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# Contents

- 1** Wood Technology in the Shona Culture: Implications on Education 5.0 within the Context of Zimbabwe’s Curriculum Framework 2015-2022  
PETER KWAIRA
- 19** The Psychology in Art and Design for Artefactual Development in Africa: Reflections on Indigenous Technical Knowledge  
REGINA BANDA, LINDA KABAIRA, INNOCENT CHIRISA & RUMBIDZAI MPAHLO
- 41** Politics and Ethics in Professional Planning in Zimbabwe  
VALERIA C. MUVAVARIRWA, ANDREW CHIGUDU AND RUMBIDZAI MPAHLO
- 59** The Contribution of Real Estate Training Providers in Botswana 2011-2022  
QUEEN KAMOGELO LEATAME, LEBOLE KGAKANA MATLAPENG, PARTSON PARADZA, HALLELUAH CHIRISA, LLOYD SUNGIRIRAI AND JAIRUS T. NDOMA
- 97** Fabrics of the Future: Economics, Environment and Equity as Calls for Critical Thinking  
EMILY MOTSI AND FLORENCE SEBELE
- 123** The Smart City Concept in Africa: Case of Zimbabwe  
TINASHE MAGANDE, ANDREW CHIGUDU, MIRACLE P. MABVUNDWI AND BEATRICE HICKONICKO
- 146** Urban Expansion and its Impact on Wastewater Management in Masvingo Town, Zimbabwe: Designing for Resilience  
GODWIN K. ZINGI
- 164** Capacity Building of Mentors in the Mentoring of Trainee Teachers  
ROSEMARY MADZORE AND SYMPHOROSA REMBE

# Wood Technology in the Shona Culture: Implications on Education 5.0 within the Context of Zimbabwe's Curriculum Framework 2015-2022

PETER KWAIRA<sup>1</sup>

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## Abstract

*The emergence of wood as an engineering material is taken back into history, as far as the very roots of humanity. It is back then, the relationship between wood and stone is highlighted in the act of fire-making for the sake of human progress and survival. We could not have come this far without these two engineering materials. Interestingly, in present day, most of the engineering solutions to several problems comprise the application of more than one material. In Zimbabwe, the advent of Design and Technology as a subject, together with all its related branches in Curriculum Framework 2015-2022, has turned out to be the case of history repeating itself, regarding the issue of problem-solving. It is within this scenario, that one focuses on Wood Technology (WT) as part of the Shona culture in a study where the task was to determine the extent to which the modern-day Design and Technology Curriculum in Zimbabwe could benefit from the roots of WT founded in Shona culture. In conclusion, this article brings to light several opportunities for such benefits.*

**Keywords:** cultural/living heritage; design and technology education; Shona culture; indigenous technology knowledge systems

## INTRODUCTION

From time immemorial, wood (and in fact, the tree) has always been one of the most important materials for the human race, together with stone. Humanity could not have come this far without these two engineering materials, one polymeric and the other ceramic. Historically, the close relationship between these

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materials is seen in one of the earliest and most creative acts of engineering at its best - the making of fire. This also happens to be one of the first incidents where a human being creatively combined materials in a typical case of problem-solving. Although this period, referred to as the Stone Age, is silent on wood as a material, fire making shows the close relationship between these two materials in the history of humanity. Lasting about 3.4 million years and ending between 4000BC and 2200BC, the Stone Age is a prehistoric period during which stone was widely used to make tools with an edge, a point or a percussion surface ([www.worldhistory.org](http://www.worldhistory.org)). By the look of it, this period appears to have been shared by nearly all the cultures across the globe.

Various accounts from the Bible show abundant evidence of both stone and wood having been used to meet human needs in everyday life. Typical examples of such cases start with the God himself, asking Noah and his family to build themselves an ark out of gopher wood (Genesis 6:1-22 in Stirling, 1941). On another occasion, God proved his prowess as the source and origin of all manner of craftsmanship, when he fashioned those two famous tables of stone containing the Ten Commandments handed over to Moses. Perhaps, this is why, for most cultural groups, there is no separation between culture and religion when it comes to craftsmanship concerning the application of various materials in problem-solving. It is actually at this point that one sees the relevance of Exodus 31:1-8 when God inspires his chosen craftsman in various ways:

--- the Lord spake unto Moses saying --- I have called by name Bezaleel the son of Uri, the son of Hur, of the tribe of Judah: and I have filled him with wisdom --- in all manner of workmanship, to device cunning works in gold, and silver, and brass, and in the cutting of stones, to set them, and in carving of timber, --- workmanship. And I, behold, I have given with him Aholiab, the son of Abisamach, of the tribe of Dan: and in the hearts of all that are wise hearted, I have put wisdom, that they may make all that I command ---, and all furniture of the tabernacle, the table and his furniture, and the candlestick with all his furniture, --- according to all that I have commanded thee shall they do. (Stirling, 1941:97)

What seems to be coming out, from as far back then up to this day, is that, in all problem-solving activities, it is the various combinations of materials that work wonders, rather than



single materials. Within the Zimbabwe's Curriculum Framework 2015-2022, the advent of Design and Technology (D&T), as a subject, together with all its related branches, is a typical case of history repeating itself. It is within this scenario that one would want to focus on Wood Technology (WT) as part of Shona culture. This article is, therefore, based on a study in which the task was to determine the extent to which the modern-day D&T curriculum in Zimbabwe could benefit from the roots of WT embedded in Shona culture.

## **THEORETICAL PERSPECTIVES**

### ***THE ESSENCE OF CURRICULUM CHANGE AND INNOVATION***

Essentially, Curriculum Framework 2015-2022 has been a revised version of the education system in Zimbabwe. Therefore, reference to it ushers in the subject of Curriculum Change and Innovation, where Bialystok (2018) interrogates several issues relating to authenticity in education, with educational aims and ideals being among some of the key factors. In several ways, Bialystok appears in agreement with Ornstein and Hunkins' (2004) views on the issue of Curriculum Change and Innovation; maintaining that it is a question of whether education is relevant for specific purposes within given contexts.

For Zimbabwe, one of the most important elements recently brought into the curriculum, spreading across all levels; from Early Childhood Development (ECD) up to tertiary level has been Design and Technology Education (DT&E), unanimously agreed upon during the nation-wide consultations for Framework 2015-2022. Key stakeholders consulted included the Zimbabwe Schools Examination Council (ZIMSEC), the Ministry of Sport, Arts and Culture,; universities; churches, teachers' associations, industry and commerce (Ministry of Primary and Secondary Education (MoPSE), 2015). Implementation of the revised curriculum commenced on the 10<sup>th</sup> of January 2017, starting with selected classes (Government of Zimbabwe, 2015a). Today, schools are encouraged to provide diversified opportunities for learners to develop key knowledge, skills and attitudes defined in this

framework under various learning areas, from ECD to Advanced Level (Government of Zimbabwe, 2015b).

On the whole, the curriculum is now geared toward learners graduating with skill profiles aligned to critical thinking, problem-solving, communication, technology, team-building, leadership, basic literacy and numeracy and business/financial literacy (Government of Zimbabwe, 2015a). In addition, the following values are expected: *ubuntu/unhu/vumunhu*, discipline, integrity and honesty. Over and above these skills and values, the MoPSE also cherishes the principles of inclusivity; life-long learning, equity, fairness, gender sensitivity, respect, balance, responsiveness, resourcefulness, diversity, transparency and accountability (Government of Zimbabwe, 2015b).

In total, consultations and trial-running at various levels, Curriculum Framework 2015-2022 now has 105 learning area syllabi: Infant (8), Junior (12), Secondary/Forms 1-4 (40), Secondary/Forms 5-6 (44) and Life Skill and Orientation Programme (1). It is, therefore, within this set-up that one needed to unearth all the threads of WT emerging from the Shona culture.

On the need to revisit the curriculum, it is interesting to note that Zimbabwe has not been alone. Since the advent of this millennium, the world has been grappling with the curricula adjustments considered necessary in various contexts. Globally, seminars, workshops and conferences have resulted in much of the literature today, focusing on topics such as Institutions of the 21<sup>st</sup> Century, Universities of the 21<sup>st</sup> Century and Curricula for the 21<sup>st</sup> Century (Bialystok, 2018). Incidentally, the introduction of the Curriculum Framework 2015-2022 in this country has been a move guided by thematic issues drawn from such topics. Being part of curricula for the 21<sup>st</sup> century, D&TE could be viewed as a broad-based thread cutting across the whole education system. This then helps to support the notion that curricula of the 21<sup>st</sup> century are no longer confined to the boundaries of traditional skills, where learners exit tertiary institutions to fit into the comfort zones of conventional areas of specialisation. Globally, the trend has been that of institutions

gravitating towards the promotion of various soft skills over and above traditional skills/knowledge (*ibid.*). This explains the focus on the human side of the graduate. Besides celebrating the graduation of an individual from college as a teacher, medical doctor or engineer, the question is, 'How human is the individual?' This is exactly why scholars and policy-makers from all walks of life have grappled with issues relating to the question of ethics, where *Ubuntu/unhu/vumhunu* has become a universal issue, with broad-based implications on the aims of education (*ibid.*).

***A GLIMPSE INTO THE GENERAL AIMS OF EDUCATION, HISTORICALLY AND PRESENT: A PHILOSOPHICAL DISCOURSE***

Concentrating on Technology Education (TE), the trend in Zimbabwe before colonialism up to this day (43 years after independence), has always been that of those in education re-thinking the curriculum from time to time to keep abreast of events at every point in time. For this discussion, one had to reflect on the Zimbabwe Education Blueprint 2015-2022: Curriculum Framework, for Primary and Secondary Education, specifically focusing on the aims of education in general and those of TE education in particular. Such a venture was premised mainly on the claim that: 'while aims of the curriculum are relative, depending on the nature of society, those of the concept of education remain solidly, permanently and constantly acting as a mirror upon which to reflect and evaluate the outputs of curriculum vis-a-vis the inputs at any given point in time'. In a way, the general aim of education may be equated to the phenomenon one could analogically refer to as the 'rock of ages'. Accordingly, the task was to conduct a content analysis of the said policy document (Blueprint 2015-2022) concerning the relevant syllabus documents and philosophical discourses. Finally, the of TE in Zimbabwe emerged within the context of an education broadly aimed at promoting the ideals of wisdom, understanding, truth, critical/analytical thinking, growth, tolerance/accommodation, survival/persistence, liberation (of the mind) and, above all, sustainability.

