analyses were used to analyse the data as outlined by Tracy (2013).

5. Results

5.1 Background to Hopley Farm Settlement

Hopley is a city-edge settlement located 16 km from the central business district of Harare (Figure 1). Informality had been the major challenge of urban planning in Harare and the situation went out of hand in the early 2000s. People were displaced from different areas and had to be accommodated, which compelled the government to initiate Operation Murambatsvina (also known as Operation Restore Order). Hopley was thus established in 2005 by the government of Zimbabwe, without providing any basic services to the allocated stands.

Two statutory plans were supposed to give effect to the development of Hopley, namely the Harare Combination Master Plan (HCMP) and the Local Development Plan (LDP31). The HCMP prescribed a southward expansion of the city, which was consequently formulated into a plan through the LDP31 to advance urban development through superseding the provision of the approved outline plan of 1959 and the Harare Rural Town Planning Scheme in the south-eastern section adopted in 1973, and which largely restricted the area to agricultural land-uses (City of Harare, 1999:2).

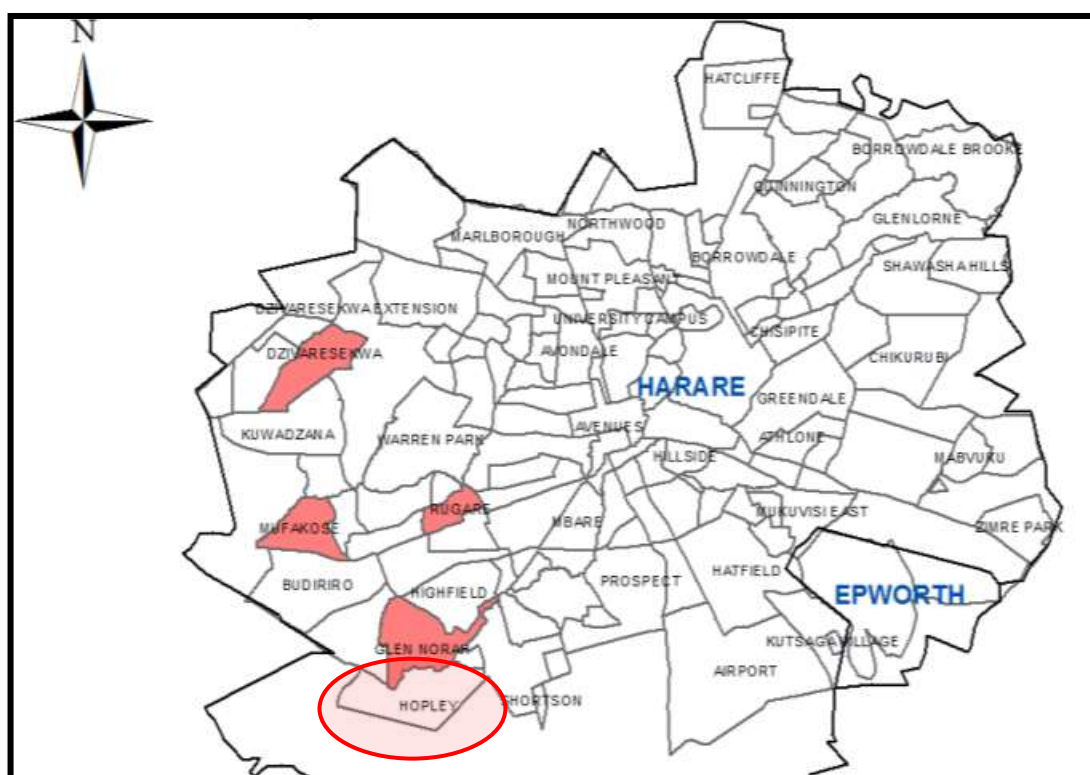


Figure 1 Map of Harare showing the position of Hopley at the fringe of the city

Source: Surveyor-General

The HCMP highlighted the deficiency of infrastructure in some parts of the city where new developments such as Hopley would have to be undertaken. The LDP31 also raised the same concern,

The provision of a reticulated sewerage system, water traffic, and transportation infrastructure, as well as electricity, post, and telecommunications systems, needs to be upgraded to meet proposed urban development in the area (City of Harare, 1999:25).

Similarly, a town planning consultant explained that the

City of Harare planned Hopley then sold stands to the public. Unfortunately, there was no take-up of the stands because the area was far from 'development' and resembled a rural area, hence there was no development. No one was initially willing to settle there.

This clearly shows the need for the provision of reticulated infrastructure in Hopley. The cost of such infrastructure development for Hopley was approximately US\$574 000; for surveying the land; US\$3 082 615 for roads and stormwater drains; and US\$2 232 032 for water and sewerage reticulation. The following response from the town planner helps to explain this failure to implement the proposed plan for Hopley,

However, we could not service Hopley; it remained undeveloped because there was no off-site infrastructure within the vicinity of Hopley. We remained with Hopley as a settlement, which we could not implement, considering that we did not have the money to install the off-site infrastructure, which is a prerequisite for developing any human settlement according to council standards.

It was also evident that access to water and sanitation had to be centralised and they relied on the existing infrastructure or need to construct new infrastructure to sustain the settlement. Ironically, until 2005, the settlement still lacked basic services and the residents had to improvise access to water and sanitation.

5.2 Sources of water supply and innovations in Hopley

Contrary to the envisaged plans in centralised bulk infrastructure provision, Hopley eventually emerged without these services and infrastructure. According to the engineer, there were one or two points where the City of Harare provided bulk supply of water. The engineer added that owing to the high population in Hopley, the communal facilities were inadequate and failed to satisfy the water demand for the population. Consequently, the communal taps were removed

because the water pressure in Hopley affected the other areas from where the taps were connected (see Figure 2). As highlighted by one of the engineers,

Inasmuch as we provided communal taps, the pressure of the water was affected in the established settlements such that we ended up disrupting that water source and leaving the residents to rely on boreholes.



Figure 2 A communal tap that has been locked and is no longer in use

Source: Author's own (2018)

Efforts to connect Hopley to the existing water supply system in neighbouring established settlements were eventually reversed when the water supply in the existing settlements was then compromised. A key informant confirmed that there was no plan for sewer or water supply and that the city did not even have concrete plans for water supply for the budding city.

5.2.1 Sources of water used in Hopley Farm Settlement

Hopley is situated in an area with abundant groundwater and residents access this groundwater by means of various strategies. Table 1 presents the sources of water used by the residents. The majority (40%) of respondents in Hopley use water from protected wells (Figure 3); 19% use unprotected wells (Figure 4); while 31% indicated that they used community boreholes (Figure 5). The state of the protected wells varies, as some are susceptible to pollution from runoff when it rains.

Table 1: Sources of water used by Hopley residents

Water source	Frequency	Percentage
Protected well	182	40
Unprotected well	87	19
Community borehole	141	31
Municipal water	2	1
Other	38	9
Total	450	100

Source: Author's own (2018)



Source: Author's own (2018)

Figure 3 Strategically situated protected wells in Hopley



Source: Author's own (2018)

Figure 4 Examples of unprotected wells used by residents in Hopley



Figure 5 The communal borehole with three water tanks

Source: Author's own (2018)

The strategies used to access water in Hopley show that there is limited use of innovative technologies. Besides the initiatives by the council to install a solar-powered borehole at the school and the three water tanks installed by UNICEF, nothing else has been done. The residents have been complaining about the pollution of groundwater due to the proximity of shallow wells and pit latrines as well as a nearby cemetery, but nothing has been done to purify the groundwater.



Figure 6 The solar system that powers the borehole at a school in Hopley

Source: Author's own (2018)

5.3 Sanitation facilities and innovations by residents in Hopley

Since a reticulated sewer system is considered the norm in urban settlements in Zimbabwe, it was proposed that Hopley would be connected through the Mukuvisi outfall to the Firle Sewerage Works (City of Harare, 1999:18). The LDP31 envisaged that Hopley could be drained to the Mukuvisi outfall sewer, which meant that the development of the settlement could be implemented in the first five years of the plan, namely by 2004 (City of Harare, 1999:11). This connection would allow the wastewater to be transported from the settlement for treatment, thereby limiting human contact with faecal matter. The need to have Hopley connected to a reticulated sanitation system was also informed by the *Public Health Act*, which encourages the safe disposal of faecal matter and wastewater.

The proposed plan as envisaged in LDP31 indicated that the use of septic tanks was discouraged due to the high population density in Hopley. The close proximity of Hopley to existing sewer works meant it would be easier for the settlement to be connected as explained above. One of the planning consultants who was part of the team that designed the LDP31 highlighted,

With regard to sewer, we were banking on the Firle as well as the use of ponds which would be decommissioned once the works were finalised.

The absence of a sanitation system in Hopley was captured in the interviews with residents who showed their disgruntlement with the absence of a sanitation system in the settlement. They highlighted that the government was responsible for the mess they were in. They felt they were the less-privileged citizens in Harare and that the government had failed them and did not care about their welfare.

In response to the absence of a sanitation system, instead using makeshift toilets, the findings from the survey showed that domestication of waste was made possible with various sanitation facilities, including open defecation, buckets and pit latrines. It emerged from the survey that 42% of the respondents used pit latrines; 33.78% made use of a sit-down toilet with a flush; while 14.44% used a squat-type toilet with a flush. Only 9.11% indicated that they used other sources of sanitation, which included 'flying toilets'; these are basically the same as open defecation, because residents defecate in plastic bags which they tie and throw on unofficial dumping sites.

Although decentralised sanitation systems help in disposing human excreta, their construction determines how the excreta will be disposed of and stored (Banana et al. 2015; Chirisa et al., 2016). This is true for Hopley where the decentralised systems are not adequately constructed

and result in wastewater and excreta being disposed of inappropriately (Figure 7 & 8). A key informant described the existence of septic tanks in Hopley as a disaster. Residents who were interviewed narrated as follows:

Self-made toilets are not safe for the people. Pits are being dug without covering them properly. This is a breeding site for flies, and is hazardous to children and even adults who risk falling into such pits.

I have a septic tank on my stand that was not constructed adequately. At times water overflows and it flows into the streets. The septic tank is also responsible for the contamination of groundwater. Above all, the smell coming from this system can be overpowering at times because I could not afford to put a slab on the tank.



Source: Author's own (2018)

**Figure 7 Left: Sanitation facility with only a seat and no water tank for flushing;
Right: Raw sewage flowing to the outside**



Source: Author's own (2018)

Figure 8 Left: Toilet under construction with a hole in the ground to contain the excreta;

Right: The hole is temporarily covered with plastic or other materials

The challenge with the shallow holes constructed to serve as septic tanks is that they fill up fast and the households are often clueless on how to manage the pits when they are full (Figure 9). There is no interaction among the residents and any other stakeholders when it comes to disposal of waste. An NGO official stated that they tried to introduce eco-san toilets in the settlement; however, the City of Harare did not approve.



Figure 9 A sewage pit filled with faecal matter exposed to the surface

Source: Author's own (2018)

In the interview, some residents mentioned that some of the pits dug for the toilets are less than one metre deep and when it rains, they see worms swimming in the sewage. This confirms our observations during the transect walk where some pits were filled up and faecal

matter exposed without being covered (Figure 9). In some cases, we observed that the excreta was simply directed into the street where it would just flow, replicating the situation that prevailed during the Industrial Revolution in European cities where raw sewage could be seen flowing onto the streets (Hall 1996:13).

6. Discussion and key findings

The literature demonstrated an array of innovative technologies that may be adopted and mainstreamed to enhance the access of water and sanitation in informal and city-edge settlements. We found that the application of innovative technologies for the provision of water and sanitation offers opportunities for improvement of water quality, energy efficiency, comfort, safety and convenience for residents. Notwithstanding the existence of such technologies, events on the ground showed that there was limited use of such strategies by the Hopley residents. They continued to extract water from shallow wells while they knew that the water was polluted. The localisation of human excreta persists and poses health dilemmas to the community. The strategies employed by the community, for example septic tanks, need to be upscaled so that they are not harmful to the community and environment. The failure of embracing the technology in Hopley is mainly attributed to lack of political will from the ruling party to engage civil society or other players who can bring in expertise and materials to facilitate the adoption of certain innovations. For example, collaborating with players such as the Bill & Melinda Gates Foundation, MIT and other NGOs may help to enhance the provision of such services. It seems that the government wants to shoulder full responsibility for water and sanitation provision and gain political support from the people. It may also be argued that the government is constrained in multiple ways, which stifle co-production initiatives. This is evident from the lack of decision support, investment and predominant conservation in service delivery provision, which ultimately frustrates the uptake of any innovative technologies.

Nevertheless, there were elements of scepticism and hesitation on the part of government with regard to the localisation of waste, as they feared that things might go wrong, resulting in an outbreak of diseases. Hence, they decided to play it safe and wait until they had the financial capacity to provide the traditional infrastructure in the area. Aside from their hesitation, it also emerged that there seemed to be fragmentation in institutions and decision-making, which restrained co-production efforts among different stakeholders; thus, Hopley seemed to be isolated by the City of Harare and the Ministry of Local Government and had been left in the hands of the politicians who did not have the capacity to organise and effect transformative change. The provisions were strict and needed to be adjusted; unlike in India where decentralised systems were permitted in urban areas as long as they were constructed

adequately. The same is not true for urban Zimbabwe, which discouraged decentralised systems on small plot sizes.

In light of the discussion presented in this paper, we make the following recommendations:

- The government must strive to eradicate the barriers that stifle the use of innovative technology and facilitate its development and adoption in enhancing the functionality of human settlements. Such barriers include regulatory barriers that hinder innovation.
- Government in partnership with research institutions may use information dissemination, for example, universities need to improve the transfer, development and adoption of innovative technologies.
- The support of innovators with favourable conditions, helping them to experiment and fine-tune their ideas, instead of criticising everything that does not conform to the status quo, namely the traditionally centralised way of providing access to water and sanitation.
- Universities need to invest in the nurturing of expert personnel who will facilitate and assist with the introduction and application of innovative technologies that enhance citizens' access to water and sanitation.

7. Conclusion

This study explored the strategies employed by residents in Hopley to access water and sanitation. We considered how planning for co-production can be mainstreamed in human settlement planning for innovative technology for access to water and sanitation. Amid the utility of co-production mechanisms in facilitating the introduction and adoption of such technologies, it seems that the government is constrained in many ways with regard to institutional capacity, lack of finances and expertise. On the other hand, politics of difference also restrict the success of co-production mechanisms, which ultimately suppress the uptake of innovative strategies in the settlements. The study concludes that innovative technologies can contribute significantly to resolving the water and sanitation challenges faced in Hopley.

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A landscape study of South African dissertations in the field of human settlements between 1994 and 2019

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Abstract

Almost 2 424 (or 1,4%) of the 176,654 digitally published theses and dissertations from South African institutions of higher learning contain “human settlement(s)” or “housing” as catalogue keywords. This paper presents a landscape study of such theses and dissertations completed since the dawn of democracy in South Africa. The goal was to identify gaps in research – both topically and geographically – to guide future research direction in the field of human settlements’ curriculum enhancement and system-wide capacity building.

The objective was to locate the originating institutions and the geographic study regions, document the nature and range of study topics by thematic category and to visualise changes in these factors over time. A purposively selected sample was studied to identify the broad need which the dissertations seek to address, and mapped to research designs and research methods. The research design consisted of a systematic desktop review.

Method: Data on South African theses and dissertations were obtained from the National Electronic Theses and Dissertations (NETD) portal and sorted by keywords and publication date. Quantitative data analysis was performed on a representative sample of dissertations and theses. Originating institutions and (where obtainable/applicable) study regions were geographically mapped. The study revealed areas of research focus mapped according to topic and region. Findings from this paper provide the groundwork for further investigation into research gaps and needs as identified from practitioners’ perspectives, to establish alignment.

Keywords

1. Introduction

April 2019 marked 25 years since the dawn of democracy in South Africa. During this time, South Africa’s public academic institutions have played an important role in building professional capacity to challenge, lead and support the production of housing and human settlements (collectively HHS). Accumulating housing backlogs and escalating service delivery protests (Department of Planning, Monitoring and Evaluation (DPME), 2018), much of which is centred on the demand for housing and utility services are a testament that the sector is not meeting the needs, or at the very least the expectations, of its citizens. Reflecting on current and recent professional capacity-building efforts may be instructive on how the academic sector can gear itself to make the most valuable contribution to the discourse on our future human habitats.

2. What is known about the current “landscape”?

In some respects, for example, policy development, the contribution of higher education to the HHS sector over time has been well-documented (Tissington, 2011). In other respects, for example, whether and how academia has contributed to sector innovation or is preparing a generation of practitioners to address grand challenges, such as climate change, anticipating population growth or meeting development goals is less clear. In part, this may be because HSS scholarship is fragmented; dispersed across institutions and between academic disciplines. Resources such as HEMIS⁴ provide little insight into the number and nature of HHS studies. The authors, therefore, turned to the published outputs from academia over the preceding 25 years, to provide a “landscape” or high-level quantitative and descriptive national overview of academic discourse and its material topical, geographic and methodological contributions to the field.

3. Data

The National Electronic Theses and Dissertations (NETD) portal hosts a homologated catalogue of openly accessible theses and dissertations⁵ from 22 of South Africa’s 26 public academic institutions. For this paper, the term “dissertation” will be used to denote both dissertations and theses⁶. The NETD displays dissertation titles, date, author, and a link to the host institutions database with an abstract, the name of the student’s institution, and a statement of the degree being fulfilled. A link to the dissertation full-text is generally, but not inevitably, provided. The number of catalogued items is rapidly increasing, and at writing, the NETD catalogued 176,654 items, with an estimated 86% relevance⁷ rate.

⁴ The Council on Higher Education (CHE) receives Higher Education Management Information System (HEMIS) data from the Department of Higher Education and Training and collects data from StatsSA and makes this publically available through VitalStats publications and the performance indicators project (CHE, 2019).

⁵ Some texts suggest that in the US the terms *thesis* and *dissertation* correspond with outputs produced in pursuit of master’s studies and doctoral studies, respectively, whilst the opposite nomenclature is applied in the European Union. In general, in South Africa, and in the NETD database the terms are used interchangeably.

⁶ Sefako Makgatho University (health sciences); Mangosuthu University of Technology; Sol Plaatje University; and Mpumalanga University are not represented on the NETD.

⁷ “Relevance” being within the years of interest and with duplicates removed, as estimated from analysis of a 17% subset of the total dataset.

4. Method

The NETD was used as the primary data resource for this paper. A search for dissertations in the field of human settlements was done using the search terms “human settlement(s)”, “housing” and “house”. This yielded a total of 5,397 eligible titles since 1994. Of these, many contained the keywords but were not relevant to the field of human settlements⁸, and were eliminated, yielding 1,795 titles of interest. Quantitative data analysis was performed on all titles of interest. A representative sample of dissertations was purposively selected for more in-depth quantitative analysis.

5. Limitations of the study

The number of dissertations uploaded to the NETD as a function of total dissertations produced is not known.

6. Quantitative analysis

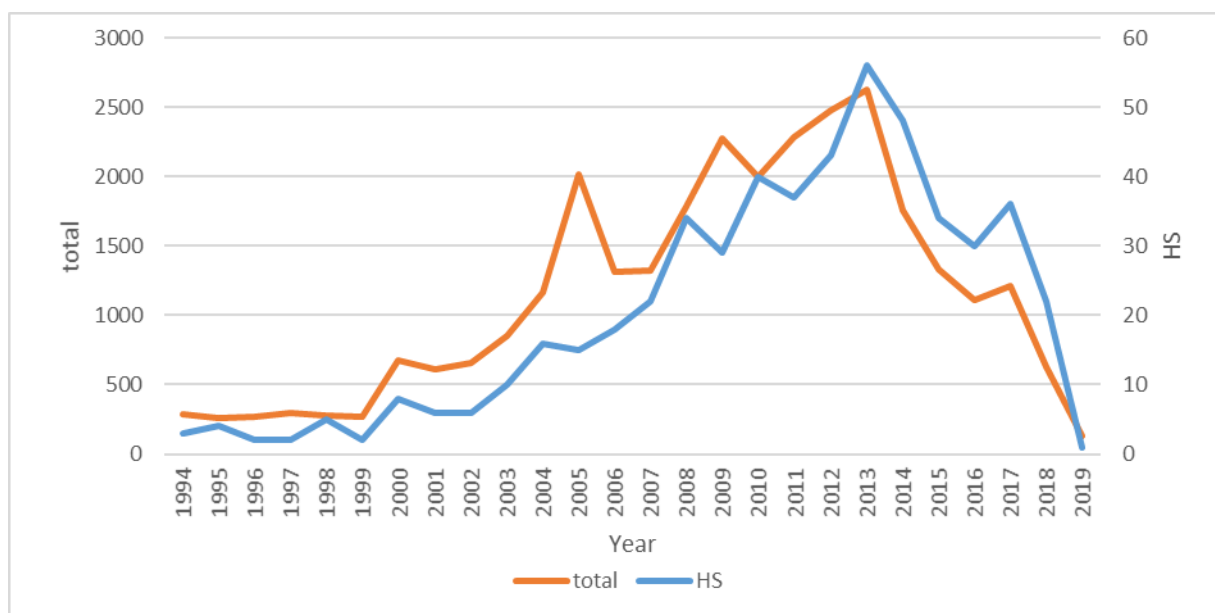


Figure 1 Number of HHS dissertations per annum and the total number of dissertations (National Research Foundation (NRF) & CHELSA, n.d.)

Figure 1 shows the number of HHS titles per year since 1994, as well as the total number of dissertations in NETD. It is apparent from the data that there has been an exponential increase in papers in HHS, peaking in 2014, and then reducing. The overall trajectory of HHS titles follows a similar trajectory to all papers. Given that the number of catalogued items is rising daily, the authors surmised that the recent reduction in published papers is attributable to the

⁸ For example, under the search term “house” titles relating to research on house flies were included

lag in uploading dissertations onto the NETD site. The increase in output observed in the graph until 2014 approximates exponential growth, which can be understood in the context of a national average increase in enrolled university students of 5.47% per annum (MacGregor, 2014).

Figure shows HHS as a percentage of all dissertations, which shows a strong increasing trend over time, from 1.54% in 1995 to 3.48% in 2018. HHS, therefore, has seen a steady rise in popularity as a topic of study nationally over 25 years.

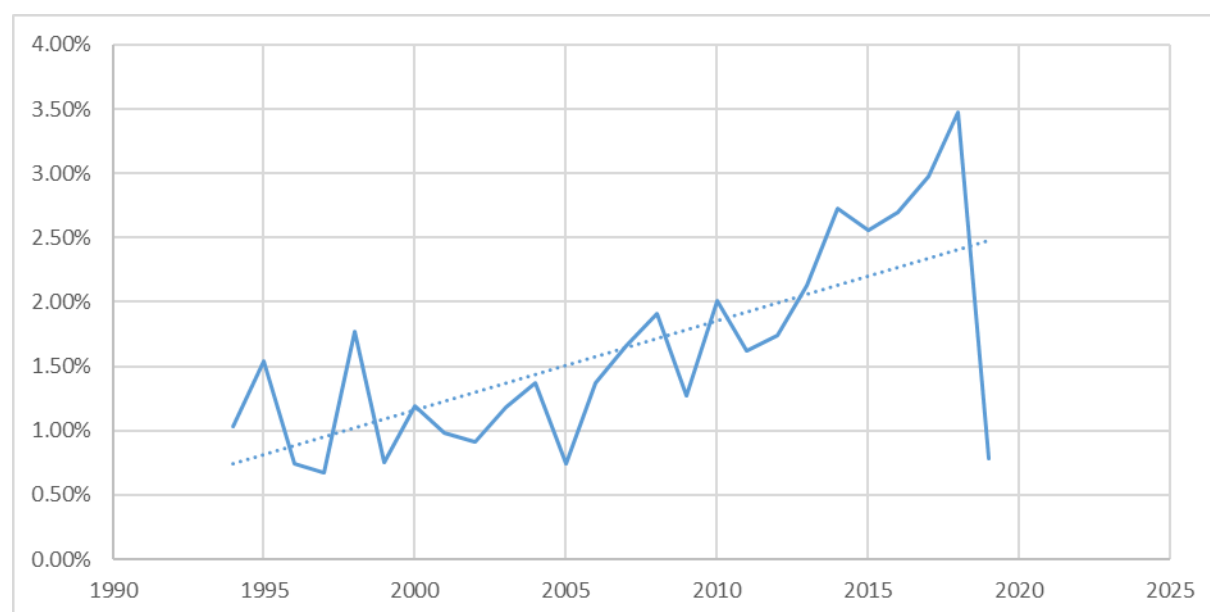


Figure 2 HHS dissertations as a percentage of all dissertations (NRF and CHELSA, n.d.)

The data was sorted into a several themes, relating to a cross-section of social, economic, environmental concerns of contemporary academic interest, to identify common areas of research as well as gaps in the field of HHS. The themes were categorised and plotted against years to establish trends in the research over time. The categories, themes and search keywords are shown in Table 1.

Table 1: Categories, themes and search words (NRF and CHELSA, n.d.)

Category	Theme	Keywords
Housing type	RDP housing	RDP, subsidy, subsidised, low income
	BNG housing	BNG, breaking new ground, middle income
	Real estate	Real estate
	Informal settlements	Informal settlements, slum, shack
Drivers	Climate change	Climate change, global warming
	Biodiversity	Biodiversity, ecology
	Development goals	SDG, NDP, development goal, new urban agenda
	Food security	Food security
	Land reform	Land reform
Implementation	Partnerships	Partner, public private
	Investment	Invest, finance, funding
	SADC	SADC, Southern African Development Community
Interest areas	Sustainability	Sustainable, sustainability
	GIS	Geographic information system
	Water	Water source, water supply
	Energy	Energy source, electricity
	Smart housing	Robotics, artificial intelligence, fourth industrial revolution
	Fire safety	Fire

Figure 33, Figure 4, Figure 5 and Figure 6 are presented on a consistent scale for ease of comparison. It must be noted that there is in some cases an overlap of categories. For example, a paper that appears in a search under the keyword “climate change” may also appear in the search results for the keyword “biodiversity”. The total number of dissertations in HHS (reduced in scale on the vertical axis) has been superimposed on Figure 33, Figure 4, Figure 5 and Figure 6, for ease of reference as to the relative frequency of themes as a portion of all published HHS dissertations.

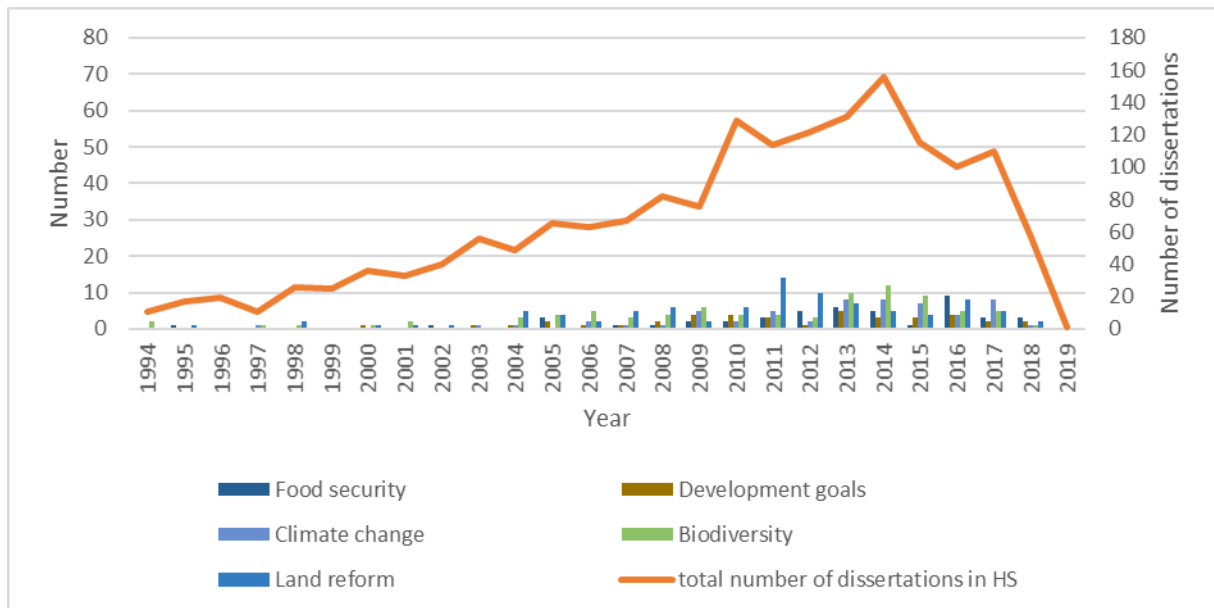


Figure 3 Frequency of search terms in category of Drivers (NRF and CHELSA, n.d.)

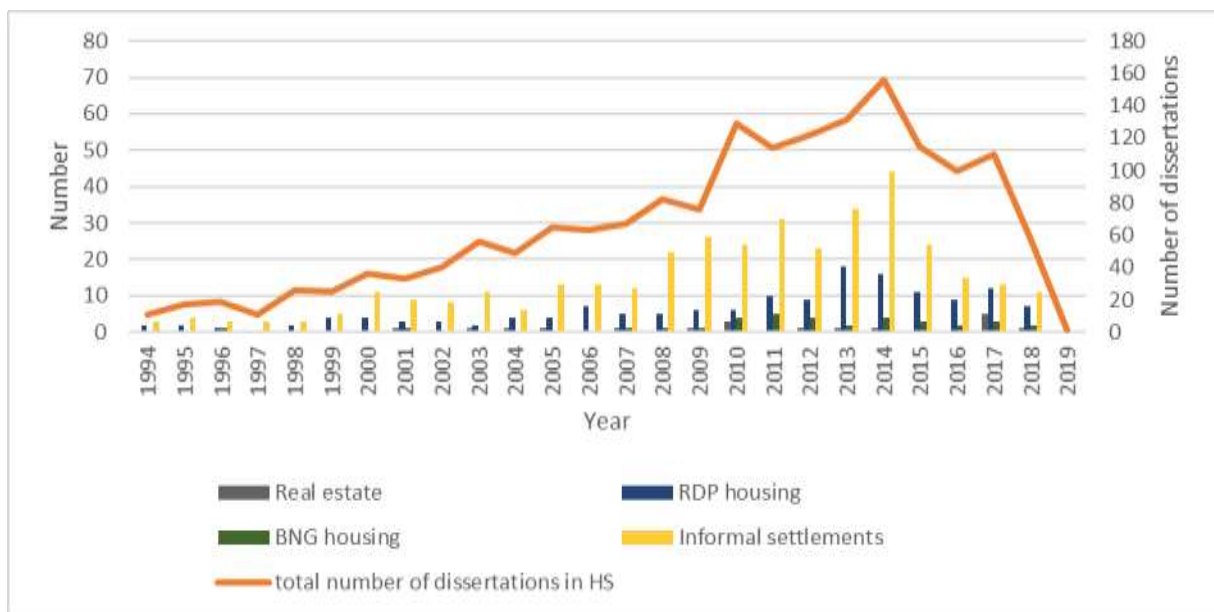


Figure 4 Frequency of search terms in category of House Type (NRF and CHELSA, n.d.)

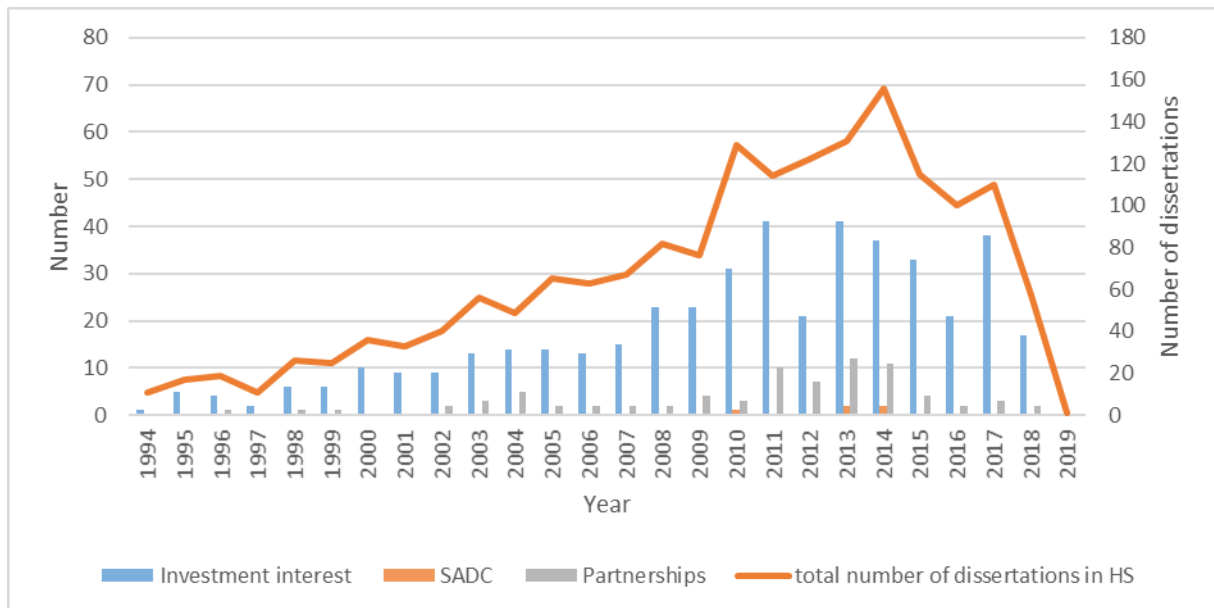


Figure 5. Frequency of search terms in category of Implementation (NRF and CHELSA, n.d.)

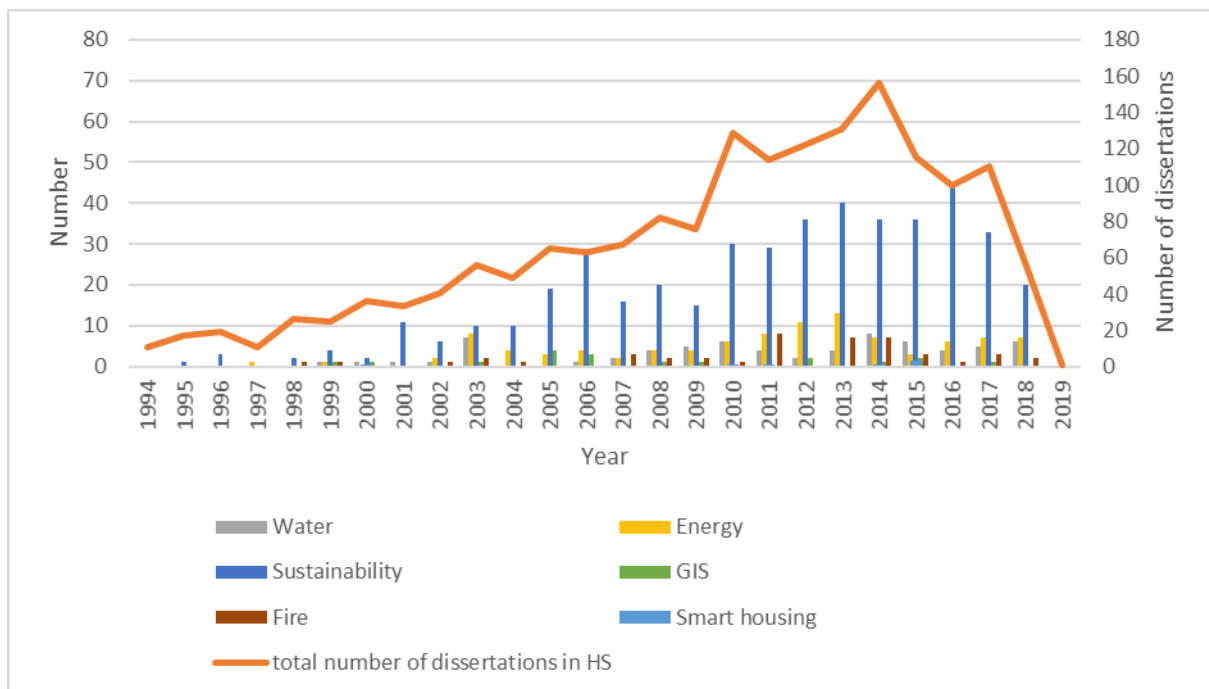


Figure 6 Frequency of search terms in category of Interest Areas (NRF and CHELSA, n.d.)

6.1 Topics of interest

When considering “House Type”, (Figure 33) it is clear that there is a significant interest in research regarding informal settlements. On the opposite side of the spectrum, there is extremely low research interest in real estate, which is a topic of study associated with the higher end of the income spectrum. The research interest in housing correlates with economic

lines – the most research has been done on the lowest income-housing bracket and the least on the highest income bracket.

When considering the “Interest Areas” category (Figure) it is evident that, apart from sustainability, which is an overarching theme, both energy and water are dominant. Overall, however, there is a relatively low number of papers in these areas.

6.2 Sample analysis

From within the 1,795 titles of interest, a search was conducted for the terms “science”, “technology” or “innovation”, to yield 241 titles (13%) for quantitative analysis. The term “science” appeared in 113 of the titles, by virtue only of the degree being satisfied⁹. Thirteen (13) titles appeared in the search concerning the degree or various universities of technology. Upon investigation, it was found that “science”, “technology” or “innovation” was used as a descriptor for applied methods in over 90% of the remaining papers. “Engineering” appeared in only three of the titles. This means that science, technology or innovation were the focus or topic of study in the catalogue in only eight of the 1,795 HHS papers.

Abstracts from the representative sample were analysed regarding the topics of interest described in the section above and represented on a heat map, shown in Figure 7. The heat map plots frequency of terms appearing in dissertation abstracts against the originating institutions.

⁹ For example Master of Science; Ph.D. (Social Science) etc.

	Water	Energy	Sustainability	GIS	Smart housing	Fire safety	Partnerships	SADC	Investment	Climate change	Biodiversity	Development Goals	Food security	Land reform	RDP Housing	BNG Housing	Informal Settlements	Real Estate
Cape Peninsula University of Technology	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Central University of Technology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Durban University of Technology	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
Nelson Mandela Metropolitan University	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1
North-West University	1	1	3	0	0	0	0	0	0	2	2	1	0	0	0	0	1	0
Rhodes University	2	1	7	1	1	1	0	4	1	3	8	0	0	0	2	0	4	0
Stellenbosch University	1	1	6	0	0	1	1	1	1	0	1	3	0	1	7	0	5	1
Tshwane University of Technology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
University of Cape Town	1	1	8	1	0	3	1	7	4	6	5	0	1	0	4	0	13	0
University of Fort Hare	0	0	2	0	0	0	1	2	1	0	0	1	0	2	0	0	0	0
University of Johannesburg	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
University of KwaZulu-Natal	0	1	13	5	2	0	2	8	3	0	3	0	2	2	1	0	12	0
University of Limpopo	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
University of Pretoria	0	0	6	0	0	0	3	0	4	0	0	0	1	0	5	1	3	1
University of South Africa	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	2	0
University of the Free State	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
University of the Western Cape	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
University of the Witwatersrand	0	0	5	1	1	0	0	2	2	0	1	1	0	1	1	0	1	0
University of Venda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
University of Zululand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vaal University of Technology	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walter Sisulu University	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	8	52	9	4	5	9	25	16	11	21	7	7	7	21	2	42	3

Figure 7 Sample themes and originating institutions of HHS dissertations in South Africa (1994 – 2019) (NRF and CHELSA, n.d.)

As was found in the broader study discussed earlier, results were biased very strongly towards urban settlement studies, with particular focus on low-income, affordable housing, informal and government subsidised housing typologies. Education featured fairly consistently as a topic of interest. Five dissertations used a variety of housing typologies for comparison studies. The term “mixed-use”, which is emerging as an important strategy in addressing housing needs did not appear in the sample set. Gender was a focus of three of the sampled papers.

7. Research methodologies

The majority (n=209) of the 241 titles sampled were case studies. Most dissertations reported a mixed (quantitative and qualitative) methods approach, with surveys, structured interviews and semi-structured questionnaires being the most common methodology deployed, followed by observations, particularly for studies related to socioeconomically disadvantaged demographic groups. Key informant studies were favoured for topics related to studies in real estate. GIS and spatial modelling were commonly used as a supporting instrument. Four

studies reportedly made use of simulation. Experimental research methods were very rare (n=8), whilst remote sensing was applied in five studies and artificial intelligence was a focus of one paper. The majority of sampled dissertations were cross-sectional and contemporaneous (n=209); with a small number of longitudinal, three cross-sectional historical (archaeological) studies; and the remaining longitudinal, historical studies.

7.1 *Originating institutions*

The sample was analysed to identify the originating academic institution with published dissertations referencing science, technology or innovation in HHS in the preceding 25 years. It was found that the number of dissertations varied significantly between institutions, even when adjusted for numbers of publication from the institutions. Seven institutions have published no dissertation in the field of HHS¹⁰ on NETD, whilst others are very prolific. Nine of the 22 institutions have catalogued doctoral degrees in the 25 years under review. No correlation between the number of doctoral theses and master's theses is observed, although all institutions publishing doctoral theses have also published master's theses.

¹⁰ These institutions did feature “non- HHS” dissertations

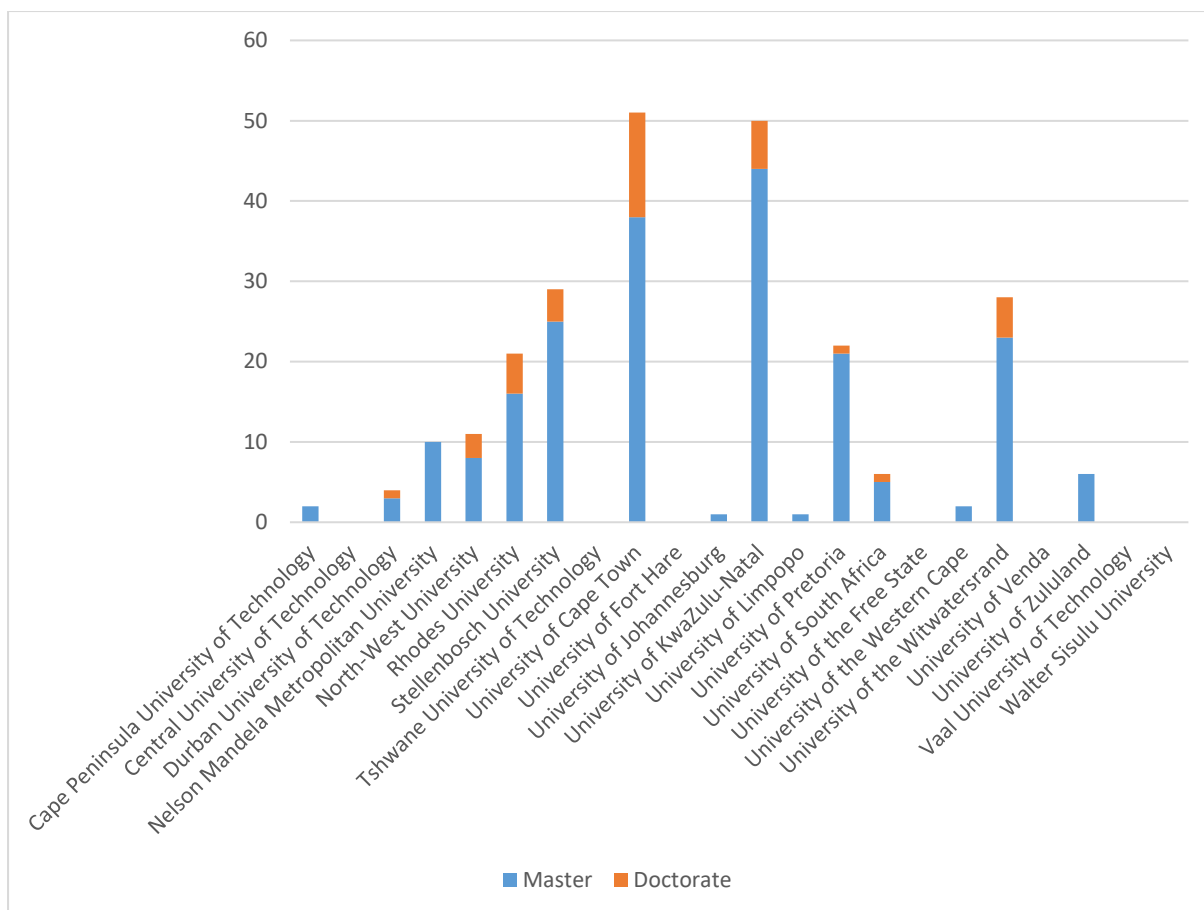


Figure 8: Number of HHS dissertations on NETD of South Africa's public universities (NRF and CHELSA, n.d.)

7.2 Study locus

Loci of study for the sample set were determined for 220 of the dissertations. For the remaining 21 dissertations, the study was of a laboratory, or theoretical nature and not "place-dependant". Only one of the dissertations sampled had the study locus outside Africa¹¹. Twelve per cent (12%, n=30) of the dissertations sampled had a study locus beyond South Africa's borders, mostly in the SADC region¹². These authors speculate that many of the SADC studies are undertaken by students whose ordinary or original place of residence is in the country of study and that these studies are related to South Africa's status as a regional study destination. Twenty-six (26) of the studies located in the context of South Africa, were national in scale. The remaining studies varied from an individual institutional/household study to a neighbourhood scale, to a provincial scale. Study locations were plotted on a map, as

¹¹ Study locus; Auckland, New Zealand.

¹² Ghana n=1; Tanzania n=2; Zambia n=2; Namibia n=7; Botswana n=2; Lesotho n=2; Swaziland n=1; Mocambique n=2 and Zimbabwe n=11

shown in Figure 96. In the South African studies, strong correlations between prolific academic institutions, which are located in major centres, and locus of study is evident. The study showed that studies in rural settlements, service towns and regional centres were rare, and, where present, focussed on the human / natural interface and were of ecological interest.

8. Discussion

The analysis above shows that the majority of current dissertation studies are focussed on housing and human settlements in settings of marginalised socioeconomic status. An academic contribution to discussions mixed typologies is absent. It is observed that studies in dissertations on partnerships are lacking. Rust, Zack & Napier (2009) propose the idea that focusing on low-cost housing for people who earn below a minimum income inevitably distorts the market making it difficult for (for example) the private sector to build and mortgage affordable housing. This idea underpins the approach taken in the official HHS policy Breaking New Ground agenda (BNG) to considering the residential market as a whole. But whilst there is an academic debate on whether improved residential mobility in South Africa is possible (such as through a “housing ladder”), in the situation dominated by state supply (Napier & Gavera, 2011), there is a dearth of dissertations investigating this theme.

It is clear that sustainability has emerged as a popular and enduring topic of study. The analysis above shows that the majority of current dissertation studies are located in areas of convenience, which may reduce the opportunity for academic dissertations contributing to rural challenges, such as averting the hollowing out of rural settlements, which is anticipated by the Green Book (Council for Scientific and Industrial Research (CSIR), 2019). Science, technology and innovation can be disruptive and transformative.

There is generally a lack of science, technology and innovation topics. There appears to be a high reliance on qualitative methods with subjective inputs and a very small footprint of experimental design methods.



Figure 96 Sample loci and themes of HHS dissertations set in South Africa (1994 – 2019) (NRF and CHELSA, n.d.)

9. Conclusion

Interest in the field of HHS study is growing and output is growing at a faster rate than the general rate. On face value, 1,795 paper over 25 years seems to be a major contribution to the field of HHS. There is a wide variety in topics of interest. On closer inspection, there is a pervasive homogeneity in geographic study locus and methodological approach to HHS dissertation. It seems possible that there is an inherent opportunity cost in the case studies approach as applied by a majority of HSS dissertations, in that, focusing on the existing situation, may be at the expense of experimenting with transformative ideas.

10. Recommendations

A follow-up study on the HHS sector would provide a useful benchmark to determine whether (i) practitioners in the HHS sector completed dissertations on the topic, and (ii) whether the dissertation studies have prepared students well for their professional activities in the field. Further research and dialogue on the apparent homogeneity in methodological approach, as well as study locus, and the extent to which this best addresses the sector needs would be very useful.

Acknowledgments

Alison Smith and Sinéad de Jager (data extraction and cleaning).

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A Foucauldian analysis of public housing in rural South Africa: A case study of the Jozini Low-Income Housing Scheme in KwaZulu-Natal

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Abstract

Public housing schemes like most schemes of this kind have been used by the state as a tool for creating what Michel Foucault refers to as “governable subjects”. This paper evinces that state led public housing schemes have played a critical role in subscribing certain labels that give the state the impetus to intervene and govern the private lives of its citizens. We further argue that the provision of housing to South African citizens goes beyond achieving socio-democratic principles. Instead, it also serves to problematise poverty, seeking ways to intervene in the everyday life of those characterised as being “poor”. The paper engages Foucault’s thoughts on “governmentality” and “biopolitics”. We theorise that contrary to their perceived role of mobilising people to rise against poverty, state directed development initiatives such as public housing programmes have systematically transformed poor people into objects of knowledge, management and governance. Consequently, to control and intervene in people’s everyday lives, the paper argues that through its housing policy, the South African government has intendedly and unintendedly produced a simplified and schematic model of the reality in which they want to intervene. To this end, the paper asserts that while the provision of housing is aimed at addressing the prevalence of material poverty among previously disadvantaged groups, it also serves as a process of conditioning state-citizens relations and promoting “participatory democracy”. Using empirical evidence extracted from qualitative data collected from beneficiaries of the Jozini Low-Income Housing Scheme¹³ in KwaZulu-Natal Province, we argue that while to a certain extent housing subsidy schemes mitigate South Africa’s housing problem, the state has intendedly or unintendedly used it as a governmentality tool. The paper explores how the production of power intersects with public housing in creating governable bodies.

1. Introduction

The post-apartheid democratic state of South Africa is always characterised by some commentators as a “developmental” one, in which the African National Congress (ANC) led government has made deliberate efforts to strengthen state-citizen relationships by facilitating citizens’ access to crucial social goods and services such as housing. The provision of affordable public housing to marginalised communities such as those living rural areas, for instance, has indeed to a certain extent advanced the material conditions of those occupying

¹³ In this paper, we use “Jozini Low-Income Housing Scheme” as a mere geographical expression and collective term. It is worth mentioning that there are numerous low-income schemes being implemented in the Jozini area. Some of these schemes are named after respective traditional leaders governing the areas in which such schemes are being rolled out.

these spaces. This paper, however, argues that while housing delivery in South Africa has been crucial to alleviating poverty and mitigating the housing problem attributed to the apartheid system, it has also acted as an effective instrument of producing governable subjects.

To support the thesis on governability above, this paper uses Foucault's concepts of biopolitics and governmentality. It incorporates the works of other Foucauldian scholars to argue that, the implementation of state-led housing schemes in South Africa is one of the many methods through which the state controls and governs its people from a distance (Foucault, 1995). This paper further focuses on how using public housing delivery as a governing tool is made effective by not only being moulded around existing foundations of traditional institutions of leadership but also social norms prevailing in that given society. Additionally, the paper reflects on how public housing materialities (the uniformity of houses in colour, structure and number of rooms) has operated as an innovative way of establishing the state's presence if not relevance among the so called "poor communities".

This paper is divided into three sections. The first section engages Foucault's (1995) concepts of "biopolitics" and "governmentality" to understand how the production of governable subjects have interacted with the production of public housing in rural South Africa. It further explores how this interaction functions to produce certain rationalities, ideologies and subjectivities that are essential to managing communities. The second section reflects on how public housing not only affords the state an opportunity to tame the rising tide of material deprivation in rural areas, but further allows it to instrumentalise poverty as an impetus to intervene in the daily lives of citizens, and intentionally or unintentionally seek legitimacy. This paper suggests that the post-apartheid state has produced and retained power by inserting itself in the everyday lives of its citizens.

Thus, it can be suggested that the promotion of "participatory democracy" by the post-apartheid state, particularly against the backdrop of public housing schemes serves as an important interface of shaping state-citizens relations and more importantly shaping the citizens' attitude towards the state. The last section explores empirical data gathered from in-depth interviews with officials from the Department of Human Settlements, traditional leaders and the community members of Jozini, rural Northern KwaZulu-Natal. It examines how the intersectionality of rural public housing delivery, participation, social norms, gender and governance has shaped the state-citizen relations in post-apartheid South Africa.

2. Understanding governmentality, biopolitics and aesthetics public housing

According to Foucault (1995: 221) governmentality is an exercise of power “...by which, in our culture, human beings are made subjects”. It “seeks to fashion and guide the bodily comportments and inward states of others and of self” (ibid). Thus, the government sets the rules to achieve the maximum benefits for the governed. In return, the governed must obey the rules established by government, hence there is a symbiotic relationship between the governor and the governed. According to Foucault (1995), the production of governable subjects occurs simultaneously with that of truth or knowledge, which should stand as a rationality of regulating social behaviour. Foucault (1991a: 79) rightly maintains that certain:

“... ‘practices’ do not exist without a certain regime of rationality ... If I have studied ‘practices’, ... it was in order to study [the] interplay between a ‘code’ which rules ways of doing things ... and a production of true discourses which serve to found, justify and provide reasons and principles for these ways of doing things ...”

Earlier, Foucault (1980:93) argued that:

“there can be no possible exercise of power without a certain economy of discourses of truth which operates through and on the basis of this association. We are subjected to the production of truth through power and we cannot exercise power except through the production of the truth”.

Moreover, exercising power over subjects through self-regulation ensures that it becomes acceptable, and is seen a good act and a norm by those being ruled. This argument is well put by Foucault (1995) who states that:

“...what makes power hold good, what makes it accepted, is simply the fact that it does not only weigh on us as a force that says no; it also transverses and produces things, it induces pleasure, forms knowledge, produces discourse. It needs to be considered as a productive network that runs through the whole social body, much more than as a negative instance whose function is repression” (p.120).

For instance, in the context of governance and the production of governable bodies in post-apartheid South Africa, the state has used objects such as public houses to institutionalise and entrench the biopolitics of power, governmentality and its discourses. The materialities of houses (design, arrangement, colour and uniformity) constructed under the Reconstruction and Development Programme (RDP), for example, enables the state to establish its presence, and relevance to poor communities. On one hand, RDP houses become sites on which the

state solidifies and claim its legitimacy of fulfilling the promises made through the provision of housing to the poor. On the other hand, RDP houses in their materialities become associated with the state and its commitment to upholding the socio-democratic principle of promoting access to housing among its citizen.

This paper contends that the aesthetics of public houses provided by the post-apartheid state has to a certain extent been important in increasing the state's visibility in spaces or communities where its overbearing omnipresence is needed the most. Ghertner (2010) theorises the effectiveness of aesthetics in institutionalising and dispensing governmentality. According Ghertner (2010), argues that the aesthetics in state-led public housing schemes assists the state to emit its identity, norms, ideologies and "truths" to its subjects, allowing to shape how its citizenry views it. Ghertner (2010:186) further posits that public housing programmes "...are effective to the extent that they produce governable subjects...individuals who evaluate the social world through lenses provided by the government". They therefore become "...an essential component of guiding the interests of targets population groups is thus the joint exercise of crafting intelligible fields for governmental intervention and problematising such fields so as to make certain "deficiencies" emerge as improvable".

When one applies Ghertner's (2010) assertion to the Jozini Low-Income Housing Programme, it is not surprising that some of the participants referred to houses constructed under this scheme which have aesthetics that are different from normal houses as "*Indlu zika Hulumeni*" (Government houses). This reference of "*indlu zika Hulemen*" feeds into the panoptic presence of the ANC- led government in the everyday language and people's experiences with housing in South Africa. Scholars such as Gramsci (1977) will interpret the above reference by some participants as a culmination and entrenchment of the state's hegemony over its citizens and an establishment of government's visibility and surveillance on public spaces. He argues that leads to a situation where ruling elites establishes the "governmentalities" of space through "consent".

Like Foucault, Gramsci (1977) also identifies the importance of "consent" in the production of governable spaces. Gramsci (1977) considers space as a discourse through which societal social relations and practices are produced and enacted (Jessop, 2005). Similarly, neo-Gramscian writer, Goonewardena (2005) asserts that the production of hegemony cannot be achieved without the production of space. Moreover, he argues that space is a medium of hegemony as it can be used to mirror the ideologies of the ruling elite. The question of space being ideological is also raised by Lefebvre (1974:210) who argues that while "ideologies [...] do not produce space, they are [located] in space". Furthermore, Lefebvre (1974) notes that space is heavily embedded with power and knowledge ready to be used in producing

hegemony and vice-versa. In exploring Gramsci's contribution to the discourse of governmentality, it is therefore important to analyse his influence on Lefebvre, more specifically in the conceptualisation of Lefebvre's spatial triad.

Lefebvre's (1974) spatial triad comprises three interrelated aspects of space: representations of space (conceived space), representational space (lived space) and spatial practices (perceived spaces). Similarly, Kipfer (2008) has argued that traces of Gramsci's concept of hegemony are seen in each of Lefebvre's spatial triad and more crucially in his writing on the critique of everyday urban life.

The institutionalisation and normalisation of hegemony can never be fully achieved without a well-crafted production and top-down appropriation of what Lefebvre (1974: 33) refers to as the "representation of space". He considers "representations of space" or "conceived space" as closely "...tied to the relations of capitalist [own emphasis] production and to the order which those relations impose, and hence to knowledge, to signs, to code, and to "frontal" relations" (Lefebvre, 1974:33). The "conceived space" is described by Merrifield (2000) as being a platform where ideology and power are embedded. It is in the "representations of space" (conceived space) that ideology and knowledge is used in intervening in the lives of ordinary citizens by the state, political elites and technocrats.

Therefore, it can be contended that the consolidation of power and hegemony comes full circle in the "representational space", which according to Merrifield (2000:174) is "...directly lived space, the space of everyday". This aspect of this space is "directly lived through its associated images and symbols of its users and inhabitants...and it overlays physical space, making symbolic use of its objects" (Lefebvre, 1974:39). The paper considers the production of this "representational space" as being directly linked to the production of social identities and spatial dispositions. Our observation also relates to that of Simone (2008) who argues that it is in the "representations" and "representational" space that attachment of identity to spatiality takes form. In his understanding of the appropriation of city spaces, Simone (2008: 70) asserts that "spaces are linked to specific identities, functions, lifestyles and properties so that the spaces [...] become legible for specific people at given places and times".

According to Lefebvre (1974:33), the "perceived space" or spatial practices represent a "...continuum midway between small-scale individual practices and large-scale social processes and institutions". He further asserts that people always appropriate space according to broader social, economic and political realities of their material existence. Similarly, like "representations of space" and "representational space", the spatial practices embody the ideologies, socio-cultural beliefs, knowledges and symbols which inform the "spatial territoriality" of individuals. While Foucault's conception of governmentality is widely

accepted as an analytical tool to understand the relationship between the governor and the governed, it is criticised for re-enforcing the centrality of state power in governance (Joseph, 2010).

3. The politics of rural housing in South Africa: producing governable subjects

The Jozini Low-Income Housing Scheme has been instrumental in producing governable subjects. Further, we argue that it is an important site of exercising “disciplinary power” and exerting social control over space and those considered as subjects. Indeed, in exercising control and intervening in the lives of the citizenry, it can be argued that the South African government’s housing policy had to (un)intentionally produce a simplified and schematic model of the reality in which they want to intervene.

To this end, while the provision of housing aims at addressing the prevalence of material poverty among previously disadvantaged groups, it also serves as a process of conditioning state-citizens relations. Parallels can be drawn between colonial (apartheid) and democratic South Africa, where the production of space through housing practises has not only intersected with identity formation but also affected the manner in which the state exercise power over its citizens. Parnell and Hart (1999) suggest that housing programmes initiated by pre- and post- democratic South African government were less to do with solving the housing crisis among the poor, but to serve the interests of capital and the state.