Historically, there has been evidence of humanity grappling with the curriculum from time immemorial, as typically shown

by one of the very first recorded incidents among several in human history. Rooted in the Bible, Verses 4 to 17 of Genesis 2 show how full authority was vested upon Adam, the first man to look after the whole Garden of Eden and its contents (The Holy Bible - King James Version, October 2016); thereby qualifying Agriculture as the first subject of instruction in human history. Adam was expected to till the land, water all plants and attend to all the animals in his custody. The course outline had clear instructions regarding what to do and what not to do. For this article, it is perhaps important to note that, this being only an example from one religious perspective (Christianity), it would be interesting to find out what similar examples could be drawn from all those other religions recognised in Zimbabwe.

Recent history continues to show people worrying about education for at least 2 500 years in most cultures, ranging from Confucius in the East to Socrates in the Middle East, with ripple effects in the West (Cohen, 2006). In Zimbabwe, we think of the Munhumutapa Empire and the Rozvi Dynasty having thrived through the application of knowledge in problem-solving.

According to Cohen (*ibid.*), beliefs about education have influenced the educational models and systems developed in various societies for specific purposes. For example, during the last two millennia, the goals of education in the Western world have shifted gradually and from a focus on the elite to focus on the general citizenry. Such changes have been driven by developments outside of education systems that include the rise of nation-states in Europe, the rise of democracy in North America, the widespread demand for skilled labour associated with the Industrial Revolution and the availability of cheap literature resulting from the invention of printing. In addition, the dominance of political and economic interests in education ensured that the goals of education reflected those politico-economic interests.

However, during the second half of the 20th century, the rise of international institutions taking primary and secondary education into their purview, led to confrontations between

Western educational thinking and the values of some non-Western societies, particularly those in the far East (*ibid.*). These cross-cultural contacts have stimulated many countries to engage in educational activities designed to prepare their citizens to deal with cross-cultural contacts and conflicts. For example, the role of education in promoting cross-cultural understanding is stressed to a great extent in the UN Convention on the Rights of the Child, originally enforced in 1990 and adopted by all nations, except for Somalia and the United States of America, which signed but had not ratified it as of June 2004 (UN High Commissioner for Human Rights, 2004). The Convention proposes educational obligations in Article 28 and educational goals in Article 29. It also calls for universal primary education and encourages the development of different forms of secondary, general and vocational education. In essence, this Convention details the aims of education, to which participating states have agreed on the following:

- Development of the child's personality, talents and mental and physical abilities to their full potential;
- Development of respect for human rights and fundamental freedoms, as enshrined in the Charter of the United Nations;
- Development of respect for parents, cultural identity and civilisations different from one's own;
- Preparing the child for responsibility in a free society, within the spirit of understanding, peace, tolerance, equality and friendship among all peoples, and
- Development of respect for the natural environment.

Like the Convention on the Rights of the Child (1990), the report to UNESCO by the International Commission on Education for the 21st Century, 'Learning (The Treasure Within)', also affirms the role education should play in promoting cross-cultural understanding:

We must be guided by the Utopian aim of steering the world towards greater mutual understanding, a greater sense of responsibility and greater solidarity, through acceptance of our spiritual and cultural differences. Education, by providing access to knowledge for all, has precisely this universal task of helping people to understand the world and to understand others (Delors *et al.* Report, 1996).

The same report (*ibid.*) highlights the following pillars of learning:

- learning to know (throughout life);
- learning to do (dealing with problem situations in teams);
- learning to live with other people (managing conflicts with respect for pluralism and peace);
- learning to become (developing one's personality and acting with autonomy, judgment and responsibility).

The Convention on Rights of the Child and the Delors Report (1996) have both indicated an international consensus, where among many other functions, education could also serve international political purposes. While this is not an exclusive function of education, many scholars of education, chief among them, Nussbaum (2005), share this belief.

Education in Zimbabwe has gone through various phases within the context of three broad eras, pre-colonial, colonial and post-colonial. It is against this background that Zimbabwe is seen as one of the committed members of the United Nations after signing, ratifying and adopting various conventions along with other nations, including the Convention on the Rights of the Child.

### ***LINKING CULTURE AND INDIGENOUS KNOWLEDGE SYSTEMS IN SUSTAINABLE DEVELOPMENT***

In Zimbabwe, indigeneity and technology have always co-existed in everyday life. From early history, these two have been packaged within cultural spheres, among which are education (mainly informal), agriculture; medicine, religion, food production and processing, military (defence), arts and crafts, entertainment and business. Atte (1989) has witnessed this in situations where typical cases have included grain storage techniques in various African countries. The growth and development of technological capabilities within these spheres has had several implications on the issue of sustainable development within various communities.

Blowers *et al.* (2012) pose the question; 'Is sustainable development sustainable?' This question challenges one to re-think the essence of sustainable development. There appears to be two linked concerns. One is the concern for maintaining, if not improving, conditions for living. This is expressed in terms of meeting needs and aspirations, looking after the planet, and, providing a better quality of life among other motives. The other is a concern for bequeathing an acceptable inheritance to future generations. This comes in such terms as, not compromising the future, handing on in good order and refraining from burdening future generations (*ibid.*). However, lately, there have been allegations of sustainable development being diverted from its central purpose and, instead, being appropriated to describe and justify approaches far more concerned with the demands and or needs of the present than those of the future. This proposition can be examined by looking at three dimensions of sustainable development – the economic, the environmental and the political (*ibid.*). It is here that indigenous technology could have lessons for modern technology. For instance, going unchecked, modern technology has been destructive to the environment, in most cases, while the former has always been known to be environmentally friendly and compatible. These are some of the issues that need to closely follow on the exploitation of environmentally sensitive material such as wood. This means that our forms of technology have to be appropriately designed, in terms of environmental friendliness.

### ***THE LINK BETWEEN HISTORY, THE CURRENT AND THE FUTURE***

According to Berg (2018), everything has a history. For example, everything we do, everything we use and everything else we study is the product of a complex set of causes, ideas and practices. Even the material we learn in various other courses has important historical elements – whether because our understanding of a topic changed over time or because the discipline takes a historical perspective. This means, there is nothing that cannot become grist for the historian's mill (<http://www.wiscosin.edu/>). In a way, understanding history also helps us understand the world at large, where we get a

detailed picture of how society, technology and government worked in the past so that we can better understand how it works now/today. While world history might seem or feel far away, studying history reveals how all events are connected. It also helps one determine approaching the future since it allows one to learn from past mistakes (and triumphs) as a society.

### ***RELATING SHONA TO OTHER GLOBAL CULTURES THROUGH WOOD TECHNOLOGY***

Historically, experience in wood technology, together with other forms of technology has been widely shared with almost every other culture across the globe. Studying the diversity of human experience helps one appreciate other cultures, ideas and traditions and to recognise them as meaningful products of specific times and places (<http://www.wiscosin.edu/>). This way, history helps realise how different our lived experience are from that of our ancestors, yet there are similarities in goals and values. In a way, we end up developing empathy by studying the lives and struggles of others in the shared world.

### ***WOOD TECHNOLOGY WITHIN THE CONTEXT OF DESIGN AND TECHNOLOGY BACK THEN AND TODAY***

Used in combination with an array of other engineering materials, wood has always been a key element in problem-solving from the days before recorded history up to this day. However, in all this, what has kept on changing from time to time has been the approach used at various levels of problem-solving.

On the issue of change, it is perhaps important to note that change can be a difficult concept to understand. This is mainly because each of us has a different experience from the rest of the world – an experience shaped by societal norms, cultural differences, personal experiences and more. We know when we as individuals crave change and why (Heeks and Stanforth, 2015). Studying history is about studying change, where experts examine and interpret human identities and transformations of societies and civilisations over time (<http://www.wiscosin.edu/>). A range of methods are used to answer questions about the past and to reconstruct the



diversity of past human experiences, resulting in an understanding of how profoundly people have differed in their ideas, institutions and cultural practices, how widely their experiences have varied by time and place and the ways they have struggled while inhabiting a shared world. This way, history helps us understand complex questions, regarding how the past has shaped (and continues to shape) global, national and local relationships among societies. It also helps us better understand how, when and why change occurs (or should be sought) by demonstrating the historical evolution of ideas, technologies, beliefs, places and more (<http://www.wiscosin.edu/>). A typical example of where such an orientation becomes important at this point is a situation where we are obliged to appreciate the need to move from Education 3.0 to Education 5.0, as the country strives towards Vision 2030.

## **RESEARCH DESIGN AND METHODOLOGY**

Typical of Developmental Research (DR), the investigation upon which this study is founded was based mainly on activities centred around a major literature review, where various documents were studied and analyzed, chief among which, was the Curriculum Framework 2015-2022. In two phases, the first round of review involved an exercise informing the study, regarding pertinent issues relating to the state of WT in Zimbabwe, while the second was a content analysis of Curriculum Framework 2015-2022. Effectively, WT emerged as one of the most prominent technical areas within the Zimbabwean curriculum, together with other areas like Metal Technology (MT).

Specifically focusing on all 105 syllabi comprising Curriculum Framework 2015-2022, a detailed analysis helped to locate all areas where issues relating to WT were implied. This was buttressed by evidence from the general literature pointing to the historical bearings and roots of the discipline, culminating in all the data pointing to the results and findings of this investigation. All data were obtained with the aid of a tailor-

made checklist, designed to capture specific aspects of interest concerning WT.

## **RESULTS**

### ***DESIGN AND TECHNOLOGY EDUCATION WITHIN FRAMEWORK 2015-2022***

Searching for the roots of WT within Curriculum Framework 2015-2022 meant a detailed content analysis leading to all those areas relating to the broad field of D&T. This resulted in all those areas implying or suggesting the philosophy of D&T being unearthed across the whole Framework, from Early Childhood Education (ECD) up to the Advanced Level (Forms 1 & 6). In total the following syllabi areas were identified:

- Wood Technology & Design;
  - Metal Technology & Design;
  - Building Technology & Design;
  - Textiles Technology & Design;
  - Food/Nutrition Technology & Design;
  - Technical Graphics, and
- Agriculture.

### ***RELATIONSHIP BETWEEN SPECIFIC AREAS AND WOOD TECHNOLOGY IN SHONA CULTURE***

All the syllabi areas identified related to WT in one way or another within Shona culture. For example, besides wood being a consumable material used in making various utility products, the equipment used also comprises wood on major components. Over and above everything else, the philosophy of problem-solving is found cutting across the whole spectrum, thereby under-pinning the related activities within given areas.

### ***SHONA CULTURE IN MODERN-DAY WOOD TECHNOLOGY RELATING TO EDUCATION 5.0***

Apart from those areas directly relating to WT within the Shona culture, through the philosophy of D&T, there are also more indirectly suggesting such a relationship. This has been through the mainly issue of heritage and the related aspects of social studies, especiall, family, religion, life skills, language, arts and other cultural aspects. It is actually these areas that

have been found cutting across the whole of Curriculum Framework 2015-2022, from one level to another. Also noted has been a trend where vigorous efforts have been made to market Shona culture through various avenues, chief among which have been business and other enterprise-related studies. Indeed, such moves have been totally in agreement with Education 5.0.

### ***INTEGRATION OF SHONA CULTURE INTO THE TEACHING/LEARNING OF WOOD TECHNOLOGY WITHIN FRAMEWORK 2015-2022***

To successfully integrate Shona culture into the teaching/learning of WT within Curriculum Framework 2015-2022, there is need for all those involved at various levels to openly share ideas for the common good, where practitioners are prepared to learn from each other. Analysis of specific cases revealed typical scenarios from other systems across Africa and beyond. Particular cases in point were those from West Africa, where Manabete (2014) has been focusing on 'Indigenous Technology for Sustainable Development', suggesting several ways of seeing it in the curriculum. Such an investigation qualifies this study as an ideal platform to generate and share relevant pedagogical ideas among educationists. For example, teachers and teacher educators could work towards the development of appropriate skills, regarding how to promote learning by incorporating the principles behind given cultures in their teaching, including Shona culture. It is also the intention here to help teachers appreciate the importance of incorporating aspects of culture in the implementation of Curriculum Framework 2015-2022, where even approaches have been designed to qualify it among curricula of the 21<sup>st</sup> century.

### **DISCUSSION**

The findings of the study behind this article showed WT coined within the philosophy of D&T and broadly spread throughout Curriculum Framework 2015-2022. The idea of revisiting the curriculum and re-designing it into what has become the revised curriculum, appears to have been motivated by the spirit of *ubuntuism/hunhuism*, aiming at making it relevant and useful to the Zimbabwean context.

According to Moore (1982, cited by Kwaira, 2007), teaching is an activity in which one consciously accepts responsibility for the learning of another. For meaningful learning, the same individual gets committed to the value judgment of the relevant content. All this results in teaching being an intentional matter, where one promotes learning that she/he can assess. Logically, this also implies the same individual being honest and sincere in his/her dealings as a professional, thereby suggesting the ethical side of the teaching profession. This is possible only where one is convinced that what she/he passes on is worthwhile, thereby bringing the element of 'truth', philosophically, the underlying basis for all knowledge considered worthwhile= (Moore, 1982). By implication, nothing is worthwhile without being true. This appears to be the main reason curricula in any context need to be evaluated, to determine their relevance and validity. Truth, concerning the value judgment of any activity impacting upon society, is one of the underlying principles of *ubuntu/hunhu* (Kwaira, 2007).

As already noted, teaching and learning bring the teacher and the learner together in an intentional interactive process, where educationists are challenged to articulate their intentions and keep checking on whether they are realistic. Relating the teacher and the learner also means considering their levels of participation as equal partners in the business of teaching and learning. Brown and Atkins (1988) elaborate this relationship by placing various teaching/learning strategies on a continuum, comprising two extremes: the lecture method in which learner contribution is a minimal and private study, where there is little control by the teacher. In D&T, the ideal is to strike a balance, where teacher and learner learn from each other, with the former mainly facilitating the process.

According to Cravens (2003), human culture and technology are continually co-evolving in a dynamic relationship, so it becomes crucial for practitioners to remain flexible and open-minded. All technologies develop in a particular cultural context as a result of changing needs or constraints (Heeks and Stanforth, 2015). However, once developed, there is a possibility of technology changing the very culture creating it (Cravens, 2003). On the other hand, when a technology spreads to another culture, the

cultural context determines the speed and the way it is adopted and applied in problem-solving. The diffusion of technologies into other cultures changes those cultures in various ways (Davis, 2021). All this seems to suggest that changes in culture that one technology creates may then influence the development of another (different) technology.

## **CONCLUSIONS AND RECOMMENDATIONS**

As the implementation of Curriculum Framework 2015-2022 continues in all schools, the need for continuous research and evaluation is going to be critical for the curriculum to remain relevant. It is, therefore, this scenario that is likely to continue challenging the government to keep Teacher Education abreast of events within the context of continuous change, concerning WT and related factors. There are several issues deserving special understanding by teachers. It is this kind of orientation that teachers need to acquire during their training.

Since WT closely relates to the broad areas of D&TE and Indigenous Technology Knowledge Systems Education (ITKSE), teachers need to be assisted in gaining a reasonable level of appreciation, regarding the essence of these concepts in various contexts.

Regarding the role of D&TE in promoting sustainable development in Zimbabwe, several parts of this article, while focusing on WT within the Shona culture, seem to suggest such an outcome is possible only where the philosophy is infused into all curriculum activities and processes. The idea of promoting this philosophy within the curriculum is likely to help cultivate the spirit of patriotism, where future generations have the potential to develop a sense of belonging, self-identity, self-respect, dignity, unity, responsibility and achievement. It is this kind of orientation that would enable the nation to deal with all problems effectively by drawing on the humanistic values that are expected to be inherited, cherished and perpetuated from history, with the present taking us into the future. Indeed, going through Curriculum Framework 2015-2022, is exactly what it appears to be standing for. The challenge is then to have all teachers in training and in-service assisted accordingly, to be cultured into such an orientation. To

do this, the idea is to recommend the development of a system characterised by programmes founded upon two fundamental principles: teacher/learner relationship, being the crucible for nurturing development and growth and the curriculum, being a co-creation between teacher and student.

Focusing on the teacher/learner relationship, one sees the consciousness of the teacher is an essential component in implementing WT as part of D&TE within Curriculum Framework 2015-2022. To the extent that teachers are preoccupied with personal issues, there is likely to be an inability to genuinely attend to the needs and potential of their students. Teachers, therefore, need time and resources to cultivate their consciousness, whereas educational settings would need to allow them opportunities to establish empathetic relationships with their learners.

On the other hand, the curriculum, as a co-creation between teacher and learner, is learner-centred and dynamic, unfolding under the interests and capacities of learners, where growth opportunities present themselves in the flow of daily life. Of special concern is the nurturing of a balanced development of the body, feelings, will and intellect.

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- <https://en.m.wikipedia>
- World History Encyclopedia ([www.worldhistory.org](http://www.worldhistory.org).)
- <http://www.o-bible.com/kjv.html>
- [www.biblestudytools.com/kjv/](http://www.biblestudytools.com/kjv/)



# The Psychology in Art and Design for Artefactual Development in Africa: Reflections on Indigenous Technical Knowledge

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## Abstract

*Indigenous African societies' lives revolve around arts and the creation of artefacts. The design of art and artefacts employs abilities defined by the communities as important, according to their belief systems, hence the reference to implicit theories of intelligence. Implicit theories of intelligence were found to be related to indigenous technical knowledge (ITK) that was employed in designing artefacts and arts. These designs and the eventual use of the artefacts and arts have an impact on the development of social norms that shaped the indigenous ways of life. The authors employed a narrative review aimed at finding and summarising existing literature while seeking to identify novel areas of study. The review included papers that informed on architecture and art, tools and implements designs in Africa. Thematic analysis was used to identify recurrent themes that pointed to the existence of implicit theories of intelligence and the creation of social norms through the design and use of art and artefacts. The themes identified included optimal use of strengths and minimisation of weaknesses as a sign of intelligence, design of artefacts for functionality purposes, design as a process of adaptation, design as a sign of social status and design as a process to ensure equitable role distribution.*

**Keywords:** theories of intelligence, social intelligence, design, artefacts, sustainable architecture, arts, social norms, taboos, socio-ecological, symbolic.

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## **INTRODUCTION**

Art and artefacts in Africa have been found to have deep meaning to the indigenous communities and how they live, making the two key aspects of indigenous African culture (Tetteh, 2013; Cocodia, 2014). The designs of the tools and equipment created vary according to context (Adewumi and Faida, 2017). Design as a product of culture is, therefore, viewed as both a process and a product of the process, which means it is as dynamic as the cultures that define it. Given the central role that arts and artefacts have in the ways of life of indigenous African communities, understanding how decisions on designs and uses were arrived at, clarifies human behaviour. Through the use of indigenous technical knowledge (ITK), the indigenous people create a sustainable relationship with their ecosystems. ITK refers to a community's culture-specific accumulation of knowledge and development of practices that are derived from their experiences with problems and situations across various aspects of their lives (Sow and Ranjan, 2021).

ITK is linked to implicit theories of intelligence as defined in the field of psychology. Maurial (1999) suggested a cognitive aspect in forming ITK, since the technical knowledge arose from continuous interaction with the environment (Blose, 2019). Shava *et al.* (2010) incorporated aspects of the context, community culture, language and practices, among other things. These cognitive and contextual aspects are key in defining theories of implicit intelligence where abilities are viewed as important if they help the community adapt to the environment, bringing in social responsibility and social intelligence that is defined according to a people's culture (Mpfu *et al.*, 2012).

Arts and artefacts have also been found to be related to how norms are developed and adhered to in communities, which is a key aspect in the psychology subfield of social psychology. Social Psychology deals with understanding the influences of society in terms of norms development. The development of arts and artefacts is described as the place where the past meets the present (Bauer, 2008). He explains that a societal constitution of artefacts allows for routines that are acceptable, leading to viewing artefacts as a continuation of the politics in the society

since possession of art and artefacts may indicate individual social statuses. As norms go through a cycle of change to obtain legitimacy, so do artefacts.

The study seeks to illustrate that ITK remains instrumental in socio-ecological decision-making. Although Opaluwa *et al.* (2012) insinuate that sustainability was achieved in ignorance, the current study emphasises that the development of art and artefacts was purposive and informed by previous experience. The indigenous people coexist with their environment as they are governed by the concept of *ubuntu* (Mashoko, 2021). *Ubuntu* philosophy shapes behaviours and attitudes of the communities by emphasising the interrelations between nature and people.