Commenting on South Africa’s self-help housing practices initiated during the urban crisis of the 1970s and certainly under the ANC’s Reconstruction and Development Programme, Parnell and Hart (1999:367) argue that the self- help housing strategy in Johannesburg, for instance was “...a prevailing method of social engineering, whose acceptance or rejection reflects perceived political and economic advantages for the state and the private sector, and [...] not a simple response to a shortage of affordable shelter among the poor”. Similarly, Escobar (1995) criticizes state directed development and service delivery programmes, arguing that far from mobilizing people to rise against poverty they have systematically transformed poor people into objects of knowledge, management and governance.

Far from empowering its intended “beneficiaries”, the Jozini housing scheme like any of its nature in South Africa functions as instrument of amassing power and politico-social allegiances by the political elite and traditional leaders. The Jozini housing scheme can be seen as an interface of accumulation where practices of corruption and racketeering promote situations of personal gains among various socio-political actors.

4. Research Methodology

4.1 Study Setting and Context

Jozini is situated in the northern part of KwaZulu-Natal Province. It is one of the five local municipalities administered by uMkhanyakude District Municipality. Jozini's population is largely rural. Similar to most rural areas in South Africa, it is characterised by high incidences of poverty, lack of service delivery and underdevelopment (uMkhanyakude District Municipality, 2018). According to the 2011 census, Jozini is the most populous local municipal area within the uMkhanyakude district with a population of 186 502 people (Stats SA, 2019).

4.2 Research Design and Approach

Our study was purely qualitative and adopted a case study research design informed by an interpretivist paradigm to understand the lived experiences of housing in rural Jozini. On one hand, "...a researcher who embarks on a case study research is usually interested in a specific phenomenon and wishes to understand it completely not by controlling variable, but rather by observing all the variables and their interacting relationship" (Dooley, 2002:336). For Kendall (2011) a case study requires detailed and in-depth data collection involving multiple sources of rich information such as participant observation, unstructured interviews and life histories (Kendall, 2011). On the other hand, an interpretivist paradigm is concerned with "...understanding the complex world of lived experience from the point of view of those who live it" (Schwandt, 1994:118). They reject the positivist notion that there is only a single identifiable reality and truth that can be measured or studied. Instead, the approaches adopt a relativist stance to suggest that reality is not singular but consists of "multiple mental constructions" (Guba, 1990:27). Additionally, these approaches are interested in "...interpreting deeper meaning in discourse and understanding multiple realities that are represented in a collection of personal narratives or observed behaviours and activities" (Guest et al., 2012:14).

4.3 Data Collection Instruments

This study used key-informant and in-depth interviews to collect data from recruited participants. Key informant and in-depth interviews elicit participants' feelings, perceptions and lived experiences which are crucial in unravelling specific phenomena (Guest et al., 2012). In conducting interviews, researchers attempt to explore "...the world from the subject's point of view, to unfold the meaning of people's experiences, to uncover their lived word..." (Kvale, 1996:1). For Nieuwenhuis (2007), the purpose of conducting qualitative interviews is that of gaining an understanding on how participants construct knowledge and social reality. We conducted in-depth interviews to capture the meanings, perception and attitudes Jozini

community members, government officials and traditional leaders attach to state's rural low-income housing scheme.

4.4 Sample Size and Sampling Techniques

This study recruited 12 participants whom the researchers thought had a deeper understanding of Jozini's social, political and housing processes were selected to be part of the study. Of these 12 participants, 3 were government officials, 4 were traditional leaders and 5 were community members. This study utilised purposive and snow balling sampling to locate and recruit participants. Purposive sampling permits a researcher to select "a case because it illustrates some features or process in which a researcher is interested in" (Silverman, 2010:141). This sampling method targets "people who fit the criteria of desirable participants" (Henning et al., 2004:71). It allows the researcher to develop "a set of criteria for the selection of participants" (Moustakas, 1990:46). For instance, in our case, we recruited government officials that were directly involved in the implementation of the low-income housing scheme in Jozini from its inception. Further, to understand the perceptions community members have towards the implementation, administrative processes and the impact or lack of thereof of low-income housing schemes in Jozini, we selected community members that have directly benefited and are yet to benefit from the housing schemes.

5. Data Analysis

Data analysis was conducted in two stages. First, we used N-VIVO 10, a computer-based data analysis software package to develop and familiarise ourselves with themes emerging from the transcribed data. The slow process of transcribing the interviews became critical in assisting us to accurately code the data both inductively and deductively and point out recurring topics and consistencies within the data. According to Henning et al. (2004) researchers who transcribe their own interviews are more competent when it comes to coding the data. The second stage involved the coding of data. Inductive and deductive approaches were adopted in data coding. In developing inductive codes, segments of interview texts were organised under identified themes emerging from the data itself. Constructing inductive codes permitted the data to speak for itself, therefore data analysis was organised and conducted around issues participants considered important. Inductive coding intended to capture the participants' unique understanding of the interactions between housing and politics. This inductive coding exercise was crucial in pointing out dissimilarities existing in the participants' views and attitudes towards housing in eJozini.

The developing of deductive codes was determined by the research objectives, theoretical underpinnings and secondary data. It is impossible for a researcher to solely depend on primary data to develop themes (see Henning, 1995; Philips, 1987). The idea that let the data

speak for itself, although useful in capturing real experiences, it is criticized by Henning *et al.* (2004) as not only an impractical data analysis method, but one that can reduce the quality of analysis. They assert that thematic analysis is not only conducted using primary data, but researcher may rely on knowledge they already have. Therefore, our thematic analysis was guided by the knowledge we already possess on housing.

5.1 The Jozini Rural Housing Scheme and the shaping of state-citizen relations in participatory democracy

Our findings suggest that the provision of rural housing in Jozini plays the important role of presenting the post-apartheid government's commitment to overcoming colonial injustices, while simultaneously creating a platform for public participation in the implementation of housing policies. For instance, the state's commitment to reduce poverty and promote grassroots participation through housing delivery was demonstrated by a government official who had this to say:

The ANC led government has committed itself in reducing poverty among the previously disadvantaged communities. The RDP document clearly states that the provision of public housing is one the important ways in which the state can redress the societal inequalities that characterise our nation. I personally believe that a house is an asset that individuals can use to pull themselves out of poverty. A house does not only provide shelter, but it can also be used as a medium of accumulating capital and further premise small businesses. I am aware of some of the beneficiaries of the low-income housing scheme that have used part of their houses to start up spaza shops and these entities have played a crucial role in reducing household poverty and boosting household income. (Interview, Department of Human Settlements Official #2).

However, the paper argues that while this scheme mitigates the housing problem in Jozini, it does little in fully including ordinary community members in the development process. It regards the Jozini rural housing scheme as animating what Gaventa (2005) refers to as an "invited space" where important decision-making in the development process is steered by those that are powerful and are considered as technical experts. In the case of Jozini low income housing scheme, we assert that the shaping of state-citizens relationship through housing follows an unequal distribution of power that borders along gender, traditional societal structures and professional classification. We note that power seems to be concentrated in the hands of the state, traditional leaders and contractors, whereas community

members to a certain extent serve as subjects in which this power is exercised on. Cornwall (2007) notes that the spaces to which communities are invited to participate in are commonly circumscribed by essentialised stereotypes of communities' concerns and capabilities, leaving little scope for rural community members particularly women to participate as citizens. He adds that for people living in poverty or subjected to exclusions, the experience of entering a participatory space can be extremely intimidating.

Cornwall and Coelho (2007:11) have asserted that power relations permeate every dimension of the participatory sphere, where powerful technocrats lay the guidelines of how the intended beneficiaries are supposed to participate in their own development process. They further capture the ambivalence of participatory democracy by arguing that participation in public or invited spaces is usually "framed by those who create them and infused with power relations and cultures of interactions carried into them from other spaces". In analysing the micro politics of participation, Gaventa (2005) regards spaces of participation as spaces of power in which "...forms of overt or tacit domination silence certain actors or keep them from entering at all". For Chaudhuri and Heller (2002), the mere production of participatory spaces does not necessarily mean everyone will equally participate in them.

In governing its rural populace, the present day South African government like erstwhile colonial administrators uses local traditional authorities to politically institutionalise their ideas and claim their presence in the mundane lives of their citizens. While Mamdani (1996) sees the use of tribal authority by those in power as an effective method of exercising hegemony through self-governance, we assert that this political strategy has had a far-reaching impact on how the South African government implements and deliver its rural housing programme. Indeed, by placing of traditional leaders (*Amakhosi*) at the helm of housing delivery processes, the state manages to carve out symbolic representations that speak to cultural inclusivity and the communities' indigeneity. Therefore, it is important to discuss the role of traditional authorities in assisting the state in not only establishing effective and responsive technologies of governance but also in shaping a seemingly democratic relationship between the state and its rural citizens.

5.2 *The resuscitation of "Indirect Rule": The role of traditional institutions in housing governance*

The institutionalisation of governmentality and power in post-apartheid South Africa continues to rely on the colonial politicisation of ethnicity and space, to enforce the governance of rural citizens by remote control. The governing of rural citizens from afar, as we have already stated has meant that the post-apartheid South Africa state revert to the colonial practice of "indirect

rule” in which traditional institutions are strategically utilised to foster the political idea of democratic inclusivity and that of a developmental state. The findings reveal that the implementation of the Jozini low-income housing replicates a colonial type of “indirect rule”, in which the state attains a panoptical governance of its citizens through traditional institutions (see Mamdani, 1996). Indeed, our research findings suggest that the state has tactically relied on the “politics of naming” to create an environment where traditional leaders and their respective subjects feel included in the housing processes. One of the government officials responsible for the implementation of the Low-Income Housing Scheme in Jozini had this to say about the important role of “naming” in fostering inclusivity of rural communities in the housing programme:

“In 2008, the Department of Human Settlements began implementing the Jozini Low-Income Housing Scheme. To effectively implement the programme, it felt that the inclusion of local communities in this developmental process was necessary. Since the implementation of the programme was done through traditional authorities who in most cases are familiar with the needs of their communities, we suggested that the programme be named after traditional leaders. So, you will find that most of the schemes under the Jozini Low-Income Housing Scheme are named after traditional leaders (Amakhosi). For instance, we have the KwaMathenjwa Phase 1 Scheme which is named after iNkosi Mathenjwa, we have Mngomezulu Phase 1 named after iNkosi Mngomezulu (Interview, Department of Human Settlements Official #2).

According to this official from the Department of Human Settlements, the naming of housing schemes after traditional leaders elicit feelings of cultural ownership of the housing scheme by communities. The participant further suggested that this sense of ownership ensures that communities commit to becoming the rightful managers of rural housing processes, while the state takes a back seat in their development. It can be argued that the naming of housing schemes after traditional leaders is not only an innovative way of encouraging the full participation of rural communities, but another method of governance in which the government rules its citizens through achieving consent. We argue that the use of traditional leaders’ names in identifying some of Jozini’s housing schemes is an effective method of achieving and governing through consent. Our argument relates to Gramsci’s (1977) assertion that the production of governable subjects is incomplete without the attainment of consent from those to be ruled.

The involvement of traditional authorities in the provision of housing goes beyond attaching their name tags to the housing delivery process, to seeking their input in the selection of

intended beneficiaries. Another official from the Department of Human Settlements, described the Jozini Low-Income Housing Scheme as primarily driven by the local community's indigenous knowledge system (IKS). For him, the community's IKS which is accessed through traditional institutions is pivotal to assisting the state to gain a deeper social understanding of the community. He notes that on commencement of any housing schemes, the Department together with traditional leaders set up scheme steering committees (PSCs) comprising members familiar with the areas where schemes are intended to be rolled out. He argues that the PSCs epitomise the government's commitment to decentralising power, placing it in the hands of communities. It simultaneously invokes the ethos of community participation. The official had this to say about traditional leaders' role in governing housing delivery through PSCs:

When the Department of Human Settlements, through local municipalities identifies land for housing, we establish PSCs (Scheme Steering Committees), because everything in as much as we are academics you know we may have knowledge in terms of academic stuff, but we still need an indigenous knowledge. So basically, in order for us to ensure that there is a balance we form a scheme steering committee. The scheme steering committee constitutes of the people that reside within an area and the way it is formed it is democratically elected, so they conduct elections where we have the community coming together to say who are the people they nominate and then they pick those names and then they vote accordingly and that becomes the PSC. The PSC is responsible for identifying and selecting potential beneficiaries of the rural housing scheme (Interview, Department of Human Settlements Official #2).

However, one politician who participated in our interviews was sceptical about the credibility of PSCs and their role in rural housing provision. Instead, he argues that PSCs are another form of indirect rule where some powerful political elites collaborate with traditional leaders to promote their political ideas and coalesce allegiances. He narrates of a past instance in which a certain member of the executive council (MEC), illegally bypassed the municipal and other departmental structures and facilitated the strategic provision of houses to certain traditional leaders.

The MEC provided the houses directly to the traditional authorities (Chiefs) in the areas and they were not controlled by the municipality in any way. The Chiefs controlled housing provision and the municipality did not play any role. Identifying beneficiaries during this period varied according to the different traditional authorities. It was largely depending on how politically active they were and who they were politically aligned to

or with. As a result, many people did not get these houses because they did not support the dominant political party that lead the traditional council during that period. If you did not give support to the political party that a particular Headman dominated, the Headmen would be informed as a result you can be left out from receiving a house (Interview, Politician #1).

According to Croese (2016), state-led housing delivery is usually hijacked by political elites who use it to fulfil their political ambitions, reward their supporters and punish opponents. In her study of state-led housing delivery in Angola, Croese (2016) argues that the Angolan National Urbanism and Housing Programme (NUHP), a state initiative, represents a case where housing delivery effectively become an instrument of patrimonialism, in which political elites through local institutions get to decide "...how, by whom and to whom [should] housing been delivered" [own emphasis] (Croese, 2016: 94). Similarly, state-led housing delivery in South Africa follows the operatives of patronage where politicians indirectly influence political behaviour. One of the community members who participated in our study had this to share:

There is an outcry from the people where you find that for example a person that is known to the councillor and can afford a house receives a house from the subsidy scheme. He works, he has a house but because he is politically active, you will find that he will get a house from the scheme even though he is not poor at all. The people that are sincerely poor in the area will not get a house because they are not politically active and neither do, they support the dominant political party (Interview, Community Member #1).

The paper argues that this patrimonial distribution of houses along political affiliations, not only creates unequal patterns of access to housing but perpetuates material poverty among some of the most vulnerable members of the society. It emerged that in the case of the Jozini Low-income Housing Scheme, the allocation of housing using one's political orientation and patronage have excluded the disabled and women from accessing housing. One community member described an instance where a disabled citizen was excluded from receiving housing, he stated that:

There is another person who is disabled, but because of their political alignment, they are still living in poverty without a house. At the house opposite where this person stays in a big house belonging to Mr Nyawo [pseudonym] who was an artisan. He has renovated his house, he has livestock and has an additional house from the

municipality within his homestead because he was politically aligned and active (Interview, Community Member #2).

This paper argues that gender roles assume a crucial place in the allocation of housing in rural Jozini and determine who gets to access housing.

5.3 The gendered nature of housing delivery in the Jozini Low-Cost Housing Scheme

In our analysing of findings, we found the Jozini Low-Cost Housing Scheme to be a gendered one. Thus, the paper considers it as being reflective of the broader societal gender inequalities that boarder along societal status and more importantly gender lines. For example, we note that while the women of Jozini participate scheme steering committees (PSC), unequal power balances exist between men and women particularly in a patriarchal manner that restricts women from fully participating. The paper uses Lefebvre's (1974) ideas on "representational space" and "representations of space" to argue that the housing processes of Jozini reproduces and entrenches the normative patriarchal and cultural dominance of men over women. We argue that since owning a house plays a significant role among men in asserting their authority and identity, they have exerted these masculine desires at the expense of women (see Meth and Charlton, 2017).

The paper asserts that the Jozini Low-Income Housing Scheme is what Lefebvre (1974) refers to as "representational spaces", where the housing schemes become a mirror that the local people of Jozi use to scheme, negotiate and re-enact their cultural identities and gender norms. Therefore, the scheme becomes a space where certain people are either included or excluded from accessing houses on the basis of their gender. To reiterate Simone's (2008: 70) point mentioned in the previous section of this paper, the paper suggests that the Jozini low-income scheme has produced and reproduced, "spaces [that]are linked to specific identities, functions, lifestyles and properties so that the spaces [...] become legible for specific people at given places and times" [own emphasis]. Participants argued that houses should be allocated to men since they are the heads of households. For instance, it was established that the married women of Jozini cannot be immediate sole beneficiaries of newly constructed houses and they can only access it through their husbands. This gendered access to housing does not only violate women's constitutional right to have access to housing, but it also accentuates their precarious state of impoverishment and powerlessness. One of the traditional leaders that was interviewed narrated an ordeal where several women involved in street trading could not access housing because they were earning an income from their informal businesses:

I remember that some women who sold goods on the road.... When we looked at the amount of money they earned and saw that it is not a lot, they earn R500 and sometimes R400, we tried to register them to receive a house, but we were told by the government department that they do earn money. It was now coming from the government department saying that they were earning something (Traditional Leader, In-depth Interview, 2014).

We contend that women's lack of access to housing is aggravated by their reluctance to challenge male domination in the gendered allocation of housing in Jozini. However, a Foucauldian critic may argue that the absence of agency among the women of Jozini is systematically influenced by a panoptic patriarchal Zulu society. The process of "panopticism" which forms the basis of self-discipline, control and surveillance have restricted women in Jozini from participating in the housing scheme in various ways. Culturally, rural Zulu women are less likely to lend their voices in democratic or participatory spaces that are dominated by males. Thus, challenging male views can be problematic. Their reluctance to participate is greatly governed by self-discipline that is inculcated through socialization and the socially constructed norms. In the Zulu culture, women should assume a subordinate role to their male counterparts. Kapoor (2005:1212) demonstrates the pitfalls of participatory democracy:

Panopticism has an important implication for participatory development since participation is public and a public participatory space can be a panoptic one. Under the watchful eyes of the community, participants perform roles by playing to an audience, living up to an expectation, or acting out a society sanctioned duty. This for example the village leader performs the authority figure, the facilitator acts as the benevolent arbiter, the woman performs her prescribed gender role, the minority groups accentuate its status as "dependant" or "victim".

Similarly, Chaudhuri and Heller (2002: 2) criticise the notion of participatory democracy for ignoring power imbalances existing between various social group. They are sceptical of scholars and policy makers who put a lot of trust and romanticise participatory democracy as a system that contributes to the empowerment of those at the bottom. Instead, these authors assert that the notion of participatory democracy with its limitations is especially,

... problematic in developing democracies where basic rights of association are circumscribed and distorted by pervasive vertical dependencies (clientelistic relationships), routine forms of social exclusion, the unevenness and at times complete failure of public legality, and the persistence of pre- democratic forms of authority (Chaudhuri and Heller, 2002:2).

Conversely, given the deep ambivalence toward participation in South Africa's local development and housing programmes, achieving equal access to housing remains an elusive dream.

6. Conclusion

This paper argues that while housing delivery in South Africa has been utilised by the state in the (re)production of socio-democratic citizenship, it has also been instrumental in shaping the politics of democratic participation and state-citizen relationship. It shows that the Jozini low income housing scheme plays an important role in subscribing to certain labels, which gives the state the impetus to intervene and govern the private lives of its citizens. It further argues that the provision of housing to South African citizens goes beyond achieving socio-democratic principles but serves to problematise poverty and seeking ways of to intervene in the everyday life of those characterised as "poor". It forwards an argument that state-direct development and service delivery programmes such as the Jozini Low-Income Housing Scheme far from mobilizing people to rise against poverty they have systematically transformed poor people into objects of knowledge, management and governance. The paper uses Foucault's thoughts on power and governmentality and other scholars that share his assertions to demonstrate that the Jozini low income housing scheme is one of the many tools of governmentality the state uses to govern from a distance. The shaping of "citizenship" and the governing of the "poor" in the new democratic dispensation has interacts with the actual production and to a certain extent the aesthetics of rural public housing.

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Exogenous Issues Contributing to Poor Performance of Enterprises in Rural Vhembe Areas, South Africa

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Abstract

Over 50% of the total micro, small and medium enterprises in South Africa fail annually despite numerous government interventions. This has contributed to widening socio-economic ills in the country. Supports being given to leverage performance of enterprises did not yield the desired result because peculiar issues are yet recognised. Often, discourse points to enterprises exogenous challenges in a generic term without considering its dynamics in terms areas, nature and typology. Lack of this variation results in misplaced support, given that a pervasive challenge confronting enterprises in one area may not apply to another area. Through the use of Creswell (2013) exploratory sequential mixed method research design, issues associated with poor performance of enterprises in rural Vhembe were established and synthesised in terms of gender, area and support status. An analysis of data gathered from 280 enterprises in 16 villages yielded 45 issues thematised in six factors. These include access to capital (14.887%), access to market (10.297%), physical capacity (8.858), operational cost (6.052%), socio-cultural issues (5.628%) and competition (4.460%). The result indicates that majority of the variables loaded in these six factors are homogenous across enterprise categories. However, some are heterogeneous and require specific concern. Therefore, a generalised intervention may not suffice. We recommend capacity building with specific focus on skills training on marketing and business management, entrepreneurship orientation, access to capital, and service provision.

Keyword: Challenges, entrepreneurship, exogenous, performance, rural areas.

1. Introduction

Over the years, South Africa has been confronted with poor performance and slow growth in entrepreneurship (Dludla, 2015; GEM, 2015; 2017; SME SA, 2017; Standard Bank, 2017). Even though the government has vigorously directed numerous support interventions, entrepreneurial performance fall below expected thresholds (DTI, 2013; Stats SA, 2017). This challenge holds common grounds in many countries in the world. It is important to note that several issues associated with the challenge have been discussed within the context of South Africa and beyond, with much emphasis on lack of exogenous supports required to facilitate good entrepreneurial activities (Auerswald, 2015; Walsh & Cunningham, 2016; Leboea, 2017). For instance, a study conducted in Gauteng, Limpopo and Mpumalanga provinces in the Republic of South Africa and the Gaborone Province in Botswana reveals that poor monitoring and control, experience and planning in finance and marketing, income constraints, and cash control are key issues (Nemaenzhe, 2010). Earlier, Van Scheers (2011) established a lack of marketing skills. Maliwichi et al. (2011) who measured performance of agribusinesses in

Vhembe District of Limpopo mentioned lack of working capital, management skills, and marketing related issues. Mafukata (2015) who explore small farming entrepreneurs in the district identifies lack of formal education, technological skills and competence in risk management and production, as well as financial skills. This conforms to Karasi (2018) who also emphasis education, finance, and access to entrepreneurship information as a challenge confronting women. Nkondo (2017) made a comparative study to explain reason why local entrepreneurs lag while their foreign counterparts succeed given equal market opportunities. Result reveals that crime, rigid labour laws, lack of effective and efficient purchasing plus supply systems, weak entrepreneurship culture and orientation, poor networking and collaboration, as well as business ties were major issues. Whereas these studies have pulled various issues from different points of view such as gender, nationality, nature and typology of entrepreneurs, the distinction between experiences of enterprises in rural and extremely rural areas of the same region lack attention. Also, we provide entrepreneurship support without necessarily following up with the beneficiaries to understand their performance and other challenges they might confront. Similarly, the extent to which the challenges cut across gender within an areas lacks proper explanation. The preceding narratives motivated the need for this paper.

Empirically, inability to breakdown entrepreneurship challenges across categories of enterprises results in policymakers propounding holistic intervention measures to heterogenous issues (Llisterri et al., 2006; Aker & Mbiti, 2010; Carlisle et al., 2013; Kyalo & Kiganane, 2018; Lewis, 2018; Littlewood & Holt, 2018). It is most appropriate for unique issues associated with certain class of enterprises to be addressed from a specific point of view rather than generalising. Assumptions are that agricultural enterprises in a remote village may be grappled with poor technology for irrigation systems, storage facility and access to sufficient market. This challenges may not be the case of others in more developed villages as often, these crop of enterprises confront high cost of bills, competition and theft. This being the case, it is important to front support measures that accommodate such dynamics. This can only be achieved through detailed survey, taking peculiar issues of each enterprise category into account.

In a general context, studies have reported several exogenous issues associated with poor performance and failure of enterprises. Inappropriate government policies (Cardon *et al.*, 2010), environmental and market competition (Lukason & Hoffman, 2015), economic instability (Gaskill et al., 1993), lack of financial resources and access to credit (Liao *et al.*, 2008; Lukason & Hoffman, 2015) are prevalent in most economy. For instance, Roomi and Hussain (1998) identified six similar impediments in Malaysia. Thee scholars emphasised that

financing barriers and disincentives, inadequate infrastructure, adverse government policies, technological constraints and lack of innovation, shortage of skilled personnel and entrepreneurial handicap are the major challenges confronting enterprise. Similarly, Abd Rani and Hashim (2017) in the same country identified lack of human capital, poor financial aid, lack of opportunity and networking. Saleem and Abideen (2011) discussed partial distribution of resources. According to the scholars, the government invest majorly on large industrial in developed areas. Sufficient attention is lacking on the side of small enterprises, especially in underdeveloped areas. Apparently, enterprises in underdeveloped areas could perform better if given sufficient and equal attention (Mahembe et al., 2011). Aside the unequal distribution of resources across geographical regions, stringent government policy, legislation and regulations happen were other issues discussed as key impediments to small business operation, especial those in underdeveloped regions of the country (Saleem & Abideen, 2011). Although a comparison of these issue between the urban and rural areas are lacking, one could relate to misplaced intervention given that often policymakers generalise intervention even though there are variations in terms of nature of enterprises and areas. It is important to note that acting based on recommendations of an empirical study performed in an urban area may disadvantage others in rural areas.

As earlier discussed, challenges associated with poor performances of enterprises are common in most countries. In India for another instance, cost of production due to high tariffs, taxes and utility bills; poor access to financial institutions and unfavourable government policy were identified (Swathy & Benazir, 2014). While high level of competition was widely discussed in the USA (Fayolle & Klandt, 2006; Solomon, 2007; Martin et al., 2013; Bolinger & Brown, 2015), high cost of raw materials, poor competitive advantage, trust on the side of suppliers, access to banks and high interest rates were mentioned in Belgium (Ooghe & Prijcker, 2008; Holt, 2013). Studies about enterprise performance in most African countries reveals a lack of functional government entrepreneurship frameworks and corruption within the public space as key issues affecting performances of enterprise. Looting of public resources is one factor contributing to lack of technology transfer and infrastructural development (World Bank 2014; Justino, 2015; Page & Söderbom, 2015; McKenzie, 2017; Zinn, 2017; Igwe et al., 2018). This also relates to electricity instability even though enterprise have been conditioned to pay high bills. Water supply and poor road networks have strong positions in the argument. Customs and trade regulations, access to finance, rents and land, as well as insecurity are also common (Kingdon & Knight, 2007; Bruhn, 2010; De Jaeghere & Baxter, 2014; Page & Shimeles, 2015; McKenzie, 2017). Using Nigeria as a case analysis, enterprise performance still fall below expected threshold despite its diverse natural and human resource (Kimenyi et al., 2010; Onuoha, 2013; Ele et al., 2013; DeJaeghere & Baxter,

2014; Malecki, 2018). Often, resources meant for entrepreneurship capacity building are being diverted, which affects the nature of capacity support and structural frameworks being fronted to spur enterprise performance (Anokhin & Schulze, 2009; Apulu *et al.*, 2011; Okpara, 2011; Ufere *et al.*, 2012; Dugguh, 2017).

Evidence from Kenya also reveals corruption leading to poor entrepreneurship education, poor access to credit and security issues (Ngunjiri, 2010; Mwobobia, 2012; Atera *et al.*, 2018; Kyalo & Kiganane, 2018; Odera *et al.*, 2018). In Angola, Justino (2015) discussed corruption as a major problem confronting entrepreneurship generally. Other underlying issues accompanying corruption in the country include lack of financial support, limited fundamental resources such as skilled labour, raw materials and finances, rigid policies and regulations, and theft. Earlier, Da Rocha (2011) talked about infrastructural damage due to the long-lasting civil war in the country, which shattered and forced many enterprises to shut down. Mendes (2012) and Herrington (2014) attributes poor enterprise performance to lack of institutional structures, stressing the country could not provide good entrepreneurship environment for enterprises to operate. Furthermore, it has failed to maintain and sustain existing entrepreneurial structures. As a result, entrepreneurs struggle to access requisite support to sustain their enterprises. According to Venter *et al.* (2008) and Justino (2015), a proper entrepreneurial environment is that which has institutional entrepreneurship support, operating physical and commercial infrastructure, flexible regulations and policies, political and economic stability, balanced socio-economic conditions, and working educational systems. It becomes difficult for most enterprises to operate appropriately and thrive in environments that lack these key functions.

Arguing further, surveys performed in Zimbabwe indicate that many enterprises have failed, most entrepreneurs have completely lost interest in pursuing career-path along with entrepreneurship for the same issues earlier discussed. Access to capital, inconsistency in currency, political instability, inadequate network structures and stifling government policies were most mentioned issues in the literature (Zimrade, 2011; Zinhumwe, 2012; Mubaiwa, 2013; Gombarume, 2014; Madichie *et al.*, 2017). Given the state of economy in which job creation within the public space is a challenge, many have migrated to nearby countries, especially South Africa for a living. Within the context of South Africa, issues commonly discussed relate to rising competition, high cost of production, non-availability of a logistics chain, high cost of distribution, access to market and capital, as well as crime (Ladzani & Van Vuuren, 2002; Fatoki & Chindoga, 2011; Van Scheers, 2011; Cant & Wiid, 2013; Fatoki, 2014; Nkondo, 2017). A close look at the literature within the context of Africa reveals that most issues associated with poor performance of enterprises are common and require urgent attention. However, very little efforts have been made to categorise these issues. Often,

scholars discuss the issues in a holistic term even though most of them are peculiar. It becomes difficult to understand the state of issues confronting certain enterprises in an area. As earlier discussed, such gaps contribute to poor policy intervention leading misplaced support. This could explain poor performance and failure of enterprises, especially in rural areas of South Africa despite numerous support being given. This study provides issues associated with poor performance of enterprises in Vhembe District. We further discussed the variation of these issues in terms of gender, areas and support status. The essence is to examine if the issues are holding common grounds across the underline categories or unique to some, thereby enacting recommendations for specific intervention. Hopes are that appropriate intervention will play a significant role in stimulating enterprise performance, survival and growth.

Statistics indicate that less than 40% entrepreneurship driven ventures in South Africa survive their first year (Stats SA, 2017; GEM, 2015: 2017; Standard Bank, 2017; Crapton, 2018), out of which less than 50% make it to the second year (Standard Bank, 2017). According to Dlodla (2015) and GEM (2017), the success rate of start-up youth-driven ventures estimated at 40.9% in 2013 dropped to 35% in 2017, even envisaging further decline. Reports also show that the proportion of early-stage entrepreneurs estimated at 10.6% in 2001, suddenly dropped to 6.97% in 2013 (GEM, 2015). In 2015, the average early-stage entrepreneurial activity rates 14% of adults, while established enterprises rate 4.5% (GEM, 2015). While failure is on the increase, entry into entrepreneurship is on the decrease (Bozas, 2011; Dlodla, 2015; GEM; 2015: 2017). Out of 41.2% youth population in the country, only 6% were involved in entrepreneurial activities and less than 40% succeed (SA DTI, 2013; GEM, 2016; SME SA, 2017). The resultant consequence of this circumstance is felt on sustainable livelihood and economic growth. Empirically, successful entrepreneurs are significant in such a way that their decline may cause socioeconomic ills. This justifies why South Africa has been grappling with, and still undergoing numerous challenges (Ndedi, 2009; Fatoki, 2010; Herrington et al., 2010; GEM, 2014; World Bank, 2016; Iwara 2018). Among other issues, unemployment remains the most crucial as also noted by Yudaeva (2013) that entrepreneurship development is a hope resource for job opportunities needed in the 21st century. Studies indicate that a sliding decline in entrepreneurship performance in 2016 amount to increase in unemployment in the country (Fatoki, 2010; Olawale & Garwe, 2010; Ndedi, 2009; Mutasa, 2016; SME SA, 2017). As a result, the country was listed among the nations of the world with highest unemployment rate, estimated at 48.2% (Mutasa, 2016; SME SA, 2017; Gaotlhobogwe, 2018; Stats SA, 2018). As of 2018, youth unemployment in the country rank first in the world at 57.3% (Stat SA, 2018: 7). Citing instances with strong economies in the world such as the USA, China, Singapore, Malaysia, Japan and Brazil that have successfully harnessed entrepreneurship as a resource

for leveraging unemployment, South Africa as one of the leading economies in Africa could adopt similar approach.

2. Study Area

Vhembe District Municipality is one of the five districts that make up the Limpopo Province. It is located in the northern part of South Africa. It shares boundaries with Botswana on the west, Mozambique in the east and Zimbabwe in the north. The district is composed of four local municipalities, namely; Collins Chabane, Thulamela, Makhado and Musina. It has a population of over 1.1 million inhabitants and covers an area of 21 407 km² (Stats, S.A., 2011). The area is predominantly rural and deficient with critical basic services (Chauke et al., 2013). It has been profiled to produce up to 4.4% of the country's total agricultural output, 8.4% of the sub-tropical fruit and 6.3% of its citrus (Vhembe District Municipality, 2018). Its rurality and numerous natural sites attract huge tourism from the global space. This reveals high potentials for robust entrepreneurial activities if adequate systems are in place.

3. Methodology

The approach to Croswell (2013) exploratory sequential mixed research design followed in this study was twofold. In the first phase, an enquiry using qualitative methods was followed to explore participant's narratives on issues associated with the poor performance of enterprises. Snowball sampling technique was employed to identify participants until point of saturation because the exact population of entrepreneurs in the area which would have informed sample estimation and the use of probability sampling technique for the enquiry is unknown (Arko-Achemfuor, 2012; Fatoki, 2014; Nkondo, 2017; Karasi, 2018). Participants were drawn from 16 villages. Four villages were sampled from each Local Municipalities in Vhembe District, Limpopo Province. Out of the four, two were in the rural areas while the other two were in extremely rural areas. The purpose of making such choice was to enable triangulation in order to establish whether there exist variation of issues in terms of areas. Also the selection of the villages was informed by the desire to know whether distance to service centres and access to basic infrastructures such as shopping malls, roads, the presence of competent human resource, health care, equitable spatial planning and land use management, improved standard of living, improved agricultural practices, and the presence of facilities for human empowerment influence entrepreneurship over those that are further away (Cruywagen, 2010; Heffner, 2015; Luloff et al., 2018; Mudumeli, 2019). A self-developed semi-structured questionnaire was used for the data collection through peer to peer interviews. Participants were asked "what would you say are exogenous issues contributing to poor performance of entrepreneurs? and How have the issues affected rural entrepreneurs?. Each

interview took between 20 to 30 minutes and about four months to complete phase one data collection. About 10 participants were interviewed in a day. The qualitative data analysis was performed using Atlas-ti v8 open coding system. This software was used because it is efficient in extracting and categorising specific relevant issues from a pool of participants' narratives. The analysis yielded 45 key issues.

The distilled issues in the first phase analysis set the stage for the second phase study. Thus, the result was consolidated into a 3 Likert-type scale with a gradation of 1 to 3, where 1 = Agree, 2 = Not sure, and 3 = Disagree. Using the Likert-type scale, the consolidated data was tested on enterprises on a larger scale. Firstly, 250 samples were drawn from rural areas closer to services. After the internal data validation, 140 were isolated for the analysis. Some of the questionnaires screened were incomplete and/or inconsistent. The same approach was used to identify similar sample in extremely rural areas far from services. In total, 280 ranked Likert-type scale tools were used, out of which 50% were supported enterprises while others were non-supported. The male accounted for 52.9% while the female covers the remaining. Unlike phase one, data collection in phase two took between 5 to 10 minutes for a participant to complete the questionnaire. The data collection process across the areas lasted for two months to complete, although there were some days intervals to rest. In all, the main data collection process lasted for 6 months.

Given a large number of issues, the Principal Component Analysis (PCA) through the IBM-SPSS v25 was employed to reduce the issues (variable) into manageable sets and groupings (Tabachnick & Fidell, 2007; Drost, 2011). The variables considered for PCA were determined after an exploratory approach which involved experimenting with different variables until a satisfactory point was reached. The Bartlett's test of sphericity and Kaiser-Meyer-Olkin measure (KMO) were used to test both sampling adequacy and the appropriateness of the variables. According to Malhotra and Birks (2007), PCA and the KMO is appropriate between 0.5 and 1.0., however, KMO is most acceptable at 0.50 and above (Halim et al., 2014). In analysis, the KMO is 0.574, which is significant and in line with the literature (see table 1). The Eigenvalue technique was utilised to determine the number of factors that should be considered for extraction in line with the scree plot diagram presented in figure 2. Extracted variables were observed in the rotated component matrix. In this study, only factors with Eigenvalues >1 were extracted. The Scale-Reliability Analysis was performed for Cronbach's Alpha test for quality assurance of the results. In the last stage, crosstabulation was further employed to explain the dynamics in terms of area, gender and support status of the items extracted, which could not be performed using PCA.

The flow of analysis in the current study conforms to the criteria developed by Kativhu (2019) for measuring the resilience of youth-owned small retail businesses in South Africa. The author also adapted an exploratory sequential mixed research design and the use of Atlas-ti, PCA. However, the Kruskal Wallis test was further performed to explain the mean ranks of the parameters unlike the current study, which is limited to crosstabulation.

4. Result: Phase One

Participants' narratives explain that funding opportunities are very limited to many enterprises. The majority have attempted to access entrepreneurship support agencies but with no success. Some of the reasons were due to distance from their villages to the secretariats, cumbersome requirements of which most enterprises don't have, total negligence by the government, favouritism and nepotism, as well as corruption. Some had expressed that without connections, it is extremely difficult to access support of any form. Often, applications to access support from entrepreneurship were delayed or not attended for similar reasons. It became a challenge to venture into new products or expand their existing enterprises.

"It is difficult to explain..." How can we perform well without capital to boost the business?" "...funding agencies are just there but not flexible and accessible." "It will shock you to know that if one does not have connections in this country, none of your applications will go through. Most of the agencies approve funding applications of people they know". Alternatively, you can bribe those involved..."

"... at least we have seen a few and heard about numerous entrepreneurship funding agencies, their requirements are unascertainable..." Some consider age and gender. Preferences would be on the youth and female. Where do they expect other categories of entrepreneurs to source funding? Some of them don't fund unless with connections..." "They pretend to be working whereas doing nothing". "...if you look closely, they are diverting the resources to their person pockets..."

Discouragements, imposition of different business ideas and theft of innovation by workers in entrepreneurship support agencies were discussed. Whereas many entrepreneurs lament poor access to funders for capacity building, some who have been supported raised a concern that in most cases their funders impose business ideas on them. They either reject their application or change their original plan. As a result, many enterprises struggle to survive with what they are not passionate about. Whereas some argued that some agencies have thematic areas, others suspect that the facilitators divert their attention so they could invest in their original new ideas.

“...most agencies provide training and funding in the area of their interest undermining the innovative ideas of entrepreneurs...” ...they forced me to change my business plan and align with something totally different...”

“...surprisingly, I saw my business ideas being operated by a staff of and entrepreneurship agency. Yes, I know him so well. He handled my application and even advised that the business is not fundable. Shockingly, he started the business for his family in my area after rejecting my application...”it is not fair!

Those who resort to loans experienced unfavourable terms. Firstly, most financial institutions require evidence of tax clearance and collateral which is a challenge to many enterprises in rural areas. Majority are unregistered and operate subsistence businesses for sustainable livelihood. Aside from the collateral terms, interest rates put fear on them.

“...the market is very small to risk a loan with high-interest rate...” “They said my business plan is not good enough for loan. I tried something else then went back, this time, the bank requested a landed property as collateral...”

“...it will interest you to know that most financial institution in the country prefers to provide huge loans for properties such as cars and houses. You will be asked combustion and frustrating requirements the moment you request for a business loan....” I could not get any. The process and conditions were much...”

There is a general challenge on service provision and physical capacity to the rural areas. Firstly, there are security issues. Often, enterprises in these areas are attacked and looted, which causes losses and instability. Due to distance to banking facilities, many risks saving their daily business income in their shops, homes and/or stokvels systems, which exposes them to further attacks and theft. Also, most ventures are grappled with poor facilities and equipment needed to run a successful enterprise. Storage facilities for preservation of goods is an issue to many, especially the farming and small scale manufacturing enterprises. Due to poor road networks, clients from urban areas find it difficult to access enterprises in rural areas. As a result, they resorted to producing less that could be sold at once to minimize wastages and losses. Middlemen capitalise on these conditions to exploit these enterprises in the areas.

“There is a lot on my farm to sell, no buyers. Even this little I have harvested may not be sold. There is no market..., in the end, they get spoiled and wasted...” “We are really struggling. We don’t have proper storage facilities to preserve our goods for a long time. No good road to transport on distance to the urban areas and we cannot sell everything here...”

“...some big enterprises use us to make their profits. They get our products and pay after-sales. Some don’t even pay at all...”. If you resist and try to make your sales, the cost of transporting the goods takes the entire profit....”

“...the key thing is service provision. No electricity, water supply and good road, still we pay taxes. I wonder what we are paying for. Does the government care? We package food and snacks for high school students. It is difficult to preserve leftover sales as a result of these challenges...”

“...security is not in any way close to us...” “It appears staying in a rural area is a disability in this country because we are entirely out of basic services.” “...crime, especially break and theft in this area is unprecedented. We open very late, sometimes 10 am and close as early as 4 pm because ‘area boys’ will hang around to attack and steal.” One would have to be admitted to the hospital for running an enterprise...” We arrested some of them, the police would release in few days...” “...this is really sad...”

Again, lack of physical capacity and basic service provision were emphasised as key issue deterring smooth operation of enterprises. Like those in agriculture, irrigation system and equipment are issues raised. Some of the areas do not have access to good road network, electricity and internet, which are paramount in doing business. Participants explain:

“...we have been using our village streams for manual irrigation for years. Even though the government has not supported us with equipment for mechanised irrigation, they are requesting us to obtain water license for the streams...”

“...no form of support for irrigation in our farms. We don’t mind paying if such can be provided. It is tiring to transport water every day from far just to sustain our farms...”
“The municipal water supply comes only when there is funeral of a politician or village leader...”

“... we travel distance by foot to harvest water for irrigation... sometimes my workers fail to water the farm and the crop suffers...”

“The land is very dry, we pay owners of cow crawl for dung to fertilise the soil to make good yields...”, it is expensive...”. “Seedlings are very expensive too and scares. Often, they bring dead seedlings to us...”

Participants see policy and regulations as not being favourable to them. Specifically, the annual upsurge of migrants who in turn struggle market opportunities with locals was defined as a threat. This was attributed to weak government institutions which allow influx of foreigners

who engage in mini-jobs rather huge investments that could create employment. More so, the influx of foreigners who struggles market opportunities with the locals. More so, there is relatively high importation of similar products that local enterprises have better advantage on. As a result, local enterprises feel threatened because most foreign products are cheaper and preferable by consumers.

“...the government still allows the importation of goods we are offering locally. How can we progress when everyone prefers foreign goods that are cheaper? “come to think of it, foreigners have made South Africa their home, they struggle opportunities with the locals. They invest even in a very common business an old woman should do to earn a living. We end up struggling in our country...”

Social and cultural issues contribute to poor performance of enterprises. In most of the villages, there is a common belief that people are most successful when they acquire a degree and obtain a job in an elite discipline. Families who manage to encourage their children through such path have high value and prestige in society. To most of them, operating individual enterprise, especially as a young graduate means failure in life. It is either, the person has failed to acquire education or not buoyant to compete with peers in the labour market. As a result, every family would like to identify with the respective class in the society, not wanting to support their youth who resorted for a venture. This assumption made many to tag bad image on young locals running a small enterprise in the area.

“...my family is not at peace with me. I started an enterprise after my first degree. It was least expected because they had wished I search for a job in a law firm or government institution”. “It appears I have embarrassed them with this dimension. Sincerely, It has been an issue because I don’t have basic support from them. I might have to quit...”

“...people here don’t have respect and value for local entrepreneurs..., there is a general mentality that any young person doing business is poor, uneducated and frustrated in life. It makes me very uncomfortable to been seen always with my business. This limits my scope of operation because I go out briefly and come back before the sunset so I may not be seen...”

“....the society does not have strong support for local entrepreneurs, especially if you don’t have a brand. One would only see people who come and get things on credit and never pays. They would prefer to buy from foreigners or spend on imported products elsewhere. They felt we are not good enough to offer standard products...”

Drawing from participants' narratives, there are lots of issues associated with poor performance of enterprises in rural areas of Vhembe District. The Atlas_ti systematic coding analysis distilled 45 standalone issues that require attention (see figure 1). This set a stage for further analysis to synthesize the issues for detailed explanation.

Figure 1: Atlas-ti textual network diagram showing exogenous issues associated with poor performance of enterprises in rural Vhembe

5. Result: Phase Two

The use of Principal Component Analysis (PCA) helps in reducing numerous issues distilled with Atlas_ti v8 to the beeriest minimum size. It also identifies principal issues with highest factor loadings that should be given much attention. The synthesis through PCA categorised the issues into key factors for a better explanation. The PCA extracted six factors (with 32 items) out of 45 with a simple structure (factor loadings >0.50) (See figure 2). Eigenvalues selected were 2 and above at the point where the elbow is sharp and began to decline constantly. Hence, the key six factors extracted fall between point 0 and 6 where the component number is tangential to Eigenvalue at point 2. The structure of six factors accounted for 53.348% of the variance, which therefor means 39 other factors contributed 46.652%.

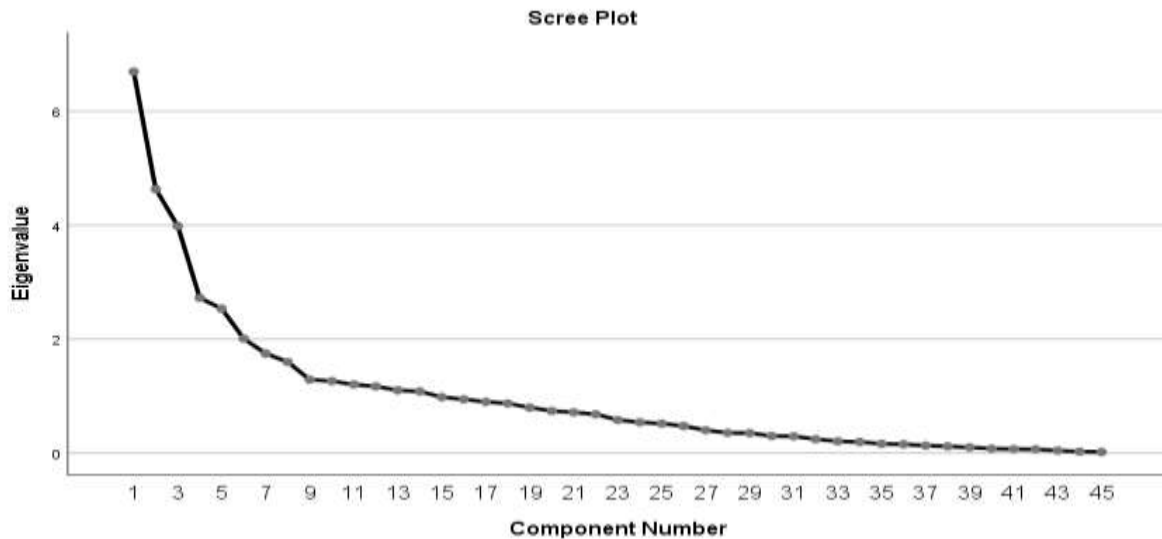


Figure 2: Scree plot used to extract factors

The factors were extracted using Kaiser Normalisation method. The first factor explained 14.887% variance which is the highest. It was labelled 'access to capital' due to high loadings by the following items; lack of credit information (0.901), politics of belonging (0.883), limited funding opportunities (0.847), access to funding agencies (0.770) rigorous application process (0.751), and high collateral terms (0.717). The second factor was named access to market due to high loading by the following variables; poor marketing networks (0.852), suppression from the larger firms (0.820), lack of standby buyers (0.804), imperfect pricing and sales (0.772), very few demand (0.755), and limited market information (0.723). The variance explained by this factor was 10.297%. The third factor was labelled physical capacity due to high loadings from the following variables; delayed delivery of raw materials (0.837), lack of storage facility (0.783), lack of equipment (0.765), poor road network (0.763), crime (0.729), and poor saving mechanisms (0.654). The variance explained by this factor was 8.858%.

The fourth factor was called operational cost because it yielded variables such as high cost of rent (0.785), operation hour policy (0.720), imposed business ideas (0.710), high taxes (0.613), and high transport cost (0.506). The variance explained by this factor was 6.052%. The fifth factor was labelled sociocultural issues due to high loadings of the following variables: people's attitudes on local-run enterprises (0.697), influences of social organisation (0.672), lack of family support (0.638) and lack of social networks (0.598). The variance explained by this factor was 5.628%. The sixth factor, which is the last was named competition. The variables that loaded in this factor were homogenous activities (0.638), high importations of similar products (0.619), and influx of foreigners in the market (0.574). The variance explained by this factor was 4.460% which is the least. Except for the six factors name high taxes, high

transport cost, lack of family support, lack of social networks, homogenous activities, high importations of similar products, and an influx of foreigners in the market whose communalities are between 0.468 and 0.368, other 25 items loaded 50 and above. This reflects that the factors extracted a large variance. The Cronbach's Alpha reliability test performed for quality assurance yielded the following points for the six factors: 0.913, 0.892, 0.890, 0.756, 0.694, 0.612. The KMO was 0.609, Bartlett's test of Sphericity yielded 8598.968, and the significance was 0.00, showing the level of appropriateness to utilise PCA. Table 1 present the result showing loading and communalities based on a PCA with Varimax rotation (N=280).

Table 1: Factor loading and communalities based on a Principal Component Analysis with Varimax rotation (N=280)							
	Factors						Communalities
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	
Factor Loading	Access to capital	Access to markets	Physical capacity	Operational cost	Sociocultural issues	Competition	
Lack of credit information	0.901						0.869
Politics of belonging	0.883						0.806
Limited funding opportunities	0.847						0.738
Access to funding agencies	0.770						0.637
Rigorous application process	0.751						0.680
High collateral terms	0.717						0.586
Poor marketing networks		0.852					0.785
Suppression from the larger firms		0.820					0.760
Lack of standby buyers		0.804					0.720
Imperfect pricing and sales		0.772					0.792
Very few demands		0.755					0.645
Limited market information		0.723					0.636
Delayed delivery of raw materials			0.837				0.714
Lack of storage facility			0.783				0.675
Lack of equipment			0.765				0.626
Poor road network			0.763				0.641
Crime			0.729				0.758
Poor saving mechanisms			0.654				0.738
High cost of rent				0.785			0.660
Operation hour policy				0.720			0.730
Imposed business ideas				0.710			0.745
High taxes				0.613			0.459
High transport cost				0.506			0.367
Peoples attitudes on local-run enterprises					0.697		0.623
Influences of social organisation					0.672		0.548
Lack of family support					0.638		0.468
Lack of social networks					0.598		0.460
Homogenous activities						0.638	0.398

High importations of similar products						0.619	0.384
Influx of foreigners in the market						0.574	0.348
Eigenvalues		6.699	4.634	3.986	2.723	2.533	2.007
% of Variance		14.887	10.297	8.858	6.052	5.628	(Total) 53.348
Test of Reliability	<i>Cronbach's Alpha</i>	<i>0.913</i>	<i>0.892</i>	<i>0.890</i>	<i>0.756</i>	<i>0.694</i>	<i>0.612</i>
	<i>No of Items</i>	<i>6</i>	<i>6</i>	<i>6</i>	<i>5</i>	<i>4</i>	<i>3</i>
KMO and Bartlett's Test							
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.609					
Bartlett's Test of Sphericity	Approx. Chi-Square	9025.602					
	Df	990					
	Sig.	.000					
Factor loading <0.40 were suppressed							

Crosstabulation was further performed to describe the extracted factors based on areas, support status of the enterprises and gender of the entrepreneurs. Except for politics of belonging wherein those in rural areas contributed more (51.1%), other issues associated with access to capital were predominant in extremely rural areas. However, none of the differences was statistically significant at 5%. This implies that the extracted issues hold common grounds in both areas. The same position was found amongst the supported and none-supported enterprises, as well as the male-run and female-run enterprises as depicted in table 3 and 4, respectively.

With regards to access to market, except for 'very few demands' which is higher on the side of supported enterprises (53.4%) and significant at 08% ($p > 0.080$), other variables across the three categories are not statistically significant at 5%. None of the variables under physical capacity is statistically significant across all the three categories at 0.05.

In terms of sociocultural issues, lack of social networks is higher in the rural areas (51.9%) and significant at 5%. Similarly, supported enterprises contributed more to people's attitudes on local entrepreneurs (56.6%) and it was significant at 0.06. Furthermore, Influences of social organisation was higher amongst the male (50.8%) and significant at 0.01. Other variables labelled under the factor are not statistically significant at 5% across all the categories. Lastly, only 'high importations' of similar products is significant at 05% in terms of Items labelled under competition. This contribution is higher amongst supported enterprises (51.3%). Other items have slight differences in terms of the frequencies but none is significant at 5% level.

Table 2: Comparison between Enterprises in Rural and Extreme Rural Areas with Crosstabulation (N=280)					
Factor	Items	Per cent		Comment	
		Rural (N=140)	Extreme Rural (N=140)	Chi-Square	Significance
Access to capital	Lack of credit information	47.1%	52.9%	1.001	0.606
	Politics of belonging	51.1%	48.9%	0.245	0.885
	Limited funding opportunities	46.6%	53.4%	1.798	0.407
	Poor access to funding agencies	49.0%	51.0%	0.346	0.841
	Rigorous application process	46.8%	53.2%	2.153	0.341
	High collateral terms	49.2%	50.8%	0.630	0.730
Access to market	Poor marketing networks	48.4%	51.6%	1.144	0.565
	Suppression from the large enterprises	51.3%	48.7%	0.906	0.636
	Lack of standby buyers	49.0%	50.3%	0.024	0.988
	Imperfect pricing and sales	51.0%	49.0%	0.597	0.742
	Very few demand	49.3%	50.7%	0.248	0.884
	Limited market information	47.6%	52.4%	1.942	0.379
Physical capacity	Delayed delivery of raw materials	49.4%	52.1%	0.746	0.689
	Lack of storage facility	49.4%	50.6%	0.746	0.689
	Lack of equipment	48.4%	51.6%	0.679	0.712
	Poor road network	49.1%	50.9%	0.388	0.823
	Crime	45.2%	54.8%	1.530	0.465
	Poor savings mechanisms	45.6%	54.4%	1.203	0.545
Operational cost	High rent cost	51.0%	49.0%	1.700	0.427
	Operational hour policy	51.0%	49.0%	0.162	0.922
	Imposed business ideas	48.7%	51.3%	0.612	0.736
	High taxes	50.5%	49.5%	1.700	0.427
	High transport cost	49.8%	50.2%	0.029	0.866
Sociocultural issues	Peoples attitudes on local entrepreneurs	51.5%	48.5%	0.335	0.846
	Influences of social organisation	49.2%	50.8%	1.340	0.512
	Lack of family support	51.8%	41.8%	1.630	0.443
	Lack of social networks	51.9%	48.1%	5.645	0.054
Competition	Homogenous activities	50.6%	49.4%	0.843	0.650
	High importations of similar products	50.6%	49.4%	1.833	0.400
	Influx of foreigners in the market	50.7%	49.3%	2.858	0.240

Table 2: Comparison between Supported and Non-supported Enterprises with Crosstabulation (N=280)					
Factor	Items	Per cent		Comment	
		Supported (N=140)	Non-supported (N=140)	Chi-Square	Significance
Access to capital	Lack of credit information	50.0%	50.0%	0.032	0.984
	Politics of belonging	49.6%	50.4%	1.493	0.474
	Limited funding opportunities	46.6%	53.4%	1.442	0.497
	Poor access to funding agencies	49.0%	51.0%	0.316	0.851
	Rigorous application process	48.7%	51.3%	0.244	0.885
	High collateral terms	47.7%	53.3%	2.950	0.229
Access to market	Poor marketing networks	49.8%	50.2%	0.039	0.981
	Suppression from the large enterprises	50.4%	49.6%	0.449	0.799
	Lack of standby buyers	50.8%	49.2%	1.373	0.503
	Imperfect pricing and sales	51.5%	48.5%	0.773	0.679
	Very few demand	53.4%	46.6%	5.062	0.080
	Limited market information	50.6%	49.4%	0.446	0.800
Physical capacity	Delayed delivery of raw materials	53.6%	46.4%	5.294	0.193
	Lack of storage facility	49.4%	50.6%	0.399	0.819
	Lack of equipment	47.8%	52.2%	1.273	0.529
	Poor road network	49.6%	50.4%	0.218	0.897
	Crime	54.8%	45.2%	1.530	0.465
	Poor savings mechanisms	50.0%	50.0%	2.000	0.368
Operational cost	High rent cost	49.0%	51.0%	1.079	0.583
	Operational hour policy	49.7%	50.3%	3.579	0.167
	Imposed business ideas	52.0%	48.0%	4.240	0.124
	High taxes	50.2%	49.8%	1.670	0.684
	High transport cost	50.2%	49.8%	0.029	0.866
Sociocultural issues	Peoples attitudes on local entrepreneurs	56.6%	43.4%	5.551	0.062
	Influences of social organisation	54.2%	45.8%	1.886	0.389
	Lack of family support	46.4%	53.6%	2.428	0.297
	Lack of social networks	48.6%	51.4%	0.714	0.700
Competition	Homogenous activities	50.2%	49.8%	1.956	0.376
	High importations of similar products	51.3%	48.7%	5.981	0.050
	Influx of foreigners in the market	50.4%	49.6%	2.815	0.245

Table 3: Comparison between Male-run and Female-run Enterprises with Crosstabulation (N=280)					
Factor	Items	Per cent		Comment	
		Male (N=148)	Female (N=132)	Chi-Square	Significance
Access to capital	Lack of credit information	54.3%	45.7%	0.674	0.714
	Politics of belonging	54.9%	45.1%	0.419	0.881
	Limited funding opportunities	55.4%	44.6%	1.309	0.520
	Poor access to funding agencies	53.5%	46.5%	0.954	0.621
	Rigorous application process	52.6%	47.4%	0.060	0.970
	High collateral terms	49.2%	50.8%	2.720	0.257
Access to market	Poor marketing networks	48.4%	51.6%	1.144	0.565
	Suppression from the large enterprises	54.7%	45.3%	2.306	0.316
	Lack of standby buyers	54.5%	45.5%	2.009	0.366
	Imperfect pricing and sales	53.4%	46.6%	3.912	0.141
	Very few demand	56.8%	43.2%	3.291	0.193
	Limited market information	54.7%	45.3%	2.473	0.290
Physical capacity	Delayed delivery of raw materials	51.0%	49.0%	0.821	0.683
	Lack of storage facility	51.9%	48.1%	0.980	0.613
	Lack of equipment	51.6%	48.4%	0.679	0.912
	Poor road network	54.0%	46.0%	0.639	0.726
	Crime	44.2%	55.8%	0.587	0.746
	Poor savings mechanisms	52.9%	47.1%	2.013	0.305
Operational cost	High rent cost	52.2%	47.8%	0.610	0.737
	Operational hour policy	47.6%	52.4%	1.225	0.546
	Imposed business ideas	45.6%	54.6%	1.033	0.597
	High taxes	53.1%	46.9%	1.817	0.403
	High transport cost	53.6%	46.4%	0.320	0.571
Sociocultural issues	Peoples attitudes on local entrepreneurs	50.5%	50.5%	1.003	0.606
	Influences of social organisation	50.8%	49.2%	8.499	0.014
	Lack of family support	48.8%	51.2%	1.616	0.446
	Lack of social networks	50.9%	49.1%	2.332	0.312
Competition	Homogenous activities	53.2%	46.8%	0.312	0.856
	High importations of similar products	52.8%	47.2%	0.116	0.943
	Influx of foreigners in the market	53.3%	46.7%	1.473	0.479

6. Discussion of Findings

Result revealed several issues categorised in six factors. These include (in descending order) access to capital, access to market, physical capacity, operational cost, sociocultural issues and competition. Six items labelled under these factors show significant differences while the other 28 hold equal grounds across categories of enterprises in rural and extremely rural areas, supported and non-supported enterprises, as well as the male and female entrepreneurs. In a broader context, results of the current study support existing literature. For instance, Chidiebere et al. (2014), Njaya (2015), Rusvingo, (2015), Karasi et al. (2017), Gukurume (2018) identifies access to capital, training and guidance, market information and international linkages as lingering constraints confronting enterprise development globally. Elijah (2007), Okpara and Wynn (2007), Mbaku (2010), Okpara (2011), World Bank (2014), and Justino (2015) explained that misappropriation of resources, nepotism and other forms of corruption has contributed significantly to enterprise failure in Africa. In South Africa, Van Scheers (2011) discussed marketing as a factor, Cant and Wiid (2013) talked about inflation, interest rates, crime, low demand for products, and wrong pricing. Lose and Tengeh (2015) explained lack of sponsorship, lack of advanced technological facilities, and production space as key exogenous issues. Similarly, Brink et al. (2003) identified competition, economic factors and socio-economic problems and change. Olawale and Garwe (2010) discussed economic, markets and infrastructural development. Fatoki (2014) mentioned high cost of distribution, crime rate, lack of finance, high competition, non-availability of a logistics chain and, rising costs of doing business. However, one key issue is that these studies did not sufficiently show dynamics in terms of areas, as a result, recommendations were generalised. The implications have been that intervention based on the generalised result may not address some key issues, especially in relation to enterprises in rural areas from a specific point of view.