### **CONCEPTUAL FRAMEWORK**

The designs and use of African art and artefacts are informed by what is important for the continued survival of communities. Arts and artefacts are fully embedded in the ways of life of the African people, including the development of group norms. Concepts from the implicit theories of intelligence and social psychology were adapted to inform the current article. Implicit theories of intelligence illuminate the idea that intelligence is not only a cognitive aspect, but also a social one (Mpofu *et al.*, 2012). Implicit theories of intelligence posit that communities shape and encourage the development of traits that are important for the communities. This includes the ability to understand one's ecosystem and social environment. Indigenous communities are dynamic and their behaviours are governed by socially acceptable rules and principles decided upon by communities. Concepts to explain this dynamic perspective and adherence to the rules are derived from Social Psychology. Norms in Social Psychology are viewed as a vehicle of change. The norms determine the patterns of interaction and a sense of social identity. Development and adherence to these norms have been linked to the development and use of artefacts (Piekarski and Wachowski, 2018). This concept defines how rules and norms that are adhered to are governed by the socio-ecosystems principles of a sustainable coexistence.

## **LITERATURE REVIEW**

The literature reviewed in this current article focuses on the indigenous principles governing the development of tools and equipment used in indigenous communities. The literature revealed the convergences in ITK and how implicit theories of intelligence are defined. Arts and artefacts inform the way of life of individuals in a community in terms of attitude development, knowledge establishment and social relations among community members.

‘Design’ can generally be viewed as a verb or a noun and understanding design as a process opens gateways to comprehending the design process as a way of solving problems (Tetteh, 2013). Artefacts are objects with historical or cultural importance that are created by a people (US History.org, 2016). Smith and Kotze (2010) qualify artefacts as a product of the community that reflects how institutions mutually coexist for instance, therefore, what an artefact means depends on the individual yet this may have an impact on the community systems. Where artefacts are produced in mass, they may become social objects and standardisation breeds some norms in their production as well as their use (Piekarski and Wachowski, 2018). Understanding design as a process is key as people learned from past crises to adapt to their changing environments in a bid to attain sustainable coexistence by minimising negative impacts on the ecosystem and increasing efficient use of available resources. (Benjamin, 2006).

The artefacts in the discussion include the environment, buildings and public places (Piekarski and Wachowski, 2018). Rugwiji (2019) refers to a “collective cultural landscape” to explicate how communities interact with their environments. Indigenous architecture proved to be done through high levels of sensitivity for the socio-ecological system which was informed by indigenous knowledge systems (IKS.) IKS inform how the communities are part of the world that is alive around people, viewing humans as counterparts of nature, thus presenting a complex and holistic system (Reitsma *et al.*, 2019). The design of artefacts enables communities to integrate with their natural settings (Benjamin, 2006). This means architecture on the

continent must be analyzed holistically, giving thought to its socio-ecological context (Mhlaba, n.d).

Mhlaba (*ibid.*) contends that culture determines how African architecture is spatially organised, further highlighting how diverse and dynamic culture is. Architecture is described as a symbolic language defined by nature and how individual communities responded to it, making the articulation of elements of weather like sunlight and protection from rain, while considering the vegetation and ground forms and surroundings, the essence of architecture (Ahmed and Suman, 2014).

Art is key in African lives because it serves as a means of communication, expression of religion and sociocultural norms and it varies from culture to culture (Opoko *et al.*, 2016). How objects appear physically and their uses are intricately connected to the values of communities in terms of religion, social and moral arenas and how aesthetics express the notions and aspirations that people have on their environment, including ways of life in general, since the art of Africans mingles fully with their way of living (Opoko *et al.*, 2016; Tetteh, 2013). Siegman (1980) observed that art in Africa is mainly symbolic rather than archetypal and symbols possess rich meanings that are complex across contexts, for instance, colours are used as decorations or ritualistic worship, among others, and these colours mean different things to different peoples and cultures (Adewumi and Faida, 2017).

The rural landscape is important as a preserve of culture, values and community traditions and the community was viewed as the custodian of the individual (Umali, 2018). Through ITK, how some domestic tools and utensils were designed, fostered their usefulness and endurance to maximise the sustainable use of the land and its resources at minimum costs. Physics principles, like the centre of gravity and centre of mass, were found to be useful in the making of clay pots and mortars, for instance (Mudzamiri, 2019). Taboos were also set in some communities to forge morality that allowed for the sustainable use of the environment (Chemhuru and Masaka, 2010) and for setting rules on design and manufacture

processes that ensured equitable distribution of labour and responsibilities among the populations (Gosselain, 1999).

Implicit theories of intelligence explain how people construct and interpret the elements that makeup intelligence (Wambugu, 2006). Although there is no consensus on what intelligence is, it is key to note that cultures and subcultures determine how intelligence is viewed (Cocodia, 2014). Social aspects of abilities in people are important to Sub-Saharan communities (Serpell, 2007 as cited in Mpofo *et al.*, 2012). Dispositional and social intelligence and social responsibility were found to be key components of intelligence, together with creative ability, including artistic expression as long as they were viewed as important in upholding community values, where considerations were made to the environmental demands (Mpofo *et al.*, 2012).

## **RESEARCH METHODOLOGY**

A narrative review was selected for this treatise because it has no predetermined search strategy (Demiris *et al.*, 2019). The research aimed at providing a detailed synthesis of previous research on the aspects that govern the creation and use of African art and artefacts. A narrative review is more flexible as compared to quantitative reviews that use narrowly defined parameters. The narrative review also affords the research the opportunity for speculation and creativity to afford the identification of more areas for future studies. A Google and Google Scholar search of articles led the study to various articles on art and artefact design and how they were useful in developing new technology and new study curriculums across varying levels of education. Abstracts were read to further screen articles.

Themes were identified using thematic analysis in the articles selected using the Braun and Clarke (2006) framework to ensure credibility and dependability of the article (Maguire and Delahunt, 2017). The recurrent themes “adapting to the environment” and “creation of social norms” pointed the research to search for psychological articles that clarified implicit intelligence theories and social psychology and norms creation.

## **RESULTS**

Two main themes were identified. The first was “design as evidence for implicit theories of intelligence” and the second was “art and artefacts in Africa as a driver for social norms”. Under the theme design as evidence for implicit theories of intelligence, subthemes included optimal use of strengths and minimisation of weaknesses as a sign of intelligence, design as a process of adaption, design of artefacts for functionality purposes, creation of environmentally suitable artefacts as a sign of intelligence and design as a component of social intelligence and social responsibility. The subthemes under the main theme “art and artefacts in Africa as a driver for social norms” included the design product as a source of social norms, design as a process of creating elite power, design as a sign of social status and design as a process to ensure equitable role distribution.

Evidence was gathered from African countries including Egypt, Zimbabwe, Nigeria and Kenya. The evidence included architectural designs of homesteads buildings and art creation together with artefact design and their uses. The analysis took into cognisance the products of design and their processes. Some of the themes were found to overlap but care was taken to include findings under their most suitable theme.

## **DISCUSSION**

### **DESIGN AS EVIDENCE FOR IMPLICIT THEORIES OF INTELLIGENCE**

Implicit theories of intelligence in the field of psychology give a varying perspective from how the West defines intelligence as a factor devoid of the social context (Mpfu *et al.*, 2012). How Africans define intelligence gives importance to the social aspects that they value in their lives, for instance, staying in harmony with their ecology, since they believe their ancestors live in nature and that the living is connected to their dead relatives. These aspects are evident in traditional communities, as they harness nature elements to create comfortable dwellings for their communities. Evidence was found in all articles read in writing this study that communities utilised resources that were readily available in their surroundings and relics did not disrupt the ecosystem but, instead, blended with nature (Smith and Kotze, 2010; Opaluwa *et al.*, 2012). Straw bales, for

example, absorbed noise and were known to provide thermal comfort (Opaluwa *et al.*, 2012). These could be grown by farmers and were abundantly available and useful without emitting destructive gases into the environment. Social responsibility and social intelligence were also components that the Shona depicted as part of being intelligent.

### **OPTIMAL USE OF STRENGTHS AND MINIMISATION OF WEAKNESSES AS A SIGN OF INTELLIGENCE**

Over generations, ITK developed to take advantage of strengths in the individuals and the environment, while reducing the impact of environmental and individual weaknesses. The Karanga believe nature consists of the physical world, the landscape and the forces that control these with the power of this nature being evident in diseases and death, droughts and floods that were interpreted as a bad omens (Pikirayi, 2013). Implicit intelligence theories posit that cultures value and encourage abilities that help communities live sustainably in their environments and ITK may have been used to encourage and share knowledge on lessons learnt from past generations to inform how future generations then interact with the environment. By using ITK to inform how to design their artefacts, therefore, the traditional communities were tapping into their intelligence which arose from learning lessons from their ancestors of what worked for them and what did not. Emphasis was thus made to encourage those aspects that enabled community coexistence and adaptation to nature. For instance, the shapes and designs for the mortar, the round huts and the conical huts, for instance, were not random and uninformed developments but were informed by the need to make the artefacts functional and this knowledge and skill was passed on and promoted through generations (Mudzamiri, 2019).

Nigerian Yoruba buildings are constructed from locally abundant materials and the houses have evolved in response to socio-cultural and climatic demands (Opoko *et al.*, 2016). Domestic Yoruba architecture has three major categories which are palaces, chief and titled men residents and the more humble and ordinary people's dwellings (*ibid.*). The quality of artistic expression and the size of the homes distinguished the



houses, while polishing the walls protected mainly the walls from erosion and was for aesthetics (Opoko *et al.*, 2016). The more affluent in the community adorned their homes with carved caryatids (*ibid.*).

### **DESIGN OF ARTEFACTS FOR FUNCTIONALITY PURPOSES**

When domestic tools were designed, deep thought was given to how they may attain their functionality. For instance, the mortar is shaped with a broad base to make it stable. The conical shape also ensures stability is maintained and that centre of mass lies within its base. The pounding must be done through the mortar's centerline to make sure the mortar does not topple over (Mudzamiri, 2019). The force applied to the centre of the mortar does not result in a turning effect of the artefact.

The *guyo* needs a rough surface to be able to crush grains using frictional force and the round hut endured the mechanical equilibrium of the structure all the time (*ibid.*). The roof's shape needed to maintain zero torque and zero resultant force so as not to damage the hut, hence careful considerations in ensuring the wind force and the weight of the material used to make the roof did not exceed the force of the building structure as a whole. Using the conical shape ensures airspeed is higher around the roof than that in the surrounding area which produces low pressure underneath the roof, thus balancing the downward pressure of the roof. Without this balance, the roof may be lifted by the air, a great danger to the community.