An aspect of concern in the current study is the fact that even the supported enterprises still confront similar challenges associated with access to capital, access to market and physical capacity. It is not very clear given that these factors constitute the major part of the framework often used for entrepreneurship capacity building. This could suggest the need for further study to provide reasons why supported enterprises still face constraints having being capacitated. A close look from the participants' narrative suggests misplaced support. Most support being given were based on certain thematic areas rather than innovative ideas fronted by entrepreneurs. As a result, majority try to restructure their enterprise to align in order to be supported, letting off their original ideas. It becomes difficult for some to sustain in the long run. Aside this issue, entrepreneurs in the rural areas have limited access to support programmes. A vast majority of agencies put in place to capacitate enterprise development focus in urban regions. Hence, those in rural areas suffer negligence. This argument conforms with a study in Malaysia by Saleem and Abideen (2011) who mentioned that poor enterprise growth in underdeveloped regions was due to negligence, pointing specifically at investments imbalances from the government. They opine that the government concentrate attention

mostly on large enterprises and urban centres at the detriment of others. Often, the rural enterprises are neglected and denied basic assistance, as a result, leaving many to struggle with performance or even fail. One of the key recommendations was the decentralization of investments to ensure that all forms and categories of enterprise benefit equally from various exogenous supports put in place by the government.

Henderson (2002) and Stathopoulou et al. (2004) also explained similar issues in the USA and European countries. These scholars mapped out that, rural areas often lack specific support required to thrive in entrepreneurship. Whereas the government continued to invest in such activities with hopes for economic prosperity, policymakers often fail to acknowledge that the nature of entrepreneurship benefit can vary depending on the area, region and classification. It was as a result of this issue Henderson (2002) maintain that policymakers and communities must come up with variety of programs that reflect on key factors which influence enterprises performance. Aside skills development, networking and resourcing, entrepreneurs must be helped to gain access to the knowledge and innovation outside rural areas, and possible measures of tapping venture capital markets to finance growth. This study emphasised a point that fronting policy intervention without the involvement of those affected often result in misplaced supports. For instance, some enterprises in the rural areas of Vhembe could prefer security measures, protection from migrant entrepreneurs, as well as imported goods and market linkages to financial support. However, often support agencies focus more attention to start-up and expansion capital, which may not necessarily be the key issue. Similarly, rather than skill training, enterprises in the extreme rural areas may require basic service provision such as power supply, road networks and water supply to thrive. This suggests the need to understand issues from a specific point of view for a precise intervention instead of generalizing.

Results in this study explain that lack of physical capacity is a contributing factor to poor enterprise performance. Because the entrepreneurs in extremely rural areas lack storage facilities and power supply to preserve their products, they offer them at lower market price. The underline argument is that some products may perish if not properly preserved or sold at its earliest stage. Another instance draws from poor road networks and poor technological transfer that has subjected entrepreneurs to high operational cost. These challenges give larger firms over small enterprise given that a unit production cost is relatively low on large quantity (Reardon et al. 2005; Kaganzi et al., 2009). This also explains why imported goods have more grounds than locally made products in the area (Laws et al., 2001; Hammond, 2013; Oyelola et al., 2013; Lucas & Fuller, 2017). Hence the need for not only capacity building but protection of enterprises in the rural areas. According to Chu et al. (2007), Casnocha (2011), Williams (2014) and Constant (2015), lack of proper capacity building militates not only performance of enterprises but affects the overall economy in terms job creation and income generation. This is concern that South Africa should take seriously. Aside the basic service provision, it is important to invest in skill development, education, innovation, and resource management. Entrepreneurship orientation and awareness through community engagement are also required. A

close observation from participants narratives explains that majority of the entrepreneurs lack requisite exposure and self-efficacy, hence, reliance on the government to provide. It becomes difficult for most of them to independently make economic sense from their existing obstacles without involving the government.

Access to the market is another crucial issue, especially in extremely rural areas. Empirically, poor market information and market networking limits business expansion, as well as growth giving that enterprises will be conditioned to operate within a confined area (Tollens, 2006; Markelova, 2009; Goyal, 2010; Mwakaje, 2010). These constraints limits diversification, collaboration and partnership in business, which could be reasons why upsurge of migrants and continues importation of goods pose strong challenges in the market. It is appropriate to relate that lack of such exposure also contributes to high market competition as similar goods and services are being offered in large amount to few demands within a constricted space (Hell McCay & Jentoft, 1998; Lowery, 1998; Jacoby, 2000; Hellin et al., 2009). Furthermore, this also explains why rural entrepreneurs fall prey to middlemen and large firms who use their products to make gains.

Generally, sociocultural issues have a stronghold and influence people's daily activities. Entrepreneurship in rural Vhembe is not exceptional. Studies have stressed that family norms, religion, social structures, societal behaviour and orientation about gender determine the nature of activity one involve, how the activity operates, as well as its performance (Basu & Altinay, 2002; Pütz, 2003; Hayton et al., 2002; Stephan & Uhlaner, 2010; Klyver et al., 2012; Mungai & Ogot, 2012; Iwara et al., 2019). For instance, strong entrepreneurship culture and orientation in countries like Japan, China and Indian motivate individuals in the country to embrace businesses as a career (Hamel, 2010; Graupp & Wrona, 2015; Steen & Baldwin, 2015). On the contrary, a norm in village in Southern Madagascar wherein rituals are performed with large herds of cattle on deceased makes homestead males in the area to invest their entire life controlling cattle for the purpose of rituals that are performed when they passed on (Williams, 2007; Zocky, 2007; Dhenak, 2016). As a result, any other form of business for sustainability is not encouraged. Societal orientation and investments are rather focused on huge ornately decorated stone tomb to house the remains of deceased. Similarly, in India, religious orientation is a strong reason why most families in certain caste deter involvement in profitable entrepreneurial activities (Vishal, 2011). In this society, people regard aggressive entrepreneurship and profit-driven business as capitalism, which is a sin. The justification is that societies with poor entrepreneurship background may confront low involvement of people in entrepreneurial activities. Most people in Vhembe District underrate local entrepreneurs, especially young graduates. Often, peers of equal are accorded more value and respect for securing a job in the government sector. This put strong resentments on many, as result wanting to quit their enterprises for a white-collar job.

7. Conclusion

This study established various exogenous issues contributing to poor performance of enterprises in rural areas of Vhembe District Municipality, South Africa. The result yielded six factors namely: access to capital (14.887%), access to market (10.297%), physical capacity (8.858), operational cost (6.052%), socio-cultural issues (5.628%) and competition (4.460%). Whereas most of the issues that loaded in these factors are homogenous across categories of enterprises used in this study, some are heterogeneous, which suggest that interventions should not be generalised. For instance, issues associated with market demand, peoples attitude, and high importation were predominant in supported enterprises. This could suggest skills training. Whereas there is no much difference in terms of gender, it was evident that distance to service centres and access to basic infrastructures influence enterprise performance.

8. Recommendations

Findings of this study are based on responses of entrepreneurs, regardless of performance. It is important to juxtapose the result with only successful entrepreneurs to see if the understanding of challenges holds common ground.

The current study only established the dynamics in exogenous issues in terms of area, support status and gender. It is important to consider the dynamics in terms of qualification of the entrepreneurs, classification of the enterprises, nature and typology of entrepreneurial activities. This will provide further insight into a precise intervention. One of the assumptions is that trading enterprise may confront an issue entirely different from a manufacturing enterprise in the same area.

Based on the current findings we recommend that proper structures should be put in place to enhance capacity building. The government should provide basic services such as electricity, road and water supply. Access to capital, skills training on marketing, resource and business management, risk awareness and innovation should be made available to entrepreneurs in rural areas.

There is a need to monitor the operations of existing entrepreneurship support agencies, institutions and programmes. It appears, very little has been done to support enterprises in the rural areas despite numerous government investments. There also issues of misplaced investments, which should be taken seriously.

Community engagement is key. Rural households in the district should be sensitised on the need to embrace entrepreneurship. This awareness should be emphasised such that parents could support

their children to consider entrepreneurship as a major or alternative career, regardless of educational background.

Lastly, there should properly control measures on foreigners, as well as importations of products that could be produced locally.

Acknowledgement

This study is an aspect of an ongoing PhD research initiative of one of the authors at the University of Venda, South Africa.

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Poverty increase against infrastructure development: rethinking the sustainable livelihoods approach for rural development in South Africa

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Abstract

While the African National Congress-led government in South Africa has made noticeable strides in extending infrastructure provision and introducing social relief programmes in rural communities since assumption of power in 1994, both the ANC Election Manifestos of 2009, 2014 and 2019, and the National Development Plan adopted by government in 2012 recognise the stubbornness of the triple challenge of unemployment, poverty and inequality that confronts the post-Apartheid state. According to Statistics South Africa Community Survey (2016) about 51% of the South African population lives below the poverty line, and majority of which reside in rural areas and informal settlements. With good infrastructure delivery performance indicators that permeate municipality annual reports a majority of rural populace continue to swim in abject poverty and destitution, with social grants being the main source of sustaining their livelihoods. The NDP advocates for an active citizenry in its attempt to redefine the power relations between state, communities and private sector in the development process. This paper undertakes a critical review of literature pertaining to Sustainable Livelihoods Approach, rural development, poverty and community participation. The paper examines the secondary data pertaining to a Case Study area of Ward 8 in Intsika Yethu Local Municipality where public sector infrastructure investment has been proven to co-exist with poverty. The paper argues that with the relatively increasing public sector investment in rural areas the correspondingly rise in poverty points to a fundamentally flawed underpinning philosophy and architecture of development management process. The paper argues that evidence is abound in the South African rural landscape of the continuing co-existence of infrastructure development products and decline in the quality of life of people. This paper critically examines the utility of the sustainable livelihoods approach as a philosophical departure in development management interventions in rural areas. The paper yields a set of strategic actions that municipalities should employ to bridge the gap between theory and practice of sustainable rural development.

Key Words: rural infrastructure, poverty, livelihoods, sustainability, investment, inequality, assets, capabilities

1. Introduction

Numerous developing countries continue to implement 'pilot' development programmes and projects in pursuit of socio-economic development. Despite the limited resources at the disposal of these countries this 'piloting' and more of trial-and-error approach to development management is usually occasioned by the lack of tested community-based planning and development models, and uncertainty about possible impact of large scale implementation. This approach has a direct and unintended consequence of delaying public policy implementation and postpones the immediate benefits of improved quality of life to the people. While pilot programmes and projects are underway other citizens are caused to wait for the outcomes and lessons that must be learnt out of the pilot projects. Other hidden and lost benefits with the pilot implementation approach to development

management include the opportunity lost in optimising on the conducive social, economic, political and technological environment prevailing at the time of implementing pilot programmes and projects. The cost of providing public services, over time, naturally increases than would be the case when large-scale development interventions were implemented. In many instances, small-scale development interventions lead to duplication of limited resources due to silos approaches followed by different agencies.

This paper provides a critical insight on the historic concept of sustainable livelihoods approach to development management. The paper elevates the important role of citizens in development interventions that are aimed at improving the quality of their life. The paper analyses a socioeconomic profile of Ward 8 in Intsika Yethu local municipality (study area) that it utilises as a test case for exploration of the SLA development management mechanism. The paper concludes by highlighting few issues for consideration by local authorities while embracing the SLA.

2. A rural development context

Since the ushering of a democratic dispensation in 1994 whose primary goal has been to transform the country, its economy, architecture, development ethos for the benefit of all citizens, the South African government has passed a myriad of policies and legislation aimed at reversing the Apartheid legacies in all aspects of societal life. However, there has been a growing recognition amongst key role-players, including the ANC as a ruling party, that unemployment, poverty and inequality still confront the rural areas, with the government interventions not yet realising their maximum intended effect. In view of this, rural development, land and agrarian reform have remained among the key priorities of the government.

Any scholarly attempt of exploring innovative measures to enhance rural development interventions, and thereby accelerate the improvement of the quality of life of the rural populace warrants a prior appreciation of the concept of rural development. To better comprehend rural development a distinction must first be made between 'development' and 'rural.' Sen (1999:18) notes that development, in general, is concerned with the enhancement of the ability of individuals to shape their lives, while Stiglitz (1999:40) views development as a transformation of society, a movement from the traditional ways of thinking, and traditional methods of production to more modern ways. As such, development must improve all aspects of people's lives. This is what Sarvaes (1999:26) regards as a multi-dimensional development.

The term 'rural' is ambiguous and used in a multiplicity of ways, implying that the concept is not easy to define (Anriquez & Stamoulis, 2007). Literature suggests that the key elements in the term 'rural' are social, economic, cultural and spatial, with 'rural' characterising a variety of contexts. Given the history of South Africa it is important to note the interconnectedness of the 'rural' and 'urban' settings. The 'rural' is not the opposite of, or separable from the 'urban.'

With the above exposition of concepts of 'development,' 'rural' and its interconnectedness with 'urban,' numerous authors have yielded some insights on the concept of 'rural development.' Madu (2003:11) characterises the essence of rural development as the improvement of the spatial and socio-economic environment of the rural space, which leads to the enhancement of the individual's ability to care for and sustain his or her well-being. Spatial and individual represent key elements of the definition. The spatial variation in availability and access to rural infrastructure results in spatial disparities in living standards both within and between regions and localities. Thus, inequalities exist between spatial units (localities) as they do between individuals (Anderson and Pomfret, 2004; Deichmann, 1999; Henderson, Shalizi, & Venables, 2001; Kambur & Venables, 2005). For South Africa, in general, and the Eastern Cape, in particular, these disparities are historical and relational. Historical reasons include the establishment of Native Reserves and Influx Control policies of the South African government between 1910 and 1948, and the separate development policies of the Apartheid government between 1948 and 1994. Some of the enduring legacies of Native Reserves, Influx control and separate development policies of the Apartheid government include:

- Landlessness of the majority Black citizens.
- Destruction of the rural livelihoods.
- Entrenched poverty, destitution and vulnerability.
- Massive infrastructure backlogs.
- Underdeveloped and unsustainable local economies.
- Artificial development of decentralisation points.
- Fragmented service delivery.
- Lack of institutional capacity to plan and implement development.
- An enduring system of patronage, and mainly tribal patronage (Department of Provincial and Local Government, 2003).

Anriquez and Stamoulis (2007:21) regard rural development as development that benefits rural populations, where development is concerned with the sustained improvement of the population's

standards of living or welfare. The Eastern Cape Rural Development and Agrarian Transformation Strategy (Department of Rural Development and Agrarian Reform, 2009:24) confirms the multi-dimensional nature of rural development. This strategy enlists seven intervention areas that the Province must focus on to ensure a sustained improvement in the quality of life of the rural population. These interventions are:

- **Ownership:** changing the ownership patterns of natural resources and assets, particularly land and means of production.
- **Employment:** creating decent and sustainable jobs or interventions that enable people to generate an income that is equal or more than what they would have earned in the labour market.
- **Poverty and inequality:** ending the reproduction of racial and class inequality in rural areas.
- **Social development and basic rights:** ensuring that people live dignified lives through the exercise of basic rights that are granted by the Constitution.
- **Entrepreneurship and beneficiation:** ensuring local beneficiation and value-add within rural economies.
- **Natural resource access, use and management:** ensuring local community control, access and use of natural resources, in a manner that benefits rural people of today without compromising future generations to access and enjoy the same.
- **Organisation and mobilisation:** facilitate partnerships for development and ensure establishment of community institutions in areas that support rural development and social cohesion such as cultural heritage, sport and recreation activities.

The above broad definition of rural development, including the exploration of its intended outcomes, in varying contexts, provides a basis for examination of the sustainable livelihoods approaches and the extent to which such approaches can enhance interventions aimed at improving the quality of life of rural populations.

3. Sustainable livelihoods approach

In many years governments, working in partnerships with civil society organisations, have explored a variety of development management mechanisms and approaches with the intention of focusing state resources and private sector investment on the priority development needs of communities to achieve the desired impact. According to Carney (1999:10) after decades of limited success in eliminating rural poverty new ideas on rural development have emerged. One of the considerations has been the Sustainable Livelihoods Approach (SLA). SLAs emphasise the need for governments and agencies to work with people, supporting them to build upon their strengths and realise their

potential, while at the same time acknowledging the effects of policies and institutions, external shocks and trends. The aim, in the SLA, is to do away with pre-conceptions about what exactly rural people are seeking and how they are most likely to achieve their goals, but to develop a more accurate and dynamic picture of them in their environment (Carney, 1999:1). The United Kingdom Department for International Development (2000:3), in addition, notes that a detailed investigation of the living conditions of the target population, called Livelihoods Analysis, is a starting point of a development project that is based on the Sustainable Livelihoods Approach. In this context, a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, and maintain or enhance its capabilities and assets, both now and in the future while not undermining its natural resource base (Scones, 1998:23).

Literature notes that the use of SLAs has grown exponentially in the 1990s. Carney (1999:3) contends that the Sustainable Livelihoods Approach emerged in the 1970s, the decade of integrated rural development, when the economic conditions of farmers changed relatively little, and donor spending shifted considerably. At the same time there was recognition within policy making circles that income generation remained important since increased crop production yields would not alone solve rural problems. It is at this point that new donor projects included social services and infrastructure, in addition to agricultural production. Perhaps, it should be at the same time that the sub-branches of the SLA such as Asset Based Community Development, Participatory Rural Appraisal, Asset Building and Community Development, Community Driven Development, and Rights Based Approach to rural development came into being. Of importance to note is that Carney (1999:3) furthermore reveals that economic conditions of the rural poor remained adverse. Few of the causal factors that are mentioned in the literature are:

- The ambitiousness and complexity of the Integrated Rural Development (IRD) projects.
- Top-down planning and implementation approaches with less regard of community circumstances.
- Few links to local government structures.

However, proponents of the SLA always caution governments and development agencies in not embracing this development management approach as a panacea for the elimination of poverty in a sustainable manner. This is the case because the SLA has been found to lean more on variable community capabilities and activities that are influenced by changing conditions of people and the socio-economic and political environment at a point in time. The term 'capability' has been used by Sen and Dreze (1989:103) to refer to being able to perform certain basic functions, to what a person is capable of doing and being. It includes, for example, to be adequately nourished, to be comfortably clothed, to avoid escapable morbidity and preventable mortality, to lead a life without

shame, to be able to visit and entertain friends, and to keep track of what is going on and what others are talking about.

It is important to note that any efforts aimed at measuring the impact of the SLA should be based on the appreciation of what a livelihood is, and then what becomes a sustainable livelihood. Chambers and Conway (1991:1) assert that a livelihood comprises people, their capabilities, the means of living, including food, income and assets. A livelihood is environmentally sustainable when it maintains or enhances the local and global assets on which livelihoods depend, and has net beneficial effects on other livelihoods. A livelihood is socially sustainable when it can cope with and recover from stress and shocks, and provide for future generations. A livelihood can be defined hierarchically. It can be viewed at a household or human group level, and yet it can be assessed at an individual or intra-household level. The intra-household level augurs well for policy and practice in the post-Apartheid South Africa where particular focus has been on previously disadvantaged and vulnerable groups such as women, youth, people with disabilities, elderly and children.

Figure 1 depicts the components and flows in a livelihood.

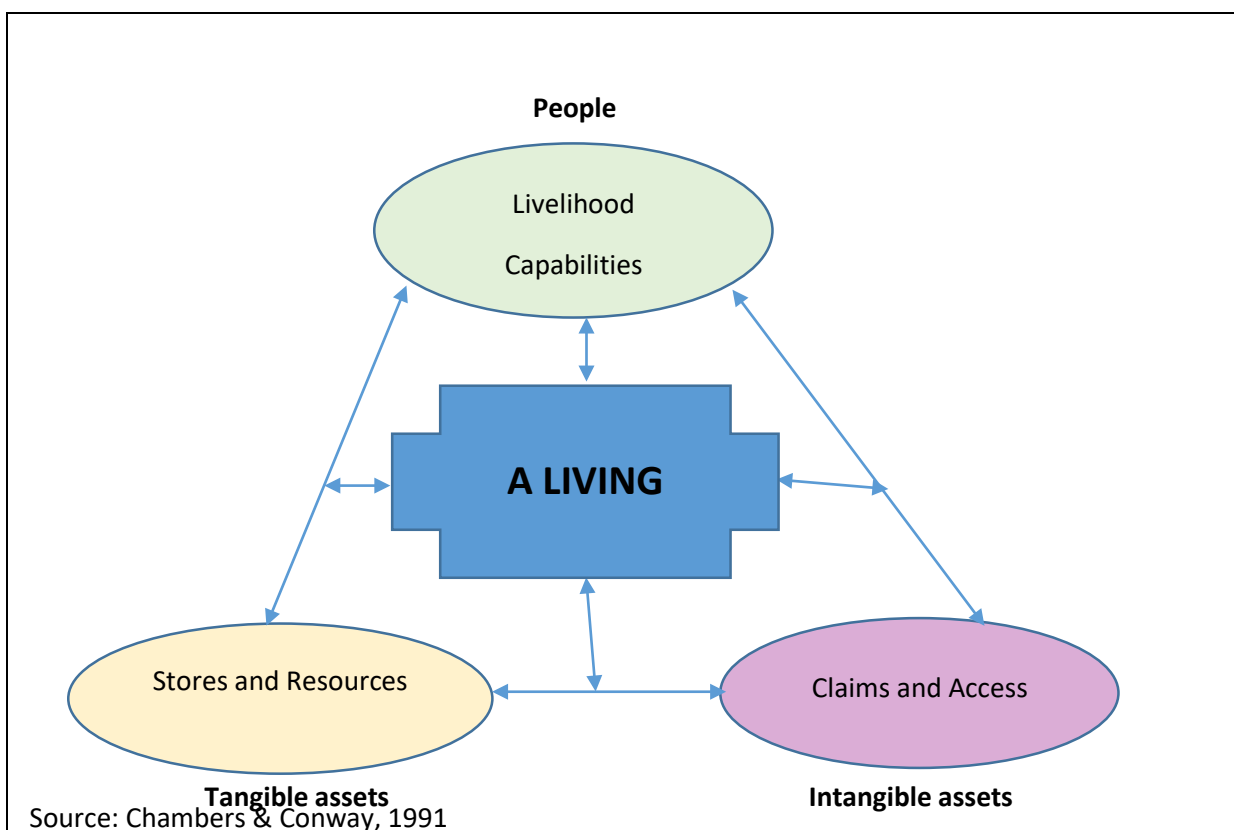


Figure 1: Components and flow in a livelihood

The key emphasis on collaboration between government and people for the success of a Sustainable Livelihoods Approach warrants a critical review of community and or public participation that municipalities, in particular, and South African government, in general, have been following since 1994. A central question regards the sporadic service delivery protests, and the concern over the low standards of living of rural populations while communities continue to participate in

government programmes. It could be that there is a different mix in mechanisms of community participation that is required for sustainable rural development. Perhaps, this could be a reason why the National Development Plan – Vision 2030 of South Africa that was adopted by the National Cabinet in 2012 introduces a concept of an ‘active citizenry.’

4. Community participation

Fox and Meyer (2004:18) define citizen participation as the involvement of citizens in a wide range of administrative policy-making activities, including the determination of the levels of services provided, budget priorities, and the acceptability of physical construction projects in order to orient government programmes towards community needs, build public support and encourage a sense of cohesiveness within society. There is quite extensive literature pertaining to citizen, community and or public participation. The notion of public participation in the post-Apartheid South Africa is enshrined in the Constitution of the Republic of South Africa, Act 108 of 1996 (Ngamlana, 2010; Ababio, 2007; Moodley & Govendor, 2006; Vyas-Doorgapersad & Muller, 2008 and Phago, 2008). The latter authors concur in that to give effect the Constitutional imperative imposed upon a sustainable, democratic and developmental local government of ‘encouraging the involvement of local communities and community organisations in the matters of local government’ numerous pieces of legislation were passed by Parliament. For instance, Section 26 of the Local Government Municipal Systems Act (32 of 2000) prescribes that the municipality:

- Must develop a culture of municipal governance that complements formal representative government with a system of participatory governance.
- Must contribute to building the capacity of the local community to participate in the affairs of the municipality.

In addition, Chapter 4 of the Local Government Municipal Structures Act (117 of 1998) enjoins municipalities to establish Ward Committees in all wards with the aim of enhancing participatory democracy. In accordance with Ababio (2007:618) Ward Committees are conceived by legislation as partners in development whose composition transcends narrow political, ethnic, racial and class affiliations, but promotes gender equality and reflects the demographics of the ward.

It must be mentioned that even though there is legislation which supports public or community participation both municipalities and their communities still fall short in this area. Some of the reasons that are cited by various authors are:

- Inadequate resources in municipalities to facilitate community participation.
- Non-payment of Ward Committee members who cannot afford travelling to meetings.
- High illiteracy in Councillors who cannot make sense of technical documents and reports that are written in English.

- Social position and elitism.
- Political patronage manifesting in Ward Committee members nominated in line with political affiliation.
- Lack of the understanding of the Ward Committee system (Ngamlana, 2010; Phago, 2008; Nzimakhwe & Reddy, 2008).

Another interesting assertion regarding community participation is the one that Kakumba and Nsingo (2008:1090) make, that citizen participation does not necessarily lead to empowerment. This contention raises an important issue regarding community participation for sustainable development. This borders on whether citizen participation is viewed as an end to itself or a means to an end. When citizen participation is viewed as an end to itself it thus suffices for a municipality to create public participation structures and allocate resources to enhance citizen participation. However, when citizen participation follows a developmental approach that is envisaged in the Development Facilitation Act (1995) the municipality will employ measures of enhancing community participation in each and every step of the development value-chain in order to realise the development outcomes that have been defined with the people. The latter point lies at the centre of sustainable development, and represents a graduation in community participation from consultation to involvement and empowerment.

The National Development Plan (NDP) that was adopted by the National Cabinet in South Africa during 2012 advocates a concept of an active citizenry which is understood to expand the role of communities in development than has been the case with the traditional public participation approaches. The NDP encourages citizens to be active participants in government efforts aimed at improving their socio-economic welfare, instead of passively relying on hand-outs from the state. The NDP envisages a South African economy that is dynamic, inclusive and in which the fruits of growth are shared more equitably. To achieve the eleven million jobs by 2030, eliminate poverty and reduce inequality the NDP visualises a South African economy that serves the needs of all South Africans – rich and poor, black and white, skilled and unskilled women and men, urban and rural, with and without capital (The Presidency, 2011).

A dynamic and inclusive economy which is backed by a strong and active citizenry, envisaged in the NDP, calls for a review and re-orientation of the existing development planning and implementation approaches. Tatsumi and Joshi (2010:1) note that policymakers, across the globe, are always concerned with the approaches of rural development in developing countries. Continuing is the long tradition of debating about the role of state, market and local community-based institutions for sustainable development through balancing of the criteria of choice between economic efficiency, social equity and environmental sustainability, in the context of globalisation. The Diagnostic Report produced by the National Planning Commission identifies passive citizenry as counter-productive and a weak link in the economic development path that the South African government and its partners have defined for the country.

Furthermore, the White Paper on Developmental Local Government (1994) defines 'developmental local government' as local government that is committed to working with citizens and groups with the community to find sustainable ways to meet their social, economic and material needs and improve the quality of their lives. In the same vein, the Municipal Systems Act, 2000, states that the process of developing an IDP must allow for the local community to be consulted on its development needs and priorities, and the local community to participate in the drafting of the IDP.

It is interesting to note that the White Paper on Reconstruction and Development Programme (1994) observes that a birth of a transformed nation can only succeed if the people themselves are voluntary participants in the processes of the realisation of the goals of this new nation. The key principles of the RDP in this regard are:

- **Integration and sustainability:** The legacy of the Apartheid system cannot be overcome with piecemeal, uncoordinated policies. Government institutions, business and the civil society must all work together to achieve the RDP goals.
- **People-driven:** The RDP is focused on people's immediate and long-term needs, and relies on their energies. Development in the context of the RDP policy is not about the delivery of goods to a passive citizenry. On the contrary, development in terms of the RDP is about people's involvement and empowerment through the public service delivery processes.
- **Peace and security:** Promoting peace and security involves people.

Davis (1993:23) notes that, in an effort to alleviate poverty in developing countries, international development agencies and multinational organisations have, over decades, been involved in development interventions. Despite good intentions, approaches that have been followed in these interventions have been paternalistic and ignored the strengths of local organisations and communities. As such these interventions have landed themselves into externally-induced measures and more of global charity in distressed communities, rather than serving to build local and durable self-reliance (Burkey, 1993:89).

5. Socio-economic community profiling

Poverty is a multi-faceted phenomenon, and to overcome it requires a holistic perspective. Furthermore, solutions to poverty should be broad-based, locally-focused and interdisciplinary (Parker, 2000:123). Development planning methodologies that reduce communities into mere beneficiaries of government subsidies and donor aid will not assist in the eradication of poverty and promotion of sustainable development.

Prior to undertaking any development intervention in an area, community, village or household there is a need for a comprehensive assessment of the prevailing socio-economic conditions. Data, or evidence, gathered through this exercise, provides a basis for determination of suitable and appropriate intervention strategies. The assessment should not be limited to socio-economic inadequacies but should profile the local capabilities and assets. A sound appreciation of local capabilities and assets is a pre-requisite for the success of development interventions that have a local focus, such as SLA. Another important aspect about local evidence generation is that the process itself must involve and seek to empower the targeted community.

In view of the envisaged SLA advocates for socio-economic development intervention in Ward 8 of Intsika Yethu local municipality, a review of previous research on socio-economic conditions of the ward was undertaken. The next section provides key findings of the review.

6. Case study: Ward 8 in Intsika Yethu Local Municipality

According to the Census 2011 results that were released in October 2012 by the Statistics South Africa, the Eastern Cape has over half of its 6,5 million population living in rural areas that are spread across its six district and two metropolitan municipalities. Of the eight local municipalities that fall under the Chris Hani District, Intsika Yethu municipality has the second highest number of residents, with 98 percent living in rural villages and 2 percent living in the towns of Tsomo and Cofimvaba. Furthermore, according to the study that was conducted by the Fort Hare Institute of Socio Economic Research during 2013 Ward 8 is one of the 21 wards that make up the Intsika Yethu local municipality. Ward 8 is comprised of Tsomo town and eleven rural villages of Daza, Maduma East Bank, Ngcongcolorha, Shweme, Tsomo Mission,

Jara, Mgwenyana, Tenza, Vrystad (kwaMiya) and Ntsongeni. The ESKOM 2010 Dot Count Report notes that there are 2077 households in Ward 8 of Intsika Yethu local municipality. The eleven villages of Ward 8 are, in terms of the traditional demarcation, falling under the two traditional authorities of amaZizi and amaBhele, and managed by five headmen.

Figure 2 below depicts the geographical spread of Ward 8 of the Intsika Yethu local municipality, and how the different settlements are connected to the transport network.

The diagram, also, reflects the proximity of the various villages to the Tsomo town.

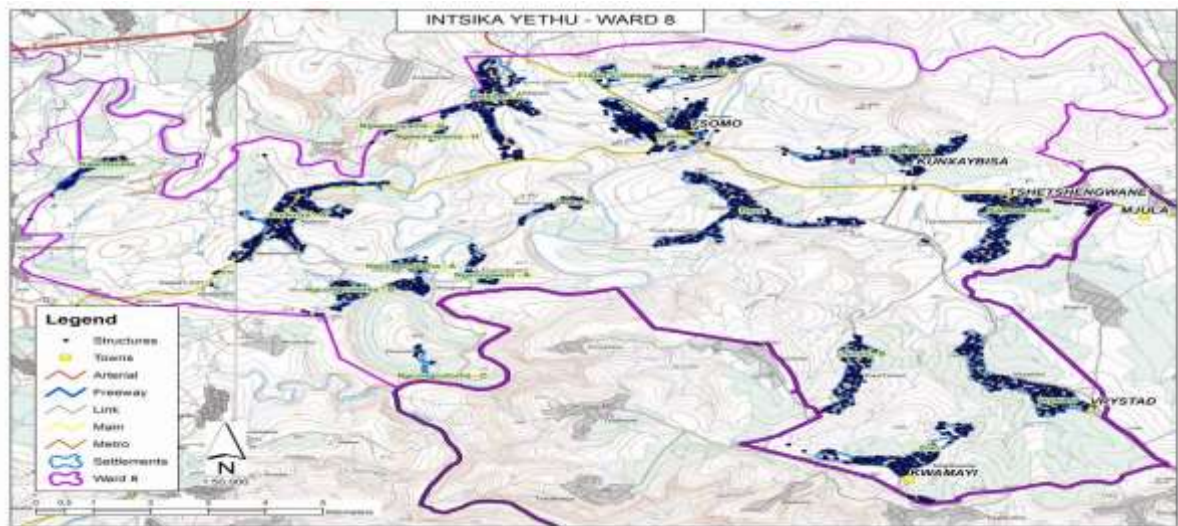


Figure 2: Spatial location of Ward 8 in Intsika Yethu local municipality

(Source: FHISER, 2013)

6.1 Demographic profile

The 2013 Fort Hare Institute of Socio Economic Research study, also, observes that 68 percent of Ward 8 population are women, and 54 percent of the households are headed by women. About 30 percent of the Ward 8 population ranges between the age of 20 and 40 years. It also notes that 27 percent of the population is made up of pensioners ranging at the age of 60 years and above. About 51 percent of the households have an average household size of three to five people while almost 27 percent have more than six people per household. Almost 78 percent of the households in Ward 8 have children who are under the age of 13 years.

6.2 Education

The majority of the population in Ward 8 sits at an education level that is less than matriculation (Grade 12) with a sizeable figure of the remainder succeeding in reaching matriculation but unable to proceed to tertiary education level. Only 6 percent of the Ward 8 population hold a tertiary qualification. The low household income is cited as the major factor that hinders matriculants in proceeding to institutions of higher learning. Of course, there are other contributing social ills such as teenage pregnancy that deprive the youth, especially girls, an opportunity to further their studies due to new responsibilities placed upon themselves to raise children.



Picture 1: A typical school in Tsomo

(Source: Author's Field Observation, 2018, An intermediate school, albeit with poor maintenance, is found in the Tsomo Town.)

6.3 Unemployment and income

The FHISER study records the unemployment rate in Ward 8 of Intsika Yethu local municipality at 75 percent, with only 14 percent on permanent jobs while 10 percent depend on part-time work opportunities. About 64 percent of households in Ward 8 depend on Child Support Grants. Almost 90 percent of the households have a monthly income that is less than R3500, and of this figure about 71 percent having a monthly income that is less than R2000.

6.4 Housing

The low income levels of the households in Ward 8 of Intsika Yethu local municipality indicates that a majority of the residents would be eligible for a government housing subsidy. From this statistic it can also be inferred that the demand for Finance-Linked Gap Market Housing which targets the household income band of R3500 to R15000 is low. The FHISER study observes that almost 72 percent of households stay in traditional dwellings made of local material. Popular household investments are the improvement of existing dwellings, household fencing, household gardening and water harvesting tanks. The pattern of self-help improvements in Ward 8 may signal that a housing subsidy programme that is geared towards the provision of building material and training of communities to build their own homes is more desirable. In recent times it has been observed that some low-income housing projects are being implemented by the government in different villages.



Picture 2: Typical homes called Imizi in Ntsogeni Village

(Source: Author's Field Observation, 2018)

A new pattern of middle-income remittances, innovative housing financing, that are re-invested in rural communities through building urban style modern homes is observed in recent times. This is a new phenomenon that challenges the municipality revenue collection policy with regards to provision of basic services. This also requires a rethinking of human settlement development and management strategies of cities and secondary towns in respect of housing provision and typologies. Some middle income earners prefer to commute between their rural homes and places of work in adjacent towns.

6.5 Access to clean water, sanitation and energy

An estimation of 63 percent of the households in Ward 8 of Intsika Yethu municipality have access to communal taps while only 6 percent have taps inside their houses, and these are mainly Tsomo town residents. Almost 62 percent have access to one or more water harvesting tanks, particularly in villages where there is no access to clean water. Rivers and streams are the common source of water where there is no access to clean water.

Approximately 96 percent of households have access to some form of sanitation facilities, and in the main these are Ventilated Pit Latrines, with Tsomo town being an exception since it utilises the waterborne sewerage system. While the figure looks good VIPs are, in terms of international standards, viewed as temporary sanitation systems with an effective usability lifespan that does not exceed ten years. It is for this reason that alternative forms of sanitation systems are explored by various developing countries. This is particularly important for environmental sustainability.

Almost 82 percent of homes in Ward 8 of Intsika Yethu municipality are electrified. However, due to low household incomes firewood, paraffin and cattle dung are the additional or alternative sources of energy. About 91 percent of the households in Ward 8 do not enjoy refuse removal services, and this is by no way uncommon in a 98 percent rural and 2 percent urbanised environment. Household rubbish is burnt down within homesteads.

6.6 Roads network and transport system

Access roads are, generally, in a poor condition in Ward 8 of Intsika Yethu local municipality, with only the Tsomo Mission village and Tsomo town having roads that are in a better state. Notably, despite the relative proximity of the Ntsongeni village to the town of Tsomo (about 6km), roads in the village, including the access road that connects the village to the Tsomo Central Business District, are relatively bad. About 55 percent of the population in Ward 8 travel by taxi to Tsomo town and surrounding villages, while 25 percent use cars and 20 percent prefer to walk.

6.7 Agriculture

Over the years the community has seen to a decline in subsistence crop production and cattle farming. Ploughing fields, in the main, are lying barren and would require more resources to rehabilitate. The majority of these ploughing fields border the Tsomo river and there have not been any attempts to revitalise them. Home gardens remain the sources of fresh produce, and even with them sporadic and not all households still bother to sow crops. Cattle farming has declined and the other contributory factor being rampant stock thefts and inability to curb such crimes. Of course, agricultural extension services are minimal to non-existent, and many families lost their livestock due to diseases such as red-water and inability to maintain them when family heads were retrenched from the mines in Gauteng and joined the unemployed. Piggery, goat and poultry farming are the few that have survived the shocks in many households.

Clearly, the population of Ward 8 in Intsika Yethu municipality, in general, has access to social infrastructure such as clean water, electricity, and sanitation. The telecommunication infrastructure exists but remains unutilised due to low income levels versus rentals associated with the use of TELKOM infrastructure. There is overdependence on social grants to sustain a living due to very low household incomes. The main employer is the retail sector. Education level is low, with few managing to reach matriculation and very few children who proceed to higher education after matriculation, and this situation maintaining the vicious cycle of low household income, inequality, unemployment and resilient poverty.



Picture 3: A rural homestead with a kraal for animal production

(Source: Author, Field Observation; 2018)

A typical rural homestead, called umzi, will have a kraal for animal production. Cattle, sheep and goats are kept as part of subsistence farming, even though when family circumstances dictate some will be sold out to meet family needs such as education costs.

7. Recommended strategic actions

A decision to explore the applicability and suitability of a combination of the Community Based Panning methodology and Sustainable Livelihoods Approach in responding to development challenges confronting Ward 8 of Intsika Yethu local municipality in the Eastern Cape, for sustainable rural development, will require to be mindful of the following dependencies.

7.1 *A comprehensive socio-economic profiling*

A community profiling should cover the level of social services, status of physical and economic infrastructure, natural resources, community assets and the community skills base. The profile should provide demographic data and trends. A review of local economy, its levers and linkages with urban and regional economy is required.

7.2 *Technical audit of local resources and assets*

The audit of existing physical infrastructure and natural resources should be supported by Geographic Information System (GIS) data and presented spatially to determine linkages in various infrastructure networks.

7.3 *Community involvement and empowerment*

One distinguishing feature of Sustainable Livelihoods Approach to rural development is the emphasis on community involvement and empowerment, moving beyond mere public participation.

7.4 *A Village Level or Neighbourhood Based Plan*

The Village or Neighbourhood Based Plan that will culminate out of the development research which follows a participatory approach should cover all aspects relating to different livelihoods within the community. While community consensus shall have been facilitated on key development priorities, including how these should be addressed, the facilitation process should not deprive a community of an opportunity to capitalise on its local strengths. The Plan should be simple and comprehensible to various stakeholders. Simplicity relates to both written language and relevance ;pf the content of the Plan to the community.

8. Conclusion

Community based approaches to development planning and management are gaining prominence in developing countries, in their ongoing struggle to uproot entrenched poverty, unemployment and inequality within society. South Africa is by no way an exception. The Sustainable Livelihoods Approach is, increasingly, becoming important in managing rural development. At the centre of the SLA is the role of communities, with more emphasis placed on their active involvement and empowerment rather than community participation for mere consultation and compliance within the prevailing development planning prescripts that are anchored on neo-liberal theories of economic development.

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Sustainable construction brick using Sugarcane Bagasse Ash

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Abstract

There are emerging sustainable development practices in various sectors as global climate change becomes a serious concern. The construction sector is one of the principal component of anthropogenic activities and a major contributor of greenhouse gases (GHGs) emissions. The manufacturing process of conventional construction materials such as cement and bricks is energy intensive and generates quantifiable amounts of GHGs emissions. Therefore, different stakeholders including researchers need to develop effective measures on how to mitigate GHGs emissions. The concerns have generated interest in developing construction materials that are more sustainable, while maintaining structural integrity as required by national regulating bodies. In this study, various factors that can mitigate GHGs reduction in the construction industry and application of sugarcane bagasse (SBA) waste in development of green bricks were reviewed. The utilization of wastes offers an attractive alternative to a disposal and contributes towards sustainable environment. SBA brick is presumed to be economically and ecologically advantageous over conventional bricks. Furthermore, the brick physical and mechanical properties such as compressive strength, and water absorption are discussed.

Key words: Sustainable development, Greenhouse gases, Sugarcane bagasse ash.

1. Introduction

Sustainable development is emerging as a key challenge all over the world, as global climate change becomes an increasingly serious concern for the future (Jayasinghe et al., 2016 and Radonjanin, et al., 2013). According to According to (WCED, 1987), “sustainable development is a development that meets the present needs and preserve an opportunity for future generations”. The idea of sustainability involves improving social, economic and environmental conditions (Akadiri et al., 2012). It is reported that the current global climate change is mainly caused by anthropogenic emissions of greenhouse gases (GHGs). This situation is expected to have negative impact on both natural and socio-economic systems even in the next century, if not properly attended. Therefore, different stakeholders including politicians, economists and environmental scientists need to develop effective measures on how to reduce GHGs

emissions (Huang et al., 2017, Chang et al., 2019 and Filho et al., 2007). Globally, construction sector is the largest consumer of raw materials, requires high energy input and causes a wide range of quantifiable environmental effects (Zak et al., 2016, Ashour et al., 2015, Turgut, 2012, Wasim et al., 2016 and Acheyini and Okibe, 2015). These environmental concerns have generated an interest in developing construction materials that are more sustainable (Danso et al., 2015, Shakir et al., 2013 and Madurwar et al., 2013). Hence, it is important to develop alternative building materials such as bricks that can give comparable properties with conventional materials, while strictly and effectively controlling the emission of GHGs (Jayasinghe et al., 2016). This short study review factors that are behind global carbon emissions in the construction industry, and investigate the potential of sugarcane bagasse ash (SBA) as an industrial waste material in the development of a brick.

2. Literature review

Recently, there is an interest among economists, environmentalists and policy makers in studying the relationship between economic and carbon growth factors, in order to mitigate high emissions of GHGs. Majority of the research conducted was based on the mechanism of carbon emissions, the relationship between carbon emissions, economic growth, and energy consumption (Huang et al., 2017 and Chang et al., 2019). In another study, (Du et al., 2019) investigated the decoupling relationship between economic growth and carbon emissions from the construction industry of China. The authors further noted that the economic development and high energy efficiency levels as key factors correlated with construction industry carbon emissions. The study findings were consistent with the results obtained by (Chang et al., 2019) investigating the driving forces of global carbon emissions. In this study, the authors mentioned economic development, carbon emission intensity and population increase amongst other factors accelerating global carbon emissions.

Factors such as low-carbon materials, waste management and construction optimization strategies are also highlighted by various researches as key strategies to mitigate high emissions of GHGs (Udawattha and Halwatura, 2016, Zhang and Wang, 2016, Akbarnezhad and Xiao, 2017 and Cabeza et al., 2013). In the case study conducted by (Huang et al., 2017), they recommended that there would be an energy saving and low carbon emission for urban buildings with the implementation of positive low-carbon development policies. The construction industry still plays a significant role in the economic growth and waste management alleviation, despite associated with high emissions of GHGs (Akadiri et al., 2012, and Windapo and Cattell, 2013). In China, for example, the construction industry contributed approximately 7% of the country GDP in 2012, making it a pillar of the national economy (Du

et al., 2019 and Ding et al., 2018). In South Africa, the economic growth is however still facing a host of development challenges impaired by the legacy of apartheid, gap between rich and poor, and high levels of unemployment (Winkler and Marquand, 2009).

3. Construction materials

Cement and bricks are important construction materials used around the world due to their continuous demand, population increase and infrastructure development. When mixed with water, cement forms a paste that sets and hardens due to the formation of calcium silicate hydrate (CSH) and calcium aluminate hydrates (CAH) (El-Attar et al., 2017). Over 3 billion metric tons of cement is produced globally every year, with volume predicted to rise to more than 4-5 billion metric tons by 2050 (Maddalena et al., 2018). However, the manufacturing process of cement is energy intensive and generates 5–7% of total global CO₂ emissions (see Figure 1) (Radonjanin et al., 2013, Akadiri et al., 2012 and Wasim et al., 2016).

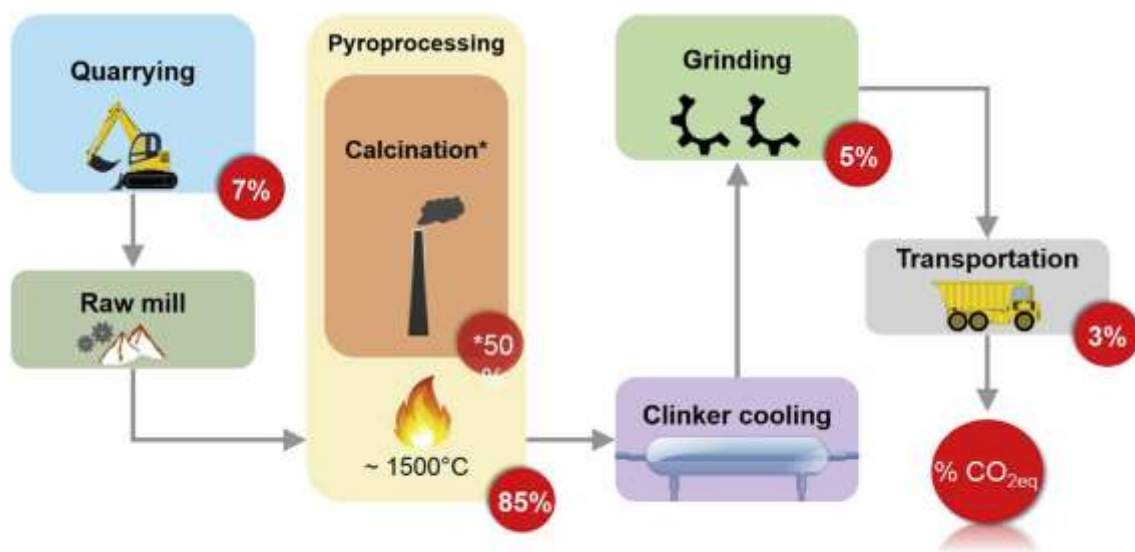


Figure 1: Simplified diagram of the cement production process (Maddalena et al., 2018).

The current worldwide production of construction bricks is about 1.391 trillion units per year, and demand for bricks is constantly rising (Hwang and Huynh, 2015, Arshad and Pawade, 2014 and Raut et al., 2012). The production of bricks is mainly based on conventional firing using clay (Muñoz et al., 2016, Lingling et al., 2005 and Kazmi et al., 2016) or cementing methods. (Torkaman et al., 2014, Wei and Meyer, 2016 and Mostafa and Uddin, 2016). These conventional methods are energy intensive, adversely affect the landscape, and generate

large quantity of greenhouse gases (Arshad and Pawade, 2014 and Zhang, 2013). Other alternative type of brick is made from industrial or agricultural by-products stabilized with cement or lime and then forming the bricks by compaction (Turgut, 2012 and Yu et al., 2005). This alternative type has gained popularity in recent times due to various reasons such as high cost of conventional bricks and willingness to adopt and promote sustainable construction materials (Hwang and Huynh, 2015, and Jayasinghe and Mallawaarachchi, 2009).

4. Sustainable construction

Sustainable construction is defined by (Zabihi et al., 2012) as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles". This practice requires the use of alternative methods including conserving natural resources, and reusing of alternative materials such as agricultural and industrial waste materials (Jin and Chen, 2015, Huang et al., 2017 and Ling et al., 2013). Sustainable construction requires a shift in industrial policy, and provision for sectors to be sensitive to changes in energy prices. Moreover, economic developments, a growing population and increasing rates of urbanization have also resulted in increased waste generation which requires establishing and implementing effective waste management policies (Winkler and Marquand, 2009). Hence, numerous directives and regulations have now been introduced with the aim of minimizing the consumption of raw materials and energy, saving earth from pollution and maximizing the re-use of materials. For the construction industry, this resulted in a social contract for sustainable methods and utilization of waste materials in order to conserve the natural resources and to reduce the quantities waste deposited in landfills (Winkler and Marquand, 2009 and Mohamed et al., 2017).

5. Industrial and agricultural waste

The large volume of solid waste generated by industrial and agricultural sectors has created an interest to incorporate this waste in developing alternative construction materials. The interest is also due to ever increasing scarcity of landfill space, accumulation of unmanaged wastes and awareness to protect the environment (Binici et al., 2007, Shakir and Mohammed, 2013, Shen et al., 2007). The use of industrial and agricultural waste as brick material provides solution to solid waste management and offers an alternative raw material. Otherwise, waste is land filled and thus, add to ever escalating cost of disposal (Raut et al., 2011, da Rocha et al., 2014 and Consoli et al., 2014). Both industrial and agricultural wastes present advantages from an economic and ecological point of view i.e., the reduction of costs related to use of alternative raw materials; the reduction in consumption of virgin raw materials; reduction on

transport and production energy costs (Ashour et al., 2015 and Vinai et al., 2013). According to the World Bank statistics on solid waste management, the world cities are currently generating about 1.3 billion tons of solid waste per year and this volume is expected to increase to 2.2 billion tons by the year 2025 (Li et al., 2012). These unmanaged solid wastes generated every year by may leads to environmental and health concerns such as flooding, air pollution and other public health scarce. In addition, the growth of population, increasing urbanization, rising standards of living due to technological innovations are also contributing to an increase in the quantity of solid wastes generated (Okeyinka et al., 2015, Singh and Garg, 1999 and Madurwar et al., 2014).

The building construction industry which is a major sector when it comes to environmental control, continue to be a viable option for waste disposal and land filling due to its high volume of consumption of waste material (Madurwar et al., 2013, Okeyinka et al., 2015 and Rajput et al., 2012). For these reasons, industrial and academic researchers are developing environment friendly construction materials from waste material that offers an attractive alternative to their disposal, and a viable solution in reducing the cost of buildings without compromising on structural strength and building standards (Chusilp et al., 2009 and Karade, 2010). Amongst the waste generated in the agricultural and industrial sectors which have potential to be used in the construction industry, the following are discussed:

5.1 Lime

Lime is a by-product of stone crushing operations in limestone quarries and normally presents a serious problem in terms of disposal, pollution, and health hazards because of its fine powder. This white alkaline material consists of calcium oxide, which is obtained by heating limestone and used in the production of hydrated lime. Lime performs better with very fine particles and can reduce the amount of water entrapped in the system to form a stable pozzolanic material (Sua-iam and Makul, 2013, Dowling et al., 2015 and Koteng and Chen, 2015). Lime typically produce a more compact structure by pore-filling effect when it reacts, leading to improvement of the strength and durability. Lime reacts with cement by binding carbon hydroxide (Ca(OH)_2) with free silica by a pozzolanic reaction forming a non-soluble calcium silicate hydrate (CSH). Lime can form several chemical reactions including pozzolanic reactions that are similar to the mechanisms of cement, leading to the formation of CSH and calcium aluminium hydrate (CAH) (Zhang and Wang, 2016, Maskell et al., 2014 and Taallah and Guettala, 2016).

5.2 Sugarcane bagasse ash

Sugarcane bagasse ash (SBA) is the waste generated by the combustion of bagasse in boilers of the sugar and alcohol industries. SBA is generally used as a fertilizer or is disposed of in landfills, which generate environmental related concerns. It is considered an important raw material for application in construction materials due to its high amorphous silica content, which provides hardness, durability, and prevents shrinkage (Tantawy et al., 2014, Xu et al., 2019, Kulkarni et al., 2013 and Kumar et al., 2018). It typically forms pozzolanic reactions when reacting with calcium hydroxide due to its high amorphous silica content, leading to the formation of the CSH (Paya et al., 2018). The pozzolanic reactivity of SBA depends significantly on factors such as its fineness, high temperatures and incomplete combustion that take place in the boilers rather than the chemical composition (Alavez-Ramirez et al., 2012 and Jamsawang et al., 2017). SBA utilization in brick production can save the sugarcane industry disposal costs, leading to the manufacturing of 'greener' bricks (Saranya et al., 2016 and Faria et al., 2012).

6. Discussion

A lot of studies related to solid waste management and environmental awareness reported the brick industry as the relevant technological sector to absorb solid waste, due to the large quantity of raw material that can be absorbed (Shen et al., 2007 and Raut et al., 2011). The bricks made from SBA waste represent an alternative future to conventional bricks because of abundant availability of raw materials, low usage of energy, and lack of specialized labour in manufacturing processes. The advantage of the brick is that there is no need for high curing temperatures as it is required for clay brick, and the release of GHGs (carbon dioxide) into the atmosphere is 80% less. In addition, the finished bricks are very accurate and uniform, and have lower embodied energy than cement and clay bricks (Falceto et al., 2012 and Shon et al., 2009). In one study, it is reported that manufacturing of SCBA bricks reduce energy consumption by 50-60 % over the commercially available clay and cement building bricks. The SBA bricks are energy-efficient, lightweight and contributes towards sustainable construction practices (Filho et al., 2007). Similar sentiments were also shared by (Alavez-Ramirez et al., 2012) who observed reduction of 38%, 40% and 21% for energy, CO₂ emissions and energy consumption respectively, in the manufacture of SBA bricks compared with conventional bricks. In another study, the embodied energy of the commercially available burnt clay brick and fly ash brick were 47 % and 5% lower than SBA bricks respectively. Moreover, the cost analysis showed that SBA bricks are economically (9% cheaper) as compared with commercially available clay bricks (Madurwar et al., 2015).

Green bricks made from SBA are produced by a simple manual press which can manufacture around 1000-1500 bricks per day. However, for large scale production and more consistent quality, motorized or hydraulic machines are preferred (Ayed et al., 2016 and Prasanth et al., 2005). When a brick is compressed it loses nearly 30% of its volume due to the mechanical compression of the press driving out air pockets, improving the compressive strength and water resistance (Saranya et al., 2016). In a study by (Filho et al., 2007), the SBA bricks mixed with lime and quarry dust exhibited a compressive strength of 6.59 MPa, which was double that of the conventional clay bricks. The brick also met the minimum requirement of Class II bricks (70 kg/cm^2) for flexural strength according to IS 4860:1996. (Patel et al., 2015) reported that compressive strength normally increases the strength of concrete with the use of SBA, while reducing the consumption of cement. This sentiment was supported by (Sajjard et al., 2017) who observed compressive strength increase of 12% with a cement replacement by 5% SBA. In another study by (Noorwirdawati et al., 2016), replacement of cement with 20% SBA enhanced the compressive strength of bricks, without any loss of workability and strength properties. (Modani et al., 2013 and Alavez-Ramarez et al., 2012) also observed a significant improvement in compressive strength with the addition of 10% and 20% SBA in combination with lime. Another major factor that is key to durability of SBA bricks is water absorption. The less infiltration of water in the brick, the more durable is the brick, hence the internal structure of brick must be intensive enough to prevent the intrusion of water. This factor typically decreases with an increase in SBA content (Saranya et al. 2016). It is normally recommended that up to 20 to 25 % SBA can replace cement in concrete bricks in order for the bricks to have permissible water absorption values (Turgut, 2012).

7. Recommendations and conclusion

In this paper, we discussed factors that are behind global carbon emissions, relationship between economic and carbon growth, and investigated the application of SBA in the development of green brick. Reduction of GHGs and embodied carbon is one of the practical mitigation options for the building sector by utilizing agricultural and industrial waste in construction materials. In such cases, low carbon building materials including SBA should be used as alternative materials to manufacture construction materials such as bricks that are not compromising on structural strength. Many policies and legislatures available in many countries including waste management policies, should be strictly implemented and monitored to mitigate a decrease of carbon emissions.

The main advantages of SBA bricks discussed is that they do not need high curing temperature in their production, and the release of greenhouse gases is less compared to conventional

bricks. Therefore, the application of SBA in the development of green bricks will mitigate a balance between economic, social and environmental challenges related to GHGs emissions. The SBA bricks can achieve acceptable masonry properties such as compressive strength, water absorption, permeability and durability to be accepted by the public and construction industry. However, further research and development is needed to develop guidelines for masonry bricks incorporating different waste material.

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Challenges in Implementing Innovative Building Technologies: Housing Case Studies in South Africa

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Abstract

South Africa has come a long way in addressing the housing backlog for the poor and has even taken further steps by providing a regulatory environment for energy efficient houses. The benefits of including energy efficiency are increasingly becoming realized, not only due to reduction in pollution but due to the additional electricity crisis affecting most South Africans. Many challenges, however, lie ahead with finding a balance between eradicating informal settlements and providing energy efficiency measures, taking into account the escalating cost of building materials. The South African regulatory environment provides for the implementation of innovative building technologies (IBT). However, the uptake of these IBTs to assist in fast delivery of houses and social infrastructure is very slow. The aim of this paper is to report on an investigation carried out on a few case studies where IBTs have been used in housing developments, by collating the data from the projects, analysing the challenges and making recommendations. The major challenge identified in the implementation of the IBTs is the construction cost. Cost analysis and comparisons are made in the paper, and it is apparent from the results that the construction costs of IBTs compare favourably with conventional construction. However, for single story units, the cost for implementing IBTs are not significantly reduced. On availability of more data, it is recommended that a more detailed life cycle cost be performed. In addition, a Housing Innovation Maturity Model is proposed in order to unify the understanding and interpretation of “innovation” in housing.

Keywords: Innovative Building Technology, Housing Innovation Maturity Model, Life Cycle Cost

1. Introduction

South Africa is a country with significant socio-economic development. However, the majority of South Africans have limited or non-existent access to basic *infrastructure*, services, education, primary health care, housing and socio-economic opportunities. At present, the urban housing backlog exceeds 2.4 million houses (SA Government, 2019), with many families living in squatter housing. Over the last twenty years, there have been significant housing innovations in South Africa. Notable examples include the introduction of standardised panel walling systems, light-weight steel and modular foundation technologies. All these systems have been approved by the certification body Agrément SA, and are commonly referred to as “Innovative Building Technologies (IBT)”. The use of the word “innovation” has been interpreted as any building technology which is developed, without the use of South

African National Standards. These innovations have basically changed what houses are made of, how the houses are constructed, how they perform, their cost, durability and how they are perceived by housing beneficiaries.

If the current rate of housing delivery by South African government is about 180,000 per year, the eradication of the housing backlog will entail delivery of an estimated four million houses in a period of more than 30 years. The government, through the National Department of Human Settlements, has prioritised the delivery of homes and has developed a number of programmes aimed at provision of sustainable human settlements. These include the Urban Regeneration Programme aimed at the eradication of backyard informal settlements, and the fast tracking of housing delivery through the use of IBTs. The intent of government is not only on quantity but improving the general quality of life of all its residents by providing sustainable quality homes. Thus, innovation in housing has important economic ramifications for the country. However, there are challenges in implementing the government strategy on IBT and these are related to the following issues:

- Innovation, like in any other industry, requires high initial capital outlay. This initial cost would inevitably increase the production cost of the product, although the cost will subsequently reduce as sales increase.
- There is still a misunderstanding of cost, i.e. cost of actual house construction compared to the Life Cycle Costing (LCC). LCC would include the costs associated with the initial design, production costs, actual house construction cost, maintenance or operational costs and decommissioning costs. However, although a house is the largest expenditure in most household budgets and is usually the most valuable asset a family owns, most end-users (i.e. House beneficiaries and developers) are not interested in LCC but actual cost of construction. This is in contrast to the fact that most houses, including social houses, are built with a life expectancy of 50 years or more. The components which are used in house construction have much shorter life spans, with, for example, roofs requiring replacement within 15 years. This means that during the life of a typical new house, much of sub-components may need to be replaced two or three times before the end of the design life. In addition, the housing beneficiary may also want to perform major alterations, depending on the dynamics of the family. Thus maintenance and running costs add a further dimension which need to be taken into account in costs analysis, thus justifying LCC.
- Other general benefits are not well understood by both the developers and the beneficiaries. For instance, the South African Government has committed itself to achieve reductions in green-house gas emissions. This is in line with their signing the Kyoto Protocol according to which then Department of Minerals and Energy had set targets of energy usage reductions. In addition, South Africa has been experiencing an electricity shortage crisis resulting in

unprecedented levels of national load shedding, affecting business, industry and households. Although the low income sector is currently not the main consumer of electricity, it presents a significant source of future demand growth as income levels rise. Other benefits also include the general improvement in health and productivity, possibilities of creating jobs both in the manufacturing plant and on-site, contributing to mitigation of climate change by reducing carbon dioxide (CO₂) greenhouse gas emissions (Conradie, 2014), and ensuring that sustainability is achieved in housing delivery.

If the above benefits are realised, the result will be a fast delivery of quality houses in South Africa. The aim of this paper is to report on an investigation carried out on a few case studies where IBTs have been used in housing developments, by collating the data from the projects, analysing the challenges and making recommendations. The major challenge identified in the implementation of the IBTs is the cost. Cost analysis and comparisons are made in the paper, and it is apparent from the results that the “construction cost” of IBTs compare favourably with convectional “Brick and Mortar” construction for multi-family residential units. However, to have a common understanding and consistent approach to housing innovation, a Housing Innovation Maturity Model proposal is presented in the paper, using successful concepts which have been adopted in information technology.

2. Literature Review

The use of the words “Innovative Building Technologies” is sometimes interchanged with the words “Alternative Building Technologies”. The intent is however the same, i.e. the use of “non-conventional” building technologies where South African National Standards are not available to assess the performance of these products against the performance requirements of the building regulations. Internationally, the concept of building performance, which implicitly promotes innovation, is used. It is recognised that houses impact on health, safety and welfare of beneficiaries, and the CIB (2003) defines performance-based building as:

“Performance-based building considers the performance requirement throughout the design life of the building and its components, in terms that both the owner and the users of the building understand, and which can be objectively verified to ascertain that requirements have been met. The requirements are concerned with what a building or building component is required to do and not with prescribing how it is to be constructed”.

In the CIB definition, it is clear that the whole life cycle is considered and the end-user performance requirements are taken into account. The “**how**” part of construction is not prescribed, which then promotes the use of innovation in construction. Throughout the world

there are many other definitions of high performance buildings. The NIBS (2008) has the following definition for high performance buildings:

“High performance buildings, which address human, environmental, economic and total societal impact, are the result of the application of the highest level design, construction and maintenance principles – a paradigm change for the built environment”.

The South African regulations (NBR, 1997) are based on a similar performance-based approach. However, meeting the functional requirements of the building regulations can be complied by meeting the “Deemed-to-comply” standards, “Rational assessment” by a competent person or by meeting the “performance requirements” of Agrément SA (2010). It is on the basis of meeting Agrément requirements that the products are called “Innovative Building Technologies”. However, to have a consistent approach to innovation, which does not necessarily exclude the use of conventional building materials in an innovative way, there is a need to review and define what is referred to as IBT, and this approach has to be based on the concept of building performance.

The nature of innovation and the benefits arising out of the use of IBTs in the complex government housing production value chain poses a challenge in the roll-out and mass scale customisation of houses in South Africa. The one main bottom-line attribute being used for the adoption of IBTs is the “construction cost”, and if this cost is within the subsidy quantum, then other issues such as social acceptability are then considered. Government is currently providing a subsidy quantum to poor households an amount of R110,000, excluding variations (SA Government, 2019). Although construction costs often determine both the rate and degree of substitution of conventional “brick and mortar” construction by IBTs, the additional improvements and benefits associated with these technologies need to be taken into account (Burger, 2004).

New technologies, in construction or any other industry, are often introduced at a premium cost to cover the initial capital costs of development, certification costs etc. However, end-users are hesitant to pay for the higher price for a new innovative product, because the value of the increased functionality is difficult to assess, particularly where the innovation is embedded in the structural integrity of the walling, roofing system or foundation system. These technological improvements are mostly realised by the home builders and the professional team as they immediately get an improvement in productivity, reduction in waste etc., all of which are invisible to the housing beneficiary. Unless the innovation is part of finishes of the product, the housing beneficiary thus has uncertainties about the use of new technologies in their houses.

This study therefore attempts to respond to some of the following research questions, which have thus far not been critically and analytically answered, and are relevant to the uptake of IBTs in the housing industry:

- How should “innovation” in construction be described?
- Do IBTs offer more cost effective construction products compared to traditional, conventional “brick and mortar” construction, during construction?
- How durable and what is the design life of houses constructed using IBTs?
- Do IBTs reduce operating costs (Life Cycle Cost) over the life of the buildings compared to conventional construction? Do housing beneficiaries have an interest in reducing operating costs in the long term or are rather interested in short-term cost savings? Considering the current, and possibly future energy crisis, do housing beneficiaries appreciate the present value of energy savings over the design life of the houses?
- Are the IBTs easy to maintain, re-model and will the products be locally available during the design life of the house?
- Does the National Home Builders Registration Council (NHBRC) provide a warranty for a house constructed using IBTs? If so, in the event of structural defects and unavailability of the home builder, will the NHBRC be in a position to fix the house and or provide the Housing Consumer with the same product? If the house is replaced with conventional materials, what happens to the loss of “potential” long term savings?
- Considering the boom-bust cycles in the construction industry, is there a willingness by construction companies to invest in long-term innovation and the further training of their employees?
- The low-income house construction is now being dominated by small and medium size home builders, is there adequate capacity and resources resources to invest in innovation in house construction?

3. Research Methodology

This research was based on case studies of real projects being implemented on the ground, and collating data from certificate holders of IBT. Due to the confidentiality nature of the projects, the names of the projects will be excluded in this paper. A certificate holder is a company whose product has been certified for “fitness-of-purpose” by Agrément South Africa. Agrément certification of a building system ensures that the product meets the performance requirements of the building regulations (NBR, 1997). The Agrément performance requirements for walling systems include:

- Structural Safety and fire resistance. Providing adequate resistance to static and dynamic actions, intentional and unintentional abuse and accidental actions;
- Structural Serviceability. Ensuring there is adequate resistance to loss of function, damage and avoidance of user discomfort;
- Structural Durability. The ability of the product to perform at the required level for the design life, typically thirty to fifty years;
- Energy Efficiency. The extent to which the building envelope optimises the amount of energy required to achieve a required level of indoor climate control;
- Condensation. Avoiding health problems caused by excessive moisture in the air, resulting in formation and growth of algae. This is commonly observed in southern coastal condensation problematic areas; and
- Acoustics performance between indoor rooms and between houses.

The case studies investigated were based on single and double storey houses, and the results were extrapolated to have an understanding of multi-storey residential units. The information collated included the type of building technology (i.e. the product materials used, availability of manufacturing plant locally), Agrément certification and construction cost per square metre of walling system. The research also utilized secondary data sources involving desktop surveys, literature surveys and Internet searches together with one-on-one interviews with innovators. The delimitation of the research is summarised as:

- Logistics was not considered in the analysis. It is noted that the dynamics and construction costs may differ if the product is to be constructed in a province far from where the manufacturing plant is located;
- Due to the limited data available, it is recognised that the LCC is the better approach to compare the cost, but for the purpose of this research, which is supported by the requirement needs of the end-user, only construction costs are considered;
- Only the construction costs of the walling system per square metre are considered. This cost included production, material and implementation (labour) costs only. The indirect cost implication of the weight of the walling system on the subsequent structural bearing elements and the foundation is analysed.
- The implications of the energy usage is not considered. This will be relevant if LCC analysis is being conducted.

The key questions highlighted in Section 3 were critically analysed and used to provide responses as to why IBTs are not being implemented at a faster rate.

4. Research Findings

In this section, the research findings based on the construction cost of the IBTs are presented. The cost comparison is based on projects which have implemented IBTs single and double storey houses. The projects utilised either blocks or panels as the building system. Examples of IBT blocks are shown in Figure 1 (a), (b) and (c). The product descriptions and the price comparison *per square metre* for an external wall are presented in Table 1. The costs shown in the table include labour, materials, plaster and or rhinolite. The costs exclude the logistics costs which may be significant depending on geographic location of the project relative to the production plant, and were obtained from the innovative product suppliers.



(a): Polystyrene



(b): Lightweight concrete



(c): Wood chips & cement

Figure 1: Typical Blocks (Samples obtained from IBT Suppliers)

Table 1: Construction cost comparison as provided by IBT Suppliers

Product Description	Cost (R/m ²)				Cost Ratio	Weight (kN/m ²)
	Labour (R/m ²)	Materials (R/m ²)	Plaster and or rhinolite	Total (R/m ²)		
Light-Weight Concrete Masonry 150 mm thick <i>blocks</i> laid on thin bed mortar	R30	R302	R85	R417	0.74	0.63
Lightweight interlocking <i>panels</i> comprising a 75 mm polystyrene beaded concrete core encapsulated by cement fibre board	R22	R455	R35	R512	0.91	0.48
200 mm <i>blocks</i> using biodegradable wood chips combined with lime cement	R75	R400	R75	R550	0.98	1.57
Light-Weight Concrete Masonry 150 mm thick wall <i>panels</i> laid on thin bed mortar	R15	R483	R75	R573	1.02	0.63
150 mm special aerated mortar with no stone	R30	R222	R75	R327	0.58	2.65
220 mm standard conventional brick	R92	R206	R265	R563	1.0	4.10

From Table 1, it is apparent that the cost of constructing a square metre of wall using IBT blocks compare favourably to the 220 mm standard conventional brickwork, with one case showing about 42% cost saving. This is shown in the table as cost ratio (= total cost of construction using IBT divided by the equivalent cost using conventional standard brickwork). However, the average cost saving for IBT panels is not significant, with even one panel system costing more than the conventional brickwork.

In understanding the cost savings, it should also be noted that there are further cost savings/increases which have not been factored in the table. These costs are attributable to:

- Possible reduction of rubble removal;
- Reduced material handling time and associated cost;
- Overall time savings on site (Preliminary and General Costs); and
- Overtime costs, overhead cost related to more people.

One of the major reasons why the IBTs cost are still high is due to the high capital outlay as mentioned earlier. The special aerated mortar technology has been in existence for more than twenty years and this is reflected in the reduced production and implementation cost, where the cost of the final product is about 58% of the brickwork cost, as shown in Table 1.

The most important impact on cost reduction in using IBT is related to the construction of multi-storey residential units. This is reflected in Table 1 by comparing unit weight of the products per square metre, as shown in the last column of the table. The weight per square metre of a 220 mm brickwork is about 4.10 kN/m², assuming a density of 1900 kg/m³. All the IBTs show a significant reduced weight per square metre compared to brickwork. The weight of “*light weight concrete*” to brickwork is about 15% and for “*interlocked polystyrene beaded panels*” is about 12%. This is a huge reduction in weight. From an engineering point of view, this will result in reduced sizes of supporting structural elements such as beams and columns, and subsequent reduced foundation costs. However, these costs can only be realised in multi-storey buildings, at least more than 4-stories. For these multi-storey buildings, foundation cost saving can be in the order of 15-20%.

Another result from the analysis presented in Table 1 is the high cost of panels compared to the blocks. This is due to high set-up costs in the manufacturing plant. However, the labour costs on site are lower. Of interest to note is that panels have a highly reduced time of construction, which can be more than ten times quicker than brickwork construction. If time is of essence, the cost of construction using panels will be much more favourable than blocks, later alone brickwork.

5. Discussion and Recommendations

5.1. Redefining Innovation in Housing

For industry consistency in defining innovation in housing, in this section a proposal is presented on a new approach developed along the similar lines of the Capability Maturity Model (Paulk et.al. 1994). Innovation in housing usually occurs when a new technology or process replaces another conventional product in the performance of a particular set of processes or functions for end-user or housing beneficiary. New technologies and processes can be considered as successful substitutes for conventional building products if they offer value to the beneficiary by providing the following:

- Functionality i.e., enhancing or adding function such as appearance, or energy efficiency;
- Productivity i.e., reducing the costs of inputs such as labour, materials equipment, as they relate to the final product (the house or a building component); and/or
- Systemic efficiency, i.e. reducing the cycle time of construction.

Based on the literature review, the National Building Regulations, Agrément performance requirements and the definitions of high performance buildings, a framework for a “Housing Innovation Maturity (HIM)” model is presented. The model is similar to the Capability Maturity Model developed by the Software Engineering Institute (Paulk, et al, 1994; Saieidian and Kuzara, 1995), and provides for incremental product and process improvement to encourage innovation in house construction. At present there are no methodological mechanisms to analyse and improve processes in house construction.

According to Paulk et al (1994):

“A maturity level is a well-defined evolutionary plateau toward a mature process. Each maturity level provides a layer in the foundation for continuous process improvement. Each level comprises a set of process goals that, when satisfied, stabilize an important component in the construction process. Achieving each level of the maturity framework establishes a different component in the construction process, resulting in an increase in the process capability of the organization.”

The proposed Housing Innovation Maturity model is presented in Figure 2. The characteristics of each level of the maturity model are described briefly below.

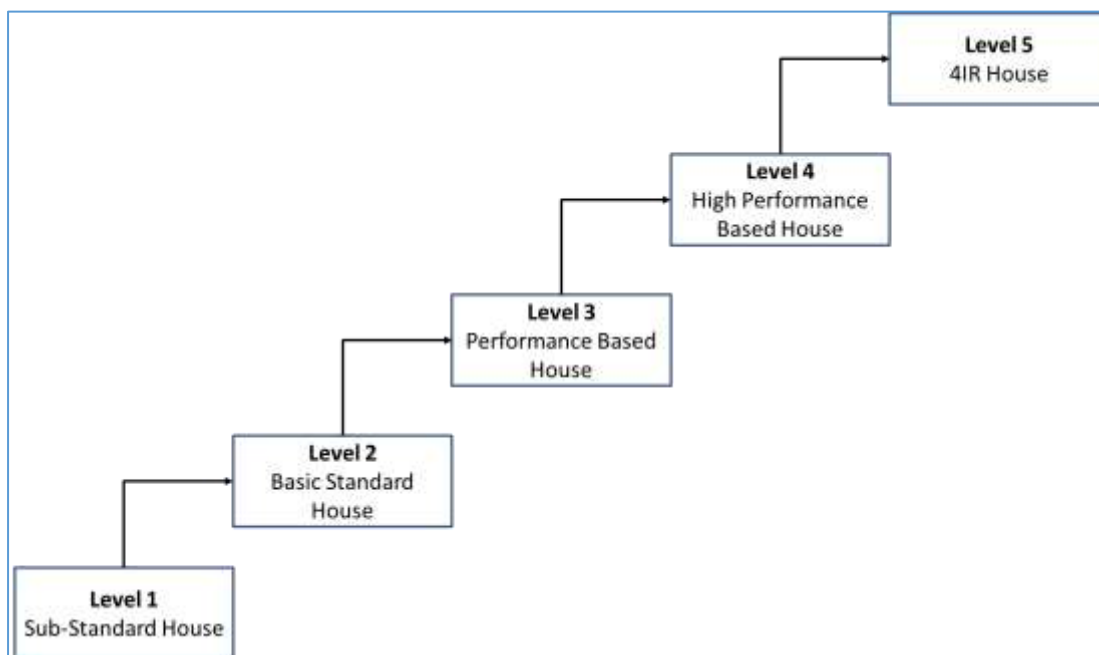


Figure 2: Housing Innovation Maturity (“HIM”) Model

Level 1: Sub-Standard House

At this level, house construction is haphazard, with very little adherence to specifications; high cost of construction, poor quality product, aesthetically unattractive and characterless. The location of the house maybe associated with unsafe environment, inadequate social

infrastructure to support schools, jobs, transport etc. The functional design is inadequate and lacks adequate space for bathrooms, kitchen, storage space and poor sound insulation. Over the design life, energy consumption is inefficient and the houses have high maintenance costs. The LCC for these houses are very high.

Level 2: Basic Standard House

As basic design and quality management control is applied, housing products become consistent with improved quality due to house constructors becoming more and more experienced, and hence developing certain “recipes” about how things are done. The minimum standards stipulated in the National Building Regulations (NBR, 1997) and the National Housing Norms and Standards (SA Government, 2019) are just met. House constructors can also make realistic delivery and financial commitments, based on the results of previous projects. As such, house constructors can track quality and functionality as well as time and costs.

Level 3: Performance-Based House

At level 3, both management and engineering activities are documented, standardized and integrated into the business of the house constructor. Houses constructed at this level exceed the expectations of the beneficiaries. The construction costs are affordable, there is social acceptability of the product and there is construction process improvement with reduced waste. The house can easily be remodelled and upgradable at minimum costs. Quality and functionality of all projects are well tracked. In fact most of the house constructors who build these houses will have quality management systems in place.

Level 4: High-Performance House (Innovation)

Houses at this level, exceed the expectations of the end-user and are associated with low LCC, flexibility of space in homes, very low environmental impact (e.g. waste, carbon dioxide emissions), comfort factors are high (i.e. air quality, sound insulation, natural light), renewable energy products using solar and wind power are utilised and water recycling is a norm.

Level 5: 4IR House

At the highest level (level 5), the *entire* house supply chain is focused on continuous process improvement. The houses at this level are based on Building Information Modelling (BIM), Artificial Intelligence (AI) to control the houses and the building elements/components are premanufactured in the factory.

The above proposed Housing Innovation Maturity (HIM) Model is still conceptual and not yet quantified. The next level of the research is to determine objective and measurable performance criteria which would enable a house to be positioned at the relevant HIM level. Only houses falling at Levels 4 and 5 would qualify to be referred to as “innovative”.

5.2. Cost Analysis Discussion

In Section 4, an analysis of cost of construction using IBTs and conventional brickwork was made. The cost savings were not significant. However, when all factors are taken into account, there is possible huge cost savings using IBTs. Interviews with some of the innovators indicated the following as inhibitors to innovation:

- The perceived high cost of construction is limiting the uptake of the IBTs;
- Challenges in getting financial support in setting-up or upgrading the manufacturing plants;
- Unsustainable streamline of projects, which leaves the manufacturing plant idle for months/years. When the plant is restarted, the start-up costs are high, resulting in higher cost of the final product (house). Such disruptions are very rare in the conventional brick manufacturing process, which keeps the costs of conventional building materials relatively stable.
- The innovations still need acceptability by local market to be successful, despite some of the innovators having managed to penetrate markets outside South Africa;
- Architects and engineers are not innovative and a number of them are ignorant about innovations in construction.
- The procurement phase is currently a major inhibitor to innovation in housing. Necessary preconditions to overcome this include an innovative brief, a preferential contract that demand innovation, and a competition between only innovators.

On the other hand, interactions and interviews with end-users and beneficiaries, including developers, points to one thing – the construction costs of IBTs must be lower than conventional brickwork. They are not interested in Life Cycle Cost (LCC), or other beneficial considerations such as energy efficiency and thermal performance. The disparity between the expectations of the end-users and the innovators must therefore be closed. To partly address this, the following recommendations are proposed:

- Government must adopt a unified approach to innovation. The HIM model proposed in this paper allows for incremental growth and attainment of high performance houses. This model does not exclude the use of conventional building materials and products that are used in a more innovative approach but will be expected to comply with minimum requirements of Level 4;

- The concept of using LCC should be embedded in government policy on innovation, and in the allocation of the subsidy quantum;
- All IBTs envisaged for human settlements projects should undergo rigorous approval processes, starting from the product conceptualisation to acceptance by the end user (Developer; beneficiary etc.);
- Thorough feasibility studies should be conducted before any IBT can be used in a specific area/province; and
- Beneficiaries and other end-users must be well educated and informed about the benefits of IBTs and the quality of the products built using IBTs. This requires a partnership between the key stakeholders in the housing value chain, i.e. Agrément SA, NHBRC and the Government.

6. CONCLUSIONS

The housing backlog in South Africa is still unacceptably high compared to other countries. Although the regulatory environment promotes the use of IBTs in building, very few innovators have managed to take advantage of this. In this paper, a proposed Housing Innovation Maturity model was presented. This model provides a gradual improvement/quality in the product and process. Houses built at Level 4 are the houses exceeding performance expectation and fulfil the requirements of housing innovation.

An analysis of cost construction using IBTs has also been presented in the paper, where it has been demonstrated that the costs are comparable to the brickwork costs. However, if all the LCC are taken into account, the use of IBTs promise to show considerable cost savings. Furthermore, the cost of IBTs are more favourable for multi-storey residential units compared to single/double storey houses. This is due to the reduced weight of the IBTs, which has a favourable effect on the supporting structures. Reduced foundation costs can be estimated to be in the order of 15-20%. Further research is thus recommended to provide objective performance criteria for the Housing Maturity Model, and how LCC can be incorporated in the allocation of housing subsidy by government.

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The trend in low-income rental housing: A need for a housing policy review

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Abstract

Although a significant proportion of South Africans live in rental accommodation, the focus of housing policies for low-income earners is on homeownership. The study premises on a problem identified by the Eastern Cape Department of Human Settlements that despite the increase in housing delivery over the years, informal settlement keeps springing up so also is the incessant cries of poor households that need homes. A survey of three Breaking New Ground (BNG) projects Wells Estate, Mount Ayliff and Lady Grey, all sited in the Eastern Cape revealed that the rate of renting in these settlements have been increasing in recent years giving credence to the need for rental housing. This paper concludes that the rental housing policy can contribute to the enhancement of residential mobility, improved labour market and livelihood opportunity, and strengthen socio-economic networks.

Keywords: rental housing; Housing policy; residential mobility; low-income housing.

1. Background

The deteriorating housing conditions in urban areas of developing countries has been of great concern to the international communities (Abdullahi and Aziz, 2017: 6) and this was underscored in 1976 at the UN-Habitat I Conference held in Vancouver; in 1987 during the International Year of Shelter for the Homeless; and in 1996 at the Habitat II Conference held in Istanbul. This concern shifted the attention of decision-makers, professionals and academics to the problems of housing as well as the formulation of housing policies to combat those problems (Aribigbola, 2011: 121). UN (1996) revealed that this is because housing deficiency is the main reason for developing national housing policies.

As of 1994, in urban areas alone, 1,075,000 households (majorly black and about 28% of urban households) were living in outbuilding, hostels and shacks with appalling conditions (PSLS, 1994)

In the last 25 years of its democracy, South Africa has undergone a massive revolution and has witnessed rapid political change. The change has mounted growing pressures and expectations for the government to fulfil its electioneering campaign promises chief of which is housing. The challenges of urban shelter have escalated as migration to cities has become unhindered, and this has brought to light the previously concealed shelter problems.

With few alternatives, Johannesburg for instance with its rapid growth has seen large numbers of black people finding shelter in shacks usually located in other people's backyards as a response that developed rapidly during the last years of apartheid and has dovetailed more recently into illegal land occupations (Turok and Borel-Saladin, 2016:392). The rapid growth of these irregular "housing" has posed a major difficulty as well as servicing problem to the authorities by its recurrent rent and service boycotts (Turok, 2016:12).

As revealed by Zweig (2015: 3) the evidence of the gravity of the housing situation is by the large proportion of households occupying rental accommodation as shown in a survey that estimated 55 per cent of the population in six major cities of formal African townships as renting. The type of tenure is not as important as the fact that some of these rentals are in the form of backyard shacks which reveals the poor living conditions of most of these renters. This condition is one reason why the government committed to owner-occupation by adopting capital grant policy to the poor to purchase serviced sites and basic housing units (RSA, 1994) and this was to create a society of homeowners as many countries around the globe intends.

This paper contends that the current neglect of the low-income rental housing in the South African housing policy will put at risk its ability to meet the shelter needs of the urban poor. The paper reviews and explores international experience on rental housing as well as the various programmes and policies that have been introduced to solve housing problems in South Africa. A summary of the findings of a survey conducted recently in three BNG settlements in the Eastern Cape will be presented to highlight the constant demand for rental housing and hence self-help rental market. It concludes with an explanation of how renting in South Africa can enhance residential mobility, improved labour market and livelihood opportunity, and strengthen socio-economic networks.

2. Rental housing experience from literature

Across the world, rental housing takes very different forms ranging from mainly private housing in some countries to mainly public in others. Although the small-scale landlord is conventional, large scale investors occasionally carry on housing management. All categories of social and economic groups: female and male, young and old, rich and poor, indigenous and immigrant are catered for by rental housing. Also, due to the varying income of tenant households, rentals provide a range of quality shelter to basic and even unsafe accommodation.

A few decades ago, cities in third world countries knew little, or nothing about rental housing but the reverse is the case today as approximately 1.2 billion people live in rented accommodation (Hu, He, Han, Xiao, Su, Weng and Cai, 2019: 657). The general policy trend across the globe since the 1970s has been in favour of homeownership and significant studies have been conducted and presented in Table 1 reveals that in most countries, the proportion of tenants has been in decline.

Where it has increased, mostly in poorer nations, the reason lies in the migration to cities and since renting is primarily an urban tenure, tenants proportion increased. However, the characteristics and prevalence of rental housing differ significantly between countries, but the distinctive experiences are considered.

For example, a distinct shift in public policy came with the elections of Ronald Reagan in the USA, Margaret Thatcher in the UK and the government of the right-wingers in Germany and Japan. Private homeownership became preferred above social rental housing. Council house tenants in the United Kingdom were granted the 'right to buy' and with a discount of up to 50%. Local authorities and Housing associations sold 1.7 million houses in England and 2.2 million in Great Britain as a whole (Sanderson, 2019: 104).

Table 2: Percentage of rental households in selected countries

Country	Year	Tenant	Year	Tenant
Argentina	1980	16%	2001	11%
Australia	1981	26%	2007-8	28%
Bolivia	1976	15%	2001	21%
Brazil	1980	23%	2010	18%
Bulgaria			2009	13%
Canada	1981	36%	2006	32%
Chile	1982	31%	2002	18%
China			2005	9%
Colombia	1985	24%	2005	31%
Czech Republic			2009	23%
Dominican Republic	1981	22%	2002	28%
Ecuador	1982	23%	2006	18%
Finland	1989	23%	2010	26%
France	1978	43%	2009	37%
Germany	1981	63%	2005	53%
Ghana			2010	31%
Hungary	1980	30%	2010	10%
India	1981	16%	2011	11%
Indonesia			2010	21%
Japan	1978	34%	2003	39%
Korea	1975	33%	2010	42%
Mexico	1980	21%	2010	14%
Netherlands	1981	56%	2009	32%
New Zealand	1976	27%	2001	33%
Peru	1981	15%	2007	15%
Poland	1974	51%	2009	31%
Romania			2009	4%
Slovakia			2009	11%
Slovenia			2009	19%
South Africa			1999	36%
Spain	1980	23%	2009	17%
Sweden	1975	56%	2009	30%
Switzerland	1981	67%	2000	65%
Taiwan	1976	20%	2007	12%
Thailand			2000	11%
Tunisia	1975	14%	2004	23%
Turkey	1985	23%	2006	39%
UK	1981	43%	2009	30%
Uruguay	1975	32%	2006	15%
USA	1980	36%	2010	33%
Venezuela	1981	18%	2007	10%

Source: Respective national housing and population censuses UNCHS (2003: Table 1), UN-Habitat (2011a, b, c, d).

As can be seen from table 1, for most countries in the South, homeownership increased rapidly during the latter half of the twentieth century. In Chile, for example, ownership increased from 33% in 1952 to 69% in 1982 (Brain, Mora and Sabatini, 2014: 170). However, the process propelling this shift was very different from that in the North.

Also, people in the advanced capitalist countries were encouraged to buy their own homes, and the emerging banking systems also provided the necessary finance to the middle and upper working classes. Tax relief on mortgage payments was offered by some governments, thereby reducing the cost of owning relative to renting. Hence, as average incomes grew, affordability increased and with this, coupled with government and building industry propaganda, the conviction of homeownership as a critical indicator of social position and 'culture' became immense. In most 'liberal' housing markets; however, the shift to homeownership was remarkable. The proportion of homeowners in Spain increased from 51% in 1960 to 91% in 2002 (García-Lamarca, 2017: 39).

After the second world war, communism emerged in Eastern Europe, China and Cuba with a promise by the state to provide housing for the people. In Eastern Europe and USSR, high-rise rental housing was built by the governments on a large scale and accommodation was provided for workers of state-owned companies in China. There was a constraint to private renting, and it was illegal in Cuba and China and as such, dominating the housing stock in most Communist countries was the public rental housing. In Estonia and Lithuania, public rental housing accounted for 65 per cent and 51 per cent of the housing stock in 1990 (UNCHS, 2001a: 88) with rents set at shallow levels. For instance, an average worker paid 1 per cent of his income as rent, and it translated to 0.7 per cent of a household's total expenditure (Zhang, 2000: 195). With a whole tenure and cost paid from general taxes, housing provision formed part of the social wage and eviction was virtually alien.

After 1989 however, when democracy returned to Communist Europe, the nature of housing provision changed and most of the public housing stock large was sold off (UN-Habitat, 2011a). By the turn of the millennium, 41% and 59% of flats in Moscow and the Russian Federation was privatised, and Bulgaria, Estonia, Hungary, Kyrgyzstan, Romania and Slovenia caught the bug with their owner-occupation levels in excess of 80 per cent (Grover, Munro-Faure, & Soloviev, 2002: 43-45). The ensuing elimination of rent control which resulted from the privatisation of public housing stimulated the growth of a private renting sector (UN-Habitat, 2011a: 34). The government in China also shifted to a market-oriented system (UN-Habitat, 2011b: 43) and this resulted in a housing reform which saw to the development of a new private housing sector and privatisation of public housing (Logan, Fang, & Zhang, 2010: 116). Eighty per cent of the public housing was sold to its occupiers by the year 2002 (UN-Habitat, 2011b: 8).

In the global south, public housing had emerged as early as the 1920s with large scale construction in oil-rich nations, socialist and apartheid regimes in Saudi Arabia, Egypt and South Africa respectively as well as specific cities with influx of refugees, such as Singapore, Hong Kong and South Korea, and 'planned' cities such as Brasília and Ciudad Guayana (Fong, 1990; Grimes, 1976; Ronald & Jin, 2010; UNCHS, 1989). Despite its design and construction, over the years, the quality of housing allocated to tenants generally deteriorated and it became evident that few governments were effective social landlords (Gilbert & Varley, 2002; UNCHS, 1989). With low rent and a lot of rental defaults, virtually every Latin American government opted to sell the existing rental housing stock and resolved in future only to build public housing for sale. However, Korea still constructs public rental housing which is eventually sold off to the tenants (Ronald & Jin, 2010).

In Africa and Asia, most people reside in poor quality accommodation without the necessary facilities and services. Housing deficit continued to rise unabated in the face of annual national

population and cities growth rate at over 3% and 5% per annum respectively, and the housing policies could barely cope. The poor in their bid for shelter resolved to self-help through informal housing and the governments usually turned a blind eye to and even encouraged it for electoral reasons in some climes. Soliman (2008: 15) projected that 62% and 72% of Cairo and Alexandria's populations, inhabited areas that were developed informally. The land invasion was encouraged by political parties in their competition for votes in Chile, Venezuela and South Africa in late 1960s, after 1958 and in the early 1990s respectively (Chant, 2017: 61; Rogerson, 2019: 190).

Because the land in the peripheral was in private hands or the government side was reluctant at encouraging the illegal occupation of land, the development of informal settlements occurred more slowly, and its prohibition was rare and was rarely sustained in some African countries. The poor acquired plots which had neither planning permission nor services as such peripheral land were usually available at a price (Arimah, 1997: 107). With this process of commercialisation, the very poor could only acquire when and if they had enough funds. However, they made do with the alternative of either renting or sharing a home with friends and family since housing policies in most countries of the South have been more of words than action. Most public housing has catered for very few people who could afford to buy or rent (World Bank Group, 2015: 30). The common aim of new housing policies has been to encourage homeownership while rent control only applies to formal housing if and where they are available. Improving mortgage systems for the middle class, the building of infrastructure to accommodate lower density urban growth and focus on slum upgrading policies in preference to resettlement is the focus of many governments. Hence, there has been an increase in homeownership in most countries in the South. For example, Brand South Africa (2002) recorded that between 1994 and 2002, homeownership rose from 66% to 77%. Only where land and housing has been expensive relative to incomes, as in Bogota and Quito, where public transport has been poor, as in Lagos, or where massive city-ward migration has occurred, as in much of Sub-Saharan Africa has the incidence of renting remained stable or even increased. However, the number of tenants has even increased in many countries where the incidence of renting has been in decline and primarily because of the pace of urban growth, informal renting has developed in various forms: in the backyard of homes in South Africa, in the informal settlements of Tanzania and Kenya, and in the rented plots in India (Thika tenants) (Gilbert, 2016: 176). With no legal framework for renting the landlords operate such that; few sign contracts, few follow the rules on raising rents or evicting tenants but there is evidence suggesting that the system work operates well (UNCHS, 2003). This brings to fore that without the emergence of informal landlords, the housing situation in the South would have been more chaotic its current state.

3. Rental housing in South Africa

Rental housing provision by the public sector for many years was most of the urban black and coloured population, and little has been recorded about the effectiveness of that sector. Even less is known about private rental housing, and a limited amount of work has been conducted in inner-city areas, particularly in Johannesburg, (Crankshaw and White, 1995: Stadler and Dugmore, 2017: 13) and surveys done in Cape Town have also shed some light on the rental and shared housing scene (Watson & McCarthy 1998). Even the statistics are somewhat vague on the number of families renting accommodation (Turok & Borel-Saladin 2016) and the figures presented in the census are unreliable and too few surveys have asked questions about housing tenure as residents in the past, tried to evade the census enumerators because

they were living in the city illegally and feared they might be deported under the influx controls. More recently, the fear has been that census enumeration would lead to the authorities demanding rent or service charges.

Palmer Development Group, (1993) observed that there are no reliable estimates of the size or growth of the household rental sector in South African urban areas, quoted that a survey of six township areas in six larger urban areas estimating that some 55% of the population were renting primarily in shacks erected behind formal township houses. What is clear, however, is that large numbers of South African families are renting a shelter, particularly in the urban areas. One estimate is that across the country more than one-third of people are living in some form of non-ownership shelter and that in urban and metropolitan areas the proportion rises to more than two-fifths (PSLS, 1994).

Different housing policies and programmes were put in place between 1996 and date, and vitally nothing has been said about informal rentals (see table 2). There are seventeen new housing subsidy programmes which include informal upgrading programmes, self-help building programmes, subsidies for integration and support for rental and social housing that have been instituted (RSA, 2014:69).

Established in 1994, the Reconstruction and Development Programme (RDP) was a central policy framework for the formulation, and implementation of a spectrum of socio-economic contexts, including housing (Wilkinson, 1998:224) and its objectives continue to define public policy (RSA, 2014c:11). Aided by capital subsidies (National Housing Subsidy Scheme (NHSS)), the RDP aimed at achieving the housing target of one million houses within the first five years of democracy (Del Mistro & Hensher, 2009:334) in other reduce the housing backlog created by the apartheid past (Moolla et al., 2011:138).

While the RDP acknowledged rental housing, it was merely a recognition of the sector with no specific strategies nor focus on addressing the informal rental market, other than as 'affordable rental'.

The White Paper on Housing followed the RDP in 1994, and its focus was on housing delivery principally with no mention of rental housing in the policy. The principles contained

in the Housing White Paper was central to achieving the later established Constitutional right to adequate housing (RSA, 2009c:12) The Growth, Employment and Redistribution (GEAR) replaced the RDP in 1996, and it had an objective of coordinating and integrating development (Goebel, 2007:293; RSA, 2009c:12).

The 1996 South African Constitution stresses the transformation of the society into a more equitable, open and democratic entity rooted in freedom, dignity and human rights (Van Wyk & Oranje, 2014:353). The 1996 Constitution makes provisions regarding the right to housing, as the foundation for all housing policies, legislation and programmes instituted after that. Moreover, this is in tandem with United Nations Habitat Agenda of 1996 which stipulates that 'Everyone has the right to an adequate standard of living for themselves and their families' (United Nations, 1996:4). However, the constitution made no case for rental housing save that it prescribes adequate housing.

The People's Housing Process (PHP) launched in 1998, was adopted to allow communities to assist themselves in housing delivery by encouraging beneficiaries to build their dwellings. The Programme provided support to households who wanted to organise and or construct their homes themselves (Landman & Napier, 2010:299).

Table 3: Post-1994 South African housing policies and rental references

Year	Policy documents and housing programmes	Phrases, concepts and number of references					
		Rent/Rental/Renting	Informal	Informal Rent/Rental/Renting	Low-income Rent/Rental/Renting	Affordable Rent/Rental/Renting	Social housing
1994	Reconstruction and Development Programme (RDP)	4	14	0	0	1	0
1994	White Paper: A New Housing Policy and Strategy for South Africa	9	15	0	0	0	4
1996	Growth, Employment and Redistribution Strategy (GEAR)	0	2	0	0	0	0
1997	Urban Development Framework (UDF)	5	18	0	0	0	0
1998	People's Housing Process (PHP)	-	-	-	-	-	-
2000	National Housing Code 2000	-	-	-	-	-	-
2004	Breaking New Ground: A Comprehensive Plan for the Development of Sustainable Human Settlements (BNG)	7	35	0	0	0	33
2005	Social Housing Policy for South Africa (Social Housing Policy) (SHP)	135	3	0	0	4	390
2007	Framework for an Inclusionary Housing Policy (IHP) in South Africa (Inclusionary Housing Policy)	25	0	0	0	1	0
2009	Enhanced People's Housing Process (EPHP)	0	2	0	0	0	0
2009	Revised National Housing Code	-	-	-	-	-	-
2011	National Development Plan (NDP)	19	100	0	0	2	1
2014	Integrated Urban Development Framework Draft (IUDF)	7	44	0	0	2	1
2016	White Paper on Human Settlements	-	-	-	-	-	-

Source: Owners Construct from the different South African Housing Policies.

A lack of capacity and active community support was also largely to blame in the failure of the original PHP to deliver at scale (Hopkins, 2007:6).

The Housing Code 2000 had the main objective of increasing housing delivery on a sustainable basis to a peak level of 350 000 units per annum until the housing backlog is overcome and this was subject to fiscal affordability (RSA, 2000:5).

By 2004, despite various challenges, an estimated 1.6 million subsidised homes had been built (RSA, 2014c:105). The Break New Grounds (BNG) policy supports progressive informal settlement eradication through integration, in-situ upgrading and improved social housing opportunities (Rubin & Gardner, 2013:68). This policy also had no reference to rental housing in its provisions.

Initiatives to draft an inclusionary housing policy materialised as a result of apprehensions regarding the success of attempts to address the apartheid's city's divisions and fragmentations (Tomlinson & Narsoo, 2008) and it birthed the 2007 Inclusionary Housing Policy for South Africa (IHP). This arose as a result of a pledge to include low-income housing prospects in commercial housing developments towards a more racially and socially integrated settlement (Tissington, 2011:71). The IHP sought to increase the supply of affordable rental

accommodation (Tissington, 2011:71) and the term 'rent' was mentioned 25 times in the policy document.

In 2009, the Housing code was revised into a lengthy document of more than 30 volumes (Tissington, 2011:73). The Housing Code (RSA, 2009) categorised National Housing Programmes according to four 'Intervention Categories', as Financial Programmes, Social and Rental Housing Programmes, Incremental Housing Programmes and Rural Housing Programmes. Under these categories, the Upgrading of Informal Settlements Programme (UISP), the Social/Rental Housing Programme and the Integrated Residential Development Programme (IRDP), under the banner of Incremental Housing Programmes, are broadly considered the core of future housing delivery.

The Enhanced People's Housing Process (EPHP) which was adopted in 2008 and rolled-out in 2009 (Clark, 2011:28) adopts a broader definition of 'self-help' and allowed for better choice and flexibility. It also recognised the public participatory approach to better housing outcomes; however, despite its call for inclusiveness, it paid negligible attention to self-help rental practices.

A broad plan and vision for the South Africa of 2030 are outlined in the National Development Plan of 2011 (NDP) (RSA, 2014c:18), and it recognises the demand people-championed development (RSA, 2011:1). The NDP admits that the capital subsidy regime has failed to meet the needs of a large segment of the population who would be better served by rental accommodation.

From the preceding, as evidenced from table 2, rental tenure in South Africa can be described as contentious. A certain stigma attached to rentals as a tool of exclusion under apartheid and as an instrument applied to deny home and land ownership and deepen dependence on the state post-1994 (Mackay, 1999:395). Ownership was increasingly equated to liberation, thus entrenching a desire to own property by the majority of those previously denied the right.

Also, international experience showed public rental/social housing to be potentially challenging to manage, mainly where rentals were provided as highrise apartments, with considerable concern for rent collection and crime where management was not attentive and well-supported (Cross, 2006a:15). The state has never shied away from vocalising the importance of access to rental housing for the urban poor (Maass, 2011:759). Bond and Tait (1997:20) questioned the validity of claims that the government had adopted any real rental housing policy, stating that at that time, the rental policy only seemed loosely tethered to policies focussed on homeownership.

Even the limited references to rental housing focused exclusively on formal rentals, with the informal rental market still largely ignored and many people still opt for this market to meet their housing need.

Furthermore, the Rental Housing Act of 1999 and the Rental Housing Amendment Bill of 2007 have provided all landlords and tenants in the formal and informal rental sectors with increased rights, protection and recourse (Lemanski, 2009:475; Mohamed, 2010:2; Tissington, 2011:38). The 2007 Rental Housing Amendment Bill provided such measures through the introduction of rental housing tribunals (RHTs) to resolve landlord-tenant disputes (Mohamed, 2010:2). However, these instruments have shown limited success (especially outside the metros), as most stakeholders in the informal sector remain unaware of their rights and continue oblivious to the existence of bodies like Tribunals (Watson, 2009b; Gunter, 2014:102).

Moreover, almost all studies, apart from Zwaig (2015), have targeted metropolitan areas and larger cities in their research activities and neglecting smaller cities and towns where informal rentals also exist. Also, the capacity to address issues related to the rental housing sector is weak, and such contexts may give the needed opportunities that can be harnessed in formulating appropriate policy interventions at the national level.

4. Methodology

The research conducted followed applied methods of investigation. Following a case study approach, the study combined both qualitative and quantitative methods of data collection. The primary data set employed in this paper was collected using a structured questionnaire administered to residents Lady Grey, Mouth Ayliff and Wells Estate between April and May 2018. Purposive sampling technique was used to select respondents wherein every house which was visited within the period of the field survey were interviewed, and a total of 1,362 questionnaires (194 in Lady Grey, 500 in Mt Ayliff and 668 in Wells Estate) were retrieved. Also, other relevant materials and data were sourced from published sources such as the report of the Eastern Cape Department of Human Settlements, journal articles, textbooks, newspaper publication and internet among others. Frequency tables and percentages were used to explain the results of the study.

5. The Study Area

The Eastern Cape (EC), with a landmass of 168,966 km² and a population of 6,522,700 (StatSA, 2018) was formed in 1994 out of the Xhosa homelands of the Transkei, Ciskei and a portion of the Cape Province, and is one of the provinces of South Africa. With its capital at Bhisho, Port Elizabeth and East London are its two largest cities.

The province is located within the most southern part of Africa lies approximately on latitude 32°17'48.6" South of the Equator and 26°25'9.8" East of the Greenwich Meridian, and it has a coast on its east which lines southward, creating shores leading to the south Indian Ocean. In the northeast, it borders Lesotho while it borders the Western Cape, Northern Cape, Free State and KwaZulu-Natal provinces on the west, northwest, north and far northeast respectively.

For local government purposes, the Eastern Cape province of South Africa has two metropolitan municipalities (Buffalo City and Nelson Mandela Bay) and six district municipalities. The municipalities and their seats of power are Alfred Nzo District Municipality, Mount Ayliff; Buffalo City Metropolitan Municipality and Amathole District Municipality, East London; Chris Hani District Municipality, Queenstown; Joe Gqabi District Municipality, Barkly East; Nelson Mandela Bay Metropolitan Municipality and Sarah Baartman District Municipality, Port Elizabeth and OR Tambo District Municipality, Mthatha. The district municipalities are further divided into thirty-one local municipalities.

The study was conducted in Wells Estate 668 human settlement (in Nelson Mandela Bay Municipality), Mt Ayliff 500 human settlement (in Umzimvubu Local Municipality a part of the Alfred Nzo District Municipality) and Lady Grey 194 human settlement (in Senqu Local Municipality a part of the Joe Gqabi District municipality).

6. Results and discussions

Table 3 depicts the pattern of the age of the respondents obtained from the field investigation. The analysis of the table demonstrates that a significant proportion of the respondents (68%) are within the age range of 20 to 60 years old. In other words, most respondents can be classified as within the economic/employable age group, while about 14% account for those that fall within the senior citizen and young people group. Two hundred sixty-two respondents did not declare their ages. middle-income earners. This result shows that majority of householders or residents of the study area fall within the employable age group and the implication is that the neighbourhoods can provide labour for any economic activity which would further enhance their purchasing power and commerce.

Table 4: Age of respondents by location

Age	Mount Ayliff	Wells Estate	Lady Grey	Total	%
Prefer not to say	95	158	9	262	18
<20	29	8	1	38	3
20<40	182	232	60	474	33
40<60	146	283	67	496	35
Above60	27	83	42	152	11
Total	479	764	179	1422	100

Source: Field survey 2018

In terms of gender distribution, as shown in table 4, 52% of the total respondents are female, while 31% are of the male gender. Most of the female respondents were also the household head which confirms the assertion of UN, (2015) that female-headed households are increasing worldwide, with divorced, widowed, or single women falling into this category.

Table 5: Gender of the respondents by location

Gender	Mount Ayliff	Wells Estate	Lady Grey	Total	%
Female	260	357	118	735	52
Male	113	276	52	441	31
Prefer not to say	106	131	9	246	17
Total	479	764	179	1422	100

Source: Field survey 2018

The occupants were requested to confirm their occupancy status, as revealed in table 5, 588 representing 41% of the total respondents said that they were owners while 33% (459 respondents) said they were none-owners. The number of none-owners are very significant and cannot be wished away, although 26% preferred not to reveal their ownership status. When further probe as to the source of their occupancy status, as illustrated in table 6, 56% said they had their units allocated to them by the government, and 13% confirmed that they were renting. 17% claimed that they were either housekeeping/housesitting for the owners and 14% claimed that they either inherited or purchased theirs. A very negligible 0.00143% claimed that they had the order of the court to occupy.

Table 6: Status of the occupier

Occupiers status	Mount Ayliff	Wells Estate	Lady Grey	Total	%
Owner	162	314	112	588	41
None-owner	163	255	41	459	33
Prefer not to say	154	195	26	375	26
Total	479	764	179	1422	100

Source: Field survey 2018

Table 7: Source of occupation

Source	Mount Ayliff	Wells Estate	Lady Grey	Total	%
Gov Allocated	174	495	119	788	56
Renting	92	76	16	184	13
Purchased	45	22	3	70	5
Inherited	70	36	19	125	9
By court order	0	2	0	2	0
Other	47	162	23	232	17
Total	428	793	180	1401	100

Source: Field survey 2018

As can be seen from Table 7, which provides a trend in the transactions over ten years of January 2009 - May 2018, several trends can be observed:

Table 8: Trend in the transactions from January 2009 to May 2018

Year	Gov. Allocated			Renting			Purchased			Inherited		
	Mount Ayliff	Wells Estate	Lady Grey	Mount Ayliff	Wells Estate	Lady Grey	Mount Ayliff	Wells Estate	Lady Grey	Mount Ayliff	Wells Estate	Lady Grey
2009	2	50	0	3	2	0	0	0	0	1	4	0
2010	1	28	1	2	2	0	0	0	0	3	0	0
2011	1	3	17	2	0	0	0	0	0	2	1	3
2012	5	1	56	3	1	0	0	1	0	3	1	5
2013	19	0	21	9	2	2	1	0	0	5	0	2
2014	10	0	4	7	3	0	1	0	0	6	0	1
2015	0	0	3	7	5	0	0	3	1	5	1	2
2016	3	0	3	15	6	4	0	3	1	7	0	0
2017	0	0	2	22	15	3	0	4	0	13	2	1
2018	0	0	0	15	10	4	0	0	0	2	0	0

Source: Field survey 2018

- i. Between 2009 and 2014 across the three sites, government allocation was the most transactions that took place (52 allocations in 2009, 30 allocations in 2010, 21 allocations in 2011, 62 allocations in 2012, 40 allocations in 2013 and 14 allocations in 2014) and this can be adduced to the fact that most of the housing units in the sites

has been completed and the government was just allocating them to beneficiaries. This period was between 14-20 year of the government's promise of housing provision as a right to all citizens of the Republic of South Africa. From 2015 to 2018, the allocation had dropped drastically to a total of 11 allocations within the four years with no allocation at all in 2018.

- ii. On rental transactions, they were low and probably new or unknown to the BNG sites. Probably due to the shack renting phenomena, a few rental transactions (5 number) took place across the three sites in 2009, and there was a total of 15 rental transactions between 2009 and 2012, but from 2013, the number was on a steady growth with 13 in 2013, 10 in 2014, 12 in 2015, 25 in 2016 40 in 2017 and 29 as of May 2018. These statistics reveal that the demand for rental housing has been on the increase with people renting for reasons ranging from residential mobility, closeness to workplace and job opportunities and better livelihood, among others.
- iii. The survey revealed that there were negligible purchase transactions with only 15 transactions within the ten years and this might have been due to the 8-year rule of sale put in place by government policy for RDP/BNG housing units.
- iv. In the area of alienation by way of purchase, to a total of 70 transactions have taken place in the last ten years with it peaking at 17 in 2017. This phenomenon has been on a steady rise, although there is no known formal market to regulate the practice and uptakes of the market towards ensuring its economic viability.

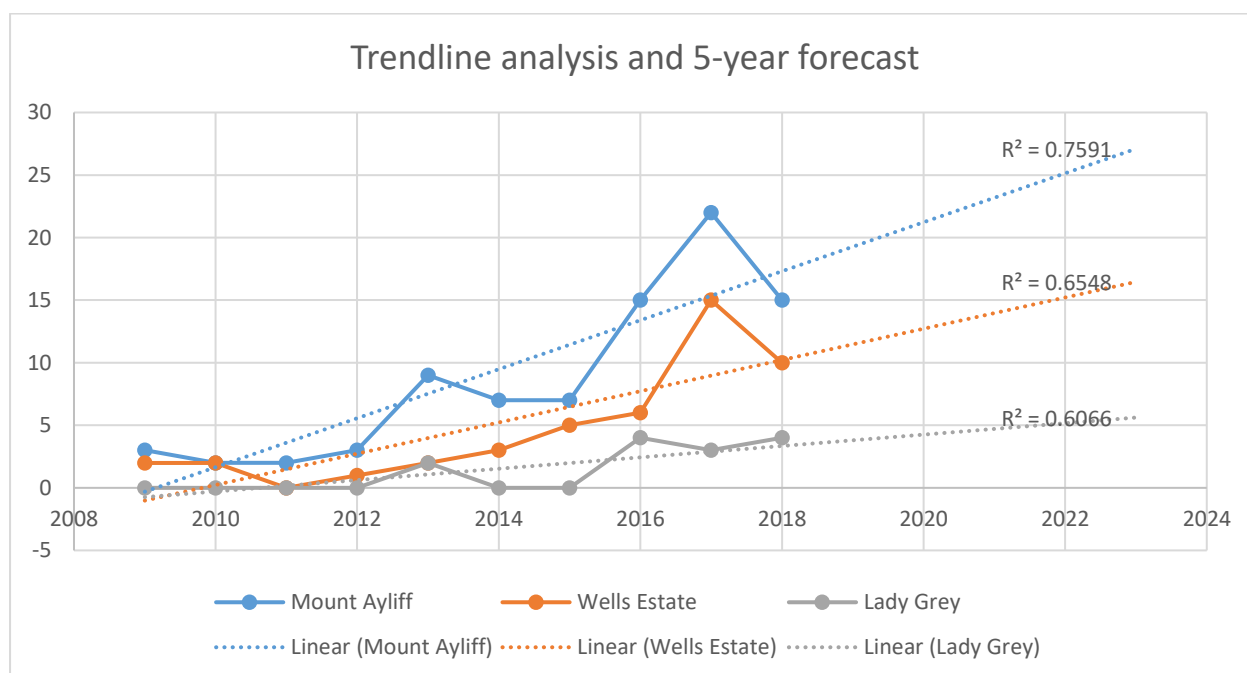


Figure 7: Trend from 2009 to 2018 and forecast to 2023

The finding from the survey was further subjected to trendline analysis and a linear forecast. Findings reveal that the trend of the rental transaction has been on the increase and using a linear forecast of 5 years to 2023, the analysis reveals that there is going to be a significant increase in rental transactions and hence a need for the provision of low-income rental housing.

R-Squared (R^2 or the coefficient of determination) is a statistical measure in a regression model that determines the proportion of variance in the dependent variable that can be

explained by the independent variable. In other words, r-squared tells how well the data fit the regression model (the goodness of fit) of the observed data, and generally, a higher r-squared indicates a better fit for the model. From the figure 1, Mount Ayliff, Wells Estate and Lady Grey have R^2 values of 0.7591, 0.6548 and 0.6066 respectively and this portrays that there is a better fit for the regression model and the projection that rentals would increase steadily in the coming years is therefore valid. Hence the need to look at rental housing as an option to meet the growing housing demand and housing gap.

7. Recommendation and Conclusion

In most government housing policy, rental housing agenda has not featured on a large scale but has strongly favoured ownership. However, based on the findings of this study on the trend of rental of low-income housing, there are many reasons why the current housing policy must be revisited to have an agenda for rental housing and particularly for the low-income sector.

Firstly, Lux & Sunega, (2012) and Oswald (1997) posited that it is possible that homeownership increases levels of unemployment in so far as owners are less mobile than tenants. If owners cannot liquidate their property quickly or cannot buy another house of the same value in areas of full employment, they may relocate not move to a new house. In the same vein, no low-income earner will move if there is no certainty of accommodation, even if it is in a shack or background rental. Hence, with the growing annual rental transactions in the study areas and a forecast of continuous growth, it is inevitable that the availability of low-income rental housing will contribute to and encourage residential mobility.

Secondly, homeownership is a barrier to labour migration. Lux and Sunega (2012: 500) explored the relationship between housing conditions and labour migration as a critical component of structural unemployment as evident in labour mobility. They posited that homeownership is a barrier to labour migration and a likely source of structural unemployment. The implication of this is that there will be an unintended consequence of making specific labour segments less mobile in the face of housing policy that focuses mainly on homeownership and if there is a shift in agenda towards low-income rental housing, there will be an improved labour market available where and when needed.

Finally, for those people who can work and contribute to the economy of the nation, residential mobility and improved labour market will help in enhancing their livelihood

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Household expenditure affordability thresholds for housing, water, energy and transport in South African Human Settlements

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Abstract

Human settlements and housing are a part of people's material living conditions and contribute directly to their life choices. Human settlements that are poorly located, constructed and serviced force households to spend a larger proportion of their income on transport, energy and water. This leaves less for food, education and health, seeking employment, starting a business or saving for a pension or a house. In poor families, this reduces access to education opportunities, increases susceptibility to ill health and disease and makes it more difficult to escape the cycle of poverty. Therefore a sustainability indicator of human settlements and housing is the amount or proportion of household expenditure on transport, water and energy. The paper carries out a literature review to understand patterns of household income and expenditure. Household expenditure indicators and benchmarks are reviewed to propose benchmarks for sustainable housing and settlements. These are critically reviewed in relation to South African human settlement data to establish their relevance and applicability. Results are discussed to ascertain implications for human settlement and housing policy and recommendations for further research developed.