Clay pot shapes and sizes vary, depending on their purpose. The Luo people of Kenya use clay pots to store water because of their evaporative cooling effect (Mwiandi and Ombaka, 2017). In Zimbabwe, *shambakodzi*, the pots used for cooking *sadza* have huge bellies to accommodate large volumes of *sadza* to suit the demands; the mouth is wide to allow for ease of stirring of the *sadza*; the pot is not painted due to soot; the *hadyana* is for relish and it is smaller to cater for smaller quantities required to feed a family as compared to *sadza*; *mbyiya* is used to serve food and it is painted and small since it serves as a side dish; the *gate* is big-bellied with a wide neck since it is used to brew beer and cook maize and other foods like *nyimo* and *mutakura*; *pfuko*

is used to store *maheu* and beer and it has a narrow long neck, is painted and has patterns and drawings on it; *hwedza* is used to keep milk and it is wide-mouthed so that it receives the milk well, while *hodzeko* is used to keep the milk until it is ferments; and *chirongo* was created light in weight to make it manageable to fetch water (Brazier, 2020). The oval shape of the clay pots allows for the larger volume of the pots, keeping the central gravity low, thus maintaining unstable equilibrium (Mudzamiri, 2019). All these variations in the artefacts arose from the need to ensure the artefact served the purpose that it was created for adequately.

### **DESIGN AS A PROCESS OF ADAPTION**

Community lives were not static but changed over the years, according to the need to adapt to their ever-changing environments. Great Zimbabwe was built in different stages (Ahmed and Suman, 2014). The Hill Complex was not built based on a preconceived plan, but evolved with time and the Great Enclosure walls follow a similar trend (Pikirayi, 2013). Pikirayi notes that the town took three centuries to construct. The impression attained from these findings is that over hundreds of years, people modified their settlement, depending on what nature presented along the way. A volcanic eruption is believed to be responsible for the flat shape of the rocks used in the construction of the monument and veld fires may have separated them from the main rock, meaning the availability of materials to use may have varied over the long period and the community had to adjust the wall's designs according to their community developments and well as environmental changes.

In Egypt, when the land was in flood, farmers became builders (US History.org, 2016). Egyptians believe in the afterlife and so they built the Great Pyramids as impressive tombs of powerful pharaohs. The Sphinx was designed to watch over the pyramids with a human head on a body of a lion, symbolising immortality. The size of the pyramids was meant to accommodate the pharaohs and their possessions and, initially, the pharaoh's slaves and animals were buried with him (*ibid.*). However, since burying the pharaoh with their slaves and animals later proved to be costly, art was used instead to depict human activity on the inside walls. Art, in this case, was used

to adapt to a huge cost that the community could no longer handle. To protect the pharaoh's remains from defilers, the hardest stone blocks were used to make a huge coffin.

### **CREATION OF ENVIRONMENTALLY SUITABLE ARTEFACTS AS A SIGN OF INTELLIGENCE**

Principles in the discipline of physics seem to have been considered, although no formal education was attained in the development process of these artefacts. In creating the yoke, a wooden beam that is used on a pair of oxen to enable them to pull a load used in agriculture, for example, it is considered that the two forces from the animals are in opposite direction to produce a momentum that has a turning effect at the middle point of the yoke, if the forces are thus equal, they prevent the yoke from turning at the centre (Mudzamiri, 2019). Mudzamiri also gives an example of the conical shape and the angle of the roof which ensures raindrops are projected away from the hut to prevent the water from wetting the pole and daga structure to prevent its weakening and eventual collapse in addition to preventing the structure from developing mould which can result in illnesses.

Farmers in Nigeria made use of locally manufactured hoes suited for their terrains and soil structures to the extent that a hoe designed in the North may not have been adequately useful in the South (Asoegwu *et al.*, 2018 ). Key considerations made for the hoes were mainly ergonomic. These hoes proved to be efficient as they could reduce labour by 50% in rice fields weeding (*ibid*).

The traditional plough is made of wood, is animal-drawn and can at times have a metal share point (*ibid*). The handle is used to guide the plough. In key deliberations in choosing the most suitable power source and ideal equipment in processes including tilling, planting and weeding, the farmers consider local factors of availability, accessibility, affordability and acceptability. To complement these key considerations, the source of power and the equipment used would be in tangent with the user's knowledge, skill, experience and must be available to complete the task on time, providing operational and financial sustainability.

For sustainable production in Agriculture, there is a need to conserve the environment and so implements must be effective and sustain fewer oxen (Gebregziabher *et al.*, 2006). The simpler support systems for animal draught technologies and their indigenous nature allows for ease of integration with the systems of the small farmers. For instance, the *ard* from Ethiopia is light and can be transported by one person across the field, the *marasha* is created from wood, which is readily available in the communities and has low maintenance and is well suited for a variety of oxen. These ploughs are designed to be effective in the ploughing task to be comfortable for the animals and easy to use for the farmers. Italians tried to introduce a heavier and more complicated plough, requiring higher power as it was heavy and was rejected because no consideration was given to the farmers' needs and requirements (*ibid.*).

The house windows of Yoruba homes are small in nature and are placed high above the ground as an anti-burglary measure to deter unwanted intruders and to control the chilling weather in the rainy season and Harmattan. An impluvium systems design is used to enable the collection of rainwater for domestic use and as a way of reducing erosion which may be caused by the rainwater which falls off the roof. For more security, the buildings are arranged in a square, joined at corners with the roofs terminating to allow the collection of water (Àmọ̀lẹ̀ and Fọ̀lárànmí, 2017).

In the Zambezi Valley, the BaTonga constructed stilted huts for shelter to keep away from the scorching sun, floods and wild animals (*The Patriot*, n.d). The stilted huts have evolved due to climatic changes that prevailed in the valley, indicating how the people were dealing with the climatic changes by selecting a proper design and proper materials to use in the construction sector are was taken to use of strong wood like mahogany and teak which to escape the floods on the flood plains of the Zambezi River with much higher poles closest to the river. Traditional herbs were rubbed on the poles to repel ants and termites.

In some other parts of Zimbabwe, the *dura* (granary) is built on large stones to allow air circulation which then prevents the attack of the harvested crops by termites and ironwood poles were mostly used because the wood repels pests (Brazier, 2020). Cow dung smeared on the walls using a smooth pebble (*nhombo*) made the polishing waterproof and smooth. The use of cow dung and, at times strongly scented plants like *zumbane*, keep the pests away from the harvest. The granaries of the BaTonga were honeycomb-shaped, storing different grains for years. The trees used to design and create the granaries were thoroughly treated with oils from reptiles to deter animals from coming closer to the granaries.

Traditional architecture in Africa is sustainable and has evolved to suit its communities as all resources to build houses, including timber, straw bales and grass have been readily available in the environment (Opaluwa *et al.*, 2012). African intelligence favoured the maximisation of strengths and the compensation of inadequacies both in the individual and the environment they reside in (Mpofu *et al.*, 2012). Africa's architecture ensured resource use neither diminished availability nor undesirably affected the ecosystem balance.

In Zimbabwe, artefacts are created using raw materials available in the local areas using very simple tools and evidence of special skill is found in the process (Mudzamiri, 2019). Opaluwa *et al.* (2012) found how ruins of buildings in Somalia, as in many other parts of Africa, indicate a sense of prowess in the builders, and how Africa was rich in highly skilled populations, evident in the Pyramids of Egypt. The construction of Great Zimbabwe was also no exception as the walls were built without mortar, using flat slabs of rock that merged with the boulders and rocky surfaces present in the area as if nature was being harnessed, peacefully to create a majestic settlement that was comfortable for the Shona people (Pikirayi, 2013; Rugwiji, 2019).

All this knowledge is evident in ITK. Pygmies built the simplest houses shaped as beehives from bendable branches covered with huge fresh leaves to suit their nomadic lifestyle (Ahmed and Suman, 2014). People who did agriculture, on the other

hand, built more permanent homes from thick mud and sturdy bamboo frames (*ibid.*). This is evidence that each community considered its context and came up with designs that were best suited for their situations which entails an element of dispositional intelligence.

### **DESIGN AS A COMPONENT OF SOCIAL INTELLIGENCE AND SOCIAL RESPONSIBILITY**

In defining intelligence, the Shona mentioned social responsibility and social intelligence as key components of intelligence (Mpofu *et al.*, 2012). One aspect that stood out in the designs of artefacts was how the roles were defined along the process of design, giving individuals in the community roles to play. How artefacts used in traditional African communities were designed seems to support the notion that African communities view social and intellectual abilities as intelligence (Cocodia, 2014).

This social intelligence included keeping the spirits of their ancestors appeased by living in harmony with their surroundings. In building a Yoruba homestead, the design and building process is done with community help (known as owing) and labour is subdivided among the members. Even the children are accommodated in the tasks as they carry made-up building materials to building sites (Àmòlè and Fòlárànmi, 2017). The owner of the homestead had a social responsibility to feed and entertain the community helpers.

Since the *ubuntu* philosophy promotes the existence of individuals within their communities (Mashoko, 2021), a workforce was available in the community (Opaluwa *et al.*, 2012). This inclusion of social aspects of communal work and distributing tasks according to capability, ensured a sense of community that was an important African value, which was a key factor in the implicit theory of intelligence according to traditional African cultures.

### **THE SOCIAL PSYCHOLOGY OF ART AND ARTEFACTS IN AFRICA**

Arts and artefacts were implicit in African culture as they define norms across various sectors of life. Norms are key in group dynamics as they determine the social behaviours of individuals

in a group setting. Inherent in the role art and artefacts play in social psychology is the creation of norms that community groups abide by. Walking sticks, for instance, are walking aids, but they are used for tribal dances as they have symbolic meaning. They were traditionally used as clubs in wars and against animals, in addition to holding ancestral spirits, giving them a unique religious value (Victoria Falls Guide, n.d). These various aspects of walking sticks define how they are designed. The snake carving is a powerful symbol for the *svikiro*, humans, who when possessed communicate with the *mhondoro* (spirit of the tribe).

### **ART AND ARTEFACTS IN AFRICA AS A DRIVER FOR SOCIAL NORMS**

Though technology is useful in art and designing of artefacts, it is not impartial politically (Foxhall as cited in Rugwiji, 2019), thus there is need to fully understand the dynamism of the control of resources in African societies and how this affected the process of creation of art and artefacts. The structures of Great Zimbabwe city communicated wealth and political power which enabled the long-term construction of the monument and availability of abundant resources, even in human capital (Rugwiji, 2019). The Great Zimbabwe nation was found to be a large kingdom which may have had 18 000 residents (Ahmed and Suman, 2014; Rugwiji, 2019).