Keywords: Sustainability, affordability, household income, household expenditure, transport, energy, water

1. Introduction

Households in the Northern Cape of South Africa spend 24,5% of their incomes on transport and 20,5% on housing, water and energy in 2015 (Statistics South Africa), 2015). This indicates that almost half (44.5%) of household incomes are spent on transport, housing and energy. This leaves about 55% for all other household expenses, such as food, water, education, health, clothing, furniture. Is this proportion sufficient to maintain a reasonable quality of life and adequate health and wellbeing standards? If this amount is too high and leads to unacceptably low standards of health and wellbeing, can guidance be developed on what should be the maximum amount or proportion of income expended on transport, housing and energy? This paper attempts to address these issues by addressing the following research questions:

What are the characteristics of household income and expenditure patterns in South Africa?

Can benchmarks be developed that indicate maximum levels of sustainable expenditure on transport, housing and energy?

Can these benchmarks be applied to evaluate South African human settlements and housing?

Are there implications from household income and expenditure patterns for the planning and design of human settlements and housing?

2. Methodology

A literature review and analysis is undertaken to address the research questions and the methodology applied is as follows. Firstly, a literature review is undertaken to understand the current human settlement and housing situation in South Africa. This focusses on quality of life and income and expenditure patterns. Secondly, a review of indicators and benchmarks applied to household expenditure is undertaken to determine indicators of sustainable expenditure on transport, housing and energy. These indicators are formulated in a simple framework. Thirdly, the framework is applied to selected areas in South Africa. Fourthly, the results of this application are analysed and discussed. Fifthly, conclusions and recommendations are developed.

3. South African Human Settlements

Human settlements are defined as the social, material, organisational, spiritual and cultural elements that sustain a community (Department of Human Settlements Republic of South Africa, 2015). Material elements of human settlements include housing, water, food, energy, transport, education and the internet.

In South Africa, about 80% of the population live in formal housing. However, a large proportion of the population also lives in informal dwellings (13.9%) and traditional dwellings (5.9%). In some provinces like the Northern Cape (20.8%) North West Province (20.8%) and Gauteng (19.8%) about 1 in 5 people live in informal dwellings (Statistics South Africa, 2017).

Tap water is available in most households in South Africa. Areas such as the Western Cape (98.7%), and Gauteng (97.5%) have very high levels of supply but this is less available in provinces such as Limpopo (75.1%) and the Eastern Cape (75.7%). However, water supplies are not always reliable and more than one quarter (27.8%) of households reported a dysfunctional service in 2016 (Statistics South Africa, 2017). This was particularly high in some provinces with 68.1% of households in Limpopo and 58% of households in Mpumalanga reporting supply interruptions of more than 2 days. During these interruptions, households have to fetch water or pay for this to be transported from neighbouring areas (Statistics South Africa, 2017).

Household food insecurity is measured in terms of whether there is inadequate or severely inadequate access to food. In 2016, this was the case in 33.6% of households in the Northern Cape and was also high in Mpumalanga (31.1%) and the Eastern Cape (26.4%).

The percentage of households in South Africa that have mains electricity has increased steadily and was at 84.2% in 2016. Connections are high in Limpopo (94.1%) and the Northern Cape (98.8%) but much lower in Gauteng (80.6%) and North West (81%). The lower proportions of households with connections in Gauteng and North West is attributed to rapid in-migration (Statistics South Africa, 2017).

In most South African households children (66.3%) walk to school. Others (9.6%) travel by car or use taxis (7.1%). The most commonly used means of employees getting to work is by private car (33.4%), followed by taxis (20.7%). About 11.1% of the working population work from home so did not need transport (Statistics South Africa, 2017).

Finances affect access to education and 18.7% of South Africa learners reported that they left school prematurely because of 'a lack of money', while 18.9% reportedly fell out due to poor academic performance (Statistics South Africa, 2017). This is despite rapid increases in the number of schools where no tuition fees were charged. For instance, in 2002, only 0.4% of schools in South Africa did not charge fees, but by 2015, this had increased to 65.4%. In the Eastern Cape, 86.2% of schools did not charge fees and in Limpopo, this was 73.4% compared to 39.3% in Western Cape and 37.4% in Gauteng (Statistics South Africa, 2017).

About 60% of South African households have at least one member who has access to the Internet either at home, work, place of study or an internet café. However, only about 10% of South African households have internet access at home. This is highest in Western Cape (23.6%) and Gauteng (14.8%) and lowest in Limpopo (1.6%) and North West Province (3.5%) (Statistics South Africa, 2017).

3.1 *Income, expenditure and affordability*

Access to elements such as housing, electricity and food not only depend on local availability but also on income, expenditure and affordability. Household spending is the amount of expenditure made by resident households to meet their everyday needs, such as food, clothing, housing (rent), energy, transport, durable goods, health costs, leisure, and miscellaneous services.

The results of the Living Conditions Survey 2014/2015 show that the total annual household consumption expenditure in South Africa between October 2014 and October 2015 is estimated at R1,72 trillion. The majority of this expenditure was in urban formal areas at 82.2%, followed by traditional areas at 11.2%, then urban informal areas at 3.7% and lastly rural formal areas at 3.0%. The average South African household spent approximately R103,293 during 2017. Of this amount housing, water, electricity, gas and other fuels take up the largest proportion at 32.6% of total household expenditure. This is followed by transport at 16.3%, miscellaneous goods and services at 14.7% and food at 12.9% (Statistics South Africa, 2015).

Social grants have increased rapidly over time and represent the main income for many households. The percentage of individuals receiving social grants from the government was 12.7% in 2003. This increased to 29.7% by 2016. At the same time, the number of households that received at least one social grant increased from 29.9% to 44.8% in 2016. More than half the households in Northern Cape (58.8%), Eastern Cape (58.5%), Limpopo (57%), Free State (52.3%) and KwaZulu-Natal (50.4%) received at least one grant compared to Gauteng (30.9%) and Western Cape (38.3%) (Statistics South Africa, 2017).

Affordability refers to the ability to pay for a service or product. Sustainable human settlement definitions therefore need to make reference not only to the availability of a service, but also to its affordability. For instance, this definition refers to location, access, security and access:

Sustainable human settlements and improved quality of household life are defined by:

- access to adequate accommodation that is suitable, relevant, appropriately located, affordable and fiscally sustainable;*
- access to basic services such as water, sanitation, refuse removal and electricity;*
- security of tenure irrespective of ownership or rental, formal or informal structures;*
- access to social services and economic opportunities within a reasonable distance* (Government of South Africa, 2019).

Similarly, definitions by the United Nations of adequate housing confirm the importance of availability, security, habitability, accessibility and affordability:

Security of tenure: housing is not adequate if its occupants do not have a degree of tenure security, which guarantees legal protection against forced evictions, harassment and other threats.

Availability of services, materials, facilities and infrastructure: housing is not adequate if its occupants do not have safe drinking water, adequate sanitation, energy for cooking, heating, lighting, food storage or refuse disposal.

Affordability: housing is not adequate if its cost threatens or compromises the occupants' enjoyment of other human rights.

Habitability: housing is not adequate if it does not guarantee physical safety or provide adequate space, as well as protection against the cold, damp, heat, rain, wind, other threats to health and structural hazards.

Accessibility: housing is not adequate if the specific needs of disadvantaged and marginalized groups are not taken into account.

Location: housing is not adequate if it is cut off from employment opportunities, health-care services, schools, childcare centres and other social facilities, or if located in polluted or dangerous areas. OHCHR (2019).

These national and international definitions indicate that the affordability of housing and basic services are a key requirement for human settlements to be considered 'sustainable' and for housing to be deemed 'adequate'.

4. Housing, Water, Energy and Transport Affordability

Housing affordability describes the challenges that households face in balancing costs related to housing and services with income (Stone, 2006). Fankhauser and Tepic (2007) define affordability in terms of the proportion of monthly expenditure of the total household expenditure allocated to housing and service costs. A review of the literature indicates that the proportion of household income spent is widely applied. While this indicator is referred to a range of ways, such as a price-to-income ratio, an outlay in per cent of total household income/expenditure and a burden thresholds, it essentially is the percentage a household pays for housing or a related services (Suhaida *et al.*, 2011; Klugman, 2002; Fankhauser and Tepic, 2007).

Thresholds for housing affordability appear to be similar internationally and tend to be 30 to 33% of household incomes (Suhaida et al. 2011). Kutty (2005) notes however that in the US, affordability thresholds vary from 20 to 50% of a household's income. Thresholds for water, sanitation service vary considerably across countries. In general, however, this falls in a band between 2% and 6% (Hutton, 2012).

Work by Briceño-Garmendia and Shkaratan (2011) suggest that electricity expenditure threshold should be 3% of household expenditure. Recent guidance in the US is double this and regards 6% of household income as an affordability threshold for energy (New York State, 2019).

Thresholds for transport expenditure vary widely between countries. South Africa's White Paper on National Transport Policy indicates that expenditure on travel should not exceed 10% of the household disposable income (Venter, 2011). Australian policy indicates that a value of 20% of household income expenditure should be regarded as a threshold. Studies by the World Bank indicates that transport costs of over 30% of income would be regarded as unaffordable for poor households (Carruthers, *et al.*, 2005). These thresholds are summarised in table 1.

Table 9. Affordability thresholds

Area	Affordability thresholds	Source
Housing	33%	Suhaida <i>et al.</i> , 2011
	30%	Saberi <i>et al.</i> , 2017
	25 - 50%	Kutty, 2005
	33%	Selected threshold
Water	2 - 6%	Hutton, 2012
	5%	Klugman, 2002
	5%	Fankhauser and Tepic, 2007
	3%	Priestly and Rutherford, 2016
	2 - 6%	Selected threshold
Energy	3%	Briceño-Garmendia & Shkaratan, 2011
	10%	Fankhauser and Tepic, 2007
	6%	New York State, 2019
	6%	ACEE, 2019
	3%	Selected threshold
Transport	10%	Venter, 2011
	20%	Victoria Transport Policy Institute, 2016
	30%	Carruthers, <i>et al.</i> , 2005
	20%	Selected threshold

5. Household Expenditure on Housing, Water, Energy and Transport in South Africa

The most recent household Living Condition Survey can be used to analyse household expenditure on housing, water, energy and transport in South Africa (Statistics South Africa, 2017a). This is presented in table 2, which shows expenditure in these areas relative to the selected affordability thresholds.

Table 10. Percentage of household expenditure for housing, water, energy and transport in South Africa's provinces compared to affordability thresholds.

Affordability thresholds (% of household income)		Western Cape	Eastern Cape	Northern Cape	Free State	Kwa-Zulu Natal	North West	Gauteng	Mpumalanga	Limpopo
Housing	33	34.25	28.79	24.52	22.42	29.91	25.23	36.71	27.13	31.23
Water	2-6									
Energy	3									
Transport	10	14.73	17.91	20.46	15.54	16.91	18.10	15.53	19.81	16.45
Total	49 - 52	48.98	46.7	44.98	37.96	46.82	43.33	52.24	46.94	47.68

The Living Condition Survey also provides cost data per income decile of the population. Table 3 shows this for the lowest, middle and upper deciles (Statistics South Africa, 2017a).

Table 11. Percentage of household expenditure for housing, water, energy and transport for South Africa's lowest, middle, and upper income deciles of the population to affordability thresholds.

Affordability thresholds (% of household income)		Lowest decile	Middle decile	Upper decile
Housing	33	29.0	24.8	35.6
Water	2-6			
Energy	3			
Transport	10	11.8	11.1	19.6
Total	49 - 52	40.8	45.9	55.2

The data in Table 2 shows that household expenditure in South African provinces on housing, water and energy were below affordability thresholds. In the case of Free State and the Northern Cape, the average expenditure was substantially lower than the thresholds. In all cases, transport expenditure exceeded the transport affordability threshold. In some cases, such as Northern Cape (20.46%) and Mpumalanga (19.81%) expenditure is about double the affordability threshold.

The data in Table 3 shows that expenditure on housing, water and energy in the lowest income decile was less than the affordability threshold and was only slightly above the transport threshold of 10%. At 24.8%, expenditure by middle decile on housing, water and energy was substantially below affordability thresholds, with expenditure on transport at 11.1% being only slightly higher than the thresholds. Expenditure on housing, water and energy in the upper decile was slightly lower than the affordability threshold, while expenditure on transport at 19.6% was almost double the affordability threshold.

6. Discussion

In discussing the results, it is useful to compare results from South Africa with other countries. An analysis of household expenditure patterns the US over the period 1996 to 2014 shows that housing costs were generally about 20% of household income for most of that period but increased to about 25% by 2014 (Pew Charitable Trust, 2016). Food makes up the next highest expenditure at about 12%, followed by transportation (7%) and pets, toys and entertainment and health (both about 3%). The US study shows distinct differences between income groups, with lower-income households spending far more on housing as a share of income (40%) than those in the middle (25 per cent) or at the top (17 per cent) income brackets. It also shows that lower-income households were spending (16%) of their income on transport in 2014, up from 9 per cent four years earlier and proportionally more than the middle (11%) and top (8%) income brackets. An analysis of the slack in household budgets (the amount available for wealth-building investments, such as short and long-term savings, education, and life insurance) showed that low income households in 2004 had about \$1,500 left over (slack) and that this had become negative (-\$2,300) by 2014, a \$3,800 decline. At the same time wealthier households had significantly increased the slack in households budgets (Pew Charitable Trust, 2016).

South African patterns differ considerably to US patterns with low-income households expenditure being aligned or under the affordability threshold and high-income households expenditure being the same or considerably higher than affordability thresholds, as shown in figure 3. This, however, is not the case for food, where households in the lower deciles spend close to 40% of their total expenditure on food. This proportion decreases markedly with increased wealth and households in upper deciles spend about 8% of their income on food. The much lower proportion spent on food in wealthier households may be attributed to the relatively higher expenditure these households have on housing and transport, which pushes down their proportion on food (Statistics South Africa, 2017a).

A review of the source and amount of incomes of the different deciles may also help explain differences in relation to affordability thresholds. About 60% of incomes of households in the lowest deciles come from government grants. Per capita incomes in this decile are under R6,485/annum (Statistics South Africa, 2017a). Households in the upper deciles receive less

than 10% of their income from government grants and per capita incomes are much higher at over R71,479/annum (Statistics South Africa, 2017a). High reliance on government grants and high levels of unemployment in the lower decile households may, therefore, explain the reduced proportion of household expenditure on transport. The higher proportions of expenditure on transport for households in the higher deciles may be explained by households having purchased one or more cars and using this for commuting as well as for transporting children to school.

The relatively lower proportion of expenditure on water, energy by low-income households may be also explained by the Free Basic Municipal Services policy. This policy requires the government to provide services at no charge to poor households. Municipalities apply a means test to ascertain whether households are eligible for indigent status. If households meet the criteria they become eligible for free or highly subsidised water, electricity, sewage and sanitation. This includes a free basic water provision of 6kl of water per household, free electricity up to 50kWh per month and free sewerage and solid waste management, as shown in figure 1 (COGTA, 2019).

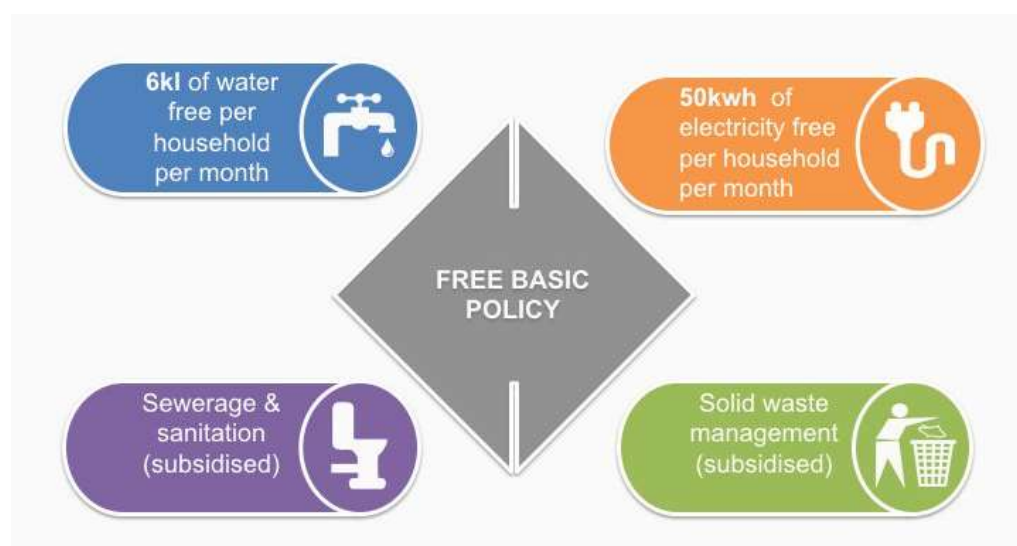


Figure 8. Free Basic Services Policy (COGTA, 2019).

A number of criticisms can be made of the affordability threshold indicator applied in the studies and guidance reviewed in this paper. The review indicates that very low-income households, such as those largely funded by government grants, most income (40%) is spent on food (Statistics South Africa, 2017a). Studies by the Pietermaritzburg Economic Justice and Dignity (2018) indicate that the cost of a household food basket in 2018 for 7 people was about R3,000 per month. This means there is very little left over for housing-related items. In these cases, 30, 20 or even 10 % of household expenditure on housing may be too high, as the costs of non-housing items, such as food may take up all of the available income (Stone, 2006). The % threshold indicator, therefore, assumes a certain level of basic income that may not exist in South Africa. To address this Stone (1990, 1993), suggests that housing-related costs or affordability thresholds should be calculated by taking household incomes and subtracting the costs of a 'minimum adequate level of non-housing consumption'. Thus the affordability threshold would be based on the amount left over after adequate costs for items

such as food, education, clothing and health have been allowed for. This model is sometimes referred to as the residual-income approach.

Stone (1990, 1993) argues that housing costs lead to shelter poverty when households cannot afford non-housing necessities. In the South African situation, housing costs may result in shelter poverty in some cases, for instance, in urban areas where rentals are relatively high. However, a more acute problem may be that incomes are so low that poor households have difficulty meeting all of their costs (not just housing-related costs). In this situation, it may be more important to focus on increasing incomes for families. This can be achieved through increasing grants, better access to employment and self-employment opportunities and enhanced access to education and training opportunities (Stone, 1990, 1993). At the same time, it is important that housing-related costs such as housing, water, electricity remain free (as is the situation with free basic services policy) or are as affordable as possible. This may combine to enable some residual income to be retained which can be used to improve education, health and access to job opportunities and thus enhance the potential for households to escape poverty (Kutty, 2005).

7. Conclusion and Further Research

The review of the literature indicates that the affordability of housing-related costs is often measured as a proportion of household income. This indicator is also referred to as a price-to-income ratio, an outlay in per cent of total household income/expenditure and a burden threshold.

The application of this indicator to South African provincial housing data shows that households are on, or near the affordability thresholds. Applying the indicator to income deciles indicates that lower decile households are under the thresholds, while higher-income households are significantly over the thresholds. This may be attributed to a number of factors. Firstly, free basic services and lower-cost housing (in the form of informal dwellings and RDP housing) may serve to reduce housing-related costs for poor households. Secondly, limited incomes of poor families may be largely expended on necessities such as food (40% of income) leaving very little for housing-related costs. Thirdly, wealthier families may live in suburban housing which requires significant expenditure on transport, water and energy to maintain. Spatial patterns and personal choice, therefore, may explain the relatively larger proportion of income spent on housing, water, electricity and transport by wealthier households.

The study indicates that there are several problems with using the proportion of household income expended on housing-related costs as an indicator of affordability. In particular, it appears to be a poor indicator for poor families in South Africa where housing and basic services such as water and electricity are subsidised and where incomes are very low. Instead, the concept of residual income or the amount of household income left over after adequate costs for items such as food, education, clothing and health have been allocated, appears to be a better one as it reinforces a conceptual approach that aims to enhance the potential for households to escape poverty. The study provides a number of useful preliminary findings and proposals which have implications for human settlement design and assessment. It is recommended that further studies are undertaken to build on this initial work.

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Unpacking opportunities and challenges in sustaining urban agriculture in low-income settlements in Durban

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Abstract

Given the high rate of unemployment, inequality and poverty in South Africa, the urban poor find themselves with limited options, but to consider the practice of urban agriculture as one of their livelihood strategies. The expansion of urban areas due to high rates of urbanization results in overcrowding, uneven distribution of basic services and increased food insecurity. This situation leads to unsustainable city centres as most people find it hard to afford the ever-rising prices of basic commodities such as food. This paper unpacks both opportunities and challenges that are experienced by those who practise urban agriculture. It also looks at how these challenges and benefits are to be managed so that the latter is optimized. It specifically focuses on community gardens as a form of urban agriculture. Both the Sustainable Livelihood and Human Basic Needs Approaches were used as the theoretical framework for the study. A mixed method of data collection was used to collect empirical data from 20 community garden practitioners in Mayville through questionnaires. Structured interviews were conducted with three municipal officials from eThekweni Municipality who were identified through purposive sampling method. Findings indicate that on the challenges emanating from community members militate the financial and advisory support from the municipality. On the other hand, available opportunities are limited to those who are actively involved in community gardening. Therefore, the study concluded that vigorous involvement of all relevant stakeholders in the practice of urban agriculture should be encouraged, so that food security for the urban poor is achieved.

Keywords: urban poor, food security, sustainable low-income human settlements

1. Introduction

Due to major city development activities, such as lifestyle changes, fast technologies and industrialization, urbanization has become a major phenomenon in all major cities in the globe (Van Tuijl, Hospers & Van Den Berg, 2018). These changes have led to more people occupying the urban space in pursuit of better economic and educational opportunities. At its unexpected rate, urbanization has resulted in political, institutional, economic and social changes in the urban landscape. Subsequent to these changes are different kinds of challenges which are, but not limited to high rates of unemployment, lack of adequate supply of low-income housing and insufficient supply of affordable food for the urban poor (Smart, 2015). These deficiencies have led to an increase in poverty rates and a state where food insecurity has become a threat to the survival of the poor households in urban areas. Food is regarded as one of the basic needs that sustains the life of all organisms. The right to food is

enshrined in the South African Bill of Rights. Similarly, the Constitution of South Africa states that, *“every citizen has the rights to have access to sufficient food and water, and that the state must take reasonable legislative and other measures, within its available resources to achieve the realization of these rights”* (Republic of South Africa, 1996). Apparently, this legal provision gives a mandate to the state to ensure that food insecurity as a societal challenge is addressed.

Yet South Africa’s response to food insecurity and hunger remains one of the biggest challenges. For example, in 2012, 54% of households had a problem of either experiencing hunger or were at risk of hunger, while 27% of children between the ages of 0-3 had signs of being malnourished (Parr & Taylor, 2015). Thus, the state has an important role to play in ensuring that necessary steps are taken to ensure the implementation of appropriate food policy measures. The most worrying fact is that while the urban poor suffers from access to adequate food due to poverty, food security does not form part of the major debates in South Africa’s Parliament and at grass root level (Kirsten, 2012). This paper unpacks the opportunities and challenges, which are associated with the practice of urban agriculture. Further, it suggests possible solutions that can assist to optimize the benefits of using urban agriculture in poverty alleviation. It also argues that a shift from an economic approach, which most cities practice to a more social aligned cities where urban agriculture is considered as one of the key instruments to be used to develop a more sustainable food systems (Van Tuijl, *et al*, 2018).

2. Study area and Methodology

The study was conducted in a small and peri-urban area called Mayville, a small township in Durban, KwaZulu-Natal. Mayville comprises of different communities in terms of race, income levels and housing typologies. The study was conducted using mixed research methodology. Non probability, through snowball sampling was used to identify community members who participate in urban agriculture (community gardens). Questionnaires were administered to the respondents, thus community members were asked to provide information related to the financial, economic and nutritional contribution that community gardens have made in their lives. Two municipal officials and a local ward councillor were identified through purposive sampling. Semi-structured interviews were conducted with the officials in order to provide information on the type of support that the municipality provides to community members who participate in community garden. Personal observation was also used to collect physical features like the actual gardens, the tools which are used to prepare the gardens and fences.

3. Literature review

Hunger and food insecurity have become endemic to the modern world. This has been accompanied by an upsurge of food prices (McMichael, 2010). This has resulted in some elementary aspects of being poor such as hunger, inadequate health-care, unhygienic living conditions and the impairment of people's nutritional status. This has introduced another field of research focusing on food supply for the urban poor as a matter that requires urgent attention from all relevant parties. Research indicates that globally, urban agriculture has been neglected (Harrington & Fisher, 2014). This results in healthy food becoming less affordable, and individuals opt for alternative food which is necessary to promoting good health. Urban agriculture is about food self-reliance. It involves creating work and is a reaction to food insecurity, particularly for the poor (Redwood, 2009). If half a dozen of families were to decide to be partially self-sufficient, and live within a short distance from each other, and supported of what they were doing to support their families, they would lead quality life. Each family would have something to produce, eat and trade with the rest of the world (Seymour, 2010). Nobody would get bored, nor get to bed hungry and there would be no child that would be declared malnourished.

One can imagine in the future a highly active society where all people would be independent and yet in some way, very independent because townships would be contributing to the cities and cities contributing to the township and then the entire nation. Existing literature proves that community gardens are another strategy that provides neighbourhoods access to an affordable food supply (Harrington & Fisher, 2014). Community gardens do not only create access to affordable and healthy food supplies, but also promote individuals and community health. Inadvertently, community gardening results in the increased consumption of fruits and vegetables, and encourages physical activity by those who practice it.

3.1 *The social benefits of urban agriculture*

The practice of community gardening has several social benefits to those who practice it and the rest of the community members where it is practiced. These benefits include improved social ties, quality health and life as people get to exercise, social cohesion, and the development of new intergenerational relationships (Cruz *et al*, 2018). Being actively involved in community gardening activities also enhances the individual's psychological status, which promotes a sense of belonging to the location and therefore mixing with groups from different social backgrounds (Miccoli, 2016). Gathering people from different families helps community members to share their challenges and success stories. In so doing, they are able to resolve their problems because there is moral support which is shared amongst members of the

community. Those involved in community gardens are regarded as agents for change and it boosts their confidence and status in the community especially during meetings where they raise their concerns and then discuss possible solutions together (van Veenhuizen, 2006). Thus, urban agriculture could be seen as source of inspiration and poor people draw their strength to face social problems such as poverty, hunger and lack of basic needs which they need for their survival.

3.2 *The economic benefits of urban agriculture*

Due to high rates of unemployment and lack of an adequate income to access food in the mainstream economy, urban agriculture has the potential to change the economic status of the urban poor (Mthethwa, 2012). The urban poor have challenges in tapping into the city's formal food supply systems (Satge, 2002). Therefore, they resort to different informal food production strategies so that they secure food and generate income for their daily needs. Thus, people who practice urban agriculture can significantly increase their income by saving money that would otherwise be spent on food or by generating revenue through selling what they produce (Harrington & Fisher, 2014). In this way, they are able to use urban agriculture as a mechanism for poverty alleviation. Furthermore, the practice of community gardening can also create job opportunities for the local people. The food and financial gains inherent in the practice of urban agriculture can be critically important to the nutritional and financial well-being of households living in low income settlements and communities which are underserved by grocery stores (Redwood, 2010).

Some scholars argue that the practice of urban agriculture may attract huge investments from the business, which in return could create more job opportunities for the urban poor, particularly in rezoned urban spaces (Cruz *et al*, 2018). Apart from enhancing poor people to improve their income and food base, urban agriculture can also assist community members to improve their agriculture related skills (Manqele, 2017). Skills empowerment could benefit women as they are a section of the population which is actively involved in the practice of urban agriculture, especially gardening (Seymore *et al*, 2010).

3.3 *The environmental benefits of urban agriculture*

The practice of urban agriculture in the form of community gardening contributes towards greening of the city. It creates green islands in the built environment where concrete masses exist (Badami & Ramankutty, 2015). This helps in the reduction of pollution as it improves air quality in the area. Urban agriculture can be regarded as one of the strategies which are used against different kinds of pollution as it promotes recycling of waste material into fertilizers

(Miccoli *et al*, 2016). It also helps to reduce soil degradation and natural disasters such as floods which happen if the soil is not occupied. Thus, urban agriculture promotes the optimum utilization of vacant land, especially in areas where commercial and residential utilization is either impossible or not allowed.

Furthermore, the practice of community gardening helps in reducing greenhouse gas emission, enhances energy and decrease the impact of global warming (Miccoli *et al*, 2016). This happens through what is often called the “urban heat island effect”, where cities are typically warmer than rural and suburban areas due to densification and tall building blocking the air (*Ibid*). In addition to this, the community gardens provide fresh and organic produce which would otherwise be provided through highly intensive energy infrastructure. Urban agriculture brings food closer to home, thereby allowing urban dwellers to consume food which is locally produced. This in return reduces transportation costs which are normally passed on to consumers if food is produced over long distances (Pearson, Pilgrim & OBE, 2010).

3.4 Challenges in the practice of urban agriculture

The practice of urban agriculture comes with challenges such as theft, unavailability of sufficient land and lack of support from government and the private sector (Mthethwa, 2012). One of the prominent challenges is that low income settlements are always overcrowded due to high demand for land (Manqele, 2017). This leads to two spatially related challenges, the shrinking of urban space due to population growth and the subsequent lack of adequate space for food production (Crush *et al*, 2011). Space constraints make it difficult for those who want to practice urban agriculture to establish big community gardens where they could produce for self-consumption and selling the surplus to bigger markets outside their location. Other challenges include insecurity of tenure which makes it difficult for the urban poor to use land that does not belong to them (Mthethwa, 2012). Limited production increases chances of food insecurity and leaves the urban poor more vulnerable to hunger. Another challenge that hinders the practice of urban agriculture is rampant crime. Research shows that all kinds of agricultural activities currently face criminal elements that threaten economic, psychological and community well-being (Donnermeyer, 2017). Given the high rise of food prices and the negative impact of climate change on yields, the provision of security services to guard or secure the operation of urban agriculture from criminal activities remains a challenge.

4. Theoretical framework

This paper adopted the Sustainable Livelihood Approach (SLA) and the Basic Human Needs Approach as the theoretical framework. The SLA was made popular by the Brundtland Commission seeking to strike a balance between environmental protection and development

as another vehicle to incorporate the socio-economic and ecological focus in policy development (Krantz, 2001). This approach utilized a holistic perspective for development in the analysis of livelihood to identify issues where integration could be strategically important for effective poverty reduction. Serrat (2010) argues that the central view of the approach is that different households have different access to livelihood assets, which comprise human, social, natural, physical and financial capital. Central to this list of capital is the fact that the poor may not have access to financial capital but have other material or non-material assets within the location (Rakodi, 2002).

Livelihood outcomes should include more income, increased well-being, reduced vulnerability, improved food security, more sustainable use of natural resources and recovered human dignity (Myeni, 2005). This approach is primarily concerned with identifying and uprooting the causes of poverty. All the income groups are seen as actors with capabilities to achieve their own goals. These principles seek to promote the analysis of the underlying cause of poverty and the relationship that exists between the livelihood activities adopted and the people. It regards different income groups as able to respond to their situation and having the ability to fight poverty and unemployment. It is for this reason that this study sought to understand the kind of resources that exist in low income settlements and how people use those resources as assets to respond to poverty, unemployment and food insecurity (Adoto & Meinzen Dick, 2002).

The Sustainable Livelihood approach was also formed to highlight different strategies that shape people's livelihoods in a community. Another persuasive focus raised in this approach is that communities can experience poverty in the same way, but livelihood strategies adopted to respond to poverty can be different. According to Babulo *et al* (2008), the types of and access to available resources in most cases determines the livelihood strategy a community is more likely to adopt. It is for this reason that the success of those livelihoods depends on the degree to which beneficiaries participate in decision-making, implementation and sustainability of those livelihood strategies. Research has shown that people protect development if they have been involved in the development process (Manqele, 2017). Hence, the SLA is based on principles that focus on the needs, issues and solutions of the local community as opposed to focusing on macro-level communities. Hence, this approach also recognizes the importance of community-based institutions which are viewed as capable of adding value to developmental programmes that are initiated by community members (Ashley and Carney, 1999).

The Basic Human Needs Approach is viewed in the context of one of the objectives of the housing policy, which is to improve the quality of life for the poor. This approach was adopted

in 1976 by the International Labour Organization (ILO) with its main focus on meeting the basic needs of poor people in the shortest possible time. It gives priority to certain goods and services which are deemed essential for human survival and active incorporation into existing culture (Myeni, 2005). These goods and services include food, clothing, safe drinking water, housing, sanitation, public transport, health, and education. In an effort to combat poverty, the Basic Human Needs Approach encourages the distribution of income and wealth, employment of the poor, education and training of the people, community participation in the development process using a bottom-up style of management (Krige, 1990). Hence, the effective use of local natural resources and small scale labour intensive technologies is encouraged. The underlying principle of this approach is that everybody is entitled to the adequate consumption of goods and infrastructure. The underlying supposition of this approach is that focus on growth of income for the poor should be emphasized by addressing issues of unemployment, inequality and poverty (Ghai *et al*, 1977). Amongst the key focus areas of this approach is the emphasis on reducing the urban poor's dependence on government. The approach promotes autonomous control through engaging the poor in development related activities. Nevertheless, this approach has not met its objective because most projects are designed by professionals without integrating the needs of the poor (Myeni, 2005). The UN passed a resolution that encouraged countries to adopt an integrated approach to development. This approach stipulated that project planners must incorporate the beneficiaries' power in decision making during planning stages and that their physical involvement in the implementation of the project should be encouraged (Krige, 1990).

5. Research Results

Through the use of questionnaires, structured interviews and personal observation, various trends and themes were identified. Women participants in community garden projects constituted 80% as opposed to 20% of their male counterparts. This concurs with assertion by Seymore *et al*, (2010) which encourages training of women in urban agriculture. Most people who participated in community gardening were between the ages of 41-61 years (70%). These are people who were either not employed as they regarded themselves as unemployable because of their age, lack of education or it is people who do community gardening because they have retired, thus community gardening is more like leisure to them, or it could be that their participation in community gardening serves as food supplement. About 65% of the community garden participants were either single or widowed. This could mean that the practice of urban agriculture was the only source of food or income in their households. For them, community gardening was for food production and an opportunity for self-employment.

Of all participants in community garden projects, 95% said that they were unemployed. The 5% that was employed worked in the private sector and most of them were on three to four months contracts with their insufficient salaries to cover all their household expenses. About 85% earned between R0-R1 500 and 15% earned between R1 501-R2 500. Out of all the respondents that participated in community gardening, 70% owned the houses they lived in and 5% indicated that they were tenants. This means that security of tenure plays a critical role in creating a sense of belonging (Mthethwa, 2012). A sense of belonging determines people's confidence to participate in poverty alleviation and community development programmes (Pearson et al, 2010). With regards to level of education of the respondents, about 45% had primary school as their highest education achieved. This was followed by 40% who were able to achieve high secondary school. About 80% of the respondents indicated that their harvest was for self-consumption and income generating purposes. Participants indicated that they were selling their produce in their local community and at the Durban Central Business District's Warwick Junction market. The other 20% was equally divided for people whose yields were for selling and family consumption.

Municipal officials who are responsible for local economic development and facilitation of the provision of bulk urban agricultural projects, the study found that the municipality was able to do a once off provision of equipment and inputs such as fertilizers and seedlings to people who are actively involved in urban agriculture in Mayville. Subsequently, participants in urban agriculture were asked to buy garden tools and other necessities by themselves. Participants training on the aspects of soil preparation, composting, organic farming, disease control, pest control, weeding, marketing, harvesting, value adding, leadership, conflict management, financial management and compliance was provided by the municipality. The study discovered that eThekweni municipality has two main categories of urban agriculture. There is bulk urban agriculture, which focuses on big cooperatives and on the other hand are community gardens.

6. Findings on challenges

The municipality raised quite a numbers of challenges regarding the implementation of community gardens. One of them was the issue of nepotism in the process of selecting beneficiaries. Most people who participated in the gardening projects were related to the local political leadership. Those who opposed to the election of the local councillor were disqualified from participating in community gardening. Furthermore, budgetary constraints which lead to the shortage of financial resources was raised as another challenge by the municipality. The problem is that most community gardens rely on government support for their sustainability. This is the case even beyond the provision of start-up funds, equipment and training.

Another challenge that was identified was the shortage of land for practicing urban agriculture. Participants indicated that the plots that they used to plough their crops were not adequate for their needs. The study established that there were more people who wanted to be part of the community garden project, yet there was not enough land to accommodate everyone. This led to conflict between community garden participants and those community members who were not part of the programme. The fight for land became a bone of contention, and this led to debates about land ownership and who came first in the locality.

Participants also mentioned that the shortage of water for irrigation was a challenge which hindered the successful implementation of community gardening. The existing water pipes do not have enough pressure and capacity to provide water which is needed for irrigation of the entire garden. Thus, the beneficiaries had to carry water for irrigation from their homes. This shortage of water compelled beneficiaries to focus on less water resilient plants such as spinach, onion, beetroot, and cabbage. Other challenges included theft of the produce especially at night. The community garden is not fenced and therefore participants lose their produce due to criminal activities. The municipality indicated that amongst the equipment it provided in the early stages of the community garden was fencing material. However, the fence was stolen as the garden went through growth stages. Pests control and a known local snake which has killed several people in the locality, together with monkeys that destroy crops are some of the challenges that the municipality has been requested to help mitigate, but these challenges remain unsolved.

7. Discussion

Given the high rate of unemployment, slow economic growth and poverty, the practice of urban agriculture in the form of community gardening should be considered as one of the urban area land uses. This requires a strategic move towards policy implementation to enhance regulation of the sector. Research has shown that this practice, if well thought through, has the potential to assist the urban poor in poverty alleviation and assurance in food security for everyone. The sustainability of urban human settlements depends on the effective and efficient balancing of three pillars of sustainable development (social, environmental and economic). Hence, the practice of community gardening has proven to yield social, economic and environmental benefits which are spread over the settlement. In most cases, women from poor communities are always excluded from leadership roles, however their role in food production and poverty alleviation deserves recognition. This is because women are in most cases the first to know the source of the next meal for the family.

Given the findings of the study, the following recommendations which are geared towards sustaining urban agriculture are suggested. The most effective tool to enhance the sustainability of community gardens or any form of income generating activity is by training community members on the importance of good business and financial management skills. This could help them in supplying what the market demands. Secondly, land policy in and around cities must be designed in a way that accommodates agriculture as a legitimate land use function. If it is legal, it could be easily regulated, and risks could be mitigated. Cities should protect productive agricultural land by encouraging dense forms of development and prevent urban sprawl (Redwood, 2010). This could be achieved by making vacant land available for urban farming on a no or low-fee lease or no tax incentive. Thirdly, cities should be able to design, promote and maintain city markets whereby those who practise urban agriculture can find it easy to sell their produce to their consumers. Maintenance will ensure that healthy standards are observed as opposed to informal marketing systems where issues of hygiene are not guaranteed (Redwood, 2010).

8. Conclusion

In view of many challenges which are experienced by the urban poor in South Africa, the practice of urban agriculture should be retained as part of the urban economic growth activities. More effort must be directed towards formulating city planning policies that are favourable to the urban poor. This will enable the poor to enhance their livelihoods through the practice urban agriculture, which despite being regarded as promising, but largely underdeveloped sector. Given the existing literature the practice of urban agriculture has a lot of challenges that need to be dealt with by the urban poor, government officials, civil society, private sector and academics. This joint effort can help replicate opportunities for sustainable city development and contribute towards ensuring that people have access to adequate, healthy and nutritious food to meet their dietary requirements.

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Does the Sustainable Building Assessment Tool address resilience sufficiently?

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Abstract

Climate change is already having significant impacts globally. These impacts are experienced most acutely in developing countries where infrastructure and population are often more vulnerable and resources and capacity for adaptation are limited. It is therefore particularly important to understand vulnerabilities to climate change in developing countries and address these in the most effective and efficient ways possible. The Sustainable Building Assessment Tool (SBAT) was developed to support the integration of sustainability in buildings in developing countries. Through analysis of current climatic change projections for South Africa, key implications for built environments are ascertained. These will be reviewed against the SBAT to investigate whether existing criteria adequately address projected climate changes. Findings from the study indicate that while the SBAT provides a robust framework for addressing sustainability, it does not address climate change resilience comprehensively. Recommendations are therefore made for how the SBAT, and other similar tools, could be improved to support climate change better.

Keywords: Sustainability, resilience, SBAT, Sustainable Building Assessment Tool.

1. Introduction

Climate change is having a substantial impact in South Africa. For instance, a number of cities, such as City of Cape Town have experienced severe droughts and water shortages (City of Cape Town, 2017). These impacts identify the need to prepare better and it is becoming increasingly apparent that resilience must be integrated into the planning, design and operation of buildings. Green building rating tools such as the BREEAM, LEED and Greenstar have an emphasis on achieving more environmental friendly buildings. Other tools, such as the Sustainable Building Assessment Tool (SBAT) aim to assess sustainability in built environment (Gibberd, 2008). The current and worsening impact of climate change has meant that developers of these tools now need to consider how climate change adaptation and resilience can be addressed in addition to environmental impacts and sustainability.

This study therefore reviews climate change projections for South Africa and the concept of resilience in order to develop a framework that can be used to assess building design guidelines and tools. This framework is applied to the Sustainable Building Assessment Tool in order to evaluate the extent to which it addresses climate change and resilience. Through

this analysis, opportunities for integrating climate change and resilience into the SBAT are identified. These are developed into recommendations for the development of the tool. The study therefore focusses on the following research questions:

- What are the climate change projections for South Africa?
- How can climate change projections and the concept of resilience be developed into a framework that can be used to evaluate building design guidelines and tools?
- What does the application of this framework to the SBAT indicate?
- Can findings from this applications be developed into recommendations for the further development of the SBAT?

2. Climate change

Climate change is one of the significant issues facing mankind (Hamin and Gurrán, 2009). While climate change modelling is subject to uncertainty, levels of accuracy and detail are rapidly advancing (Guan, 2009). Recent climate change modelling of South Africa has been carried out at an 8 x 8km resolution (Engelbrecht, 2017). This indicates that significant climate change impacts are projected. It also indicates that the nature and extent of climate change impacts will vary across South Africa. For instance, it indicates that some areas are projected to receive increased rainfall while in other areas this will be significantly reduced and drought conditions are regularly expected. The modelling developed a range of projections based on different mitigation scenarios. For this study the lowest mitigation scenario has been selected (RCP 8.5). Representative Concentration Pathways (RCPs) are defined according to their contribution to atmospheric radiative forcing in the year 2100 relative to pre-industrial values. An RCP 8.5 therefore represents the addition to the earth's radiation budget as a result of an increase in GHGs of +8.5 W/m². A review of the projections for this scenario for the period 2021 – 2050 relative to 1961-1990 indicate a number of broad trends which are outlined below.

Higher temperatures: Temperature increases of 1 to 2.5 °C in the southern coastal areas and 3°C in the northern areas of South Africa are projected for the period 2021 to 2050, relative to temperatures in the period 1961 – 1990.

Minimum temperatures: Minimum temperatures are projected to increase by 2 to 3 °C for the period 2021 – 2050, relative to the period 1961 -1990.

Very hot days (days above 35 °C): An increase in very hot days is projected for the period 2021 – 2050, relative to 1961 – 1990.

Changes in rainfall: Increases in annual rainfall are projected in the central interior and east coast of South Africa, while reductions are expected in the western interior and the north-eastern parts in the period 2021-2050, relative to the period 1971 – 2000.

Extreme rainfall events: Extreme rainfall events are projected to increase in frequency in the central interior and east coast for the period 2021-2050, relative to the period 1961 – 2000. For the period 2070-2099, relative to the period 1961 – 2000, reductions in these events are projected for Lesotho and Kwa-Zulu Natal Midlands areas.

Increased wind speeds: Wind speeds are projected to increase in the northern interior regions of South Africa and decrease in other regions for the period 2021-2050, relative to the period 1961 – 2000 (Engelbrecht, 2017).

These changes have significant implications which are being addressed in national plans, such as the National Development Plan (National Planning Commission, 2012). The level of detail provided in these projections also enable their implications for the built environment to be ascertained and addressed (Gibberd, 2018). The science of how climate change can be accommodated is being developed in a rapidly evolving field, broadly referred to as Resilience.

3. Resilience

Resilience has its origins in ecosystem theory and can be defined as ‘the persistence of relationships within a system and the ability of this system to absorb changes, and still persist’ (Holling, 1973). Since its origins in ecology, many different definitions of resilience have been developed for different fields (Adger, 2000; Perrings *et al.*, 1995; López-Ridaura *et al.*, 2005; Zhou *et al.*, 2009; Holling, 1973; Pimm, 1984; Lele, 1998).

Understanding and defining resilience becomes increasingly complex in large multifaceted entities such as buildings and cities which have both natural and artificial systems (World Health Organisation, 2009; Piketh *et al.*, 2014). It is therefore useful to review resilience at a sub component level; at the level of natural systems such as ecosystems, as well as at the level of artificial systems, such as social resilience, and understand how this relate to built environments.

3.1 Natural Systems Resilience

Resilience within the ecology field refers to the ability of an ecosystem to accommodate disturbance without a fundamental change to its structure or function (Holling, 1973). Adger

(2000) attributes resilience in ecological systems to a range of factors related to ecological diversity such as:

Diversity (Schulze and Mooney 1993; Mooney and Ehrlich, 1997; Tilman, 1997)

Diverse and resilient resources (Adger, 2000)

Rapid self-regulating and regenerating functions (Costanza, 1995)

A characteristic of ecological resilience can be illustrated through the concept of ecological redundancy. Ecological redundancy is created when more than one species performs a given role. This redundancy within the system reduces vulnerability by avoiding reliance on single part of the system and therefore supports overall stability of the system.

The concept of ecosystem services and ecological resilience is being applied through an urban planning approach that includes ecological land-use complementation (ELC). This aims to support biodiversity and ecosystem health through clustering synergistic function and land uses (Colding, 2007).

Similarly, the concept of a buffer, or buffer capacity as developed in ecosystem science, as a capacity to absorb disturbance, is being applied in cities in a range of ways. A simple example is the way swales and retention ponds can be built into storm water systems to absorb the disturbance generated by urban runoff surges resulting from a downpour.

There is a strong relationship between natural system resilience and social system resilience, particularly for communities that rely directly on the environment for survival (Adger, 2000). However this relationship exists for all communities through the provision of ecosystems services. Ecosystem services describe the range of services provided by ecosystems to man and include provisioning, regulating, cultural and supporting services (Colding, 2007).

It is argued that man, by disturbing natural cycles, through for instance, fire suppression, or urban development, cause environments to move from one type of ecosystem state to another less desirable one (Gunderson and Pritchard, 2002). This less desirable state not only provides reduced ecosystem services for man, it is also more vulnerable and less able to absorb shocks. Built environments must therefore not only ensure the natural systems thrive

and are enhanced, they must also ensure that these are resilient and are not negatively affected by climate change.

3.2 Artificial Systems Resilience

Artificial systems refer systems developed to provide particular services to communities such as water supply, communication and transport systems. They also include systems which govern or structure the functioning of communities such as social and economic systems. In this review, the focus is on understanding social and economic resilience and how this can be supported by built environments.

Resilience in social systems has been defined as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change. (Adger, 2000). Folke (2006) refers to social – ecological resilience as:

“The amount of disturbance a system can absorb and still remain within the same state..,

The degree to which the system is capable of self-organization..

The degree to which the system can..increase the capacity for learning...”

The understanding or resilience within social systems is still exploratory and there are still many uncertainties (Folke, 2006). Extensive work however has been carried out to identify and understand the key factors that contribute to social resilience. These are:

Learning, flexibility, self-organization (Folke, 2006)

Organizational and institutional flexibility (Grumbine, 1994; Danter et al., 2000; Armitage, 2005; Ostrom, 2005)

Social capital (including trust and social networks) (Enemark, 2006)

Social memory (including experience for dealing with change) (Olick and Robbins, 1998; McIntosh, 2000)

A modern productive infrastructure (transport, broadband provision, etc.). (Christopherson et al., 2010).

A skilled, innovative and entrepreneurial workforce (Christopherson et al., 2010).

A supportive financial system providing patient capital (Christopherson et al., 2010).

A diversified economic base, not over-reliance on a single industry (Christopherson et al., 2010).

Economic growth and the stability and distribution of income (Adger, 2000).

Inclusivity and degree of trust (Harriss and de Renzio, 1997)

Rules which govern the social system (Aldger, 2000)

The concept of social resilience is complex and can be studied at many levels. This includes understanding the role and impact of economics and institutions (Aldger, 2000). There are a clearly a wide range of implications of social resilience for city design and management. Examples include economic planning to creates a diverse economic base and the avoidance of an over reliance on a single employer or business. It also includes the creation of accessible social infrastructure that supports learning, innovation, inclusion and trust.

Built environments must therefore ensure that characteristics of artificial systems such as social cohesion and learning are enhanced as they provide a valuable way of increasing resilience and reducing vulnerability to climate change.

The review of climate change projections and natural system and artificial system resilience can be used to develop a simple framework which can be used to evaluate the design guidelines to ascertain the extent to which they address resilience.

4. A Resilience Assessment Framework

The resilience assessment framework outlined below is based on a review of climate change projections, natural and artificial systems resilience. The framework aims to provide a useful way of assessing whether design tools and guidelines such as the SBAT addresses climate change directly, through measures that address projected change, or indirectly through enhancing the resilience of natural and artificial systems.

Table 1: Resilience Assessment Framework (by the author)

Aspect	Key questions
Higher temperatures	<p>Does the tool or guideline include built environment measure that address projected increased temperatures?</p> <p>Measures could include site planning, building form, building envelope, mechanical and passive cooling measures that reduce ambient temperatures on site and within buildings.</p>
Very hot days (days above 35°C)	<p>Does the tool or guideline include built environment measures that address very hot days?</p> <p>Measures could include measures indicated for Higher Temperatures (above) as well as specific measures such as well as support for personal adaptation measures. These measures enable people to adapt their behavior to cope with increased temperature, by for instance, drinking more water and being less active during the hottest periods of the day.</p>
Changes in rainfall	<p>Does the tool or guideline include built environment measures that address increased or reduced rainfall?</p> <p>Measures for increased rainfall could be improved waterproofing, drainage provision and flood prevention.</p> <p>Measures for decreased rainfall include more efficient water fittings, the adoption of rainwater harvesting and greywater systems, the avoidance of water-based sanitation and xeriscape landscaping strategies.</p>
Extreme rainfall events	<p>Does the tool or guideline include built environment measures that address extreme rainfall events?</p> <p>Measures for extreme rainfall events include strengthened roof and building structure, enhancing the capacity of rainwater goods, improved onsite drainage systems.</p>
Increased wind speeds	<p>Does the tool or guideline include built environment measures that address extreme rainfall events?</p>

	Measures for flooding avoidance measures such as avoiding flood zones, building on stilts and increased floor levels.
Natural systems resilience	<p>Does the tool or guideline include built environment measures that enhance the resilience of natural systems?</p> <p>Measures to enhance resilience of natural systems include retaining and enhancing existing natural systems and environments and creating and supporting new ones, through for instance the creation of indigenous ecosystems and landscaping, roof gardens and biological waste water treatment plans.</p>
Artificial systems resilience	<p>Does the tool or guideline include built environment measures that enhance the resilience of artificial systems?</p> <p>Measures to enhance resilience of artificial systems include support for social cohesion, the local economy, economic diversity, communication and education.</p>

5. Sustainable Building Assessment Tool

The Sustainable Building Assessment Tool (SBAT) aims to assess the sustainability performance of buildings. It does this by measuring the extent to which built environment characteristics deemed to support sustainability exist in a building or a design of a building (Gibberd, 2008).

Built environment characteristics measured in the SBAT are based on a definition of sustainability that includes both minimum quality of life (defined using the Human Development Index developed by the United Nations) and environmental limitations (defined with reference to the Ecological Footprints and the earth's carrying capacity) (World Wildlife Fund, 2006; Gibberd, 2017). This basis is markedly different to green building rating tools LEED, BREEAM and Greenstar which have an emphasis on incremental environmental performance improvement of buildings. The SBAT therefore has a broader remit and indicators are derived from environmental, economic and social sustainability objectives as shown in table 2.

Table 2: Sustainable Building Assessment Tool Categories, Areas, Objectives and Indicators
(Gibberd, 2008).

Category	Area	Objective	Indicator
Environmental	Energy	Built environment is energy efficient and uses renewable energy	EN1 Orientation, EN2 Building Depth, EN3 Roof Construction, EN4 Wall Construction, EN5 Floor Construction, EN6 Window to Wall Ratio, EN7 Ventilation openings, EN8 Daylight, EN9 Internal Lighting, EN10 External Lighting, EN11 Installed Equipment Power Density, EN12 Food Cooking, EN13 Water Heating, EN14 Renewable Energy Generation
	Water	Built environment minimises the consumption of mains potable water	WA1 Toilets, WA2 Wash Hand Basins, WA4 Showers, WA5 Hot Water, WA6 Landscape, WA7 Rainwater harvesting
	Waste	The building minimises emissions and waste directed to landfill.	WE1 Recycling Area, WE2 Recycling Collection, WE3 Organic Waste, WE4 Sewage, WE5 Construction Waste
	Materials	Construction impacts of building materials are minimised.	MA1 Building Reuse, MA2 Timber Doors and Windows, MA3 Timber Structure, MA4 Refrigerants, MA5 Volatile Organic Compounds, MA6 Formaldehyde, MA7 Locally Sourced Materials

	Biodiversity	Built environment supports biodiversity	BI1 Brownfield Site, B14 Municipal Boundary, BI3 Vegetation B14 Ecosystems
Economic	Transport	The building supports energy efficient transportation.	TR1 Pedestrian Routes, TR3 Cycling, TR3 Public Transport
	Resources	The building makes efficient use of resources.	RE1 Site Density, RE2 Area per occupant RE3, Renewable Energy Generation, RE4 Food Production
	Management	The building is managed to support sustainability.	MN1 Manual, MN2 Energy Metering, MN3 Water Metering, MN4 Recording, MN5 Residents Association
	Local Economy	The building supports the local economy.	LE1 Locally Sourced Materials and Products, LE2 Small Enterprise, LE3 Construction Workers Support
	Services and Products	The building supports use sustainable products and services.	SP1 Fruit and Vegetables, SP2 Bakery Products, SP3 Beans and pulses, SP4 Milk and Eggs, SP5 Clothing, SP6 Furniture, SP7 Equipment Hire, SP8 Notice Board
Social	Access	The building supports access to facilities.	AC1 Internet Access, AC2 Banking, AC3 Groceries, AC4 Post Office, AC5 Creche, AC6 Primary Schools
	Health	Built environment supports a healthy	HE1 Exercise, HE2 Health facility, HE3 Fruit and Vegetables, HE4 Bean and

		and productive environment	Pulses, HE5 Milk and Eggs, HE6 Water, HE7 External Views, HE8 Daylight, HE9 Openings, HE10 Roof Construction, HE11 Wall Construction, HE12 Volatile Organic Compounds, HE13 Formaldehyde, HE15 Construction Worker Health
	Education	The building supports education.	ED1 Primary Schools, ED2 Secondary Schools, ED3 Ongoing education, ED4 Internet, ED5 Noticeboards, ED6 Space for Learning, ED7 Building User Manual, ED8 Construction Worker Education
	Inclusion	The building is inclusive of diversity in the population.	IN1 Public Transport, IN2 Groceries, IN3 External Routes, IN4 Entrances and Exits, IN5 Lobby, IN6 Window, door and lighting controls, IN7 Doors, IN8 Bathroom, IN9 Kitchen, IN10 Inclusive Employment, IN11 Affordability
	Social Cohesion	The building supports social cohesion.	SC1 Occupants, SC2 Community space, SC3 External Facilities, SC4 Residents Association

The SBAT consists of a locked preformatted Excel spreadsheet (the tool) and manual. The tool generates a rating and graph based on data entered into the tool, as shown in figure 1. The report shown is for the SBAT residential which measures performance of housing. In the SBAT the overall rating is shown under 'Achieved' in the report. The graph in figure 1 shows actual performance against targeted performance. Performance in the different sectors, such as environmental, economic and social performance are provided in the table below this. The EF and HDI factors refer to Ecological Footprint and Human Development Index and reflect

performance of indicators that are related to these areas. Finally, details of the Assessor and validation process are provided.

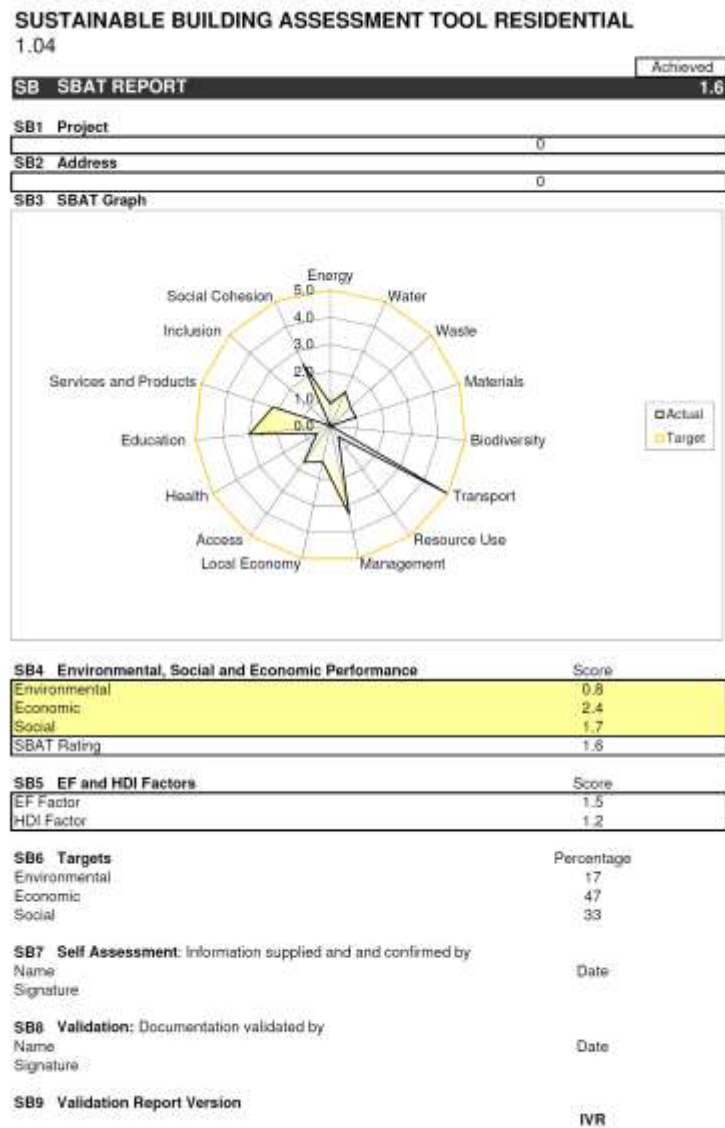


Figure 9: Sustainable Building Assessment Tool Report (Gibberd, 2008)

6. SBAT Evaluation

In order to evaluate the SBAT the resilience assessment framework developed earlier is applied. The findings are outlined below, under the headings provided in the framework.

Higher temperatures

Criteria in the SBAT that address temperature in buildings fall under Energy and Health categories and include Orientation, Building Depth, Roof Construction, Wall Construction, Floor Construction, Window to Wall Ratio, Ventilation Openings and Daylight. Criteria define building characteristics such as a northerly orientation of the building (Orientation), roof colour and thermal performance (Roof Construction), thermal performance of walls (Wall Construction), exposed thermal mass of flooring material (Floor Construction), glazing (Window to Wall Ratio), the location and size of ventilation openings (Ventilation Openings) and location and sizing of windows relative to interior space (Daylight).

While these criteria help measure key characteristics of buildings that support low energy use and occupant comfort and health in warmer climates, they do not specifically address the higher temperatures projected under climate change. It is therefore recommended that the criteria within the Energy and Health categories be reevaluated in light of increased temperature projections. This evaluation should review whether, and how, existing criteria, such as thermal performance, should be updated to reflect climate change projections. In addition, it is recommended that criteria that include additional measures should be considered. These include:

Site layout and landscaping strategies which support cooling such as ensuring access to ventilation, increasing shading and trees around buildings and reducing the extent of hard paving (such as car parking) around buildings (Zuo et al, 2014; Santamouris, 2015; Wong & Chen, 2009)

Integration of specific passive cooling strategies such as cross ventilation, evaporative cooling and night-time cooling (Karimpour et al, 2015; Peacock et al, 2010). As these strategies tend to be site and climate specific, care should be taken to avoid developing overly prescriptive criteria and instead should advocate a responsive approach instead.

The application of low energy mechanical cooling such as ceiling fans and evaporative cooling systems that are powered by renewable energy systems (such as photovoltaic systems).

Very hot days

Criteria in the SBAT that are relevant to very hot days have already been listed above under Higher Temperatures. These criteria do not address the extreme nature of hot days projected under climate change and their potential detrimental impacts on health. Therefore, it is recommended that the existing temperature related criteria in the SBAT are reviewed and that criteria for additional measures are considered. Additional measures could include support for the following personal adaptation measures:

Provision of drinking points that encourage occupants to drink more water means of keeping cooler and health under very hot conditions

Working practices that accommodated clothing suitable for hot weather and encouraged occupants to be less active and indoors during the hottest part of the day (Krecar et al, 2014; Hatvani-Kovacs et al, 2016; Saman et al, 2013).

Changes in rainfall

As climate change projections indicate increased rainfall in some areas and reduced rainfall in other areas, different criteria for different areas are required. The SBAT only addresses rainfall through the Water criteria. These include water efficient sanitation (Toilets), water efficient taps (Wash Hand Basins), water efficient showers (Showers), reduced wastage (Hot Water), reduced irrigation (Landscape) and water harvesting and storage (Rainwater harvesting). These criteria will help address water shortages that occur as a result of reduced rainfall but should be re-evaluated to ascertain whether the measures are sufficient for projected shortages under climate change. The SBAT however does not address projected increases in rainfall. Therefore this should be considered through criteria in the SBAT that measure the extent to increases in rainfall can be accommodated. Examples of measures include:

Water proofing details which avoid potential dampness and moisture-related problems in buildings.

Sustainable urban drainage systems which ensure that additional precipitation and resulting runoff is addressed adequately on site.

Extreme rainfall events

The SBAT does not address extreme rainfall events. This therefore should be addressed in the tool through criteria that included:

Strengthening structural elements of the building, and in particular, the roof to withstand projected rainfall events.

Enhancing the capacity of rainwater goods such as gutters and downpipes to accommodate projected flows.

Increased wind speeds

The SBAT does not address increased wind speeds. This therefore should be addressed in the tool through criteria that included:

Strengthening structural elements of the building, and in particular, the roof to withstand projected wind speeds.

Strengthening elements exposed to wind, such as walls and facades, to ensure they can withstand projected wind speeds.

Natural systems resilience

SBAT criteria that address natural environments are found primarily under the Biodiversity category and include, avoiding green field sites (Brownfield Site), reducing urban sprawl (Municipal Boundary), enhancing onsite planting (Vegetation), supporting ecosystem (Ecosystems). These criteria appear to support the objective of natural systems resilience well. However, it is recommended that these criteria are reviewed and enhanced where possible.

Artificial systems resilience

The SBAT criteria that address social and economic system resilience are distributed across a number of categories including Local Economy, Education, Health, Inclusion and Social Cohesion. Criteria include, local sourcing of materials and products (Locally Sourced Materials and Products), using small enterprises (Small Enterprises), locating the building near local primary, secondary and going education (Primary Schools, Secondary School and Ongoing Education), including facilities that support education and awareness (Internet, Notice boards, and Space for Learning), specific support for construction worker education (Construction Worker Education) and understanding of the building's systems by users (Building User

Manual). Specific criteria in the SBAT aim to promote social cohesion and include spaces where occupants can interact socially (Occupants), spaces, facilities and organizations that support social interaction and organization within the local community (Community Space, External Facilities, Residents Association).

The SBAT appears to have numerous criteria supportive of artificial systems resilience and it is difficult to readily identify additional measures. Therefore, it is recommended that the existing criteria are reviewed in light of artificial systems resilience literature in order to ascertain whether they can be improved and whether additional measures can be developed.

7. Discussion

The review indicates that the SBAT does not comprehensively address the additional risk to built environments represented by climate change. In some cases, the nature of climate change risks, such as flooding and the urban heat island effect, requires that these are addressed at a larger scale than the building level. Here urban planning tools and policies that govern land use and development are likely to be more effective than building-scale tools. It is therefore important that tools and policies that address the larger-scale are also reviewed and updated to ensure that a comprehensive and linked up approach is developed.

At a building level, the SBAT provides general support for improved sustainability performance, however, it does not provide specific measures that address the risks generated by climate change. The review indicates that additional measures may be available that could be incorporated in buildings to improve their resilience to climate change. These include additional shading, heat island mitigation measures, provision of drinking water, enhanced water proofing, increased rainwater and storm water system capacity and reinforcing roof and façade structures. These measures, in most cases, could be easily integrated in existing buildings and new designs and would contribute significantly to achieving more client resilient buildings. It is therefore recommended that these are include as criteria in an updated version of the SBAT.

The SBAT includes a large number of criteria that are supportive of natural and artificial systems resilience. A review of these criteria suggests that they are well suited for the purpose of enhancing natural and social resilience. This, however, is achieved implicitly, and it may be valuable to define natural and artificial systems resilience in the tool and design criteria to

explicitly address this. Through this process relevant existing criteria could be enhanced and new criteria added, where necessary.

8. Conclusions and Recommendations

Climate change must be addressed both in existing and new built environments. By understanding the risks presented by climate change, measures can be identified which enhance the resilience of built environments. Local natural and artificial systems also make important contributions to local resilience. Built environments can address climate change by incorporating physical measures which enable buildings and their occupants to adapt to projected change. They can also foster local resilience by supporting increased local and natural system resilience.

A review of the Sustainable Building Assessment Tool indicates that it does not comprehensively address climate change resilience or enhance the resilience of local natural and artificial systems. Valuable additional assessment criteria supportive of resilience are identified that can be integrated into the SBAT. It is recommended that these are integrated into the tool when it is next updated.

Acknowledgements

This work is based on the research supported in part by the National Research Foundation of South Africa (Grant Numbers 103996).

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Considering healthy indoor environments in the development of human settlements by characterising the building indoor microbiome.

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ABSTRACT

As humans we spend up to 90% of our lives in indoor environments. Considering the rate of urbanisation in South Africa and globally, it would be prudent to consider the health quality of the indoor environments of current and future planned human settlements. The impact of the built environment (BE) on user health is widely known, with up to 15% of people contract healthcare acquired infection (HAI) in hospital environments, family members contracting tuberculosis (TB) in home environments and cost concerning workhours lost (USA). Yet we know very little of the health related characteristics of the indoor environment.

An emerging field of the microbiology of the built environment (MOBE) could unlock our understanding towards future planning and design. Characterising the indoor BE requires interdisciplinary approaches that include architecture, microbiology and engineering. The methodology adopted was applied at two case study facilities. It includes microbial sampling of indoor rooms; sensor data collection for CO₂ and temperature; and spatial metrics that include occupancy, people type, room function with internal flow patterns through spatial modelling. Correlation of the data sets provided identification of environmental factors that play an influential role on the microbiome of the indoor environment brought about by the typical user type.

The findings indicated that the indoor biome varied seasonally and consisted of unique air and surface communities. Unique biomes were observed at a room space level, with similar communities at building typology level. The indoor built environment is dynamic, the need to extend these investigations into the residential and housing sphere is critical. The influence of building design decisions (operations, layout, planning, hardware and systems...) has a direct effect on the microbial composition and structure of the indoor built environment and consequently user health. This study presents an empirical quantitative approach to assess and determine what healthy indoor environment applicable in human settlements at large could be.

Keywords

Microbiology of the built environment, microbiome, health, spatial analytics, hospital design, Infection prevention and control, hospital, health care, risk, microorganisms

1. Introduction

Africa is poised to urbanise with an estimate growth rate of 300% over the next 40 years from 395 billion to 1.339 billion, with an expected estimated 1.3 billion people living in urban environments (Gunalp et al 2017). This rapid and expansive migration to urban environments will drive the need for housing and social services. As is evident from development patterns, the rate of change however, will most likely result in poor human

settlement development. Focussed on delivery, over built environment and indoor environmental quality. This has a direct impact on health and wellbeing of the built environment inhabitants. Higher density urban spaces has the potential to provide improved and accessible infrastructure and healthcare services as appose to rural isolated settlements. Prasad et al (2016) however suggest the opposite is more likely. Data from a comparative study of risk factors for TB in India and Korea suggest an increase TB incidence rates in some countries over others due to factors of increased poverty and poor living conditions. The authors concluded that without proper urban planning, supported services, quality social and economic conditions, the likelihood of increased adverse epidemiological conditions is a certainty, as found in the India - Korea case study. Therefore, strategic planning, health focused development of human settlements are critical in user health and wellbeing.

Considering healthy building standards for indoor built environments become paramount in shaping human settlements. Through considered policy and informed planning, health consciences design can be fostered. Transmission of healthcare associated infections (HAI) (and not limited to healthcare environments), occur in three ways: contact, droplet and airborne spread. The built environment plays a significant role in all three modes of transmission. In an era of increased antimicrobial-resistant microorganisms, two focal strategies address the occurrence and spread of antimicrobial-resistant microorganisms, 1) optimising antimicrobial use and 2) preventing the transmission of resistant organisms (Brink et al. 2006). The role of the built environment directly relates to the second strategy. Current research indicate that hospital's and the built environment as a contributor and potential incubator, in pathogen transmission that causes various illnesses through infection (Yates, Tanser & Abubakar 2016). Most studies focus on healthcare environments; with little research on human settlements. The lack of empirical data to verify and quantify health risk in the built environment has been established (Schweitzer, Gilpin & Frampton 2004; Evans & McCoy 1998). The studies suggest that more research on the Microbiology of the Built Environment (MoBE) – the study of the microbial community within the buildings - could provide such empirical data. The research work of the author and fellow MoBE researchers, have suggested a paradigm shift in understanding building ecology. Building ecology based investigations have increased in recent years, and more particularly from a microbiological ecosystemic perspective. Considering that 85 percent of our time is spent indoors (Klepeis et al 2001), and people are the leading contributors of bacteria in indoor environments (Hospodsky et al. 2012), it becomes imperative for designers and architects to understand the microenvironments in which we live and play. MoBE research combines built environment studies and microbiology, through interdisciplinary investigations in engineering, architecture, microbiology, health sciences, epidemiology and anthropology (Briere & Resnick 2017). Africa and in particular developing

world environments have very little data on the building microbiome. The relationship between microorganisms and the built environment is much more significant than previously considered, as indoor ecosystems are dynamic, unique and location specific; but still strongly influenced by their outdoor environments. This paper presents, and therein postulate an investigative approach to microbiome identification for the application in human settlements, as piloted through two healthcare buildings. From the insight, gained in healthcare related investigations, human settlement typologies for housing and social settings could benefit with the characterisation of built environment microbiomes

2. Methods

The MoBE research methodology combines architectural, engineering and microbiological factors that can produce insight to architectural design, planning and potential transmission risk management. In a recent hospital, ward study by Lax et al (2017), it was found that the user patient defined the indoor microbiome, were the ward resembled the microbial signature of their patients up to 24hours after discharge. The author postulates utilising a matching methodology to investigate human settlements, as conducted in a recent doctorate investigation that performed microbiome characterisation of two hospital environments. This study considered and correlated spatial analytic findings, environmental measures and microbial sampling. The study sites were two public hospitals in the Western Cape South Africa, (MPH) and (KDH).

2.1 Spatial analytics, engineering and microbial sampling

Spatial analytics: This requires data from on-site observations, collected and processed following a methodology derived from Space Syntax principles and visualized through the Depthmap™ program. The Space Syntax methodology for spatial analytics employs various observation techniques as described in the Space Syntax methodology guide (Grajewski and Vaughan 2001; Al-Sayed et al. 2014). For the healthcare investigation, two observation techniques were elected and applied: Firstly, a mental snap shot and secondly a movement tracer technique. Effective determination of the most beneficial and representational time a pre-study questionnaire was circulated to staff at both hospitals. This determined the low and high peak times, patient load and active spaces, personnel perception of personal safety and healthcare associated infection, as well as perceived cleaning regimes. Data area processed through GIS and modelled in Depthmap™ for analysis and user flow correlation. The data on flow patterns (human movement) and space use (function) compared with the original planned design use (or potential space usage). This provides insight to design -versus actual space utilization. From the data, graphical axial representations and percentage flow, which indicated the user spatial distribution within the building spaces versus the 'planned/designed' user

distribution were, derived (Al-Sayed et al. 2014). The study requires multi-seasonal investigations due to varied ecological conditions. Field researchers conducted systematic observations at each facility following a predetermined route, over a continuous twelve-hour period and for four consecutive days from Friday to Monday, as determined by the pilot questionnaire. (Nice, 2019)

Engineering data: Utilising sensors, CO₂, temperature, lighting (LUX), humidity are collected. Continuous sensing and sampling of CO₂, Temp and RH were gathered to correlate with user and occupant flow findings, and microbial sampling. Full characterisation of the mechanical system is required to determine air source, airflow, direction flow and pressure drop between spaces within the various facilities. (Nice, 2019)

Microbiology: This microbiology methodology was developed from a broad literature review that included sampling, equipment, analysis, sequencing techniques, database selection and the selection of bioinformatics platforms. To ensure comparability of this study reference was made to similar previous studies that included Meadow et al. (2014), Kembel et al. (2014) and a classroom study at Oregon University, USA by Adams et al. (2015). The healthcare investigation performed culture analysis with selected media to detect growth of identified HAI indicator organisms, i.e. *Staphylococcus aureus* (from surfaces), *Pseudomonas aeruginosa* (from surfaces), *Pneumocystis carinii* pneumonia (PCP) (air) and *Mycobacteria tuberculosis* (air). Further colony identification via the MS VITEK™ mass spectrometer was performed. DNA-extraction and PCR (using 16S rRNA gene V3-V4 primers) were performed on both the air and surface samples. A p-value of 0.05 and lower was accepted. 113 6275 sequences were received, with 6493 sequences per sample (175). It is important to note that both culture and 16S Rna sequencing or pyrosequencing is required, to determine both presence and viability of organisms. (Nice, 2019)

3. Human settlement hypothesis

To improve our understanding of indoor environments and the factors that influence the microbiome of various built environment typologies this paper suggest utilising a closely matched methodology as utilised by the author in healthcare settings. The following variations should be considered. 1) Seasonal investigations, in matching housing typologies in different regions within a metropole. 2) Comparing high-rise housing typologies typically associated with urban environments to low rise typologies typically single free standing dwelling in suburban environments. 3) Time related investigation, considering both occupancy and in unoccupied times, that will provide insight into the microbial community fluctuation and potential space 'flushing' 4) Considering room comparison between typologies and lastly 4) Increased number of microbial samples per space due to potential low biomass.

4. RESULTS

Healthcare investigations

Key findings included: 1) the designed plans spatial analysis indicated integrated and connected environments that were spatially intelligible¹⁴; similarly, it predicted spaces of clustering. 2) comparing the global user flow patterns of the MPH and KDH to the design layouts as planned in both summer and winter seasons, higher correlation were achieved in one facility over the other seasonally (R^2 0.38 vs R^2 0.30 vs R^2 0.58 correlation to potential design) 3) The variation between the facilities could be attributed to the utilisation of function and layout. In addition MPH had measured a 30% increase in occupancy in winter. At the KDH the Central Nurse Station (CNS) measured a 120% increase in summer. 4) From the microbial sampling the CNS of the MPH also indicated an increase in the number of Operational Taxonomic Units (OTU), i.e. a larger number of identified microorganisms compared to other rooms for both hospitals. The data indicated that there is a correlation with the change in flow patterns, occupancy and the quanta of organisms. 5) Occupancy counts varied seasonally and social factors influenced facility preference. 6) When considering occupancy rates and the variation in summer and winter in the microbial sampling of surface and air total OTU's, an increase was observed in indicator species related to an air source. This can be attributed to an increased illness rate in winter as reflected in the increase occupancy in winter. 7) Microbiome changes between the MPH and KDH in winter versus summer is noteworthy as it infers a variable indoor environment and a variation in species presence and abundance. 8) Room types such as the clinical service provision spaces per season, the MPH indicated a 60% biome variation in most zones when grading activity rates; one can attribute this finding to the clinical needs variation between two seasons. Lastly, in many respects, the gate counts and flow measures were strongly associated with the potential predicted simulations of where one would expect to find congregation or low occupancy. (No clinical data was collected during this study)

4.1 Human settlements hypothesis

As per the healthcare typology findings, it would be expected to find variations based on season and typology and even microclimate. The emergence of niche areas is likely. Spatial layouts and room configuration will influence the microbial community and be evident in OTU counts. The external environment will be of critical importance as large quanta of outdoor air

¹⁴ The level of spatial connectivity and integration with neighbouring spaces is termed spatial intelligibility (SI), it provides insight into potential social interactions. The functional use of spaces impacts the required level of integration and connectivity. Clustering of core functional spaces theoretically provides a high level of connectivity and correlates strongly with spatial integration. The level of intelligibility represents how easy it is to comprehend local position within a global structure. (Al-Sayed et al. 2014)

is present indoors. The successful outcome of predictive space use as per the space syntax model and the observed measures presents an opportunity for accurate future design planning. Furthermore, when considering the environmental and microbial indicator factors identified in the healthcare study, combined with spatial modelling design guidance for health conscience design can be achieved.

5. Conclusions

Core findings that would benefit from further typological investigations within the field of human settlements include: The indoor air and surface samples, which were sequenced and analyzed, the majority of organisms were found indoors where humans interacted. Furthermore the study found that human sourced organisms amount to 65%, and 35% of organisms come from outdoor sources in both hospitals. To note - the majority of organisms in any indoor environment are not pathogenic (it is estimated that less than 1% of all known organisms are pathogenic to humans (Nature, 2011)) but yet the 1% has a significant effect on our immune system especially in impoverished environments with malnutrition, lack of social and healthcare services etc. This is significant when one considers that people spend most of their time indoors, up to 85% (Evans & McCoy 1998; Klepeis et al. 2001). The study of how people use space and specifically programmed space is essential to the understanding of the indoor microbiome. The research findings gathered from the healthcare study provide guidance on infection prevention decision making for example: mechanical systems and services selection, localised filtration, policy implementation versus building design program, efficacy of planning design through user flow reducing potential cross contamination and lastly identifying core cluster development and spatial interrelationships to reduce cross infection and contamination. Spatial layout is a significant contributing factor in the microbiome composition. Spatial analytics and indoor microbiome dependencies (common sources, ventilation etc.) found in the healthcare study demonstrated that the modelling techniques can be applied for risk grading in hospital environments. (Nice, 2019).

Applying MoBE research methodologies to human settlement investigation will provide empirical data that could support decision-making tools and policies. The data will inform (as found in other studies) planning selections, environmental awareness, material selection, user health, and support the characterisation of building typologies and appropriate building system selection for improved user health.

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Does the Built Environment Sustainability Tool (BEST) Address Resilience Sufficiently?

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Abstract

Climate change is already having significant impacts globally. These impacts are experienced most acutely in developing countries where infrastructure and population are often more vulnerable and resources and capacity for mitigation are limited. It is therefore particularly important to understand vulnerabilities to climate change in developing countries and address these in the most effective and efficient ways possible. The Built Environment Sustainability Tool (BEST) was created to guide the development of more sustainable neighbourhoods in developing countries. Through analysis of current climatic change projections for South Africa, key implications for neighbourhoods are ascertained. These are reviewed against criteria in the BEST to investigate whether the tool adequately addresses projected climate changes and promotes associated resilience measures. Findings from the study indicate that while the BEST provides a useful guide for addressing sustainability in neighbourhoods it could be enhanced by addressing resilience more comprehensively. Recommendations are therefore made for the further development of the BEST.

Keywords: Sustainability, resilience, BEST, Built Environment Sustainability Tool.

1. Introduction

Climate change is already having a significant impact globally (Pachauri and Meyer, 2014). As a result, there is a growing realisation that urban and built environment policies and guidance have to be updated to address climate change adaptation as well as mitigation (Hamin and Gurran, 2009; VijayaVenkataRaman *et al.*, 2012; Hrabovszky-Horváth *et al.*, 2013). Adapting to climate change, however, is still an emerging science and has not been addressed widely in built environment policies, strategies and guidance (Hamin and Gurran, 2009). Methodologies to support this are therefore urgently required.

This paper explores how methodologies in this area can be developed. It proposes, and tests, a climate resilience assessment framework that can be applied to assess built environment tools. The framework is applied to Built Environment Sustainability Tool (BEST) which has been developed in South Africa to assess the extent to which the tool addresses climate change adaptation and resilience (Gibberd, 2015). Findings are discussed and developed into recommendations which can be incorporated into an updated version of the BEST. The following research questions will therefore be addressed in the paper:

- What types of climate change impacts are projected for South Africa?
- Can these climate change projections provide the basis for a climate resilience assessment framework that can be used to evaluate the building design guidelines and tools?

- What are the findings of applying the climate resilience assessment framework to the BEST?
- Do findings from applying the framework provide useful guidance on how the BEST can be updated to address climate change adaptation more effectively?

The paper addresses these questions in the following way. Firstly, the paper reviews current climate change studies to understand climate change projections for South Africa and to develop a list of key impacts that will affect the built environment. Secondly, a literature review is undertaken to define resilience for built environments and the South African context. Thirdly, this review is used to propose a climate resilience assessment framework, which is presented in the study. Fourthly, the BEST is introduced. Fifth the climate resilience assessment framework is applied to evaluate the BEST. Sixth, the findings are reviewed and discussed in relation to the research questions and other neighbourhood sustainability tools. Seventhly, conclusions and recommendations are presented.

2. Climate Change

Climate change is one of the most significant issues facing mankind (Hamin and Gurran, 2009). Climate change science has advanced rapidly, enabling improved understanding of the existing impacts and the ability to project future situations with increasing accuracy. For the first time, climate change modelling has been carried out at a resolution of 8x8km in South Africa (Engelbrecht, 2017). This level of detail has provided in depth future climate change projections which show localised non uniform effects across the country. In this study, results from the low mitigation scenario (RCP 8.5) are reviewed for the period 2021 – 2050 relative to 1961-1990. This scenario indicates a number of broad trends for South Africa which outlined below.

Higher temperatures: Increases in temperature of 1 to 2.5°C in southern and 3°C in the northern areas of South Africa are predicted for the period 2021 to 2050, compared to temperatures over 1961 – 1990.

Very hot days: Very hot days (days above 35°C) are projected to increase significantly during the period 2021 – 2050, compared to 1961 – 1990.

Changes in rainfall: Annual rainfall increased are predicted in the interior and east of South Africa, while reductions in rainfall are expected in the western interior and the north eastern parts of South Africa over the period 2021-2050, relative to 1971 – 2000.

Extreme rainfall events: Extreme rainfall events are predicted to increase in frequency in the interior and east of the country over 2021-2050, compared to 1961 – 2000. In Lesotho and areas of Kwa-Zulu Natal Midlands reductions in these events are projected over the same period.

Increased wind speeds: Wind speeds are projected to increase in the northern interior regions of South Africa and decrease in other regions over 2021-2050, relative to 1961 – 2000 (Engelbrecht, 2017).

Further detail is available on maps which chart impacts across South Africa for different provinces, RCP scenarios and timeframes. This level of detail enables implications of climate change for buildings to be analyzed and understood. Understanding implications and how they can be addressed can be described as resilience, which is addressed next.

3. Resilience

Resilience can be understood as ‘the persistence of relationships within a system and the ability of this system to absorb changes, and still persist’ (Holling, 1973). While the concept of resilience can be illustrated fairly simply in examples from ecology, this becomes much more complex in large entities such as urban environments and cities which consist of both natural and artificial systems (Holling, 1973; World Health Organisation, 2009; Piketh *et al.*, 2014). To avoid making the framework and assessment process overly complex, resilience in the proposed assessment framework for this study, defines and assesses resilience in relation to built environments in three ways.

Firstly, resilience in built environments can be enhanced by incorporating measures that respond directly to projected climate changes. These measures respond to projected changes, such as extreme rainfall events, by strengthening aspects of building fabric such as the roof structure to adapt to future events (Gibberd, 2018). In the resilience assessment framework these measures are referred to as ‘Direct building adaptations’.

Secondly, built environments can enhance the resilience of local natural systems. Natural systems play a valuable role in helping environments adapt to climate change impacts. For instance, local wetlands can reduce the extent of flooding and mitigate the impacts of this when it does occur by providing a ‘buffer’ where runoff can be stored and released in managed way (Woods-Ballard *et al.*, 2007; Gibberd, 2017). By protecting and fostering these systems, local ‘natural systems resilience’ is enhanced which contributes to the resilience of built environments. In the resilience assessment framework these measures are referred to as ‘Enhancing natural systems resilience’ (Gibberd, 2018).

Thirdly, built environments can support local social and economic resilience. It is argued that humans are not passive receipts of climate change impacts but can develop mechanisms to resist and cope with these impacts (Jones and Boer, 2003; Pelling, 2003; Smith, 2001; Blaikie, Cannon, Davis, and Wisner, 1994). For instance, local organizational structures and co-produced policies and strategies can be used to reduce and adapt to climate change impacts (Pahl-Wostl, 2007; Pelling, *et al.*, 2008; Lemos and Morehouse, 2005). Access to resources are also important addressing climate change impacts (Vincent, 2004). Therefore a strong diversified local economy provides a valuable ‘safety buffer’ which enables valuable resources to be drawn on for both anticipatory strategies as well as for coping with post-shock events (Vincent, 2004). In the resilience assessment framework these measures are referred to as ‘Enhancing artificial systems resilience’ (Gibberd, 2018).

The Resilience Assessment Framework is shown in table 1. This shows the three built environment resilience areas under **Area**. To the right of this is **Objectives**, where resilience objectives are defined. To the right of this are **Questions**, which are applied to assess the extent to which built environment tools and guidance address resilience.

Table 1: Resilience Assessment Framework (Gibberd, 2018)

Area	Objectives	Questions
Direct building adaptations	Built environments are resilient to projected higher temperatures	Does the tool or guideline include built environment measures that address very hot days? Measures could include measures indicated for Higher Temperatures (above) as well as specific measures such as well as support for personal adaptation measures. These measures enable people to adapt their behavior to cope with increased temperature, by for instance, drinking more water and being less active during the hottest periods of the day.
	Built environments are resilient to projected increases in very hot days (days above 35°C)	Does the tool or guideline include built environment measures that address increased or reduced rainfall? Measures for increased rainfall could be improved waterproofing, drainage provision and flood prevention. Measures for decreased rainfall include more efficient water fittings, the adoption of rainwater harvesting and greywater systems, the avoidance of water-based sanitation and xeriscape landscaping strategies.
	Built environments are resilient to projected increases and decreases in rainfall	Does the tool or guideline include built environment measures that address extreme rainfall events? Measures for extreme rainfall events include strengthened roof and building structure, enhancing the capacity of rainwater goods, improved onsite drainage systems.
	Built environments are resilient to projected extreme rainfall events	Does the tool or guideline include built environment measures that address extreme rainfall events? Measures for flooding avoidance measures such as avoiding flood zones, building on stilts and increased floor levels.
Enhancing natural systems resilience	Built environments enhance the resilience of local natural systems	Does the tool or guideline include built environment measures that enhance the resilience of natural systems? Measures to enhance resilience of natural systems include retaining and enhancing existing natural systems and environments and creating and supporting new ones, through for instance the creation of indigenous ecosystems and landscaping, roof gardens and biological waste water treatment plans.

Enhancing artificial systems resilience	Built environments enhance the resilience of local artificial systems	Does the tool or guideline include built environment measures that enhance the resilience of artificial systems? Measures to enhance resilience of artificial systems include support for social cohesion, the local economy, economic diversity, communication and education.
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4. The Built Environment Sustainability Tool

The Built Environment Sustainability Tool (BEST) aims to enhance the sustainability of neighborhoods. It provides a methodology that can be used to assess the sustainability of neighborhoods and enables options to improve sustainability performance to be evaluated. The tool provides a holistic assessment of the sustainability of neighborhoods and is based on definition of sustainability developed by the World Wildlife Fund (2006). This defines sustainability as the ability of human populations to achieve minimum universal quality of life standards without exceeding the earth's carrying capacity. Quality of life in the definition is based on the Human Development Index (HDI), developed by the United Nations. This defines quality of life in terms of:

A long healthy life, measured by life expectancy at birth

Knowledge, measured by the adult literacy rate and combined primary, secondary, and tertiary gross enrolment ratio

A decent standard of living, as measure by the GDP per capital in purchasing power parity (PPP) in terms of US dollars (United Nations Development Programme 2007).

For sustainability to be achieved, populations must achieve at least 0.8 on this index. Currently many developing countries in Africa, Asia and South America are below this, while developed European, Asian and North American countries, exceed this level.

This quality of life however must be achieved within the carrying of the earth. In order to quantify this as a clear target, the earth's carrying capacity is measured in terms of global hectares (gha) and divided by the global population to delineate an equitable share. This is defined as being 1.8gha per person (Wackernagel and Yount, 2000). In order to ascertain whether individuals are achieving this target it is necessary to calculate their ecological footprint. The ecological footprint (EF) measures the amount of land and sea required to provide resources for a human population and is based consumption of resources and the production of waste in the following areas:

Food, measured in type and amount of food consumed

Shelter, measured in size, utilization and energy consumption

Mobility, measured in type of transport used and distances travelled

Goods, measured in type and quantity consumed

Services, measured in type and quantity consumed

Waste, measured in type and quantity produced (Wackernagel and Yount, 2000).

The WWF definition of sustainability is useful because it provides quantified targets and a clear indication of the key issues that need to be focused on. The Built Environment Sustainability Tool therefore closely follow the theoretical basis of this definition by focusing on built environment characteristics related to the HDI and EF. The BEST therefore aims to define,

and measure, the capacity of the built environment to support the achievement of Human Development Index and Ecological Footprint targets (Gibberd, 2014).

BEST criteria areas are derived directly from the sub criteria of the Human Development Index and Ecological Footprint and are listed below:

Shelter

Food

Mobility

Goods

Waste

Biocapacity

Products

Services

Education

Health

Employment

Within each of these areas the tool defines sets of built environment characteristics that are required for occupants to achieve HDI and EF targets. For instance, in order to achieve an overall ecological footprint of 1.8gha requires individuals to ensure that respective EFs for Shelter, Food, and Mobility etc do not exceed specified limits. Avoiding exceeding these limits requires that local built environments have specific characteristics, for instance, in order to have a Food EF within required limits, low ecological footprint food such as locally grown affordable fresh vegetables and fruit must be available within walking distance.

In the tool, required characteristics to achieve EF and HDI targets are also referred to as built environment capability and are measured in a scale from 0 (no capability) to 5 (full capability). An annotated illustration of the tool is provide in figure 1.

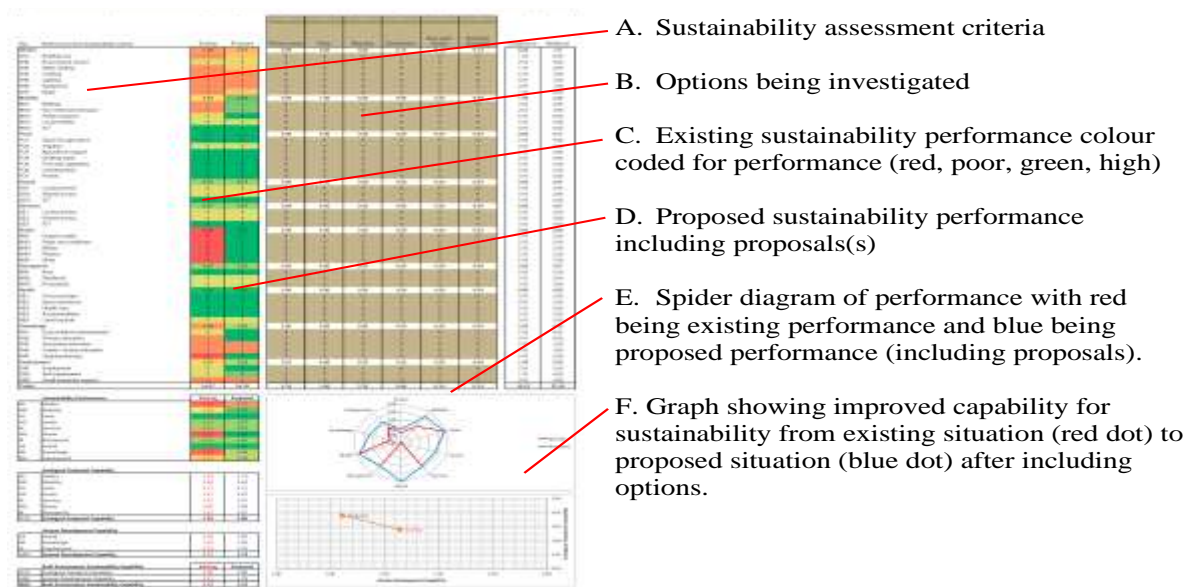


Figure 10: Built Environment Sustainability Tool (Gibberd, 2015)

5. Findings

The resilience assessment framework outlined below is based on a review of climate change projections, natural and artificial systems resilience. The framework aims to provide a useful way of assessing whether design tools and guidelines such as the BEST addresses climate change directly, through measures that address projected change, or indirectly through enhancing the resilience of natural and artificial systems.

5.1 Direct building adaptations

A review of the BEST criteria indicate that there some direct building adaptations are included. Under 'Shelter', the criteria for Environmental Control, indicates that full capability (score 5) requires that "Internal conditions are comfortable throughout the year or rely on renewable energy only for heating and cooling for comfort" (Gibberd, 2015). If this stringent criteria is achieved under current conditions it would ensure that built environments were adapted to some extent for higher temperatures and very hot days. It should however be noted that under projected conditions, the building would probably would not retain full capability as conditions become more extreme and additional measures may be required to retain this level of performance.

Under 'Shelter', the criteria for water indicates that for full capability (score 5) "All water used sourced from onsite / local rainwater harvesting" (Gibberd, 2015). Achieving this currently would enable the building to achieve a strong level of resilience to future projected conditions. However, under future conditions, this level of capability is unlikely to be maintained and additional measures would be required to retain this level of performance.

The BEST does not address flooding or increased rainfall. It also does not address extreme rainfall events. Under 'Biocapacity', the tool does make reference to natural systems which could support adaptation to extreme rainfall events, but this measure would not be considered a 'direct building adaptation' but rather a measure to 'enhance natural system resilience', so will be covered under this heading.

5.2 *Enhancing natural systems resilience*

The 'Biocapacity' set of criteria in the BEST provides strong support for natural systems resilience. Achieving full capability (score 5) in this area requires that natural environments cover over 30% of the site's environment, and consist of highly productive linked ecosystems with a diverse range of species (Gibberd, 2015). Other criteria that enhance natural systems resilience include criteria for recycling organic waste on site, through composting or other means (Waste) and support for local agriculture (Food). These criteria are strongly supportive of local natural systems resilience.

5.3 *Enhancing artificial systems resilience*

Enhancing artificial systems resilience refers to measures within the built environment that enhance local social and economic resilience. A number of criteria within the BEST align with these objectives. Measures to encourage walking (Mobility) enhance social resilience by increasing social interaction and fostering relationships between occupants (Gibberd, 2015). Similarly, a criteria for local facilities such as schools, retail, and recreation within walking distance (also under Mobility) would enhance social interaction as occupants would be more likely to build local relationships. The 'Local Facilities' criteria also enhances economic resilience as the local economy, local employment and a diversity in local incomes is supported.

The 'Goods' and 'Services' criteria of the BEST also have a number of criteria that enhance artificial system resilience. The 'Local' criteria for both of these enhances economic resilience as procurement of local goods and services are promoted, supporting a diversified local economy (Gibberd, 2015). This criteria also enhances social resilience as relationships between people are supported. The 'Shared Use' criteria within the BEST requires shared-use-facilities such as libraries, equipment hire/libraries and carpools to be in place (Gibberd, 2015). Shared-use-facilities within the local area can support economic resilience as the cost of starting and running a business is reduced supporting increased diversity of local small businesses and a wider range of employment opportunities. Social interaction at the shared-use-facilities can also enhance social resilience by encourage local relationships and social interaction. Finally, the criteria for 'ICT' could enhance local economic and social resilience by ensuring there is local low cost high speed access to internet and computing facilities. Lower costs and improved access to information can enhance economic resilience by reducing overhead costs and improving the competitiveness through increased access to economic opportunities and partners. Access to ICT may also enhance local social resilience by supporting relationships, for instance, through social media, as well as by providing improved access to information about local events, services and products, that could lead to local relationships.

The 'Health' and 'Education' criteria in the BEST may also enhance artificial systems resilience by placing an emphasis on local facilities that enhance education and awareness as well as health and wellbeing. Education facilities, such as crèches, primary and secondary schools, libraries, and ongoing learning centers within walking distance are likely to enhance social interaction and relationships between children, between parents and between adults enhancing their education (Gibberd, 2015). This will also enhance economic resilience as the these type of local education facilities can be more responsive to local business needs,

enhancing the competitiveness of local businesses. Local education facilities also increase diversity in local employment and incomes enhancing local economic resilience.

Health and wellbeing facilities, such as local sports and recreation facilities, clinics, healthy food retail promote local social interaction and relationships, enhancing social resilience. These facilities also represent increased economic diversity and opportunity enhancing economic resilience. Within 'Health' there are also 'Hazards' criteria which requires the neighborhood to address, and avoid, any hazards that may affect health or wellbeing (Gibberd, 2015). Thus, measures in the neighborhood would have to ensure that hazards, such as crime and car accidents as well as natural disasters, such as flooding, would have to be avoided. This criteria directly enhances social and economic resilience. Reducing fear, for instance, of crime, within the neighborhood could increase walking and social interaction enhancing social resilience. Avoiding the costs of impacts, such as crime and natural disasters, could also reduce the overheads of businesses, who would not need to invest in measures to combat crime and disasters such as flooding, enhancing economic resilience.

6. Discussion

The Built Environment Sustainability Tool is one of a range of tools that addresses neighborhoods. Others include BREEAM Communities, LEED-NC and Cascadia, as shown in table 2. The BEST takes a significantly different approach to these tools. Firstly, BEST by being linked to the WWF definition of sustainability, and HDI and EF targets, has a clear framework by which criteria are defined and targets set. This framework requires the BEST to ensure built environments 'provide the capability to enable occupants to achieve HDI and EF targets, defined in the WWF definition of sustainability'. Other tools appear to have less defined theoretical frameworks governing their development and the processes by which criteria, and their weighting, may be subjective and arbitrary (Sharifi and Murayama, 2013).

Other neighborhood tools generally have been developed in developed country contexts, for developed country neighborhoods. This leads to assumptions, that social infrastructure, such as local schools and clinics are in place. It may also include wide range of other assumptions such as; pavements and road crossings are in good condition and safe to use, there is a safe clean source of water, healthy affordable food is readily available, access to ICT facilities, such as the internet, is cheap and readily available, there are very low levels of crime, there are no environmental hazards, such as flooding and pollution, local employment opportunities are readily available and households have resources to pay for local schools and healthcare. In neighborhoods in developing countries, for instance, in informal settlements, many of these assumptions are incorrect. By avoiding these assumptions, the BEST recognizes the current state of neighborhoods, wherever this may be, and provides a way of improving this. This makes the tool much more applicable and useful for developing country contexts (Sharifi and Murayama, 2015).

Table 2: Neighborhood sustainability assessment tools (adapted from Sharifi and Murayama, 2013)

Neighbourhood Sustainability Assessment Tools	Country
LEED-ND	US
ECC	US
BREEAM Communities	UK
CASBEE-UD	Japan
Qatar Sustainability Assessment System (QSAS) Neighborhoods	Qatar
Green Star Communities	Australia
Green Mark for Districts	Singapore
Green Neighborhood Index (GNI)	Malaysia
Neighborhood Sustainability Framework	NZ
HQE2R	EU
Ecocity	EU
SCR	Australia
EcoDistricts Performance and Assessment Toolkit	US
Sustainable Project Appraisal Routine (SPeAR)	UK
Cascadia Scorecard	US

It is interesting to note that the BEST does not incorporate the direct building adaptations and it appears that this is an area that could be addressed in an update of the tool. In particular, neighborhood level measures of improving physical resilience, such as Sustainable Urban Drainage (SUDS) systems, could be integrated into the tool (Woods-Ballard, *et al.*, 2007).

The tool however, appears to be very successful at addressing ‘Enhancing Natural Systems Resilience’ and ‘Artificial Systems Resilience’ as a result of the numerous criteria related to achieving low ecological footprints and minimum Human Development Index performance. The emphasis of ‘local’ in the tool seem to be a particularly valuable mechanism for this. An emphasis on local bio capacity and agriculture directly support natural systems resilience. Similarly, the focus on provision of a diverse range of facilities within walking facility directly enhances social and economic resilience (Tight *et al.*, 2011).

Conclusions and Recommendations

The onset of climate change has confirmed that built environments and urban areas are inadequately prepared. Existing built environments have not been designed for projected

climate change and design guidance and tools have not been updated to ensure that this is addressed in new built environments. This urgently needs to change. The study demonstrates how a simple assessment framework can support a process of addressing resilience and adaptation to climate change in built environments. Application of the framework to the Built Environment Sustainability Tool (BEST) indicates that it does not adequately promote direct building adaptations for climate change. However, it also demonstrates that tool includes criteria which directly enhance natural and artificial systems resilience. It is recommended that future updates of the tool include support for direct building adaptations for climate change and refine existing criteria that enhance local natural and artificial systems resilience. This will ensure the BEST responds to changing environment continue to support the pivotal role of neighborhoods and the facilities housed within them can play in supporting sustainability performance (Williams, 2007).

Acknowledgements

This work is based on the research supported in part by the National Research Foundation of South Africa (Grant Numbers 103996).

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Privatisation of urban public spaces and its impact on sustainable cities and social inclusion

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Abstract

The privatisation of urban public spaces (UPS) raises questions about the sustainability of urban settings and the impact that privatisation has on social inclusion and access to urban land and well developed public spaces. This paper reports and discusses findings from a critical review of local and international literature on the privatisation of UPS. Although cities partner with the private sector in the planning, development, maintenance and management of UPS in attempt to build socially cohesive, environmentally friendly, and economically competitive cities, the review findings reveal that privatisation is associated with the decreasing 'publicness' of UPS and shortcomings in the fulfilment of social and political responsibilities. Some of these shortcomings are the result of cities using privatisation as a vehicle for economic development and financial revenue and not necessarily incorporating all sustainability attributes in terms of city planning and development. This paper argues that local authorities, city planning decision makers and the interests they are pursuing, influence the sustainable and socially cohesive design of cities.

Keywords: Privatisation, Inclusivity, Sustainability, Public spaces.

1. Introduction

The focus of this paper is on privatisation of UPS and the impact that privatisation has on social inclusion and sustainable spatial settings in urban areas. Privatisation of UPS is conducted through the formation of public-private partnerships (PPPs). These partnerships are a global phenomenon and with reference to UPS the model on which they are based is often termed a business improvement districts (BID) model. More often some cities with inadequate financial capacity to attract and maintain investments and tourists would partner with the private sector in the planning, development, and maintenance of UPS (Fredua, 2017). This is supposedly meant to build socially cohesive, environmentally friendly, and economically competitive cities as these attributes have become key essentials for sustainability. However, the criteria or strategic position for these cities in initiating such partnerships would not necessarily incorporate all sustainability attributes in terms of city planning and development. Some of

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them would focus more on economic development and financial revenue (Wang, 2018), leading to environmentally and socially unfavourable outcomes.

Land resource allocation in planning is associated with institutional arrangements (Wang, 2018). In other words, each and every development taking place in any city has to be approved by local government which must also take responsibility for it. However, the BID model that cities use has been strongly criticised for weakening the publicness of UPS. It has been argued that it restricts social interaction, constrains individual liberties, and excludes undesirable populations (Fredua, 2017). Public exclusion, gentrification and redundancy of certain public authorities in service delivery are some of the concerns raised in the literature in regard to the sustainability and publicness of urban settings. This paper reports and discusses findings from a critical review of local and international literature on the privatisation of UPS. It begins by briefly explaining public-private partnerships in the form of UPS development, management and maintenance and the different forms of these partnerships, placing them within the context of UPS. It explores the impact of UPS privatisation on social inclusion and sustainability. The paper aim to offer new insights into the UPS conundrum.

2. Research Methods

This paper is an outcome of a critical review of literature exploring both national and international perspectives on the subject. The objective of this paper is to investigate the impact that the privatisation of urban public spaces has on the attainment of inclusive and sustainable urban settings. In order to achieve this objective, a detailed review of the related literature was conducted. The authors believe that as much as BID's or PPPs are advantageous to some degree, certain elements of sustainability aren't incorporated in these initiatives especially taking into consideration the public opinion thus creating a discourse in the public realm. Literature spanning almost a decade from 2010 to 2019 was included in the study.

Review materials were sought from electronic data bases and search engines including Google, Google Scholar, and Academic Search Complete, Scopus, University of Johannesburg library and Research Gate. The key words and phrases as listed in the abstract were used and various sources such as journals, conference proceedings, books, theses and dissertations were reviewed based on their relevance to the topic and currency. The study is conducted within the qualitative research paradigm. Data was analysed and synthesised through a comparison of deferent scholarly view points from deferent fields of study in attempt to elicit criticisms and gaps in the implementation of public-private partnerships for the planning, development, and management of urban public spaces.

3. Literature Review

Urban public space literature is indicative of deferent alternative forms of public space management and ownership. Most of these forms are based (De Magalhaes, 2017) on transfer and contracting-out of managerial responsibilities from the public hand to organisations outside the public sector. Whether these forms are in the shape of (De Magalhaes, 2017) Business Improvement Districts, Town Centre Management schemes, land development trusts, community asset transfers or the contracting-out of managerial tasks to private companies or voluntary sector organisations under a variety of arrangements. The question of whether privatisation of UPS does integrate the urban poor or not is fundamental for the purpose on this study.

3.1 *Placing PPPs in the context of UPS*

With the underlying pressure that cities find themselves in due to globalization, they attempt to bid for the highest order in terms of attracting and maintaining both national and international investments and tourists. In so doing, it becomes imperative for them to build socially cohesive, environmentally friendly, and economically competitive cities as these attributes have become key essentials for sustainability. However, not every city has the adequate financial capacity (Fredua, 2017) to undertake and achieve such goals. Some cities will resort to the formation of public-private partnerships (PPPs), what Eick (2012) often refer to as 'urban entrepreneurialism'. Cities partner with the private sector in the planning, development, maintenance, and management of public spaces (i.e. parks, streets, inner city precinct, etc.).

Public-Private partnership is defined as 'any arrangement between government and the private sector in which partially or traditionally public activities are performed by the private sector' (Forrer et al, 2010). This is a very broad definition that accommodates a variety of arrangements, from contracting out to the use of vouchers. To try and narrow this definition down to urban infrastructure, Brinkerhoff (2011) defines PPPs as 'a form of structured cooperation between public and private partners in the planning, construction and / or exploitation of infrastructural facilities in which they share or reallocate risks, costs, benefits, resources and responsibilities'. These can further be defined as space management models (Abhilash, 2016) used to integrate the existing isolated hybrid spaces in to the city fabric, and to create new integrated system of public space network.

PPPs have long been advocated and analysed as organisational solutions to pressing societal problems that call for the comparative advantages of government, business, and civil society. Often these partnerships are initiated and accelerated (Forrer et al, 2010; Hui, 2010; smith, 2018; De Magalhaes, 2017; Peyroux, 2012; Gomes, 2019) due to government experiencing fiscal deficit and look for alternative ways to finance and deliver government services.

However, it can be argued that governments often embark upon such arrangements without significant and genuine engagement with communities, citizens and users who will ultimately benefit from the facilities or services being delivered (Hui, 2010). By so doing, governments are creating spaces that are often referred to as 'white elephants'. Meaning spaces that the community don't see value in or are not conducive to the society leading to underutilization or redundancy. It is believed that community engagement is key in the development and management of UPS.

3.1.1 Forms of PPPs in the context of UPS

Among a number of public-private partnerships as mentioned above, Business Improvement Districts is one form of PPPs (Peyroux, 2012) and privately owned public space (POPS) is another (Cao, 2017). The former focuses more on governance arrangements regarding security and policing and social control (Peyroux, 2012), while the latter focuses more on development and regulation (Zamanifard, 2018), ownership and management (Cao, 2017) of UPS. Because the space is owned and managed by private owners, it is termed privately owned public space (POPS). This paper explores how advancements in these partnerships impact the city spatial form in relation to sustainability and inclusivity.

3.1.2 Business Improvement Districts (BIDs) Model

In many countries across the world (Peyroux, 2012; De Magalhaes, 2017; Smith, 2018) BIDs are seen as a new model of sub-municipal governance to secure private capital to improve the attractiveness of UPS. Originating from North America and has spread to other countries including South Africa, this model is often based on PPPs what Peyroux (2012) often refers to as a model of self-taxing districts. Existing literature reveals that in relation to the BIDs model, particular attention has been paid to two factors such as 1) governance arrangements regarding security and policing and 2) social control particularly in terms of exclusion and discrimination (Peyroux, 2012). The prime objective of this model according to Peyroux as much as it has largely been criticised by a number of researchers, is strengthening global competitiveness of the city. In contrast, other scholars are of the view that existing institutions such as local authorities lose their significance when such model is implemented. They have a view that societal or economic processes are more easily achieved through BIDs than traditional public governance. Some of the local government strategic responsibilities such as land use planning BIDs also intervene (Peyroux, 2012; De Magalhaes, 2017).

Smith (2018) in his study for commercialization of public spaces describes BIDs as a radical way of governing UPS and emphasize that this model is applied to gentrify these spaces and reclaim them from undesirable users. However, he also encapsulates an opposing position taking from his study that focuses on urban public parks that, using parks for events helps

cities to promote attractive images to external audiences, but this is not always compatible with everyday uses. Of the same opinion is Marquardt (2012) who suggests that studies on gentrification has documented the often profound changes for local neighbourhoods resulting from the reorientation of buyers, developers and city planning. BIDs contribute to the production of space in a wider sense, shaping the public imaginary of urban neighbourhoods (Marquardt, 2012).

In this instance public exclusion, gentrification, redundancy of certain public authorities in service delivery are but a few of the outstanding factors negatively affecting sustainability and the publicness in urban settings. In contrast, contracted-out management of UPS (De Magalhaes, 2017) might not necessarily affect publicness negatively. Contracting-out management of UPS requires carefully designed accountability mechanisms and clear decisions by all key stakeholders, including local authorities, about whose aspirations will be privileged and how other aspirations should be protected.

3.1.3 Privately Owned Public Spaces (POPS)

The current neoliberalization of cities has made UPS increasingly commodified and privatised (Cao, 2017; Nemeth, 2011). In developed countries, cities that are both sites and objects of capital accumulation increasingly use market mechanisms and relies on PPPs to offer publicly accessible spaces. These cities partner with private property developers to develop and managed public spaces. This is done through the use of zoning concessions, where private property developers are encouraged by local government to offer more public space on the ground level of their high-rise developments in exchange with bonus space or exceed height or bulk limits of their developments. The space is owned and managed privately but for public use, therefore for this reason it is termed privately owned public space (POPS). This is a confused term meant to describe a confused arrangement of operations. It leaves ample ambiguities in its regulation and management.

Its public accessibility and usability (Cao, 2017) depend on evolving policies, maintenance and management by private property owners, and the public's perception and uses. POPS or so-called bonus space is a type of public space by mutual beneficial collaboration between the public and private sectors (Yoon, 2016). UPS advocates have questioned whether the trade-off between these two parties is equitable. Many authors perceive POPS to be diminishing the 'publicness' of UPS by restricting social interaction, constraining individual liberties, and excluding undesirable populations (Nemeth, 2011). it can be argued that the use of POPS leads to increased control over use, behaviour (use of surveillance and policing techniques) and access to UPS.

3.1.4 Privatisation of UPS and its effects

Fundamentally, to privatise means (Chiodelli, 2015) literally to transfer ownership and control from public to private hands. Is that the case with UPS, if so can they serve the purpose to which they were intended for? These are some of the questions this paper seeks to address. The debate on public space that emerged in the 1990s is structured around 'narratives of loss' claiming the 'end of UPS' (Gomes, 2019; De Magalhaes, 2017; Smith, 2018). The end of UPS in South Africa and in many other developing countries across the world raises concerns in a number of researchers. Cao (2017) postulates that genuine UPS not only diminishes gradually but also falls prey to sensitive surveillance and control. Privatisation of UPS allows the private actor to exercise dominion over the spatial jurisdiction and employ restrictive and prohibitive measures to limit other public space users from access (Fredua, 2017, Abhilash, 2016). With that in mind, it can be argued that privatisation decreases the 'publicness of UPS' and can be associated with shortcomings in the fulfilment of their social and political responsibility.

Gomes (2019) is of the view that privatisation of UPS implies an effort of replacing pre-existing practices and users (i.e. local authority's responsibilities), apparently reflecting patterns of exclusion and displacement. Gated and exclusive communities are a very good example of exclusion and displacement (also known as gentrification), fuelled by security concerns (Smith, 2018). Although it can be argued that UPS remain largely the property of the state. Privatisation is not the result of a coherent political strategy for UPS, rather, it is the result of opportunistic tactics from both the municipality and the private actor. Privatisation (Gomes, 2019) becomes more likely as the encroachment of private interests in UPS increases. With regards to party interests, Tang (2018) posit that privatisation is a key idea of neoliberalism, which also advocates individualism. Both these parties that enter into a contract have their own interests they are pursuing which in most cases disregards that public interest. In contrast, Abhilash (2016) believes that the development of active UPS is possible through the management model such as POPS through PPPs.

4. Findings

In this section a thorough comparison of deferent scholarly view points from deferent fields of study in attempt to elicit criticisms and gaps in the implementation of public-private partnerships for the planning, development, and management of urban public spaces was conducted. Based on the review of the related literature conducted in the sections above and for the reason that UPS literature is indicative of deferent alternative forms of UPS management and ownership. The study evidence that most of these forms are based on transfer and contracting-out of managerial responsibilities from the public hand to organizations outside the public sector. Whether these forms are in the shape of BIDs, Town Centre Management schemes, land development trusts, community asset transfers or the

contracting-out of managerial tasks to private companies or voluntary sector organizations under a variety of arrangements. One important finding is that privatisation of UPS does not integrate the urban poor. Another interesting finding is that some of UPS advocates refer to these forms of partnerships as urban entrepreneurialism. It can be argued that these forms of partnerships are created in order that cities share or reallocate risks, costs, benefits, resources and responsibilities with the private sector. However, this does not necessarily benefit the communities and users.

It is interesting to note that some authors perceive that oftentimes PPPs are initiated and accelerated due to government experiencing fiscal deficit and look for alternative ways to finance and deliver government services. However, in so doing, governments often embark on such partnerships without significant and genuine understanding of public participation. Thus creating spaces that excludes the poor or at worse creating spaces that the community does not see value in them or are not conducive for the society leading to underutilization or redundancy. In this instance public exclusion, gentrification, redundancy of certain public authorities in service delivery are but a few of the outstanding factors negatively affecting sustainability and the publicness in urban settings. Another significant finding is that some authors do not really perceive PPPs as a challenge, rather an opportunity. Literature revealed that contracting-out management of UPS requires carefully designed accountability mechanisms and clear decisions about whose aspirations will be privileged and how other aspirations should be protected by all key stakeholders, including local authorities.

It is also very interesting to note that a large number of authors have identified the negative impact that privatisation of UPS has on city sustainability and social inclusion. PPPs are for the benefit of only the two parties involved (governments or the private sector) excluding the beneficiaries or users. This exclusion then results into compromised publicness, accessibility and usability of these spaces.

5. Sustainability and Social Implications

“Urban space production in private regimes is considered profit-driven and often geared towards exclusionary spaces that are oriented towards specific use and users. The urban spaces that are produced are spaces of order and control, of aesthetic homogeneity and uniformity. They form enclaves of predictability and serve as places of retreat for wealthy people who want to avoid encounters with differences” Devereux, 2017

Looking at UPS as an inherently social concept, we can draw attention to how UPS is always negotiated, defined, and redefined by different scholars. Beyond the physical reality of UPS lies an inherently social nature that influences people’s actions and relationships they have or

might have towards one another. UPS as a social concept allows us to examine these sustainability and social implications. As people move in space every day, space tends to influence and direct their movement, behaviour, and even their way of thinking. The frequency of spatial restrictions that are found in UPS and their effect on society leads to social divide and social behaviour. Local authorities, city planning decision makers and the interests they are pursuing, influence the sustainable and socially cohesive design of cities. Also how UPS are managed and regulated is key, not who manages and regulates them.

If marginalised groups seem to be less welcome to certain public spaces than others, social cohesion would remain a 'pie in the sky'. Public spaces should be equally accessible to everyone, regardless of their social status, purchasing power, age, gender or abilities. By regulating behaviour in UPS, spatial segregation undermines people's right to move freely in cities. It regulates not only certain types of activities or behaviour, but also general social behaviour by directing people's movements and influencing their ways of behaving and thinking. For this reason, urban public spaces will not serve the purpose to which they were intended for.

6. Conclusions and Recommendations

This paper has highlighted privatisation of urban public spaces and the impact that privatisation has on social inclusion and sustainable spatial setting of urban areas. The study identified that privatisation of UPS is done mainly through public-private partnerships. These partnerships would be in the form of business improvement districts or privately owned public spaces. The BID model focuses more on governance arrangements regarding security and policing and social control, while the POPS focuses more on development and regulation, ownership and management of UPS. These two commercialization / privatisation models are arguably focused more in pursuit of individual interests of the parties involved resulting in the exclusion of the users or inhabitants.

Results indicate that advancements in these partnerships impact the city spatial form in relation to sustainability and inclusivity. Public exclusion, gentrification, redundancy of certain public authorities in service delivery are but a few of the outstanding factors negatively affecting sustainability and the publicness of UPS in the urban setting. The study further reveals that the introduction of these commercialization models has done nothing but increased control over use, behaviour (use of surveillance and policing techniques) and access to UPS.

7. Recommendations

Public participation for UPS transformation: Local authorities should develop neighbourhood level and city wide public participation programmes aimed at rejuvenating

UPS. Local authorities should make resources available for the two levels of public participation. Firstly, at neighbourhood level, a detailed stakeholder analysis should be undertaken prior public participation processes so that all interest and vulnerable have adequate representation and voice. Secondly, public participation should be sensitive to local languages and availability of elderly people including requirements of those living with disabilities.

Business operating models for UPS: While it is recognised that local authorities face deficit challenges to manage and maintain UPS in order to provide basic services, the complete commercialization or privatisation of UPS is not the only solution. This is particularly true for developing countries with high levels of inequality and urban fragmentation. For local authorities to realise the combined outcomes of UPS, self-reliance and social cohesion hybrid business operating models should be explored. These may include cooperatives, partnerships with schools of Built Environment and Real Estates in university towns, partnerships with institutions that advance public interest such as Non-Governmental Organisations, Churches and development finance institutions instead of private individuals and companies who exist for personal gain as a business motive.