The conical tower symbolises the dominance of men which spoke of the patriarchal nature of the Rozvi dynasty, who are believed to have built Great Zimbabwe, while the number of huts communicates the polygamous families and how they were organised, allowing the architectural designs of the homesteads to give an insight on the communal organisation of the ancient nations (Rugwiji, 2019).

In terms of religion, birds were traditionally believed to be messengers and the *hungwe* (fish eagle) indicates an appropriate messenger for powerful and important peoples of Great Zimbabwe since it is the biggest and most powerful birds (*ibid.*). The bird signified the importance of religion to the inhabitants of Great Zimbabwe, as it was believed to pass messages between people and the creator. The Yoruba are no exception in using art and artefacts to establish the norms in

their religious processes. Their art is deeply entwined with their lives to the extent that one author claimed understanding the Yoruba was incomplete without the study of their arts and sculptures and figurative sculptures of the Yoruba are useful for religious purposes and everyday use (Àmòlè and Fòlárànmí, 2017).

### **DESIGN AS A PROCESS OF CREATING ELITE POWER**

Spatial segregation in Zimbabwean tradition involved the separation of the elite from the commoners in their residential designs and the setup of the stone architecture at Great Zimbabwe was not only a reflection of the existence of the elite in society, but an indicator of the process of creating the elite power (Pikirayi, 2013). The wall decoration and the features of architecture symbolise the presence of royalty and a sacred place for holding rituals (Garlake, 1973, as cited in Pikirayi, 2013).

The architectural developments and designs involved the manipulation of the natural environment to accommodate human settlements. Architecture thus had to combine the natural power of the environment, viewed as a link to the ancestral world (Pikirayi, 2013). This means constructing Great Zimbabwe was a process that involved the construction of social and political power through the use of ideology, thereby producing social roles, not merely a reflection of them. How then social power and ideological concepts were linked were shown in the architecture of Great Zimbabwe where the walls extend and highlight the natural landscape and its features (*ibid.*). Connections with the cultural landscape that was normally out of reach of the humans were made.

### **DESIGN AS A SIGN OF SOCIAL STATUS**

The Yoruba live in FAMILY compounds. Social background and social order were key considerations when the homesteads were designed. Their compound structures can be round or rectangular, being politically and socially organised with the compound being the family focus. The courtyard of the Yoruba homestead signifies the individual matrimonial family unit, while at the same time indicating they are a part of the extended family and the community at large as the population



can depend on the family resources to work on their land (Àmòlè and Fòlárànmí, 2017). The family compound signifies the security of the family given that to be rich, the family compound needs to keep expanding, showing the family is growing. The structures were thus built primarily to support the social and religious ways of the Yoruba people (*ibid.*). Ceremonies to guarantee the renewal of buildings were engrained in the communities' socio-cultural practices (Opaluwa *et al.*, 2012).

For the Yoruba, how a house is decorated indicates the social status of the family and decorations at shrines and palaces are more elaborate to give a spiritual and symbolic interpretation of the art and design (Àmòlè and Fòlárànmí, 2017). For example, the size of the palace is indicative of the size of the kingdom and its population. The palace is a symbol of wealth, prosperity and belief systems. Yoruba buildings are thus a reflection of what they believe in, not in terms of the security provided by the walls themselves, but in the protection obtained from entrusting in the deities they have pledged allegiance to.

### **DESIGN AS A PROCESS TO ENSURE EQUITABLE ROLE DISTRIBUTION**

Women made pots while men manufactured iron using clay furnaces (Brazier, 2020). Many taboos were linked to the making of clay pots and they may have served to create a trade that was suited for a specific class of people in the societies. For instance, menstruating and pregnant women were forbidden from using the clay pots and girls in puberty were not allowed to attend some stages of pot-making or at times make some pot categories, or even make decorations due to the fear that they may become infertile (Gosselain, 1999). This served to exclude men and younger women and girls from partaking in pottery while encouraging post menopause women and widows or abandoned women who faced harsh economic situations (*ibid.*). Artefact creation in this instance was key in encouraging a norm of protecting the livelihoods of a group of vulnerable members of the communities.

Similar concepts were found in the use of “*zvierá*” in the Shona culture where communities use them to foster a moral compass in the people (Chemhuru and Masaka, 2010). *Zivera* encourages

conformity to norms established within society. For instance, Chemhuru and Masaka (*ibid.*) mention it was taboo to go to a well with a dirty clay pot because this would anger the water spirit. This taboo served to keep the water sources clean from pollution. How morality is understood is preferred by the African communitarian perspective of humans where one's actions are viewed within the context of the community. The Shona, just like other African tribes, thus transmit social values that are key in the development of the societies they live in. Enforcement of taboos depends on that no one questions the scientific explanations behind them but instead, society holds them as sacred, thus no need to doubt them (*ibid.*).

### **CONCLUSION AND RECOMMENDATIONS**

This article managed to bring out how indigenous technical knowledge is related to the concepts of intelligence according to how African traditional communities define intelligence as both a cognitive and a social construct. It shapes how individuals relate to each other and the environment. Individuals are concerned with the sustainable and mutual coexistence of the environment and humanity. Over years, relevant information was gathered on how to engage in sustainable coexistence between people and their environments and this information was passed through generations after communities believed it was relevant and important to them. The design and use of artefacts were found to depend on what communities viewed as important in their ways of life. The design of arts and artefacts is also important in understanding human behaviour by giving rise to norms and systems that are acceptable and key to the survival of communities. Taboos were among social rules employed to preserve and foster adherence to the way of life of indigenous communities.

In the same manner that indigenous communities learnt from their predecessors and adapted to changes, in the modern world, lessons can be drawn to care for the environment as the indigenous peoples did and local intelligence be used to preserve both communities and the environment. More studies need to be done to document the modifications to ITK, given that they are not static. More studies need to be done on how the ITK can be merged with advances in technology for the

production of a more sustainable way of living. Modern communities need to be able to identify abilities inherent in their people and to optimally use them to coexist with the communities.

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# Politics and Ethics in Professional Planning in Zimbabwe

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## Abstract

*Politics can either be democratic, monarchical, oligarchic or authoritarian. This depends on the rule of the country and its acceptance of the rule. How then do politics and ethics relate? The leaders' role is to attain and maintain high standards in their private and work lives. This article explores and discusses the argument that politics in Zimbabwe has not only negatively affected planning, but has also had detrimental effects on professional planning ethics. The professional planner's virtues have been compromised in certain situations. It is against the background that politics and planning are interlinked; planning caters for the good of citizens and politics aims at delivering to the people. The article plugs the gap in the literature that professional planning ethics can be eroded or built upon by politics. Evidence points to a few issues: politics can be a hindrance to planning activities because of the differences between politicians and planners; professional planning ethics can be eroded by politics; and planners face a variety of ethical issues due to difference in cultures and values.*

**Keywords:** virtue, policy, management, sustainability, institutions, credibility

## INTRODUCTION

In his book, *The Prince* (1533), Machiavelli made a distinction between politics and ethics. Ethical principles accommodate honesty, loyalty, trustworthiness, respect and adherence to the law. Aristotle stated that the two, politics and ethics, are related

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but are two different fields (Giorgini, 2019; Moussaly, 2022). Ethics focuses on the good of the individual and politics focuses on the good of the city. What option does one choose; a way that benefits the individual or a way that benefits the whole city?

Politics can either be democratic, monarchical, oligarchic or authoritarian. This depends on the rule of the country and its acceptance of the rule. How then do politics and ethics relate? The leaders' role is to attain and maintain high standards in their private and work lives. Only in this way can political morality and public ethics be fulfilled (Chipkin, 2022).

The ethical decision-making framework for professional ethics is utilitarian which is outcome-based, deontological, based on duty, virtue-based and communitarian which is community-based (Bowen, 2018; Reamer, 2019). Almost all ethical bodies are governed by the same principles of trustworthiness, transparency, accountability, confidentiality, objectivity, respect, obedience to the law and loyalty. These principles encompass what people expect from others when being dealt with, being courteous to other people in a professional and personal capacity.

## **BACKGROUND**

Planning came into play as a way of creating order in the city and its people. It ensured a variety of aspects of people's lives such as health, economy and general social well-being, are protected. This brought with it issues such as the demarcation of land and its uses and prohibiting certain activities in certain areas. It brought some people who were willing to accept the knowledge provided by planners and engineers and also other people who could incite the public and did not agree with the given choices (Green, 2019).

The game of politics has a variety of players that compound its complexity, the more actors, the more complex. In times of trouble, citizens turn to look to their elected members, who may be councillors, MPs and any influential person they know (Hutter and Weisskircher, 2022). These people usually do things to further their own agenda in a way that may not be in line with what the people need at that particular time.



Ethics have always been there, manifesting through the values of the people. To govern, professional practice or those people who were doing tasks for the public good, five principles of ethics were brought forward and they are autonomy, justice, beneficence, non-maleficence and fidelity (Davidson and Hughes, 2020). With ethics, professionalism can be observed in a different light, one that has high regard for the benefits to the citizens (Kenter *et al.*, 2019). The main ethical principle guiding planners is to serve the public interest by allowing them to participate in issues determining their happiness and continued livelihoods and society, provision of clear and unadulterated information and assistance in decision-making, goals and objectives through their clarification to the citizens.

Politics and planning have almost always butted heads because of the differences in outcomes expected from the two groups (Friendly, 2019). However, planning is considered a political process, hence there is need for complementarity between the two (Joelsson and Scholten, 2019). The rulers of a nation have mostly diluted the importance of planning because they expect that their plan is the most valid and viable, neglecting that some other professionals took time and patience to gather the knowledge necessary to provide valuable information that they ended up ignoring. This is mostly because of the conflict between the ruling and opposition parties where one or the other party may try to undermine the efforts of the other by impeding certain plans and goals.

Planners usually capitulate to politics of patronage, blinded by the benefits that they may get due to propelling one goal versus another (Lebakeng, 2021). This undermines the public interest goal because they will be acting on selfish interests and by so doing, erode the values of planning principles. The integrity and credibility of planning are being undermined by political actors (Nochta, Badstuber and Wahby, 2019). This has arisen as a way for political actors to gain favour in the eyes of the citizens by discontinuing a national goal in favour of goals that endear them to the citizens. This is most prominent in areas known to have residents who are vocal and critical of politicians.

There are complexities surrounding the ethics of a profession and how they are applied. This is due to the intricate

relationships between planners and citizens and other stakeholders (Hoch, 2019). This also governs the conduct of the planning profession since it is guided by the legislative, institutional and regulatory frameworks of a nation. The ideology followed by a nation determines the planning arena and, in turn, the ethics and values that they put forward. In Zimbabwe, from the 1980s to the 1990s, the goal of the country was to propel mainly economic growth and vitality and in so doing, promote the beautification of the country and improve its efficiency (Nyandoro and Hatti, 2019). In the coming years, issues, such as environmentalism, began to emerge and have also had an impact on the planning profession. This is where most contestations between political actors and planners begin. The planners determine that an area is not suitable for a certain use but political actors come in and override that decision because there is 'someone' they want to make happy and give them the green light to further their development.

### **CONCEPTUAL FRAMEWORK**

In this article, political planning is viewed as a crucial component because one cannot separate planning from politics because of their natures. Planning requires politics for the objectives to be met and adopted. Therein lies the importance of professionalism, where one ought to work in a manner that upholds the office they hold and also to perform the duties they are expected to do. For professionalism to be adopted in the planning field, there is need for the maintenance and encouragement of following set ethics to ensure there are accountability, transparency and fairness in all planning decisions.

### **POLITICAL PLANNING**

Political planning refers to activities of planners that have a political awareness of policy-making. It is political intervention in the management and administration of a system. Political planning intimates that political actors and planners should work together because the work that they do involves every aspect of the city, be it good or bad. This includes the economic standpoint of a city, quality of life, urban renewal or gentrification and urban preservation (Gualini, 2018). Planners perform their duties for the betterment of the lives of the people

and the politicians perform their duties by advocating for certain developments and also putting forward information to guide legislation and frameworks that work in a nation. For planning to function well, there is need for political awareness (WHO, 2018).

### **PROFESSIONALISM**

Professionalism refers to when one holds and conducts themselves in such a manner that is formal, fair, legal and in accordance with profession guidelines, values and principles (Carr, 2014). This demands some form of language and communication and respect from all involved. In professionalism, certain people are expected to hold a high standard in the implementation of tasks for the attainment of different goals (Signitzer and Prexl, 2007).

### **ETHICS**

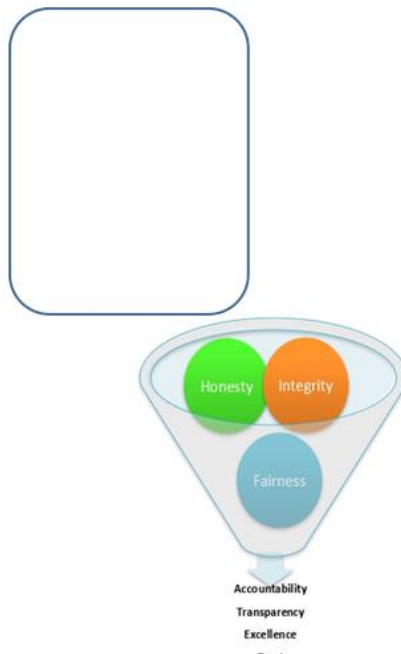
These refer to the norms by which behaviour is deemed to be acceptable or unacceptable, determined by society or national leaders (Wagner, 2018). This can also be taken to mean the various values and customs that a certain community or society have concerning their conduct and performance of tasks (Saha *et al.*, 2020). Ethics can be based on the outcome, duty, virtue or community (Carpenter, 2018). A certain outcome demanded by a policy can guide the ethics that will be employed in different settings. In another scenario, the community can determine the ethical bounds in that area depending on their societal upbringing and what they value most.

### **LITERATURE REVIEW**

This section looks at the importance of ethics in the planning field. This is vital since planning decisions have a common effect on the decision-makers and other citizens and so there is need to be considerate of those without planning powers. All people require fairness and so ethics try to balance out the unfairness that may arise in individuals. The section also looks at the concept of planning and politics being complementary, that they ought to be for the benefit of the city and the country at large.

## WHY ARE ETHICS SO IMPORTANT TO PLANNING PRACTICE?

Ethics are vital in all organisations as they provide guidance, help the relevant authorities to keep promises and encourage people to help each other (Sarwar *et al.*, 2020). In an organisation, ethics are important and cannot be ignored, especially if one wants to be an upstanding citizen who provides standard service to the people. In the planning profession, ethics are vital as they guide the planners and all those working in the planning field to be honest and therefore ensuring accountability and transparency in dealing with the people (Barrett, 2018). They provide frameworks that guide daily decision-making for everyone and the planning professionals, providing a basis for positive outcomes. Ethics encourage integrity in planning authority and development control (Pels *et al.*, 2018). This also makes citizens gain trust in their planning authorities, making them more participatory in issues to do with their community, the community's development and the budget to do with their development.



**Figure 1:** Importance of ethics in planning

Ethics are important in planning practice because of the benefits that are gained from encouraging virtue, such as accountability, transparency, excellence and trust (Weber-Lewerenz, 2021). With ethics, people in power get to use their powers for the good of the community and the country. They provide an opportunity for people to be treated fairly or equally and, therefore, awarding equal opportunities empowers previously ignored or vulnerable groups.

### **CAN POLITICS AND PLANNING BE COMPLEMENTARY?**

Politics and planning are supposed to be complementary in day-to-day business (Huq, 2020). This is because planning encompasses almost all the aspects that affect a city or a country. Therefore, it is vital for planning and politics to be in harmony since they all have an impact on the quality of life of the citizens (Dela Santa, 2018).

However, they may also be contradictory in cases where politics and planning are in contestation; for instance, in cases to do with urban renewal (Hestad *et al.*, 2020). This is a scenario where the urban area that was once flourishing goes through a period of difficulty that may be financial or human capacity challenges and development stops and the area deteriorates. With time, the government, through the local authority may embark on a mission of urban renewal. This may be frowned upon by politicians or the current occupants of that area because it means an increase in the land price of that area once development has been done and improvements have been made. An improvement of the area usually directly translates to an increase in the land price, accompanied by pushing out the urban poor in the revamped area.

When politics and politicians come in, there may be challenges in the implementation and success of the project because some politicians will need the people in that area to vote for them and so will not be willing to go against them. This has, therefore, compromised the ethics of the planner and derailed the progress of the national initiative of the betterment of the city or area, putting paid to ideals like Harare Vision 2025 of making Harare a world-class city (Magidimisha-Chipungu and Chipungu, 2021). This does not stop there since it is part of

Vision 2030 and Vision 2063 (Jumanne and Keong, 2018). Hence, without cohesion, politics can be detrimental to planning and the success of planning initiatives.

Regional planning is another sector that faces challenges, especially when politics and planning are at loggerheads (Molebatsi and Morobolo, 2021). Regional planning is determined mostly by political will and political support given to it (Chimhowu, Hulme and Munro, 2019). In the case of Zimbabwe, it was initiated as a way of reducing the urban population by developing the regional or marginal areas that were previously ignored. It is a good initiative but it can be seen that Zimbabwe is facing challenges of proper implementation and success because of political interference. Some people in rural areas are using that opportunity to put forward and 'encourage' people to vote or lean towards a certain political party, threatening that if they do not, there will be no development in their area for a long time.

## **RESEARCH METHODOLOGY**

The study used mainly secondary data sources, such as published analysis and research documents. The focus was on Zimbabwe and how planning has been an instrument for successful planning or an instrument against successful planning initiatives. It is, therefore, a qualitative study that hinges upon quantitative aspects to gain the full picture of the politics-planning nexus. Published articles provided most of the information for the study to reveal the trend established in Zimbabwe.

## **RESULTS**

The planning arena in Zimbabwe has been shrouded mainly by political divisions. The political parties have been in some sort of tug-of-war in regard to power and planning decisions. This has been seen in land reform programmes in the country. The planning field has also seen a lot of arrests regarding abuse of power. This shows a lack of professionalism where the standards of the offices that they hold are not being upheld. The state of the economy has led a large number of corrupt individuals taking advantage of the prevailing situation and trying to benefit from those seeking services. However, some

have indulged in unprofessional practices because of intimidation from powerful people in other areas. The rapid urbanisation occurring in Zimbabwe and other developing states has led to a large rural-urban migration pattern, resulting in land scarcity. Since planners deal with spatial issues, they hold the keys to most spatial decisions, hence the need for the consciousness of professional ethics and values.

Muchadenyika and Williams (2016) believe that the planning arena is unsettled due to the political standing of the country with ZANU-PF being in control of the national policies and the Citizens Coalition for Change (CCC) having controlling power over local authorities. This creates challenges because they are not from the same political party and there may be cases of sabotage in executing some policies or the local authorities may have challenges in performing to the best of their abilities because not enough resources may have been allocated for certain projects. Hence, politics has a major role in the planning arena.

Planning focuses on the allocation of land uses in preparation for what is to come. There is the use of master plans and layout plans that show proposed areas for different uses, be it residential, commercial or industrial. In Zimbabwe, according to Muchadenyika (2015), the Fast Track Land Reform Programme (FTLRP) acted as an obstacle to planning procedures ensuring that there was fairness and transparency in allocating land and for the uses it was meant for. This has, therefore, made it difficult to execute the planning procedures required for the proper sustenance of the land.

Planning requires power and that power is to decide who gets what, where and why (Bush and Doyon, 2019). It is aimed at improving the development of a city or country to achieve set national policies and agendas. Since planning is a powerful field, those who hold that power need to be accountable to the people. There have been many instances where planning office-holders have been arrested because of abuse of power (*The Herald*, 2020).

In June 2020, a town planner in Chiredzi was reportedly arrested for corruption as there were allegations of abuse of power in the allocation of residential stands (Dziva and Kabonga, 2021). In April of the same year, 26 councillors and officials were arrested for corruption (Winstone, 2020). Some were arrested on alleged crimes they committed whilst holding offices of the mayor, own clerks and housing department officers. Also, another arrest was made on 20 October 2020 on allegations of abuse of power for change of use of open spaces and being given to 'friends' of the accused (*ibid.*).

This shows that planning professional ethics are being eroded. This may be due to personal gains outlook or may be due to intimidation. The profession has been clouded in secrecy and corruption, making it difficult to be transparent and therefore making it difficult for people to have their trust in planning professionals and believe that they are working for the benefit of society.