Social development performance indicators for PPPs: In instances where local authorities have already entered into long-term agreements with private organisations for the management and maintenance of UPS, the contracts should be reviewed to incorporate social development performance indicators. These indicators may include practical measures to increase access to vulnerable and historically disadvantaged groups in society; shareholding and company board management with intention to increase publicness of UPS entities.

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The rural school as a place for sustainable community development

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Abstract

The South African democratic struggle realised the demise of apartheid and the ultimate defeat of unfair practices, and it promised freedom, transformation and development for all citizens. Twenty-five years into democracy, however, for a large section of the population that struggle continues. Rural communities in South Africa face various obstacles such as poor service delivery, unemployment, spatial challenges, poor education, division among classes, and social exclusion. In rural communities, the rules of engagement differ from those in urban areas. Communities in rural areas also suffer from sub-par education, which leads to unemployment and negative economic growth in its spatial context. Social gathering spaces in rural areas are generally located at schools, which act as quasi-community centres. This raises a critical question: how can the rural school enhance the socio-economic sustainability of rural communities?

This research examines various literature sources in order to understand the challenges facing rural communities, rural schools spatial programmes and factors influencing economically and socially sustainable development. Various sources reviewed reveal a lack of decent infrastructure, poor educational systems and mindsets that negatively impact sustainable economic and social development in rural communities. The paper argues that the adaptive reuse of space in the rural school can create a vital socio-economic hub for the advancement of education, culture and micro enterprises in rural communities. Through the literature review the authors highlight the pertinent issues facing South African rural communities and possible measures that can be implemented to successfully contribute to growth and sustainability. The paper aims to redefine design thinking for the sustainable transformation of rural schools as socio-economic communal hubs.

Keywords: architecture; community; rural schools; social sustainability; South Africa.

1. Introduction

Twenty-five years into democracy, South Africa still faces various challenges left behind by the apartheid regime. One such challenge is the physical planning of towns and cities which has remained almost unchanged, due to the in-situ infrastructure. The issue of rurality remains a physical, economic and social struggle in democratic South Africa. Although the country's leaders profess a free and equal society, this is far from true for most South Africans facing the various issues of rurality.

Rural areas operate in a different style to urban areas and the day-to-day needs differ. In rural communities, access to basic services and infrastructure is difficult, leading to a downward spiral of the micro-economy. However, rural communities are resilient, and creative methods

of living are often adopted. Numerous ideas are conceptualised in rural areas, making them powerhouses of innovation. When northern Malawi faced its worst droughts that led to famine, thirteen year old William Kamkwamba invented a windmill which brought electricity and water to his village (Mealer & Kamkwamba, 2010). Kamkwamba's innovation is an inspirational example of the resilience of rural communities.

The issue of sub-par education in rural areas is also a stark reality. However, this is not solely a South African problem. According to Hlalele (2012:113) rural areas of Australia, China and the United States face similar problems in rural education. He describes the phenomenon as “out of sight, out of mind”, as rural communities are often forgotten. Although the government has introduced various strategies to boost schooling infrastructure, the poverty of education can be inextricably linked to infrastructure, unemployment, nutrition, exercise and wellbeing (Nelson Mandela Foundation, 2005:132).

The South African National Development Plan calls for South Africans to have compulsory education up to matric, or equivalent vocational training. Furthermore, by the year 2030 learners must have access to the highest possible quality of education, comparable to international standards for countries of similar development (NPC, 2010:296).

Consequently, the South African government has promulgated policies outlining various strategies to achieve these goals. One such policy is the Rural Education Policy, gazetted in January 2018. The policy aims to improve access to, and the quality of, education in rural schools, utilising the strengths of the communities (Department of Education, 2018:22). Furthermore, the policy recognises the need for social cohesion which can transform the rural economy. A key question, however, is how can this be achieved?

According to Abotsi, et al. (2018:11) factors leading to dropouts in schools include, but are not limited to: poverty; low level of parental education; poor attitude of both students and teachers; and long distances to schools. Although there is a high dropout rate in rural schools, children who eventually move to cities to find jobs indirectly contribute to the micro-economy of rural communities. However, rural communities also hold their own skills and resources to drive their local economy (Hlalele, 2012:113). Within communities it is understood that education and training promote progress and can ignite innovative approaches. While communities have the potential to grow, however, what infrastructure supports their growth?

A school makes a community, it is the binding element that keeps the community together. Malhoit (2005:10) points out that:

The school is the most important public institution in a rural community, a rallying point for services to poor families and children, a polling place, the library, and the community center. Rural schools also represent the economic lifeblood of the community.

The rural school is seen as a quasi-community centre and focal point of the community in terms of infrastructure. This paper discusses the importance of school infrastructure and develops the narrative of a rural school being a place for sustainable community development.

2. Literature Review

2.1 Spatial justice in a South African context

The 1994 South African elections heralded the birth of a free and fair country. Twenty-five years later, however, South Africa still struggles to deliver on the promises of socio-economic redress and spatial transformation. In recent years, South Africa has faced tremendous challenges pertaining to spatial justice and the redistribution of land. Although this may seem to be a South African problem, in fact it is also a global problem. To understand the spatial issues currently facing South Africa, the authors position this study within the conceptual framework of spatial justice.

According to Soja (2009:1) the term “spatial justice” is often not used explicitly by geographers and planners and is almost watered down into terms such as “territorial justice” and “environmental justice”, or to even more generic terms such as “just city” and “just society”. He further affirms that spatial justice must be linked inextricably to physical geography and the term will not suffice using other formats (Soja, 2009:1). Furthermore, Soja (2009:2) reinforces that spatial justice is the fair and equitable distribution of socially valued opportunities and resources in space.

Another position is presented by Marcuse (2009:3) who understands the term “spatial justice” as a derivative of social justice, placed in a physical location. He further argues that “social (in)justice” occurs before space is involved, steering the theory into a social agenda.

Although the opinions of both Soja and Marcuse differ slightly, the central issues are fair and equal distribution of valued social resources and opportunities. It must be understood that spatial and social (in)justice have occurred in the South African context due to the policies of apartheid (Adegeye, et al., 2018:2). The authors focus on rural communities where injustices of the past are most prevalent. Although spatial justice is a key driver of injustice in rural communities, what hardships do rural communities face? In the next section, the authors examine the common issues facing rural communities.

2.2 The issues of rurality in South Africa

Defining “Rural”

The word “rural” has a stubborn reference to geography that is used in common definitions: a place or space located outside a developed city, or a view of the countryside (Hoggart, 1988;

Halfacree, 1993; Cromartie & Bucholtz, 2008). The mind's eye definition of rural then becomes a farm or a place that is not densely populated or even a place that is sparsely built. However, this definition needs to be refined and a more succinct meaning is required. According to Sauvageot et al. (2007:15-17) the word rural has many facets. It includes the area or landscape, the density of the area, classification by the municipality according to inhabitants, access to services, economy and employment statistics. It is argued that the definition of rural is still unclear (Sauvageot et al., 2007:15). The authors of this paper, however, assert that rural should be defined according to the various facets presented by Sauvageot et al. (2007:15) and further include ideas of social theory relative to the context of rural.

Poverty

One of the most evident complications of rurality in South Africa is poverty. According to Fransman et al. (2019:50) a key objective of the South African government after the end of apartheid was the alleviation of poverty, and the reduction of disparities and imbalances of the past. Various programmes were put in place to achieve this goal, for example: the Reconstruction and Development Programme (RDP); Growth Employment and Redistribution (GEAR); and the National Development Plan (NDP) (Fransman et al., 2019:50). However, the issue of poverty still exists and rural poverty is still a major challenge. According to Malhoit (2005:11) the term "rural" is often associated with poor.

He further states that the instance of child poverty in a rural setting is much higher than in an urban setting. In rural areas there is lower quality health care, lack of satisfactory housing, suitable nutrition and acceptable child care (Malhoit, 2005:11). It is almost impossible to unlink issues of poverty from the term "rural"; and this is not exclusive to South Africa.

The economy of a rural place has drastic bearing on the community; it is for this reason that the authors posit that driving economic growth in rural areas will lead to socio-economic sustainability within its context. Although poverty is a challenge in rural areas, various other factors contribute to rurality; this is discussed further in this section.

Social and Community Capital

In rural areas, social and community capital play an important part in the cohesion of the community. In essence, social capital is a combination of two words, "social": a gathering of people or the act of living with other people and "capital" which is an invested resource which has power in the form of returns from a market place. Social capital can therefore simply be defined as the social assets, interpersonal relationships, institutions, innovative ideas, financial support, and information of a social group or community. However, it must be understood that

the formation of social capital occurs in a group or a network; it is far removed from individualism (Rivera et al., 2018:67). According to Bourdieu (2018:51):

Social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition - or in other words, to membership in a group - which provides each of its members with the backing of the collectively-owned capital, a 'credential' which entitles them to credit, in the various senses of the word.

Social capital, is in fact a resource amongst a network of people, such as rural communities. According to Van der Ploeg et al. and Von Munchhausen et al., social capital can be understood to be one of the key building blocks of what they call the "rural web" and argue that all these building blocks must come together to ensure that the challenges faced by rural economies can be overcome in a sustainable manner to assure their future prosperity (Cited in Rivera et al., 2018:67). Malhoit (2005:10) posits that while rural communities may face severe economic and social issues. "Community capital" is strong and this makes it an attractive place to live in and raise children, providing a strong commitment to protect and uplift children. However, there is a growing desire to move to the city when children eventually finish school and seek better opportunities. In the next section the authors discuss this topic.

Loss of the younger generation and an ageing population

One of the biggest challenges rural communities face is the loss of the younger generation and an ageing population for those who remain behind as part of the community. According to Fichtner and Masters, the issue of ageing societies has become an enormous social problem, not only in developed countries, but also in developing countries (Cited in Zou et al., 2018:437). According to McCracken et al. (Cited in Amanda, 2011:191):

Median values for indicators of social and economic wellbeing are commonly used to link the growth in older populations to negative social and economic outcomes for the broader population.

It is evident that an ageing population leads to economic downturn within an area and may very well be even more detrimental in a rural area with a low population. Malhoit (2005:11) states that rural communities are rapidly losing their population size and consequently the economy of that rural community suffers. He further states that the loss of young talent diminishes the community's ability to survive and prosper (Malhoit, 2005:11). It is understood that the loss of the younger population in a rural area is detrimental to its wellbeing; furthermore

an ageing population does no good for the socio-economic sustainability of the rural community.

2.3 Policy for rural schools in South Africa

The rural school is an important community asset, it adds to its social capital and is the one piece of infrastructure that is used often for various activities. However, various issues exist within the realm of rural schools. In this section the authors briefly explore policy issues.

Policy forms an important part of any institution. In South Africa, various policies in the domain of education were adopted after the advent of democracy. This paper briefly explores the policies of education and specifically rural education.

In 1994, the African National Congress (ANC) published: *A Policy Framework for Education and Training*, in which it explicitly acknowledged the need for intervention in rural and farm schools (ANC Education Department, 1994). Furthermore, in Part 6 of the document entitled “The Special Case of Rural and Farm Schools” the ANC government raised an important point:

Where possible, schools will operate as Community Learning Centres with a range of after-school activities linked to the social, educational, health and recreational needs of the community, linked to rural development projects. (ANC Education Department, 1994).

It is from this point that the authors lead the discussion on policy development for rural schools.

In early 2018, the draft policy on rural education was released by the Department of Education, 24 years after the ANC’s pledge for holistic community-based education infrastructure. This report includes several issues including but not limited to: context specific approaches; quality of education; inadequate resources; teacher shortages and dropouts; and on the positive side: community assets; indigenous knowledge systems; and communities’ sense of belonging. (Department of Education, 2018:8). The Rural School Policy aims to provide the following benefits:

- A high quality of education in line with the democratic principles of the constitution of South Africa and the 2030 National Development Plan initiative.
- A detailed financial implementation plan for rural schools.
- The Department of Basic Education is to monitor and evaluate the implementation of the Rural School Policy.
- The improvement of rural education by providing support services including but not limited to health, social development, transport and economic development.

- Interlinking the various levels of education into a holistic view of transformation where education mediates development (Department of Education, 2018:23).

The Department of Basic Education in fact has a strategy to implement the various solutions through policy. However, how will this be achieved through school infrastructure? In Section 3, the authors put forward their position in terms of uplifting a rural community through the development of school infrastructure, whereby the school becomes a community node.

2.4 Precedent Study: Gando Primary School

Francis Kéré, a native of Gando, Burkina Faso is a German trained architect. Kéré, grew up in a small village which had no school infrastructure, forcing him to move to a village 40km away to attend a school (Kéré, 2012:67). Gando has almost 3000 inhabitants and the illiteracy rate is 80%. Having no other choice, the inhabitants rely on farming to support themselves (Kéré, 2012:67).

After finishing school Kéré received a scholarship to study carpentry; thereafter he went on to study architecture (Kéré, 2012:67). While still at university, Kéré formed an organisation called Schulbausteine Für Gando (Bricks for Gando School) (Kéré, 2012:67). Kéré and his colleagues worked hard and obtained finance to build the new school, notwithstanding his knowledge acquired in Germany in terms of architecture (Kéré, 2012:67). Even though Kéré had gone to Germany, he returned to assist by designing and building a school in Gando using community engagement, sustainable building methods, as well as indigenous knowledge (Kéré, 2012:67).

Kéré reinforces that the building of the school was a true community effort, and states that most of the labour was supplied by the villagers (Kéré, 2012:68). In Gando, people use mud bricks which are shaped by hand and by using wooden frames. Using modern technology Kéré advanced this method by creating a machine handled by no more than two people (Kéré, 2012:68). This method clearly defines the advantage of using indigenous knowledge infused with modern methods. Kéré states: “The process has had other rewards, too. Many of the workers who have been trained on site have since found work as skilled labourers on construction sites beyond Gando”. (Kéré, 2012:68).

Even though the project was successful, Kéré and the villagers did not expect such a large turnout of students wanting to attend the school. Soon after this, Kéré began work on an extension of the school to provide for the needs of the community. In true community spirit, a women’s centre, library and secondary school were built using the similar principles learnt from the initial project (Kéré, 2012:71) (Figures 1 and 2).



Figure 1: Exterior view of the Gando school designed by Francis Kéré and built by the community (Source: <http://www.Kéré-architecture.com/projects/primary-school-gando/>)



Figure 2: Interior view of the Gando school designed by Francis Kéré and built by the community (Source: <http://www.Kéré-architecture.com/projects/primary-school-gando/>)

The Gando school project is an admirable example of community engagement that has benefitted the community through the production of infrastructure, inclusion and upgrading of existing skills, and creation of economic opportunities. Most importantly, it has benefitted the community in both social and community capital. Furthermore, Kéré has shown remarkable commitment to his village of Gando by returning and passing on the skills he learnt in Germany.

3. Discussion and Recommendations

3.1 School infrastructure as a place for sustainable community development

The authors position this research on spatial justice and the various issues faced by rural communities, i.e. poverty, social and community capital and an ageing population, in rural areas. Furthermore, existing policies for rural schools are investigated.

Spatial justice, as defined in the literature review, relates to fair and equitable distribution of socially valued opportunities and resources in space. South Africa, like many countries, has large amounts of spatial injustice. However, unlike other countries South Africa's spatial problems in the larger cities resulted from the spatial policies of the apartheid government. This left the majority of people living outside cities in demarcated zones. These areas lacked services, infrastructure and there was an overall absence of socio-economic drive. Lack of services and infrastructure in rural communities are pressing issues, and are contributing factors in classifying a rural area. Due to lack of services and infrastructure, areas suffer not only from poverty but also from the lack of social cohesion. The authors therefore position spatial injustice as a root cause of the various issues of rurality.

Poverty is another critical issue in rural areas. The nonexistent infrastructure is a contributing factor in economic downturn in rural areas; there is simply no place for economic activities. Nelson Mandela on many occasions reminded business representatives involved with rural areas that; "you can smell poverty when you visit many parts of rural South Africa" (Nelson Mandela Foundation, 2005:viii). This sentiment invokes a lasting image of rural poverty. Reviewing the precedent of the Gando School, the community through support from Kéré was able to generate an economy not only from the schools and other infrastructure they built but also through the skill they gained. This phenomenon is not exceptional. In fact, there have been cases of economic drive that have occurred in various other rural communities e.g. the case of William Kamkwamba and his windmill. The authors, with reference to the positive applications listed above, reaffirm that investment in infrastructural development will stimulate and promote the economic sustainability of rural communities.

Social and community capital should form an important part of any community, more especially rural communities where complex problems exist. Social capital can unite an entire community through working together for common benefit. Referring back to the community of Gando, its social and community capital increased due to the community working together for common benefit. The community benefitted from infrastructural investment, but also gained in terms of defining relationships and identity. The authors posit therefore, that social and community capital are of the utmost importance in a rural setting, providing more than mere physical or economic rewards.

The loss of the younger generation in a rural area is one of the most disheartening factors. When a youngster, who would have benefitted from the efforts of the community for his/her development and success, leaves a community, that social circle loses power and integration. Through Kéré's ambitious efforts to return and build a school for his community, it is evident that bringing back learned skills into the community strengthens it. The authors believe that this is one method of moving a rural community forward.

The South African Department of Education has made a great leap forward in terms of creating a policy for rural schools. This policy will see advancement of rural schools throughout South Africa, if implemented as detailed. The authors argue that, although this is an improvement, the policy lacks attention to the design of the infrastructure in which community activities will take place. It is critically important to understand that rural schools operate in a different way from their urban counterparts; it is for this reason that the design of infrastructure requirements differ.

3. Design Thinking

The authors of this paper, architects by profession, highlight the need for design thinking. In this section we describe briefly the need for rural schools to be flexible in their design.

A rural school can be viewed as a quasi-community centre. Schools in rural areas play various roles. A school can serve its primary function as a school or a secondary role such as a library, clinic, adult education centre, function venue, or voting station. It is a built place that facilitates various activities within a community.

The Department of Education has recently created policy taking into consideration the various roles a school plays; however the policy is silent on the design of school buildings. It is this silence that has motivated the authors to briefly recommend a few points on the design of schools. The principles of rural school design as quasi-community centres are listed below.

- Flexible and adaptable space in school buildings.
- Defensible courtyards for learning, convening and playing.
- Sustainable design towards net-zero status.
- Community gathering space such as a hall with pluralistic functioning.
- Community sports field and other sporting infrastructure.
- Library and information centre; dual use for students and community.
- Agricultural training and spaces for growing crops, for food security.
- Workshops for skills training.
- Cultural spaces.

Although a short list, these spaces are essential to the socio-economic sustainability of rural communities. The authors posit that if a design thinking method is employed, the rural school can truly be a place for sustainable community development.

4. Conclusion

The problem of rurality is not one that can be solved in a short space of time, however the key factors and policies considered can create a change of mindset in approaching the challenges

facing rural communities. The authors sought to describe the challenges affecting rural communities by using various theories, concepts, literature and precedent in an attempt to understand the issues. Although not every single issue has been emphasised, the discussion seeks to raise dialogue around the way in which rural schools can be designed to benefit the community through social and economic stimulation.

Acknowledgements

To all that contributed in time and effort, we thank you.

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The impact of women's participation in urban agriculture: A Case Kwasa Gardening Project in Gqebera Walmer, Port Elizabeth.

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Abstract

Poverty is one of the major challenges faced by a majority of citizens of South Africa today, even after twenty-five years of democracy. South Africa is still grappling with many issues which include, among others, a large section of the population which is still living below the poverty line with the most affected being women and children. Hence poverty alleviation is one of the key priorities for the government. Those the communities where the poor live do engage in projects that support poverty alleviation. Moreover there is assistance provided with skills development and provision of strategies for gaining greater financial freedom. In this paper, the focus is on the impact of women's participation in the Kwasa project which is an urban agriculture project providing poverty alleviation via a vegetable garden in Walmer Township. This research investigation has followed a qualitative approach which includes individual interviews using an interview schedule. To supplement the above, a range of relevant secondary sources were also consulted. The research objectives include investigation of the challenges facing the Kwasa Gardening Project. In the final analysis, this paper provides conclusions and recommendations aimed at resolving some of the problems that have been identified. The paper also aims to contribute meaningfully towards policy improvements in relevant spheres of government.

Keywords: Poverty, poverty alleviation, skills development, urban agriculture

1. Introduction

Firstly, this paper provides a brief historical background of the study, followed by an outline of the research objectives. Secondly, the research techniques employed in the study together with a discussion of the research ethics are outlined. Thirdly, the notion of poverty is explored in order to provide a conceptual framework for the study this in turn is followed by the literature review. Lastly, the paper outlines the research findings, together with conclusions and recommendations.

2. A brief historical background of the study

For many decades, poverty as a concept has been defined according to the conventions of the society in which it occurs. For example, Francis., Kanji and Braathen (2001) define poverty as the a lack of income and of basic services, while others argue strongly for a multi-

dimensional view of poverty which includes a lack of economic, social, political and environmental assets and resources.

According to the World Bank, poverty is measured in terms of humans' basic consumption needs or income required in order to satisfy those needs. In other words, poverty is basically an inability of individuals, households or community members to access sufficient resources to satisfy a socially acceptable minimum standard of living.

Post 1994 elections, a newly democratic South Africa is still grappling with the issue of poverty. Moreover the Eastern Cape Province remains one of the country's most poverty stricken areas. Walmer Township (Gqbera) is also grappling with the issues of poverty hence the focus of this research is on poverty alleviation here with reference to the Kwasa Gardening Project.

3. Research Objectives

The objectives of the study are as follows:

- to investigate the impact of urban agriculture projects such as Kwasa in terms of poverty alleviation in Walmer Township.
- to make appropriate recommendations for addressing some of the problems pertaining to poverty in Walmer Township (Gqebera) and in the Eastern Cape Province.

4. Research Methodology

The study has followed a qualitative approach which includes, among others, interviews and observations. According to Hammett, Twyman & Graham (2015) interviews are used to develop a detailed, subjective understanding by drawing on people's knowledge, memories and perceptions. Therefore, data were collected via in-depth unstructured interviews in order to ensure conversation flow and the freedom to move the conversation in any direction without being over-restricted by pre-planned questions. This has allowed the researchers the freedom to follow up on unexpected responses and room to explore different meanings and understandings. An interview guide was designed and utilized in order to pose relevant questions during the interviews at the Kwasa Gardening Project in Walmer Township in Port Elizabeth. The main focus was to investigate the challenges faced by women working on the Project.

According to Hammett et.al (2015) direct observations involve the recording of interactions, thoughts, reflections and behaviours in order to build up a picture of everyday life. Hence, in light of the above, data were also collected by means of direct observations. The researchers

collected data by visiting the project site and observing the participants in order to record relevant occurrences and behaviours. This enabled the identification patterns of behaviour relevant to the study. Although the observer intermingled with the participants but did not interact so as to protect the trustworthiness, reliability and ethical requirements of the research study. To supplement the interviews and observations, relevant secondary material including scholarly books, journals and other sources were also consulted.

Thirty-four people are involved with the Kwasa Garden Project. Group of ten women was chosen group for the research sample. These research participants are all involved in community projects aimed at alleviating poverty. The Kwasa Garden Project was chosen because it has been very actively involved in alleviating poverty in Walmer Township.

Ethical Approval for this research was requested and approved by the Ethics Committee within the Faculty of Business and Economic Sciences at the Nelson Mandela University. The researchers then proceeded with the research study by visiting the project site in order to collect data. Ethical considerations were also addressed. For example, the main ethical principles to be adhered to were explained and clarified. In addition a consent form with detailed information about the purpose and nature of the research was distributed. It was explained that participation was voluntary and that participants had the right to withdraw at any time and at any stage of the research study. The participants were fully informed about the principles of confidentiality, anonymity and transparency that would be adhered to throughout the process of the research study. Protection of the respondents' privacy would be ensured by not revealing their identities.

5. Conceptual Framework (Poverty)

The notion of poverty provided a conceptual framework to provide understanding of the prevailing conditions at the Kwasa Gardening Project. It was deemed to consider definitions of poverty from different scholars who have conducted research in this area. Kehler (2001), for example, defines poverty as the inability to attain a minimum standard of living. However, according to May, Woolard & Klasen (2000: 5), "absolute" poverty is the one that is easy to identify as it defines what is lacking and what is threatening lives: hence this absolute poverty can be eradicated, unlike relative poverty which is more difficult to quantify and identify.

Kane & Kirby (2003), on the other hand, define poverty in two ways: one being absolute poverty which refers to a set standard of living needed in order to sustain lives. This include

any inability of the poor to afford basic and minimal necessities such as food and shelter: hence absolute poverty exists when citizens are not able to adequately satisfy basic needs such as access to sufficient food, water, shelter and clothing in order to survive and sustain their households. Even though they make a distinction between absolute and relative poverty, as well as identifying other types of poverty such as seasonal and chronic poverty, Kane and Kirby (2003) also introduce a measurement of what they have termed “capabilities”. Poverty: this refers to an ability to live a life characterised by qualities that cannot be measured in monetary terms, such as a healthy life, an informed and knowledgeable life, a feeling of personal security and the ability to participate actively in society. They also believe that providing opportunities and increasing various capacities for the poor are sustainable strategies for eradicating poverty. Such strategies are especially important in rural areas where people face chronic poverty owing to high levels of unemployment due to lack of education and basic skills. Moreover because of these factors, people living in poverty are prone to crime, abuse and diseases which undermine their overall well-being.

Furthermore, the definitions of relevant poverty allow for the communities to be flexible in addressing pressing local concerns and worries, while the notion of absolute poverty allows for tracking of progress and comparing one area to another (Khumalo, 2013). However Khumalo (op. cit 2013) provide a different perspective by identifying other two forms of poverty, for example, “transient” poverty which is identified as a seasonal poverty, because it occurs due to seasonal conditions. For example, a state of sudden and severe poverty may be caused by natural disasters such as floods, earthquakes, and erupting volcanoes. An example of this kind of poverty occurred on the 26th of December 2004 when the Indian Ocean Earthquake and Tsunami caused widespread destruction with some of the most affected and hardest hit areas being Indonesia, Sri Lanka, India and Thailand. During that devastating time many thousands of citizens lost everything due to this natural disaster.

Moreover, Khumalo (2013) also identifies another form of poverty, i.e “chronic” poverty which occurs when generation after generation are trapped in a vicious cycle of poverty. Significantly one-half of the population of South Africa is trapped in such a chronic poverty cycle. For example, the majority of black families in South Africa have seen their great grandparents, grandparents and parents suffering the same fate and now find themselves lacking the means to satisfy their basic needs. Some of those who mired in poverty during apartheid now still find themselves trapped in a web of poverty that seems to get worse even in a democratic South Africa. In response to these kinds of endemic poverty, members of the Kwasa Gardening Project in Walmer Township have embarked on the strategy of growing vegetables with the view of creating some jobs and also feeding the poor within their community.

6. Literature Review

This section is divided into three sections: firstly, there is a discussion of research conducted on urban agriculture; secondly, the benefits of urban agriculture are outlined and thirdly, there is an exploration of strategies for poverty alleviation.

Urban agriculture has been introduced in a lot of poor urban communities in the form of community gardens. According to Hollard (2004) a community garden is a green space managed and developed by a neighbourhood community in which agricultural activities take place:-a community that engages in these kinds of activities can achieve a number of benefits, such as improved health and nutrition due to consumption of healthy food, reduced vulnerability to food insecurity, and creation of cash income due to selling of products - and thereby achieving some degree of poverty reduction by earning extra cash. This “community garden” strategy resonates with the current research study whereby women of Walmer Township came together and started a vegetable garden which aims to provide their households with improved health and nutrition of and also become a means of generating an income. Urban agriculture of this type has also proven to be an important tool for developing a sense of belonging as well as a sense of community cohesion that facilitates exchanges within the community. Community members involved in community garden projects get opportunities to share their lives, and can give each other advice. This is especially valuable for those who are from socio-economically disadvantaged backgrounds such as the members of the Kwasa Gardening Project in Walmer Township.

Hollard (2004), as also Duchemin, Wegmuller & Legault (2008) have argued that urban agriculture improves economic conditions as well as the health of poor and vulnerable families and, more specifically, women and children in these families. It combines agricultural issues with those of related to city development, and it has both a direct and an indirect impact on the various aspects of the community’s quality of life”. Further, Duchemin et al. (2008) explain that the introduction of urban agriculture is in line with the fight against food insecurity experienced by vulnerable, and often poor, urban populations. It can contribute to food justice and the creation of a more viable city by offering practical and applicable solutions to the kinds of problems raised by the urban context. Urban agriculture projects have also assisted in food expenditure savings as well providing a source of improved nutrition. Therefore is it important to consider the urban agriculture projects as being one of the many possible ways to alleviate hunger and poverty in poor urban communities and as a way of providing both economic and social relief.

Furthermore De Bon, Parrot & Moustier (2010: 22) have identified three characteristics of urban agriculture: (1) the social role of urban agriculture in relation to the urban population

growth; (2) The economic functions of urban agriculture and the emergence of its multi-functionality: for example urban agriculture contributes fundamentally to the livelihoods of the urban poor and it is sometimes a source of food in terms of both self-consumption and purchasing of the products and (3) The constraints and the risks of developing an urban agriculture for human consumption. This basically means on top of playing a part as a source of urban food supply, urban agriculture also plays multiple roles in terms of its environmental, social and economic functions.

7. The Benefits of Urban Agriculture

According to Battersby & Marshak (2013: 450) the urban agriculture in the form of garden projects has proved to have certain benefits: firstly, the individual benefits as it provides a sense of self-worth and self-confidence, psychological security and well-being due to its being able to create a sense of place and greater stability for the immigrant population. It also has a way of alleviating some of the distancing aspects of modern lifestyles, especially for people from rural areas. Secondly, the community benefits as garden projects can provides opportunities for connecting people and places. For example, it has been known to change people and places and people's relationships with the spaces in which they live as it raises community development through the use of shared spaces, experiences, tools and skills. In many communities it is used to create empowerment amongst its members as it has the power to transform communities and neighbourhoods by enhancing neighbourhood pride and helping to change the way community members feel about their community and their environment. Thirdly, there are also certain potential social benefits: for example, urban agriculture can also enhance the social life of the community members as they become important social centres where people can come together for social events, make friends and discuss their problems and concerns and share new ideas. Fourthly, there can be safety benefits, for example, improving urban safety by providing a safe place, especially for women and children who can now have a place to play away from the harsh and dangerous realities of street life, especially in low socio-economic environments.

Owing to all these potential benefits, urban agriculture, in the form of community garden project, is viewed as a potential powerful development tool to use, and to understand how poor people survive in urban areas. And most urban agriculture projects can play a pivotal role in both poverty alleviation by improving household food security and nutrition, and in economic development by providing economic activities that can contribute to job creation and income generation.

8. Poverty Alleviation

According to the World Bank (1990) & Motlounq & Mears (2002) educating a child of the poor can greatly improve their chances of escaping poverty, and youth training schemes can also make a meaningful contribution to combating poverty, provided that employment opportunities are available or that entrepreneurial skills are further developed. Martin & Hulme (2003) have argue d that poverty alleviation takes the form of either livelihood protection or livelihood promotion: the former reduces the vulnerability of the poor and the latter increases their income, productivity and employment prospects. South Africa's urban population has grown rapidly in the past 23 years and this is partly due to the results of high rates of both natural growth and rural to urban migration which is a natural process in which labour is withdrawn from the rural sector to provide the labour needed for urban industrial growth.

Boaduo et al (2009) have an unconventional approach regarding solutions for alleviating poverty: their suggestion is to look at the potential that the old people can have in helping to reduce poverty. For example, they look at the potential contribution that senior citizens can. Literature has revealed that several senior citizens' entrepreneurial programmes have successfully assisted in empowering senior citizens to make positive contributions towards sustainable social and economic development in the country.

According to Edralin et al. (2015) poverty alleviation poses the challenge of transforming the physical and social context^s in which the poor lives. Poverty alleviation projects generally in South Africa are spoiled by the lack of active participation by the people that are the most affected by poverty. This has been partly due to Government's poor handling of affected communities' involvement and lack of participatory development by government.

Hlahla, Goebel & Hill (2016) recommend the adoption of a "green economy" to alleviate poverty and to ensure sustainable development. They look at how this green economy can be used to alleviate poverty and protect the environment at grassroots levels. This project was started by women in Pietermaritzburg and it has helped them to generate income, improve their livelihoods and has also contributed to the sustainability of the environment.

According to Hlahla et al. (2016), the green economy aims to address the underlying problems of unsustainable development by producing a new economic growth model that improves human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. It is expected to contribute to the poverty alleviation effort through the creation of green jobs and the protection of ecosystem goods and services that the poor depend on for their livelihoods. Hlahla et al (2016) explain-s further that the concept calls for social change strategies that link people to their surrounding environment, thereby allowing for a symbiotic relationship. South Africa is highly dependent on fossil fuel resources such as coal

for electricity, and faces the challenges of water scarcity and poor potable quality, food insecurity, high levels of unemployment and extreme poverty in both rural and urban settings. These challenges motivate the search for approaches that could create employment, alleviate poverty, provide educational opportunities and help to address other environmental problems.

9. Data Analysis and Interpretation

According to Struwig & Stead (2001) data analysis enables the researcher to organise and bring meaning to large amounts of data. Henning, Van Rensburg & Smit (2004) point out that data analysis involves a process of converting raw data into final and meaningful thematic patterns. For the purpose of this research, data that were collected by the researchers from the interviews were analysed with the view of identifying the themes that emerged. The information was then grouped into themes by using codes and then collated together into categories that contain related codes: these could then be interpreted in terms of contexts to the study.

Some of the respondents' narratives that emerged from the interviews are as follows:

- Participant 1: *"The project has a potential to grow bigger and bigger if the resources were always available all the time, but because there are challenges such as ukubiwa nokumoshwa kwezinto esisebenza ngazo (vandalism and stealing of equipment that we use) we sometimes wonder if it's worth all the hard work if at the end some criminals will reap from our hard work".*
- Participant 2: *"Yes the project benefits me and my family and even my extended family members. I benefit by getting skills. I now can sew, knit and have started my own small vegetable garden at home, oomama apha bandifundise izinto ezininzi (women here have taught me a lot of things). My family benefits from the food parcels we get and I sometimes share my food with neighbours and family members."*
- Participant 3: *"As a parent it is nice to see your family eat a healthy meal and going to bed with full stomachs. On the day we go to the market to sell the products it is always a success story because we always come back happy and with money. It is also nice to know that you are not only assisting your family but neighbours as well. It's a nice feeling when everything is going well".*

The above-mentioned narratives clearly demonstrate that despite the challenges experienced by the members of the Kwasa Gardening Project, there are positive benefits for the members.

10. Research Findings

The researchers discovered via the interviews they conducted that participation in the project was open to all residents from the Walmer Township community. However, very few men are involved with the project: but they do come to help when they are needed for jobs that might require physical strength. Some also assist with planting the seeds, cleaning up and clearing the weeds

Many of the women join the project due to high levels of unemployment within the Walmer Township community they joined the Kwasa Gardening Project to alleviate poverty and for greater economic empowerment and freedom. The vegetable garden has helped with providing financial independence and has also provided some women with an opportunity to put "bread on the table": this has helped in a lot of households to eliminate the financial burden. The research investigation revealed also that some of the women joined the Kwasa Gardening Project in order to gain training and skills that will later help them to establish and develop their own individual business ventures: for example, to go into commercial farming.

It was revealed that the women, their families and the community at large are benefiting to some extent from the projects as they receive food parcels and fresh vegetables. The vegetable garden produces vegetables such as potatoes, cabbage, and carrots, thereby helping to provide some food with real nutritious value to the families who are benefiting from the project.

The researchers have discovered that some participants are fulfilled by being part of the project because it brings a sense of belonging and community support. However, even though the women have worked hard and diligently throughout the years, the project has not been without challenges, the major one being theft and vandalism. For example, the project has suffered a major setback due to severe theft and vandalism on numerous occasions where by fencing, irrigation pumps, nets, storage containers and working material have been stolen. Even the concrete poles used to support the fencing and produce from the garden have been stolen overnight by the thieves. Moreover things that could not be carried away have been vandalised.

It transpired that owing to the above-mentioned problems, there has been a lack of assistance from the local municipality because every time they donate something to the project, the thieves visit the site and steal material or vandalise the property.

Some of the challenges have left the women feeling despondent and discouraged after working so hard on their project. Owing to these challenges the project is starting to show signs of collapse. Morale is down and motivation has been undermined. The enthusiasm and the drive to make a difference are no longer evident when many of the women speak about the project.

In the light of the above, major setbacks it is now evident that the project no longer possesses the proper structures to run as a profitable entity, even though it has all the necessary tools to be successful.

Moreover, the study revealed that there are no elected members (i.e. no executive committee) to ensure the smooth running of the business. The vegetable project is handled by one person and they expect her to do everything herself. This is partly due to the fact that the women do not have any formal schooling, and therefore lack the necessary skills and confidence to take up lack the to take up a leadership roles, particularly those which require s financial knowledge and skills.

11. Recommendations

The researchers have the following recommendations to make in terms of addressing some of the challenges faced at Kwasa Gardening Project:

Firstly, it is highly recommended that there be a security upgrade. Installation of electric fencing should be effected as a matter of urgency to protect the area and to minimize the constant theft.

Secondly, no clear written professional roles or portfolios are in place at Kwasa. This applies to, for example, financial management, procurement and marketing. Current it is a free for all with no clear systems to follow. Hence there is a great need to set up proper structures: for example, the establishment of an executive committee with a chairperson, deputy-chairperson, a secretary and treasurer is a priority. This committee should take the responsibility for running of the daily activities of the project.

Thirdly, the majority of the women participating in the project were not part of the decision-making processes: sometimes they were not even aware of why certain decisions were being made. Therefore, it is necessary for them to be involved in decision-making of the project in order to understand how the projects are managed and how decisions are made.

Fourthly, to maintain sustainability, it is highly recommended that the Kwasa project recruit young people and empower them with the necessary skills because at some point the current members will get older and no longer have sufficient energy and strength power to continue with the project.

Fifthly, agricultural skills' development is desperately needed in order to empower the members of the project: for example, courses are required for teaching skills such basic time management, how to take minutes the secretary, and how to handle meetings etc. for the chairperson and the deputy chairperson. Further, basic financial courses for the treasurer on how to organise a budget, balance the books etc is highly recommended.

Lastly, the local Municipality needs to come on board with some assistance on key requirements such as provision of seeds, and ensuring a supply of water for the project so that they can increase vegetable production.

12. Conclusion

The Eastern Cape is one of the poorest Provinces in South Africa. Similarly, Walmer Township (Gqebera) is one of the Province's most disadvantaged places, with a substantial number of households without proper access to basic needs such as sufficient clean water, food and shelter, as well as not having access to essential benefits such as adequate health care and good education. Ensuring sustainable of Kwasa Gardening Project in Walmer Township is essential so as to continue the fight against poverty by providing healthy food and creating opportunities for members of the community.

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A community based innovation model to achieve green and smart human settlements in South Africa: A Case Study of the Ndlambe EcoSun Green Village Model

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Abstract

Similar to other countries, South Africa is committed to attain green and smart human settlements through using innovative technologies. This ongoing quest is complex and lessons learnt to date highlight the need for people-centred approaches that integrate technology and innovation to achieve these envisaged settlements. This paper presents findings of a qualitative research study at Ndlambe Village, Eastern Cape wherein a community-based green and smart human settlements model was developed. The development of this people-centric model was inclusive and based on interviews and focus group discussions with policy makers, development cooperation partners and the municipality. The model was also informed by secondary data collected through literature review and desktop study. This model highlights critical pillars and elements necessary to achieve green and smart settlements. The paper concludes by outlining a set of guidelines and principles for the successful implementation of the green and smart village model, referred to as the Ndlambe EcoSun Green village model. It describes how socio-economic outcomes can be achieved through such a model, and the requisite partnership approach and roles of various actors involved and outlines key concepts of smart and green communities.

Keywords: Green Village, Smart Cities, Smart Communities, Sustainable Human Settlements, EcoSun Green Village Model, Innovation for Sustainable Human Settlements, Green Settlements Framework,

1. Introduction

In line with the 2030 Agenda and the Paris Agreement, South Africa acknowledges that innovative approaches are required in order to respond to risks posed by the global phenomenon of climate change whose impact on human settlements continues to highlight the urgent need for green and smart solutions. The extent to which South Africa, particularly the rural areas are able to respond to climate change risks and incidents is somewhat impaired by limited access to information and solutions that reduce risk and vulnerability to climate change impacts whilst strengthening their resilience. Globally, there is an increasing awareness and commitment to integrate green and smart design and implementation approaches to realise sustainable human settlements. One of the

mechanisms to respond and be resilient to the impacts of climate change includes the deployment of appropriate innovative technologies. It is in this regard that a qualitative research study was undertaken at Ndlambe Village, Eastern Cape to develop a people-centric green village model, referred to as the Ecosun Green Village Model. The purport of the researchers holds that this model is key within the context of sustainable development goal 11 on “making cities and human settlements inclusive, safe, resilient and sustainable” and the National Development Plan’s outcomes on sustainable human settlements and vibrant rural communities. Despite the acknowledgement of leveraging innovative technologies to attain green and smart villages, there is a lack of appropriate models and guiding frameworks on how innovative technologies can be exploited to achieve these envisaged settlements that are resilient, carbon neutral, energy and water efficient.

This paper outlines the Ecosun Green Village Model and a set of guidelines and principles to successfully apply the model within the context of South African rural communities. This model advocates for a holistic partnership-based approach in demonstrating how green and smart settlements can be achieved through the application of innovative technologies. The paper firstly offers a brief history on how the model emerged, it then examines literature on and smart and green human settlements, innovation and sustainability, as well as key concepts of green villages and smart communities. Secondly, it examines and defines components of the EcoSun Green Village Model as proposed for implementation in Ekuphumleni, Ndlambe Municipality. Thirdly, the paper reflects on the partnership approach and roles of various actors involved. Lastly, the paper discusses a set of guidelines and principles necessary for the successful implementation of the EcoSun Green Village model.

2. Background to the Emergence of the EcoSun Green Village Model

The EcoSun Green Village Model has emerged out of a structured partnership between various stakeholders in South Africa and in Germany. These various actors each carried a distinct responsibility in the definition of the model, but would also support the piloting of the model through various contributions i.e. technical and specialist knowledge, funding and provision of technology.

The Department of Science and Technology has been entrusted with the mandate to boost socio-economic development in South Africa through innovation. It has tested and demonstrated a number of technological solutions to some of the problems faced by the state. Some of these are technologies for human settlements towards a sustainable path. The concept of the green villages and smart

settlements is a priority area of research for the department. The Council of Science and Industrial Research (CSIR) is the Implementing agent to the project and will be responsible to appoint all the professional service providers associated with the development of the community innovation multi-purpose centre (CIMC) and project manage the construction.

The National Home Builders Regulatory Council (NHBRC) is a housing regulatory body which promotes the use of innovative building technologies in the creation of sustainable human settlements. The interest of the entity is to assure quality homes for the consumers. The GTS is a German company that will provide planning documents and architectural drawings for housing units for an EcoSUN Green Settlement in accordance with the needs of the EcoSUN model, ensure compliance of technologies with RSA legislations, and the needs of the people; provide architectural drawings for a CIMC , participate in construction and/or construction supervision of the housing units and the CIMC, supply and install point-of-use drinking water preparation systems in the kitchen of up to ten houses of the EcoSUN Settlement, equip the CIMC with a grey water treatment facility at a capacity of up to 5 kl per day and producing service water of a quality level given after EU legislation and SA legislation. This water will be for usage in the individual housing units for laundry purposes and flushing toilets, and other applications which do not need drinking. GTS will erect, as part of the construction of the CIMC, a facility for preparation of drinking water using water from sources provided by the public water supply system facilitated by the Municipality, at an amount of 20 kl/d of drinking water, including all technical equipment; provide planning documents for grey water treatment facility for servicing the EcoSUN settlement and carry out an energy planning of the EcoSUN Settlement.

The stakeholder partnership approach and responsibilities of various partners is summarised in the diagram below:

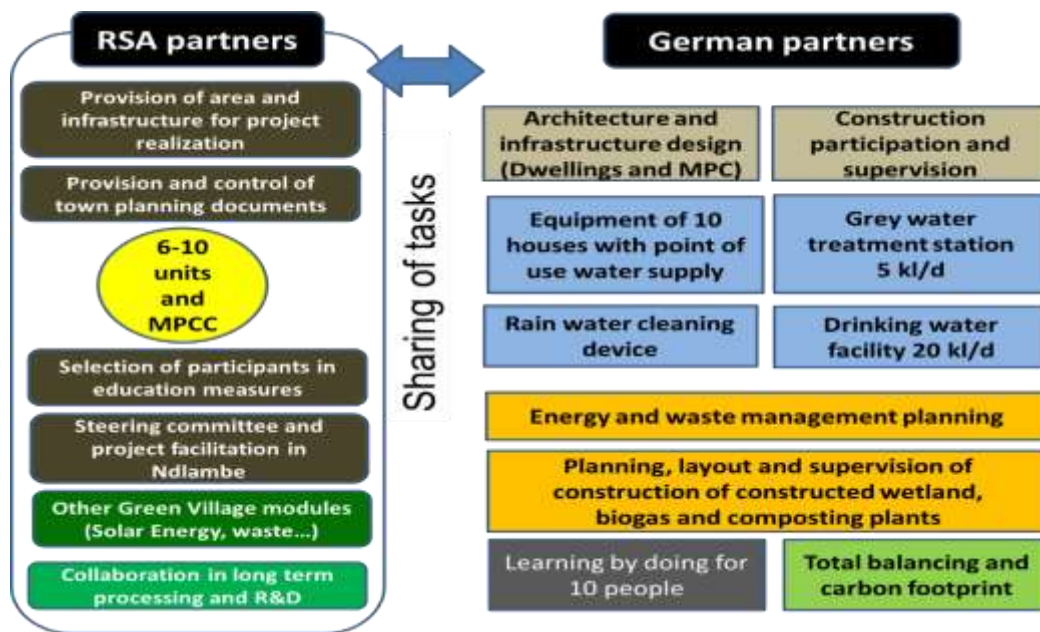


Figure 1: Stakeholders and their Responsibilities

3. Background of Ndlambe Municipality- Ekuphumleni Community Pilot Site

The project stakeholders defined a criteria to select the project site in which the model would be piloted and implemented. The area identifies to meet the pilot site criteria is Ekuphumleni Community in Ndlambe Municipality (ward 4), in the Eastern Cape, South Africa. The site was selected due to the settlements challenges which the integration of technologies could address such as poor infrastructure, water and electricity supply shortages. The growth rate per annum is 2% meaning that from 2011 until 2018 there is an increase on the population figures presented. This has been exacerbated by the exodus of farm workers to the towns for work opportunities and better life, putting pressure to the municipality to provide services. Being a holiday destination numbers in the certain areas can increase ten-fold during the season, this puts pressure on the supply of sufficient electricity and water.

Kenton-on-Sea and Ekuphumleni settlements had a population of 5 194 occupying 1 879 households with an average household size of 2.8 people. The residents contribute 8.5% towards the total inhabitants living in the Ndlambe municipal area. 24.7% of the population in Ward 4 are under the age of 15, 13.2% are older than 64 and the remaining 62.1% fall within the 15 to 64 age bracket. At least 8.2% of the inhabitants over 19 years of age in ward 4 had not received any schooling and 31.6% completed or underwent some primary education. A further 23.4% matriculated or received a higher learning degree.

The situation suggests that a mixed labour market exists in the ward, notably with a large component of elementary and semi-skilled workers and the municipality and Sector Departments should promote labour intensive development projects. About 23.1% of the 5 194 inhabitants are employed in the formal sector, 2.7% in the informal sector, 4.5% in private households and the remaining 69.7% fell within the not applicable category. (pensioners and workers not active in the labour market). Approximately 15.3% (287) of the 1 879 dwellings in the ward did not receive any income so technically 1 in every 6.5 households are impoverished. In addition, 37.1% of the population in ward 4 did not receive a monthly income and a further 25.6% earned less than R801.00 a month according to StatsSA 2011.

As such, the proposed project pilot site has been selected as it provides ideal site to demonstrate how the EcoSun Green Village model could be used to derive socio-economic benefits to the community given the challenges facing the Ekuphumleni Community.

4. Definitions and key concepts

Smart Cities and Communities

Literature reveals that the terms smart cities and smart communities are used interchangeably. Kondepudi and Kondepudi (2015) defines smart cities as innovative cities that make use of information and communication technologies to ensure an improved quality of life for those who live and work in it, ensures efficiency of urban services and operation and is competitive. It should be able to meet the needs of both present and future generations with respect to economic, environmental and social aspects.

According to Colldahl et al., (2013) smart cities are cities where investments in human and social capital and traditional and modern communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance. These two definitions may be similar but are not entirely the same. The first echoes an urban environment more than the latter which echoes a need to be sustainable. Both however converge in their implications of a sufficient, self-sustaining city. It should be noted that both definitions could be applied at a settlements level, to describe a self-sufficient and self-sustaining settlement that relies on a community driven approach to achieve sustainability.

Recently, there has been renewed interest in the concepts of sustainable human settlements and green economy. The concepts of green villages and smart settlements are both anchored within these principles and both are applicable to both rural and urban contexts. There is however no clarity on the criteria used to classify a settlement or city, as smart (Kondepudi and Kondepudi (2015)). We note that smart settlements, in both contexts, are influenced by smart growth and smart development, both rooted in the principles of green economy and sustainable development. The definition of what sustainability refers to is not standard, it changes with each sustainability model's priorities, it is a fuzzy and normative concept which should take into consideration, among others, space, scale and limits while applying systems thinking as an organizing concept (Bergstrom and Harrington, 2014) (Harrington, 2016) (Kate et al., 2005).

Harrington (2016) offers vital conceptual points to consider in the application of Sustainability within rural contexts and defines Sustainability as the capacity to maintain or to improve on the state and the availability of certain desirable materials or conditions over the long-term contrary to the widely used definition of which he argues accentuates to the global scale. At a settlement level, a number of scholars are in agreement with the definition that a settlement that extracts non-renewable resources within the earth's ability to replenish them, dumps waste within the earth's ability to absorb, where local and biodiversity systems are not destroyed, minimizes waste whilst moves towards the utilization of renewable energy and where consumption and basic service delivery is shared fairly amongst the rich and the poor- is a sustainable human settlement (Swilling, 2004)

Most literature found addresses smart cities within the urban context, a further lack is evident in the publication of those within rural context (Naldi et al., (2015); Edwards and Haines, (2007); McCann and Ortega-Argilés (2015)). This problem may rise from the fact that, the term 'smart cities' has *urban area* undertones.

McCann and Ortega-Argilés (2013), and Vanthillo and Verhetsel (2012) imply that defining smart cities, as influenced by smart growth, within the context of rural environments, has proven to be of high difficulty. The literature argues that, this difficulty emanates from the fact that smart growth is based on innovation and knowledge and; as suggested by theory, innovation should be positively related to agglomeration. The spatial implications of smart growth therefore disfavour rural contexts (Vanthillo and Verhetsel, 2012). This however, does not imply that smart growth cannot be applied in rural contexts; it seeks to ensure that smart developers are aware of this challenge and as stated in Edward and Haines (2007); they should then apply smart discipline in the planning dialogues regarding the applicability of smart growth in rural communities.

It can be gathered that, since Smart growth is not strictly nor clearly defined due to the fact that it cannot be directly measured, different communities can then define their own smart growth policies in a manner that speaks to each community's immediate needs and realities. Each smart city or community can then make use of appropriate proxy indicators to measure the effectivity of the development path taken towards achieving the required growth, this is done in Ching and Ferreira (2015). This raises the importance of tailoring and user-orientation in growth or a model adopted to achieve a smart community or city.

Ching and Ferreira (2015) highlight that the definition of smart cities in Boston, San Francisco, Amsterdam, Stockholm, Singapore and Rio de Janeiro do not converge to a single definition of a smart city but rather use different approaches and adopt different element combinations from a variety of theories to define what a smart city is. The literature reports that this activity has become a success that other developing smart cities can learn from. Kondepudi and Kondepudi (2015) also acknowledge that there is no standard definition of smart cities. Their arguments are also in support of those by Ching and Ferreira (2015) as they emphasize that every definition of smart cities is correct in its own right since it speaks to each community in its uniqueness.

Holland (2008) on the other hand strongly argues against this lack of definitional precision, stating that it leads to a confusion of what these concepts actually mean, what the ideology hides and what it reveals. In his argument, he adds that this vagueness leads to an inability to measure how 'smart' a city is and thus inevitably leads to the concept becoming self-congratulatory, a problem that is also identified by a number of authors including Allwinkle and Cruickshank's (2011) and Naldi et al (2015).

The EcoSun Green villages is a concept that has been defined and contextualized within the broader discourse of smart cities and sustainable development principles which promotes carbon neutral green buildings. As pointed out in the current text and other previous literatures, a need to create a standard definition of smart settlements (urban and rural contexts) and green villages may exist. But not just the definition, the articulation of what constitute a green village is necessary if we are to understand how such green and smart communities can be achieved. The current texts acknowledge that but accept the argument made by Ching and Ferreira (2005) that every definition is correct and acceptable in its own right. We add that, every definition should however be rooted in the principles of Green Economy and Sustainability. Likewise, in a literature where Smart Cities are defined, the definition ought to be rooted in the principles of sustainability and influenced by smart technologies

and innovation and their role in achieving area growth through prioritizing the needs of that specific geographic area and local context.

Green Economy and Sustainable Human Settlements

One of the arguments of Sustainable development is that if the consumption of natural resources to sustain cities, towns and communities is not reduced, this will continue to decline the capacity and resources that support human society, under which a continuous decline creates conditions that no longer enable human society to sustain itself (Harrington, 2017). The alternative is to explore how society is able to transition to buildings that are less demanding in terms of energy and water consumptions i.e. green buildings, through the use of alternative building technologies. The concept of green economy seeks to reduce environmental risks and ecological scarcities, it is a means of achieving sustainable development and to move towards poverty eradication, without any environmental degradation (Musvoto et al., 2015).

The transition to green economy, however, will inevitably come with landscape changes, changes of which, as argued by Selman (2010), will bring about opposition and protests which may build a barrier to the achievement of these much-needed activities towards Green Economy and Sustainable Human Settlements. Trier and Maiboroda (2009) explored the community member's attitudes and perceptions that create the resistance to this needed but resisted change that sustainability proposes. The literature concludes that, this resistance is effectively diminished by, not only explaining the benefits of the proposal to the community members but also through involving them in the processes that bring about the change that will affect them. It is however, highly imperative that in such cases where the project is to go in partnership with or include community members, time and resources are effectively invested in the preparation phase before the project is initiated as supported by McKenzie-Mohr and Smith (1999), proposing that at least 4-6 months of thorough planning be invested. The suggestions made by Tier and Maiboroda (2009) are accepted for the proposed EcoSun Green Village model. The proposed green village will be community based and user-oriented.

Bina (2013) presents a study where part of the debates on Green Economy, defined within the context of Sustainable Development and Poverty Eradication as per the first preparatory meeting of the UNCSD, in New York. He reveals that some countries in the developing world have raised their concerns and reservations on adopting Green Economy. A question had risen questioning the unclear risks that come with Green Economy. There is a fear that Greening may slow down development and growth for developing countries. The response to these apprehensions holds that the aim of green is

not to hinder growth and development but rather to respond to social and environmental crises while ensuring that development and growth takes place (Bina, 2013). The Rio+20 nationals-reports synthesis, reveals that many countries expressed their concerns as well on the lack of clarity and definition of Green Economy (Bina, 2013). Nonetheless, South Africa is among the countries (to name a few: Brazil, Singapore, Norway, United States, Germany, Australia) worldwide that have adopted the principles of Green Growth (Kibert, 2016).

This model makes use of green growth, we however are not ignorant of the concerns that greening or fears that greening may be yet another imposed concept to the developing countries that may not fit and may hinder growth. We acknowledge that Greening is not a one size fits all. We encourage tailoring the concept for best fit in our context. We agree with Ching and Ferreira (2015) on their view of smart city definition, we seek to adopt this view and use it in the definition and deployment of green villages in the context of South African Rural Communities. However, this requires locally defined adaptive models to address local reality whilst achieving the ideals of the green and sustainable smart communities.

Green Villages

The concept of green villages is a concept that promotes sustainable livelihoods in communities. Its definition is modelled around three pillars of sustainability. It encourages self-sufficiency and leaving a green footprint through the use of green technologies. This model is not new through our proposed implementation. Many countries are ensuring that green growth models for smart communities or villages are defined and tailored for their specific needs. South Australia, proposed a model for the LochiePark Green Village to achieve a reputation as a clean green state and to foster a culture of sustainability to contribute towards the fight against climate change effects (Blaess et al., 2007).

Within the context of India, Parajuli (2018) defines a green village as a green idea with a focus to explore social and economic reasons for environmental issues, he further states that the solutions of this idea are intended to lead to an envisaged self-reliant and self-sufficient community where man and nature co-exist in harmony, their focus was on the environment.

In Zambia, Draijer (2017) of the Green Knowledge Institute for African countries defines the Green Village concept as a concept aimed at developing a rural electrification through the use of green technology with the objective of instantly converting a rural village into an electrified rural town that is capable of achieving a greater level of economic activity and self-sufficiency. Addressing the immediate issues of Zambia, one of the main focuses of their green village is to ensure access to basic and adequate energy supply essential for rural area modernization, improved health and standard of living as well as an overall reduction of poverty as those who live in the green village will work in it to ensure the fulfilment of a self-sufficient village.

In Rwanda, since the 1994 genocide against the Tutsi, one of the main national developmental goals and priorities of the country is to promote the concept of a safe home to the citizens who find this basic need, elusive. A green village is aimed at ensuring financial and food security to community members through job creation and nutrition improvement, sending children to safe schools and them returning to a safe home. The Green village concept was therefore defined along the lines of poverty eradication and the restoration of a safe home to the nation (Climate Adaptation UNDP, 2018).

In South Africa, some of the national main priorities is to address water scarcity issues, poverty eradication, transforming human settlements, building safer communities and promoting environmental sustainability as addressed by the National Developmental Plan for 2030 (NPC, 2012).

According to Kibert (2016) green building refers to the quality and characteristics of the actual structure created using the principles and methodologies of sustainable construction (the Sustainability of which ought to be measurable as argued by Kates (2018) and reviewed by Hardi et al (1997). Within the current context, there is a variety of literatures reporting on the methodologies that can be used to measure the sustainability of and to predict the performance of green buildings, the most popular and commonly used being the Building Research Establishment Environmental Assessment Method (BREEAM) and Leadership in Energy and Environmental Design (LEED) (Schwartz and Raslan, 2013).

Between 2012 and 2015, the McGraw- Hill construction conducted a design and construction survey which reports that the number of businesses and consultants in South Africa which anticipated that over 60% of their business to be green tripled. The country competes with Brazil, Norway and Germany where green businesses only doubled within the given time period.

Literature reveals that there is already work on green buildings that is being done in South Africa, specifically in the business space (Kibert, 2016). The current study defines the a green village as: A type of smart village which means the creation of more transformative, self-sustaining, liveable, carbon-

neutral neighbourhoods and settlements leading to improved access to quality basic services in a manner that supports and stimulates economic growth that guarantees for the welfare of the people through job creation, income generation and poverty eradication. Emanating from the vision of a green village as articulated above is the EcoSun Green Village Model with its various components as outlined below.

Definition of a “model”

In its simplest sense, the term ‘model’ refers to a graphical, physical, mathematical or verbal simplification of any concept, relationship, system, or any real world facet. Models are defined differently across the various disciplines. In this case the model seeks to simplify the concept of a green village by offering explanation of how various integrated green technologies can work to create this calibre of envisaged settlement.

5. Research design and methodology

The study employed a qualitative approach to collect data. The primary data and secondary data was collected to understand and define the EcoSun Green Village model but also to derive principles for the model implementation. Literature review was conducted as well as the review of the Ekuphumleni project documents as part of secondary data collection. Primary data was collected through focus group discussions (FGDs) and key informant interviews. Three focus group discussions were organized in South Africa and one in Germany in the form of a Summer School on the conceptualisation of green villages. Each focus group discussion consisted of at least 8-14 participants. The participants were selected purposively from various project stakeholders consisting of municipal town planning and infrastructure practitioners, the provincial and the national human settlements practitioners, the representatives of the research councils, housing regulatory bodies and the department of science and technology to conceptualise the EcoSun Green Village Model.

In addition to the FDG. 12 key informants selected purposively based on their role and participation in the Ndlambe EcoSun Green Village project were selected for interviews. These key informants included stakeholders from the Department of Science and Technology (DST), Eastern Cape Department of Human Settlements (ECDoHS), National Department of Human Settlements, the Nelson Mandela University (NMU), the Council for Science and Industrial Research (CSIR), National Home Builders Registration Council (NHBR), the German Ministry of Research and Education, and the

Potsdam University as part of the German-South Africa scientific cooperation. The analysis of data was done through thematic, content and contextual analysis.

6. Description of the Ecosun Green Village Model

The EcoSUN Green Village approach in the narrow sense comprises of an infrastructure package that combines practically proven technology modules of ecological sanitation (Ecosan), safe drinking water supply, renewable and solar energy use (SUN), information communication technology (ICT) and individual housing combined with centralized infrastructure components (the innovation multi-purpose center) designed to improve the life of the community as a whole, in an innovative manner to achieve sustainable settlements for the people.

Central is a technology and innovation community hub to which houses are directly connected for water and/or energy related activities to allows privacy in hygienic activities in the people's homes, and cost-efficient high-quality centralized supply of water and energy, as well as offers community-oriented activities including sports activities and youth involvement, internet café, commercial and business activities.

The model consists of technological and socio-economic related features. It is a package consisting of four priority components: i) ecological sanitation, ii) waste management, iii) renewable and solar energy use, and iv) modern design principles of town planning and house design, and combined as EcoSUN technologies (see figure 2) aiming to create sustainable settlements.

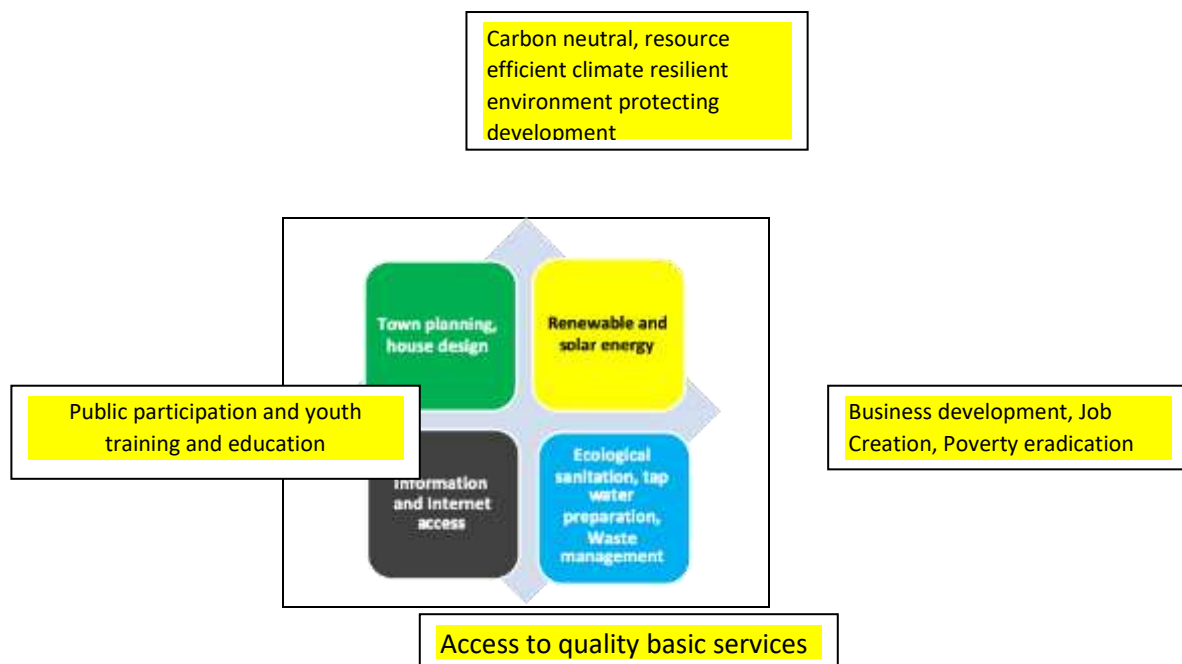


Figure 2, General components of the EcoSUN Green Village concept

Figure 3, represents an overview of technology options applicable in the EcoSUN Green Village as it relates to the MPCC.

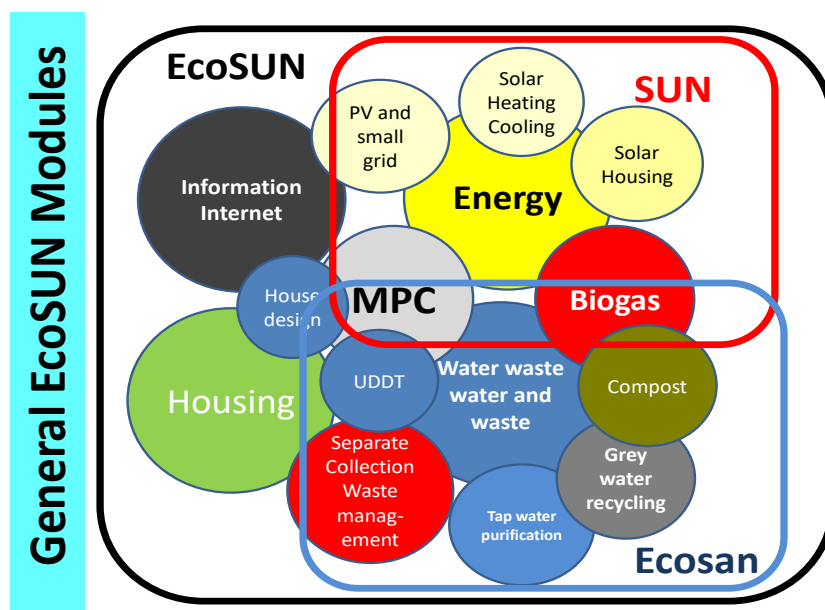


Figure 3: Technology options overview: EcoSUN modules

The socio-economic focus is on creating social change by consideration of the real needs of the people under the given economic constraints. Essential features are public participation, technology and knowledge transfer as part of education and training, development of business opportunities including service teams for maintenance and improvement of the existing demonstration units and its rolling out in other Municipalities. Privacy and dignity of people and their life are high ranking goals, as well as principles of African culture such as Ubuntu principles of cooperation and neighborhood, or the Zenzele principle of self-reliance, self-help and self-confidence, both to get people involved in all steps of the process. Moreover, the demands will be met of better resource economy and the usage of local or regional material and energy resources, as well as a smaller carbon footprint for improved climate protection.

Through the use of innovative sanitation technologies (Ecosan), this reduces settlements demand for fresh water whilst waste water disposal is kept under control. This approach will ensure that water consumption is reduced and the reuse of valuable components of waste can be organized ecologically as well as economically. In addition, using renewable energy will create a cost-efficient and a sustainable way to provide energy to the people. This, as well as the design of the houses and the settlement, adapted to the predetermined local environment, will improve the overall living conditions.

7. Findings and discussion

Guidelines for the EcoSun Model Implementation

The study revealed that for the model to be successfully implemented, a neighbourhood development approach which unlock and create local economic development opportunities through innovation is required and the need to learn from similar models and adapt to local contexts and conditions in necessary.

Some participants in the key informant interviews reported that for the model to be successful a phased approach which places the community innovation multi-purpose center as catalyst to support individuals and the community members to realize a clean, sustainable, enterprising, green off-grid settlement is key. This will help the project to be implemented by starting small whilst chasing the bigger vision. This will require the multi-purpose center to stimulate and enhance the existing energy and activism of the community members and social entrepreneurs.

Public participation, Community Training and Empowerment

According to the participants in the FDG's. A basic challenge of technology transfer is education of users and operators of plants. To guarantee long term maintenance and operability, education should be the focus of the EcoSUN approach. During the project a number of technicians should be educated through learning-by-doing and by regular courses or skills transfer programme. A teaching manual should be developed based on the identified educational requirements and skills gap. This will require cooperation between technical and vocational colleges (TVETs) and the German institutions providing technologies being installed in the CIMC or households to create a cohort of artisans.

The Community Innovation Multipurpose Centre

The FGDs further indicate that the functions of the CIMC in the EcoSun model should be two fold: Firstly, it is a "usual" Community Centre (or Facility) - and offers a range of services in one location, and may comprise rooms for communal services, education, training or sports activities etc., and/or commercial activities such as a laundromat, and is equipped with sanitation devices such as showers and toilets which are necessary in case of meetings, or sports activities, by hygienic reasons. On the other hand, the Centre is the shelter for the installations of the EcoSUN related technical systems, and is, fully or in part, depending on the level of technologies applied, equipped with facilities for grey water treatment, tap water production, and devices for energy management, such as heating and cooling systems, storage tanks for warm water, and photovoltaic cells for power storage.

Guidelines for Technology Selection as core elements of the EcoSun Model

As part of the EcoSUN Green Village Model a variety of technology modules should be considered. The key informants and participants in the FDG are of the view that, not all technology options can be applied with the model. Technologies that can be selected for implementation will always depend on the conditions on the ground. The technologies discussed below are suggested but the list may change from one community to the next and the guidelines applicable to each technology are outlined in the discussion below.

Piping system for water in the Community Innovation Multi-purpose Centre and Individual Households

Some key stakeholders observed that the piping system is an essential part of the EcoSUN model. Its function is to transport all kinds of used water except toilet water, summarized as grey water, from the individual houses to the CIMC from where it is recycled as high-quality service water, after

treatment in a grey water treatment plant, and which allows people to reuse the water for different services individually in their own home. This situation is in contrast to the Communal Waterhouse approach (Soyez, 2015), where water recycling services are centralized in a building, where people can use it, instead of using the services in their own households.

EcoSun Tap Water Preparation Technologies

Some key stakeholders observed that there is a need for policy redesign to allow beneficiaries to use innovation. The key informant participants, further reiterated that, the sanitation related mantra of EcoSUN is simple and well understood however not yet applied generally: Use water reasonably - adapt water usage to the quality needs. No drinking water for flushing toilets. "Water demand has traditionally been met with water from the best available sources of quality water. However, such sources are limited, and more important, not all uses require the same water quality" (WRC, 2013). Water for flushing toilets which amounts to up to 40% of domestic water usages can be substituted by water which does not qualify for drinking and other human uses (Ilempobade, 2012). Amongst that recycled water is a main source. On a wider scale, recycling means that more high-quality sources will be available for higher quality uses, and reduced waste water amount may result in smaller waste water treatment plants, which both means reduced resource needs and lower costs.

This implies that the model encourages the use of Grey water and grey water technologies provided these are recommended by law and have certified technologies. This is the most important core elements of the EcoSUN Sustainable Village model.

In RSA grey water usage currently means untreated grey water, e.g. for toilet flushing or irrigation for which application regulations are under development (Rodda, 2011, WRC, 2013). In contrary, the EcoSUN concept involves a grey water treatment step before any usage. The result is co-called "service water" - no drinking water by law, but well suited for all non-drinking purposes.

There is a number of technologies available for grey water treatment so that the best solution can be selected for specific applications which approach is also recommended by the Water Research Commission. In case of the EcoSUN Sustainable Village the AQUALOOP system of grey water treatment (www.intewa.de) is intended for application. Its performance fits into the needs of high-quality levels and covers the needs of the European Union Bathing Water Directive (EU, 2006) or the British Standard and is well suited to treat domestic grey water as expected from the households of RSA settlements.

The technology includes filtration and bioprocesses only, no chemicals needed. Fresh grey water passes a separator and a pre-filter before the bioreactor where the biological degradation takes place

by means of natural micro-organisms. After micro-filtration it can be stored and pumped to the users. Rain water can be channeled into the system before the membrane station.

Black water treatment

Black water means the effluent from flushing toilets and is treated separately. As an alternative to a conventional aerobic waste water treatment station, anaerobic digestion may be applied which results in energy rich biogas as an extra benefit. In several waste water works in RSA; vintage types of bio-digesters exist which are not operational due to longer down time and lack of maintenance. In case they can be upgraded, these devices are worth considered a part of the EcoSUN solution. In all other cases investment costs are too high, operation is expensive, trained personal needed, and it is then not a preferential approach therefore.

As a less sophisticated, though by no means simple, alternative, constructed wetlands can be considered where black water is treated in an open biological system, often named reed bed. Bio-filtration, removing of sediments, decomposing of organic pollutants and uptake of heavy metals, are the process results. Technologically, constructed wetlands form a sequence of water bodies which, depending on the design, allow even to tread on the surface of such areas. Therefore, they can form an integrated part of a settlement and in case of proper operation they contribute to an improved micro-climate. It is also a benefit that the systems work locally and need no long-distance water piping. This type of black water treatment is considered part of EcoSUN settlements.

Under the condition of extreme water scarcity, water free toilets can be a matter of choice, and a variety of such systems exist including the Urine Diversion Dry Toilets (UDDT) which are characterized by good hygienic standards and extra benefits through production of marketable mineral or organic fertilizers. However, UDDT is not first choice of the users, and the combination of housing architecture and UDDT design pose a variety of challenges if operated together with solar air heating systems.

Tap Water Treatment

The FGD confirmed that as part of the EcoSUN system, locally available water sources will be treated to a quality standard ruled by law, considering two options: I) a centralized treatment facility and ii) a point of use system in the households. Another specific task is cleaning of rain water in collection tanks

which impose the risks of diseases over longer periods depending on the rainfall intensity and duration of dry periods.

As a central water preparation unit the EASY FILTRATION system (www.evers.de) will be used which is characterized by specially conditioned Anthrazite based filter material and a reasonably constructed re-flushing system needing small amounts of energy only. A plant for a capacity of 20 kL daily, will become part of the MPC design.

Renewable Energy

Energy supply is another indispensable service to people in modern settlements and forms a key feature of the EcoSUN sustainable village concept. The focus is on reasonable energy management, and its provision from renewable resources and from the sun, making solar radiation a main source as an alternative to the provision through the central grid. Let the sun work for the people, is one of the central ideas of EcoSUN.

Preferred solar energy usage is for the production of heat which is relatively cheap and is a reliable source. On the other hand, since electricity is indispensable in every household for modern daily life, solar power must be taken into consideration. In the EcoSUN approach we follow the mantra: Make the village a power station.

Solar Heating System

Use of solar energy for water heating is well established worldwide and also in RSA. Its application is growing substituting electrical geysers. The other option is to generate hot air which can be used for room heating in the cold season directly, or to heat up water indirectly. As a more sophisticated design the combined approach - room heating and/or warm water preparation - is preferred in the EcoSUN system.

Solar Power

Some key stakeholders observed that Electrical power is an indispensable part of energy supply as for lighting, operation of TV and radio, and machinery etc. Power from the sun is well known worldwide and considered for future energy supply as it is independent of fossil fuels and therefore climate

neutral. However, even though there has been a substantial decrease of costs, during the last decade, for investment and operation, solar power is still expensive. In the EcoSUN concept a specific solution is proposed: Instead of placing solar modules separately in a plant outside the village, fit the modules on the roofs of the houses - The village the power station. In case the amount of power produced exceeds the needs of the house, a certain amount can be fed into the national grid. As an example: 100 houses equipped with a roof area of about 100 m² each will result in more than 1 MW electrical output from which only a part is needed in the village itself and the bigger part can be sold to power utility i.e. ESKOM. However, a pre-condition is that a feed-in-tariff would be paid. In the EcoSUN approach the houses will be pre-equipped with appropriate roof structures making it possible to apply solar cells as soon as the financial conditions were met.

Town planning, Landscaping and House Designs

Modern town planning and house design for human settlements require the full consideration of principles of sustainability which means best practices in terms of technology and architecture, as part of an integrated approach towards best solution regarding community life, effects on nature, climate, the economy, etc.

The key informants confirmed this point of view, each kind of settlement can become completed by the addition of EcoSUN modules as described, or vice versa, the EcoSUN components can be attached to an existing settlement as add-ons i.e. retrofitting. However, better results will be achieved in such a case that the settlement is designed, from the very beginning, under full consideration of EcoSUN technology modules and as a complete system. Solutions for that kind of approach are developed and applied in the EcoSUN system.

The need of an integrated approach results from the fact that, the components must be adjusted to each other, and some of the technologies can only work efficiently if some specific pre-conditions will be met, e.g. amongst others: To realize the general concept the Community Centre need to be situated preferably central so that piping is shortest. If a constructed wetland is foreseen there must be enough space in or nearby the settlement. The recycling of water needs a double piping system, the energy yield of a solar power system is best if roofs are oriented East-West or North depending on the system used.

The EcoSUN Architecture has to consider good architectural principles, such as described in the National Housing Code and the Guideline for human settlements (CSIR, 2005), and alternative construction materials guidelines. Moreover, it has to observe social and economic requirements as well as human settlements norms, standards and principles. Both the houses and the Community Centre must be designed taking into account the community and the individuals needs and considering the cultural background and context. It is encouraged and vital that the public participates in all activities including training and education for their buy-in and ownership attitude as well as understanding of future maintenance needs.

Amongst the features regarding the design of the dwellings, it is important that owners of houses become encouraged and enabled to enlarge or finish their homes in case the families grow or they require more space for personal reasons. The current basic structure of the subsidy houses in the South African context does not support variations in typologies allowing easy alterations to such buildings.

8. Conclusion

The aim of this study was to define an Ecosun Green Village Model that can be applied in the context of South African rural communities, outline the elements of the model, describe the background to the emergence of the model and to provide guidelines for the implementation of the model. The findings of the study demonstrate that there is a need to define and develop possible national policy frameworks for implementation models of green villages and smart settlements within the context of housing delivery in the South African context.

Factors to be considered in such a frameworks/ model are inclusive of performance measurements, contextualisation and localisation to areas specific requirements of such models, community empowerment and training, public participation and smart settlements technology selection guidelines. Green and smart settlements should explore and increase the use of renewable energy, provide better and greener public open spaces, and manage their natural resources including waste. Use ICTs to improve connectivity and access to basic services, improve living conditions and use innovative methods to manage resources such as water, energy consumption at household level whilst creating economic opportunities and increase the welfare of people through job creation, income generation and poverty eradication. Clearly, green settlements require a broad participation of various stakeholders and should be enabled and supported by clear policy guidelines and frameworks.

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**Red tape in upgrading of informal settlements: The case of Nelson Mandela Bay
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Abstract

This study sought to investigate causes of red tape in specific Informal Settlements Upgrading Programme (ISUP) developments in local authorities to uncover the underlying contributory factors to red tape and ultimately suggest possible remedies to reduce red tape and its adverse effects. Applying a qualitative methodology, data was gathered through document review and face-to-face interviews from targeted respondents across various departments within and outside the municipality, involved in ISUP developments. Two ISUP projects in Nelson Mandela Bay Municipality were selected as case studies. The study unearthed various factors attributed to red tape including; inept internal management procedures, misconception of legislation, silo mentality and lack of capacity in housing delivery. Thus, the rules, legislation and procedures prevalent are not in harmony with the dynamic macro environment. To reduce red tape, it is argued that municipalities must consider realignment of their internal procedures, integrating project teams or functional departments, engagement of beneficiaries through the entire project course, invest in new technology and training.

Keywords: administrative, informal settlements, ISUP, local authorities, legislation, municipality, red tape.

1. Introduction

Even though there is general acknowledgement of the existence of red tape in low cost housing, very little effort has been made to unearth its underlying causes. Administrative red tape in Informal Settlement Upgrading Programme (ISUP) projects is hampering the government's efforts to upgrade informal settlements, as evidenced by the slow pace of housing delivery and perpetuating informality in urban areas. Red tape also causes frustration to Small, Medium, and Micro Enterprises (SMME's) that are involved in the low-cost housing delivery value chain who suffer cash flow problems leading to some closing down due to delays incurred from payment of their services by the local authorities. This hindrance does not spare the majority of municipal employees whose roles are interdependent with other departments. Of great concern are the residents who have developed a culture of expressing their displeasure caused by such bottlenecks through sporadic and violent service delivery protests which have since become a prominent feature of South African cities.

Government agencies are created, supposedly, to serve the interest of the people, but in reality, they act as bureaucratic officialdom (Johnson *et al.*, 2014:424). Any set of rules within

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an organisation can be viewed as having a possibility of eventually becoming red tape within that organisation (Brewer *et al.*, 2012:290). Bozeman and Anderson (2014:24) suggest that unclear policies lead to organisational tragedies, which usually cause excessive control measures, mislaid accuracy, red tape and an excessive need to conform to standards. Johnson *et al.*, (2014:424), warned that managers may advocate for a deliberate strategy, while in reality, the organisation may be following a different strategy.

Urban informal settlements, shantytowns and other poor residential neighborhoods have now become a global phenomenon (UN Habitat, 2016:2). Notably, informality is also present in developed countries. They exist in urban contexts all over the world, in various forms and typologies, dimensions, locations and are known by a range of names; squatter settlements, favelas, poblaciones, shacks, barrios bajos and bidonvilles (UN Habitat, 2016:2). Often informal settlements are vulnerable to environmental hazards owing to the lack of infrastructure such as drainage systems and dwellings built using inferior, materials (Drivdal, 2016:21). Approximately twenty-five percent of the world's population dwells in informal settlements (UN Habitat, 2016:3). Integrated development policies at both the national and local levels, especially linking, financing and legal components related to informal settlements and informal settlements, are not prioritised, and policies that prohibit forced evictions are yet to be institutionalised (UN Habitat, 2016:5).

Red tape has considerable impacts on both public and private sectors. The core mandate of every local authority is the delivery of basic services, which includes housing. Most South Africans are still on the never-ending waiting list for low cost housing delivery. The process of housing delivery is going at a snail's pace in comparison to the demand. Residents in many local authorities wait for lengthy periods before they can access this basic need and socio-economic right which is espoused in Section 26 of the Constitution of the Republic of South Africa (Act 108 of 1996). Many role players in upgrading of informal settlements have suffered frustrations due to bottlenecks that exist in various procedures. This can be attributed to the red tape within the internal and external municipal systems that deal with land administration. Authors of this paper contend that despite the shortage of suitable and well located land for housing delivery, including the rising cost of urban land, cumbersome procedures in the administration of available land hinder housing delivery and sustainable human settlement development in various local authorities. It is argued that land administrative procedures within local authorities are inefficient and ineffective to deal with eradication of informal settlements resulting in red tape. A close examination of the phenomenon of red tape in low-cost housing delivery is justified.

2. Literature review

Genesis of red tape

The term “red tape” originated from the sixteenth century, during the regime of Henry VIII of England (1491–1547) when the government began producing proclamations that were written on scrolls, and tied with red tape (Bozeman & Feeney 2011:20). Those who received these documents started using the term “red tape”, to refer to complex and onerous laws. Many scholars including Pandey *et al.*, (2007:400), Brewer and Walker (2010:110), Brewer and Walker (2008:1113); Feeney & Bozeman (2009:710), Wegmann & Cunningham (2010:7), Van den Bekerom *et al.*, (2017:303) and Campbell (2017:76), cited (Bozeman’s 2000:12) definition of red tape are: “rules, regulations, and procedures that remain in force and entail a compliance burden, but do not advance the legitimate purposes the rules were intended to serve.” In this paper, red tape is defined as administrative bureaucracy brought about by redundancy in rules and legislation within and outside governmental organisations.

Red tape internal and external to organisations

Red tape can emerge from within or outside an organisation (Chen & Williams, 2007:420). Internal red tape starts inside the organisation (Yousaf *et al.*, 2014: 926). For instance, in Latin America, cities are marred by exclusionary regulatory frameworks and bureaucratic land and urban management systems, that fail to harness the inclusivity of all stakeholders (Fernandes 2011:2). This is explained by the effects of which is evident from the approvals and subdivision of land which take approximately five years to complete. External red tape refers to the impinging of red tape from external forces outside the organisation, which affects performance within the organisation (Yousaf *et al.*, 2014: 926). External organisations impose rules, regulations, and procedures on public organisations (Van den Bekerom *et al.*, 2017: 317).

Red tape has considerable impact in both public and private sectors. Red tape demotivates employees, especially in the public sector, where it is commonly found. Consequently, it affects an organisation’s effectiveness and frustrates communication with clients (Brewer & Walker, 2008:1124; Brewer & Walker, 2010:110; Bozeman & Feeney, 2011:22; Giauque *et al.*, 2012:64). Brewer and Walker (2010:247) pointed out that when management protects its employees, the adverse effects of red tape are reduced, and vice versa.

While many researchers agree on the fact that red tape impact negatively on many aspects of life, whether social or economic; other scholars hold divergent views in that, “one man’s red tape may be another’s treasured safeguard,” (Kauffmann & Tummers, 2017:1315). They went on to argue that the so-called “burdensome” procedures are valuable to managers overseeing larger organisations. For instance, they can be a useful tool to delay promotions within the

organisation. Thus, the effects of red tape are not necessarily evenly spread throughout an organisation in that, some managers may perceive a rule as red tape, whereas others see it as useful (Brewer & Walker, 2008:1113). Similarly, Moynihan and Herd (2010:657) pointed out that some policymakers create red tape, to further their own interests.

Insofar as previous researchers managed to unveil the benefits and the adverse effects of red tape, it is important to note that rules, regulations and procedures are also meant to reduce risk, especially in local government, where this research mainly focused on. The reason being that, local government deals with very high cost projects. Where there are rules, regulations and procedures, there is control thereby reducing the level of risk. However, when the level of control overweighs the purpose it becomes irrelevant. This study therefore provides direction to eliminate over-control, with the view to give high priority to the municipality's vision.

South Africa Housing policy

Formal dwelling refers to a house built according to approved building plans. A survey by Statistics South Africa in 2016 revealed that 79.3% of households in South African live in formal dwellings, while 13.9% dwells informally and 5.9% of households live in traditional shelter. Section 26 of the Constitution of South Africa states, "Everyone has the right to have access to adequate housing. In this regard, the State must take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of this right." Thus, the Constitution makes it obligatory for government to take all-rational actions to ensure that its entire population have access to housing. It is from this compulsion that the South African government engaged in creation of Sustainable Human Settlements plan commonly referred to as Breaking New Ground (BNG). This plan gave birth to numerous of housing subsidy programmes, which include; Upgrading of Informal Settlements (UISP), Rural, Consolidation, Social Housing, Individual Subsidies and many others. As such, the UISP is a very crucial programme that helps to upgrade the living conditions of the poor. It entails application for funding by municipalities from provincial government to develop informal settlements by provision of tenure security and access to basic services in an inclusive and participatory manner (SERI, 2008:22).

Public Participation in Housing Delivery

It is mandatory for a local authority is to inspire the contribution of communities and community organisations in local government (Section 152(1) (e) of the Constitution of South Africa). This objective is further captured in the Municipal Systems Act, 32 of 2000, which necessitates the development of a culture of participation by the community, and the setting up of mechanisms and procedures accordingly. The vision of active citizenship as enshrined in the Constitution has not yet been realised in the public participation models set out in laws and practice.

Researchers agree on the notion that public participatory processes and systems in South Africa lack transformative qualities and are flawed by a combination of negligence, corruption, infrequent feedback, limited involvement and inexperience on the part of planners and officials (Lues, 2014:802; Tsheola, *et al.*, 2014:393; Mubangizi & Gray 2011:4; Booysen 2009:1). Public participation processes in South Africa are fraught with glitches ranging from politics of representation, power play and party politics (Theron & Mchunu 2013:106). In particular, this is so for residents of South Africa's growing informal settlements. More often than not, it is necessary for one to employ a variety of communication and consultation methods to reach all the stakeholders. However, it is noteworthy that, inasmuch as the municipalities need to accommodate requests from residents, the vision of the local authority should never be neglected. Hence, there is a need to strike a balance between meeting community demands and the broader developmental objectives of the municipality.

Statutory Rules and Regulations Impacting on ISUP in South Africa

Legislation also affect the implementation of UISP. Environmental Impact Assessment (EIA)s have been enacted into law in South Africa as a requirement in accordance with the National Environmental Management Act 1998 (Act No. 107 of 1998) to development projects like UISP. In general, the intention is to assess the impact of the proposed development on habitats, ecosystems and species, with the guiding principle of preventing substantial detriment to the environment (Chand Consultants, 2010). The Spatial Planning and Land Use Management Act (SPLUMA) also govern UISP, just like any other development. Section 33 of SPLUMA enforces that all land developments and the local authorities upon application by developers should permit transactions. Municipalities then draft bylaws in line with such legislation outlining the procedures for such application processes within their jurisdiction. Even though UISP projects seek to address an urgent need to fulfill a constitutional right to housing, they are not exempted from any of the provisions of such legislation and bylaws. Hence, the municipality as a developer goes through the whole application process to seek approval for land development. While a normal application process takes six months to get approval, UISP projects are taking even longer, due to several factors such as EIAs, changes of layout plans and closures to public spaces. The manifestation of red tape in the latter development planning processes would be better comprehended when examined within a case study.

3. Methodology

Case study area background

Nelson Mandela Bay Municipality was used as the case study in this research. It is one of the metropolitan cities in South Africa with a population of about one and half million people. The coastal city was established in 2001 as an amalgamation of Port Elizabeth, Uitenhage, Despatch and the surrounding farmlands. Formerly, it was designed based on apartheid laws, which segregated people along racial lines. The majority of its residents are low income earners located in townships and informal settlements. The municipality has over eight hundred households on the housing waiting list. As this figure surges, the housing delivery process is getting slower owing to a number of administrative bottlenecks. The NMBM is one of the fastest growing economic hub in Africa boosted by the existence of two ports where people are flocking to in search of better life opportunities hence researchers selected this municipality. Two ongoing UISP projects within this municipality were selected in this study for data collection and analysis namely Missionvale and MK Silvertown-Qaqawuli, all in NMBM.

Missionvale Garden Lots, falls under Bethelsdorp, and it comprises various erven, which were consolidated and subdivided into 2500 erven, to accommodate those in informal settlements who had invaded the area. The area is divided into five phases, that is from phase one to phase five. The surveying of the land has been completed, and the residents now await completion of services and title deeds. A lot of problems have been reported regarding this project which include, incorrect alignment of services, sites built on flood areas, the poor quality of houses and the delays in title deeds and essential services like water and sewage. This study zoomed into particular areas in this project where red tape was experienced, investigated the causes and then gave suggestions on preventive measures to guide future projects on the upgrading of informal settlements.

MK Silvertown 2 Qaqawuli, which falls under Ward 16 in New Brighton Ibhayi, consists of Erf 108 (municipal owned) and Erf 421 (Transnet owned). Ownership of erf 108 vests in the NMBM, and consisted of approximately six hundred and twenty shacks, and Erf 421 had approximately one thousand and ninety-nine shacks and this yielded one thousand seven hundred and nineteen shacks, whose occupants had to be provided with houses. However, it was discovered that Erven 108 and 421 combined, could only accommodate 1115 erven (with an average erf size of 150m²), thus leading to six hundred and four families necessitating relocation.

Figure 1: Spatial location of case study sites



(Source: Nelson Mandela Bay, 2017)

Research Design

Qualitative research approach was used in this study to gather data. Apparently, not much research has been done in the study of red tape within human settlements hence qualitative methodology presented the supreme option in exploring the causes of red tape in ISUP projects. Purposive and snowball sampling were used in this study. The use of purposive sampling for this study is supported by Neuman (2014:169) who argued that purposive sampling is instrumental in special situations like exploratory research, which relates with this study. In this regard, based on Neuman (2013), “the judgement of an expert or prior knowledge was used to select cases and respondents who participated in the study”. In this type of research, there is a need to select a group of participants who represent diverse perspectives on the issue (Leedy & Ormrod 2013: 221). The researchers in this study purposely selected people who are directly involved, with prior knowledge or are in positions of influence regarding housing delivery in the NMBM. The respondents included executive and middle management staff of NMBM for administrative and technical questions and also on the political front, councillors from the city council and ward committee members. This was done to assist in drawing accurate conclusions about the system, and to expose the researchers to some new

ideas in this area of study. While purposive sampling seemed adequate for this stage, snowball sampling also played a complementary role in getting more detail and enhancing the accuracy of the research. Neuman (2014:170) pointed out that the two sampling techniques can be combined. As envisaged, in the process of interviewing other participants, referrals were made to some individuals who have high level of expertise in some area related to the study but had not been initially targeted. The researchers targeted twenty-one participants, but due to various reasons, only seventeen participants gave their responses in the data collection interviews. Of all those who responded, only three are not in the employ of the government. Only four respondents have lived in urban areas for a period of between ten and eleven years, while the rest of the population have lived in urban areas for more than twenty-one years.

4. Results

The information gathered from interviews shows that municipal departments are incapacitated, there is varying perceptions on legislation, internal procedures are out dated and there is lack of accountability. Political influence and scarcity of land are also to blame for the red tape in upgrading of informal settlements.

Lack of capacity

Respondents pointed out lack of capacity and resources as one of the major causes of red tape. The municipality and external departments related to UISP projects suffer incapacity. For instance, when asked why the process of Water Use License application took so long, one responded explained that there was a lack of capacity for reserve determinations. *“The hiccup is because determinations for reservations for the whole country are only done at head office. If it was done at provincial level, it would have been probably faster,”* he elaborated. While external departments make effort to speed up process by introducing Information Technology systems such as “eWulas”, an online system, in which environmental authorisation applications and queries are made online to speed up the process, some municipalities are still stuck in manual procedures. *“By this we were trying to get rid of the hard copy manual application system, but local authorities like the NMBM are still submitting hard copies which take a lot of time to process,”* explained one respondent. Municipality officials interviewed in this study also mentioned lack of resources, such as internet facilities, as one of the causes of such delays. *“We do not have the internet capacity to communicate, to share information with external role players or applicants and to make electronic applications hence we resort to manual ways of communication, thus sending hard copies through messenger or post,”* said one respondent

Perceptions on legislation

Information gathered from the interviews shows that there seems to be conflict between the goals of the local authorities and various legislation affecting land development, particularly ISUP projects. One senior municipal official argued that while the municipality is battling to reduce a backlog of more than seventy thousand households on the housing list, the Department of Environment is only concerned about protecting the environment. *"I don't know whether it's lack of concern or just trying to be difficult,"* he complained, referring to the EIA procedures. Respondents internal and external to the municipality converged on the view that processes like EIA and Water Use Licensing (WUL) should run concurrently, to save time, since they are basically the same.

According to the NMBM bylaws for Land Use Planning Ordinance 15 of 1985, authority for land surveying of a new township in areas, which were previously classified as black areas under the Group Areas Act of 1950, must be obtained from the provincial offices in Bisho. It appears getting such authorisation is a mammoth task. One respondent mentioned that, *"We have been trying to get an approval since 2014, and we have not got any response up to now, 2018!"* While the Group Areas Act was repealed with the dawn of independence in 1994, provisions in some legislation are still tied to it. This coincides with Bozeman (2000:12)'s definition of red tape "rules, regulations, and procedures that remain in force and entail a compliance burden, but do not advance the legitimate purposes the rules were intended to serve."

Municipal Internal Procedures

Evidence gathered from the case study area revealed that functional departments within some municipalities work in silos. One respondent pointed out that, *"We work very much in silos. For instance, on our side, we draw a layout then those from Transportation section will pass a comment after three months. Such information could be available to us when we are drawing the layout."* Asked if the public processes were successful, one official replied, *"Insofar as our part is concerned, they were successful"*. This divulges that role players are not working as a team; they are not concerned about the whole project, but rather their part only. Moreover, an *"It's not my job"* attitude is inherent within the municipalities.

Lack of accountability

Generally, participants in the data collection interview concurred with the fact that in ISUP projects role players are not held accountable for noncompliance with contractual obligations. There are no corrective measures for municipal officials who do not comply with their duties in ISUP projects. For instance, some officials do not attend vital meetings, and some do not

respond to mails addressed to them. Often role players make excuses for their non-performance. On the other hand, external role players in ISUP projects seem to exploit such weaknesses in the internal system, by breaching their contractual terms. One municipal official mentioned that, *“When I started working on this project, the first thing I noticed was that the designs which were being used had not been approved, and they were already far advanced with the construction work.”* Municipal contracts for the area under study are in accordance to the General Conditions of Contracts for Construction Works (GCC), 2015 that makes provision for consequences for parties breaching terms, but there seems to be a relaxed approach to the enforcement of such provisions.

Political Influence

All ISUP projects used in this study were marred by political squabbles. In one case study area, ward demarcations boundaries changed during the course of the project leaving the settlements divided between two wards. Even though both wards were under the administration of one political party, the two councillors had political differences, so much to the satisfaction of the rival political parties who would gain a political mileage from such anarchy in the project. Contrary to the normal procedure, houses were built before services were laid out on the ground. *“When I tried to stop them to do the right thing, I was chased away with malicious allegations because I had become a stumbling block to their plans to cause mayhem in the project,”* complained one respondent. Thus, the project became a battlefield for winning votes through tarnishing the image of other role players, which concur with Theron and Mchunu (2013:106) who hold that community projects are “fraught with glitches, ranging from politics of representation, power plays and party politics.”

Some municipal officials in the performance of their duties, were drawn into political disputes in the communities, and ended up working to meet political agendas. It was also alleged that politicians succumbed to pressure from the residents and drifted away from agreements, which they had made with officials resulting in delays on the implementation of projects. Respondents complained that political intervention in some instances compromised ethical principles in case study areas. This outcome coincides with that of Muraguri (2011:7), who says that diverse political, cultural and religious beliefs in society create suspicion and mistrust between residents and their leadership, resulting in slow decision-making.

Scarcity of land

There is not enough land to cater for all the demands of the residents in informal settlement. Generally, residents in these informal settlements were entitled to the land, which they occupied to such an extent that they did not like the idea of the area being evenly subdivided.

Moreover, formal settlement layout plans could not accommodate all the dwellers in that community; hence, some were to be relocated to other residential areas within the metro. Residents were not keen to relocate for various reasons. For instance, some had children going to school in that area, some were working in the city centre and that location was convenient for them in terms of transport, and some were operating economic activities in that area. *“So, to them it was either you accommodate us all or you don’t develop at all!”* stated one respondent. In order to accommodate all the households, the other options were to reduce the erf sizes or to build double storey structures, which also they rejected citing cultural reasons. One respondents stated that, *“In African culture, a household must have some land on the ground to perform family rituals”*. Hence, double storey would deprive those living up the stairs of that traditional value.

5. Discussion

Municipal departments are incapacitated

There is heavy reliance on consultancy work in housing projects. Simple procedures like application for environmental authorisation and water use licenses are subcontracted to consultants. Such service providers have to go through lengthy procurement and supply chain processes, thus adding more red tape to the projects. Such red tape could be cut by doing more work internally. The researchers therefore hold that red tape is caused by the lack of resources within the municipality. The more services and goods are outsourced, the more, red tape, we have in the projects.

There are differences in the interpretation of legislation, resulting in red tape

After the data collection interviews, the researchers found that in most cases legislation is not to blame for red tape, but rather about how the role players interpret the laws and the regulations. It is evident that there is overlapping and duplication in the application of legislation. For instance, it was gathered that the municipality under study does the applications of Water Use License and Environmental authorisation sequentially, but those processes can be done concurrently. In addition, requirements of water use licensing can be dispensed to the EIA. Furthermore, there is no flexibility on the part of external departments to relax some of their conditions. For instance, the department of environment is firm on protecting the environment while the constitution of the republic stresses on access to basic services like housing to every household. On the part of the municipality, there is no sense of urgency in implementing changes to legislation. For instance, by laws take years if at all to be amended to align with changes to the legislation. The authors believe that ISUP projects could be exempted from some provisions of legislation that affect land transactions like sections 57, 71 and 72 of SPLUMA bylaw in NMBM on municipal land. We argue, why a local authority

would go through lengthy procedures to subdivide its land. Moreover, if ISUP is a major priority why not treat these development projects with urgency by for instance stipulating a bylaw that deals with such projects in particular.

Archaic internal procedures

Red tape in ISUP projects in municipalities can be attributed to outdated systems. Most strategies, policies, rules and regulations that govern municipalities in developing countries are not congruent to the dynamic external environment. From results gathered above one can argue that the vision of the municipality under study to clear the housing backlog is incompatible to the internal systems and structures prevailing. This ranges from lengthy supply chain processes, hierarchical authorisation procedures, and outdated administrative methods. One wonders why in this digital age, officials still rely substantially on manual administrative methods. It is safe to point the reluctance by local authorities to explore new ways of doing things, and to utilise Information Technology (IT), and phase out manual procedures as one of the culprits to red tape. There is conservatism within the internal structures. Documents move from one office to another, through messengers; something that could be done through an IT system.

Lack of firm empowerment policies could be one of the causes of red tape. Local authorities are still stuck in hierarchical structures in which certain roles, which are urgent, are not delegated to available junior officials for speedy processing. Management officials are sometimes not available or out of their offices, without delegating responsibility in their absence. Red tape is exacerbated by the fact that there are no consequences for those who do not meet deadlines. The prevailing internal systems are not strict on timeous performance of duties by officials.

Role players operate in silos

Suffice it to say, that the fact that silo mentality is one of the loopholes in municipalities. Lack of co-ordination is causing other role players to make uninformed decisions, resulting in documents moving up and down within hierarchical structures. There is no sharing of information. Each department performs its own role in isolation. For instance, in one of the case study areas, it was gathered that houses were built before services were laid on, resulting in many errors in alignment. One could argue that if the role players had been working as one team, such omissions and mal-performance could have been avoided.

Cultural and political orientations affect ISUP

From the interviews carried out, one can conclude that the values, morals and ethics of both political players and officials, have been compromised regarding ISUP projects. This has been

evident in some cases where municipal workers were reported to have taken political sides in the performance of their jobs resulting in a number of squabbles. While it is a constitutional right of every individual to have a political choice, it should be clarified that municipalities are there to serve all irrespective of political orientation. Hence, the researchers argue, the ideal scenario would be that where role players in ISUP would be apolitical in the performance of their duties for the benefit of all who need housing. Other problems emanate from lack of objectivity by political leaders in pursuit of hidden agendas. Sometimes politicians set undeliverable objectives to the officials, simply to lure the residents to their political ideologies.

6. Conclusion

This research revealed that red tape caused by maladministration systems. It is about operational effectiveness and performing tasks to meet service delivery requirements timeously and better. This inevitably necessitates methodical reflection and review, to find opportunities for improvement. Co-operation with various government departments is vital for red tape reduction. Elimination of red tape necessitates a strategic reorientation in managing departments, as well as substantial changes in management and training programmes. There is a need to design a Red Tape Reduction Programme, in ISUP developments within the municipalities, which will be informed by lessons learnt from challenges faced in previous projects, and national red tape reduction initiatives.

7. Recommendations

To reduce red tape, the municipalities must establish platforms for public engagement and awareness programmes to ensure transparency in housing processes as well as reviewing its supply chain processes to speed up release of funding. Local authorities should also consider investing in the training of human resources and acquisition of new technologies. The NMBM should also consider organising project teams around functional departments to ensure collaboration and link reward to performance within the project teams. ISUP typology must be culturally sensitive to avoid resistance by beneficiaries on cultural grounds. The local authority can also explore the idea of providing serviced land to residents who can afford to build houses.

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Sustainable Disaster Relief Shelter: an innovative model

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Abstract

Natural disasters such as wildfires, floods, thunderstorms, earthquakes, hurricanes, tornadoes, and have proved to be inevitable and every so often such events leave a substantial number of people in need of disaster relief shelters and homes. Disaster relief (DR) shelters are very instrumental in disasters stricken communities and are an imperative part of disaster response and recovery. DR shelters offer secluded and secure accommodation for people who have either been displaced, or have lost their customary accommodations as a result of a disaster incident. DR shelters not only provide instant and short-term accommodation for victims of a disaster, but they also help them to recover from the trauma of a disaster as well as provide a base to start the process of rehabilitation. A review of the literature, case studies, and reports relating to the design of DR shelters demonstrates that their provision and performance are not presently as effective as they could be. A gap of sufficient consideration with respect to economic, environmental and technical measures for DR shelters have each been identified as sources of poor performance resulting into an unacceptable standard of living. The principal aim of this paper is to compare the conventional disaster relief shelter against the proposed one highlighting improvement of conceptual system design, materials to use, form and shape, use and reuse of the units, and in particular, how future shelters can be developed to be more sustainable. The paper asserts the importance of ensuring that shelters provided, protect people against adverse seasonal environmental conditions and help reduce social problems in the disaster areas. It concludes by presenting a sustainable disaster relief shelter model which incorporates such measures from a design phase.

Keywords: Disaster relief (DR) shelter, innovation, economic factors, environmental factors, and technical factors.

1. Introduction

Natural disasters are known as remarkably powerful and destructive weather events which result in loss of property and death, as well as livelihood in many parts of the world (Boudreaux, 2010). The frequency and magnitude of severe weather events such as tropical cyclones, hailstorms, droughts and floods appears to be on the increase globally. This trend has been partly attributed, to anthropogenic climate change but likewise, to rapidly increasing human vulnerability to climate and other natural hazards. These natural disasters on average, account for more than 70% of all insured economic losses. The burden applied by disasters is at its highest in countries with low per-capita income (CSIR, 2018). More Forecasts for the future are consistent with current trends; most scientists warn of an increasing frequency and severity of natural disasters (in particular those that are weather and climate-related) on a local and global scale (IPCC, 2014). In line with the national trends, the Eastern Cape Province can be affected by a greater frequency of natural disasters in the future.

The increasing vulnerability of marginalised, poverty-stricken communities is also likely to exacerbate the state of affairs even further. In the Eastern Cape, the provision of disaster relief shelters after a disaster incident is widely accepted as a necessary element of response and recovery following disasters such as damaging winds, hail, lightning and flash flooding

(DEA,2018). These disasters especially affect the environment, which can threaten the lives of people now and those in of future generations.

Disaster relief shelters are generally viewed as important aspects for climate protection, security, personal safety, resistance to ill health and disease (IFRC/RCS, 2013).Such shelters are commonly used until a displaced group of people can be re-housed in either their rehabilitated initial dwellings or new permanent accommodations. The commonly used types of disaster relief shelters include: prefabricated shelters, public places such as community halls, schools and places of worship. A shelter may be used for periods that extend to numerous months or even years after a disaster.

In practice, the provision and performance of shelters in certain cases has been hindered by various environmental, economic and technical challenges (DRDLR, 2019). This paper therefore, seeks to present a disaster relief shelter model which incorporates environmental, economic and technical measures from a design phase thereby providing of sustainable and comprehensive shelters for those affected by devastating disaster events.

2. Justification and contextualisation of the study

The Eastern Cape Province is prone to severe convective natural hazards and disasters which over the years have been destructive and resulted into death, loss of property and livelihood (AgriSA, 2017). The following natural hazards: severe thunderstorms, hail, damaging winds flash flooding and lightning have been particularly apparent and have given rise to disaster events which have over the years left thousands of vulnerable rural populations homeless(PDMC,2019).

These disaster events have largely occurred in two districts within the Province, namely: Alfred Nzo and OR Tambo districts. The Department of Rural Development and Land Reform (DRDLR) in collaboration with the Department of Human Settlement have over the years provided disaster victims throughout the province with some form of shelter either temporal or semi-permanent. In practice, the quality of these shelters is often too different and unsuitable, the delivery on location is complicated, time consuming, costly with some shelters demonstrating lack of durability. The types of shelters provided by both departments have not evolved much overtime, consequently innovation has not been realised. This is attributed to the fact that government department's major goal has been solely about providing emergency relief and not necessarily about innovation in materials and technology a gap for creating sustainable innovative options whilst solving humanitarian problems remains.

3. Study area

The study area is the Eastern Cape Province where the DRDLR provided relief shelters to thousands of homeless disaster victims.



Source: DRDLR (2018)

Figure 11 - Map showing the Eastern Cape district municipalities

4. Literature Review

Disaster relief has over the years taken many different forms with some proving more effective than others (Haberler, 2017). The most primitive form of disaster relief has always been tents. While tents have often been used after disasters, it should be noted that tents are not good in terms of sufficient insulation, but given that they provide quick and easy solutions for a short time (e.g just a few days/nights). Tents may be the unique solution for some climate conditions and geographical locations. As for the shelters, Yu et al., 2016 content that shelter(s) without insulation are detrimental to the health and well-being of their occupants. Insulation is a vital aspect in these shelters to accommodate thermal resistance based on external climate. Disaster relief shelters as a principle need to protect the occupants from high temperature and humidity in summer and cold and windy weather in winter (Felix,2013).

A disaster relief shelter constructed by Salvalai et al., 2017 called “The shelter” was constructed in such a way that it is able to maintain acceptable internal thermal comfort conditions by reducing the fuel consumption during winter season. Before disasters occur, governments are expected to evaluate and have plans for the types of shelter/temporary housing that would be most suitable for their regions and situations considering the lifestyles of population in potentially vulnerable areas (Abulnour,2015).

5. Methodology

A comparative case study method was used as it is particularly useful for understanding how context influences the success of an intervention. A comparative analysis was made between the conventional emergency shelter constructed out of fiber cement and the proposed disaster relief shelter constructed out of colorplus Zinalume. The comparative approach was premised on the following variables: economic, environmental and technical measures.

Economic measures include scenarios whereby a temporary shelter unit costs more than rebuilding a permanent house. Experts claim that such units can be up to three times more expensive (Johnson et al., 2006, Hadafi and Fallahi, 2010). Another economic aspect is a

shelter's lifespan. More often than not shelters are usually set up for a temporary period. Nevertheless, these shelters often may require facilities, services, and utilities such as electricity, sanitation, sewerage, roads, etc. Thus, the entire infrastructure of such shelters requires a substantial amount of money, which makes them very expensive to build, especially for less developed areas.

Environmental measures become apparent when changes in climatic conditions are not taken into consideration by designers, such as when simple tents are provided to survivors in a winter season (Johnson et al., 2006, Johnson, 2007a, Félix et al., 2013b), or when a lack of local materials and resources is overlooked (Arslan, 2007, Arsalan and Cosgun, 2007), such as a lack of hygienic water and air (The Sphere Project, 2011), which leads to a significant amount of pollution (Johnson, 2007b).

As far as the technical measures it is important that shelters should be easy to assemble and dismantle. They ought to have few pieces and be of light weight. Time is of essence when erecting shelters therefore if the design of a shelter is complex it will require more training and resources to build it. (Arsalan and Cosgun, 2007, IRP and ISDR, 2011).

6. Results

The contemporary relief shelters which are being provided are constructed out of fibre cement. However the proposed innovative relief shelters will be constructed out of colorplus Zinalume. Advantages of using a Zinalume and disadvantages of using fibre cement when constructing disaster relief shelters are clearly indicated below.

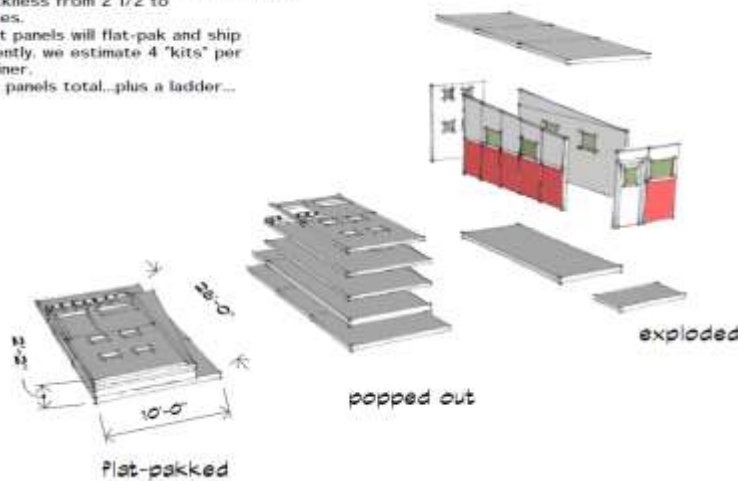
COLORPLUS ZINCALUME	FIBRE-CEMENT
<p><u>Lifespan and Durability</u></p> <ul style="list-style-type: none"> ➤ Cannot crack or Warp ➤ ALUMINIUM coated material has excellent corrosion resistance even in coastal areas ➤ Hail Proof ➤ The material is pre-painted so no painting to take place on site. ➤ Paint will last in excess of 15 years ➤ Colourplus is rust free ➤ SABS approved ➤ No Maintenance Required ➤ Has a steel door that cant not swell , bend or warp 	<p><u>Lifespan and Durability</u></p> <ul style="list-style-type: none"> ➤ 9mm Fibre-Cement is brittle and can crack and break during and after installation. ➤ Possible Hail Damage Risk ➤ Units are hand painted which does not last more than 5 years ➤ Fibre Cement is very susceptible to water damage and needs to be painted every three years to avoid water damage. ➤ The material is porous and absorbs moisture ➤ Has a wooden door that absorbs moisture causing it to swell and warp.

Source: Author (2019)

Figure 12 – Comparison between zinalume and fibre cement

According to Arslan (2007), disaster relief shelters must be durable and easy to upgrade and reusable. Shelters that are not durable and not easy to upgrade turn to produce pollution and cause a significant damage to the environment.

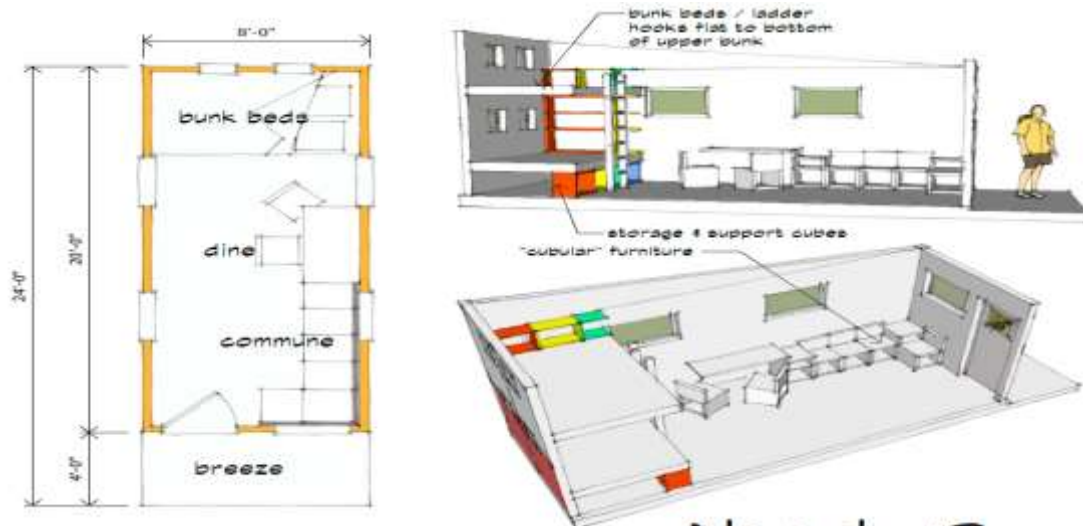
PLACE researched construction systems include: 4' x tall SIPs, pre-assembled wall panels, and modular. These systems range in thickness from 2 1/2 to 4 inches. Precut panels will flat-pak and ship efficiently, we estimate 4 "kits" per container. Seven panels total...plus a ladder...



Source: Author (2019)

Figure 3 – shelter material to be used during construction

As illustrated in Figure 3, the proposed disaster relief shelter will be easy to erect and dismantle because the zincalume material to be used will be light in weight, with few pieces and erected within a short space of time. The material does not pose a threat to environment



Source: Author (2019)

Figure 4 – Shelter security and dignity

The proposed disaster relief shelter is not a mere physical structure but is designed in such a way that it will provide security and dignity to the occupants. During the design of the proposed unit security, privacy and dignity of users was considered extensively.

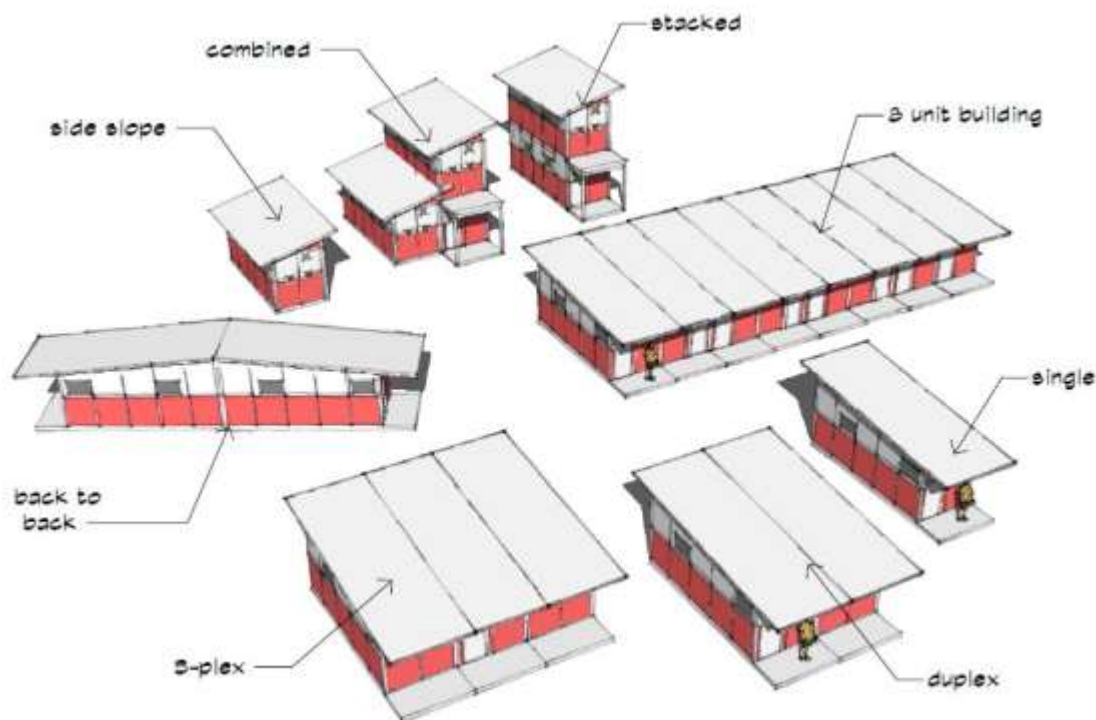


Figure 5 Proposed innovative option: disaster relief shelters

7. Conclusion

Losing a home during a devastating disaster event also means losing one's security; privacy, dignity and identity consequently this increases vulnerability to other lifethreatening conditions. There is need for good planning before disaster strikes in order to take into account sustainability, flexible/long-term design and minimum energy consumption, safety for occupants, low-cost and quick erection. The proposed disaster relief shelter incorporates economic, environmental and technical measures in order to create sustainable dwellings constructed with clean materials for the best quality of life. The successful implementation of the proposed shelter will reduce stress for the surviving disaster victims, improve living standards and stimulate swift disaster recovery.

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