Kampala politics interfered in planning procedures as evidenced by the land grabs that occurred (Bidandi and Williams, 2020). Coercion was a tool used by the elite in this city as a way of obtaining land that they would then sell. This could have been of great benefit to the people if planning procedures were correctly followed, with every stakeholder benefiting from the development. Some of the land that was grabbed was land designated for agricultural use and even industries and this, therefore, skews land use zones because most land was used for residential purposes. Land issues are too fragmented such that without proper ethical rule, many people suffer whilst the elite few continue to benefit.

Several ethical issues have arisen due to rapid urbanisation in most African countries. Urbanisation is accompanied by a large number of people and by infrastructure development. The masses need housing and other infrastructure services that need spatial establishment and utilisation. Professional planning ethics need to be adhered to, to function and benefit society.



## **DISCUSSION**

Planners work in the public domain and so do political actors and they provide material or information for the creation of legislation and constitutional development. The key principles that govern both planning and political ethics include integrity, responsibility, respect, fairness and honesty (Sharma, Agrawal and Khandelwal, 2019). These principles are deeply rooted in ethical considerations that need to be present in public decision-making.

In this case, integrity is seen as having the moral strength and courage to act or otherwise, depending on certain information and a person's consideration and not just knowing what the right thing to do is (Peng and Wei, 2020). This is because most times some professionals know the right thing to do. After all, the laws have been drilled into them but they would not have considered the reasoning behind those decisions. Hence, behaving correctly is important but also knowing why a certain decision is right is important

Responsibility is taking ownership of the decisions one would have made or not made, the responsibility for ones actions or inaction and the plans that they have made or plans that one failed to make (Carter *et al.*, 2020). This is a basic acceptance that every action or inaction has consequences and owning up to that is vital, especially in the public domain, because whatever action is made or not made needs someone responsible, one who has the power, to speak up and give reasons why a certain route was taken.

Respect is hinged upon treating other people with kindness, or in a courteous manner (Dument, 2019). Planners and politicians must be wary not to use derogatory language in communicating with various stakeholders be it citizens or those performing different duties. There is need to show high regard for others and by so doing, the planner will have a plan or design presented that emulates the people and empowers them and the politicians will lobby for more empowering designs and policies to reach the national goals.

Fairness is another valuable principle, where people are called upon to make decisions impartially (Kirkpatrick, 2020). There is a need for objectivity in decision-making, especially on issues to do with public interests. This calls to order those who are corrupt as fairness calls upon people to not just do what they want or make a decision that only benefit will them as it is part of human nature to be selfish. Planners and political actors are meant to be fair in decision-making, to be done on merit and not because it makes this or that person happy, disregarding the feelings and needs of others. The decisions made should be free of favouritism and prejudice and must also be free from conflicting self-interests.

Honesty is also vital as it refers to the understanding of the truth and acting truthfully, be it in communication or conduct. Being true to oneself and others is a vital trait because, with that truth, one obeys the law and follows the policies and procedures set up for them (Lindstrom, 2022).

It is vital to note that if there is need to change operations, many other things change, things such as ideology with regards to service provision and development strategies. Holding onto the negative aspects of history does not help in the improvement of how business is done, rather it makes people bitter and also chips off some of the ethical values that people may have.

## **CONCLUSION AND RECOMMENDATIONS**

Planning holds the power to control development. This can only be the case when planners are given proper power and authority to do so. Since it is a sector that holds power over other aspects of development, there is need for the establishment of professional ethics. Without ethics that govern how to do work and why, it becomes difficult to execute plans and justify them.

Politics has been seen as a major challenge to planning ethics. This is because of the high rate of planner arrests that are recorded all over the world, such as in Zimbabwe and India. This has seen people lose faith in their planning authorities because of some people who wish to gain at the expense of the

city or those who bend the rules to accommodate their friends, family and other people in return for favours.

The interruption in ethical consideration in planning has been due to a variety of issues. It has been claimed that poverty is one of the major determinants of professionals ignoring their ethical duties. This is because one entity may bribe the planning office to award a certain bid in their favour. This eliminates fairness.

A break in the ethical professional conduct of planners is also attributed to political 'interference'. This usually stems from issues of planners having agendas do not fit in with what the politicians want or deem necessary and so politicians override those agendas. Like the situation with the fast-track land reform, political interference prevented proper planning procedures from being followed.

Growing economic hardships have been a challenge to following these rules and guidelines that ensure transparency and accountability for all projects and planning decisions made. The article, therefore, concludes that one must not focus on themselves in decision-making, especially if one holds a public planning office because the fate of the community and society is in their hands. Hence, the need for a sectoral ethical guideline development to cater for the specific setting and allow transparency accountability and fairness to be present in all planning decisions made.

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# The Contribution of Real Estate Training Providers in Botswana 2011-2022

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## Abstract

*The contribution of universities as engines of knowledge is measured by the number of graduates and their research output. Previous studies in Botswana focused on the number of programmes offered, but little is known about the number of locally produced graduates and the amount of research output by each real estate (RE) school. This study seeks to bridge this knowledge gap through interviews and document analysis. This study was qualitative in nature, based on a case study of three RE tertiary education and training providers in Botswana, the Gaborone University College of Law and Professional Studies (GUC), the BA ISAGO University (BIU) and the University of Botswana (UB). An archival approach was adopted and documents were accessed online from the websites of the Botswana Qualifications Authority (BQA), the Human Resources Development Council (HRDC) and the three aforementioned universities. RE schools in Botswana have played a critical role in knowledge creation and dissemination. However, a lot more needs to be done on postgraduate research programmes and for graduates. An increase in postgraduate programmes and students can also have a direct impact on the increase in research publications.*

**Keywords:** education, real estate (RE), research, universities.

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## INTRODUCTION

At the onset, it is important to define the two key terms for this article which are higher education and training provider. The Botswana Qualifications Authority (BQA) (n.d:03) defined higher education as:

...any studies were undertaken beyond the level of secondary education but excluding technical and vocational education and training (TVET).

Also, an education and training provider (ETP) is defined as:

...a person or entity that provides or organises a programme of education and training, including the provision of professional development services (*ibid.*).

This brings the two definitions together, RE higher education and training providers (REHETPs) as educational institutions that provide RE education and training beyond the level of senior secondary.

Institutions of higher learning play a critical role in national development since they are engines of innovation and incubation centres for ideas. Tertiary institutions create and transfer knowledge that is relevant to addressing problems at local, national and global levels. There is a global consensus that universities should contribute to national development through the creation of knowledge. In that respect, local universities are expected to be the drivers of Botswana's desire to become a knowledge-based economy as spelt out in its tertiary education policy of 2008. Sections 1.1 and 1.2 of the recommendations of the tertiary education policy over 20 years (2006 to 2026) as shown in Box 1.

### **Box 1: Tertiary Education Policy Recommendations 5.2 and 5.3**

#### **1.1 Human Resource Development** (*Ministry of Education and Skills Development, 2008*)

This Policy seeks to increase the tertiary education gross enrolment ratio from the current 11.4% (2007/8) to a minimum of 17% by 2016 and then to a further minimum of 25% by 2026.

#### **1.2 Research and Innovation**

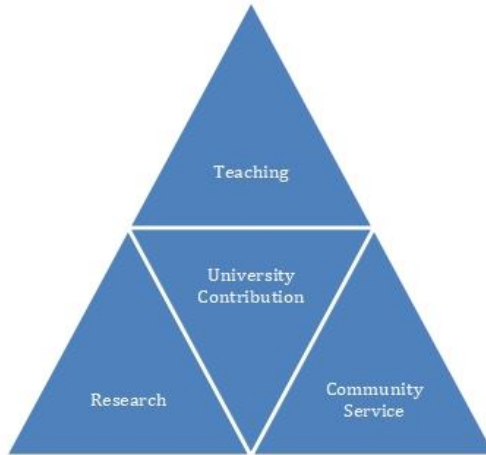
As a key component of Botswana's Research and Innovation system, this Policy will ensure that the tertiary education system produces inventive, pioneering, high-impact research and educate creative, talented and capable researchers for the successful transformation of Botswana into a Knowledge Society.

Botswana has three registered and accredited HETPs offering RF, namely the UB, the BIU and the GUC (<https://www.bqa.org.bw/he-etps/>, Accessed: 27-06-2022). According to Kampamba, Nkwae and Tembo (2015), the first RF programme in Botswana was introduced in 2011. Even though REHETPs have been in existence for more than a decade in Botswana, their contribution is under-researched. This study seeks to bridge this gap by answering the question, "What has been the contribution of REHETPs in Botswana over the past decade?" By answering this question, this research hopes to paint a picture of the contribution of REHETPs towards meeting human resources development, research and innovation targets of the 2008 tertiary education policy.

## **LITERATURE REVIEW**

### **THE ROLE OF UNIVERSITIES IN A KNOWLEDGE-BASED ECONOMY**

This study is guided by the Human Capital Theory (HCT). This theory emphasises the importance of a skilled workforce as a driver of economic growth (Sweetland, 1996; Laroche *et al.*, 1999; Stevens, 1999; Bae and Patterson, 2014; Tan, 2014). It is widely accepted that a country's capacity to generate wealth and achieve high levels of well-being is closely linked to its capacity to generate knowledge (Koto, Syukri and Arief, 2018). Brown, Hesketh and Williams (2003) said that people with degrees are seen as the backbone of economic growth on both the micro and macro scales. It is worthy noting that many countries are making great efforts towards exploring RF as a probable field for economic wealth generation. It is a global practice that the contribution of universities to national development is usually measured using three parameters: teaching, research and community engagement (Leal Filho *et al.*, 2015).



**Figure 1:** *The Concept of University Contribution to National Development* (Authors, 2022)

As shown in Figure 1, universities are usually expected to contribute through the teaching of students, research output and community service. Though community service is sometimes accorded less time as compared to research and teaching, of late, it has gained more recognition with the spread of concepts such as corporate governance, corporate social responsibility and sustainability. Currently, the contribution of universities goes beyond their traditional core businesses of education, training and research, they are expected to contribute to a broad stakeholder list. Although community service is important, it is outside the scope of this study (Howlett, Ferreira and Blomfield, 2016).

Ahmed (2006) and (Bano and Taylor, 2015) point out that there is no universally accepted definition of a knowledge economy. However, scholars agree that knowledge is the cornerstone of a knowledge economy (Harris, 2001; Bae and Patterson, 2014; Bano and Taylor, 2015; Olopade *et al.*, 2019), hence the importance of universities as laboratories where new ideas are conceived and born can not be overemphasised in any development discourse (Saad and Zawdie, 2011). Breznitz and

Feldman (2012) argue that universities can no longer be relegated to the passenger seat, but should be at the forefront of development-related initiatives.

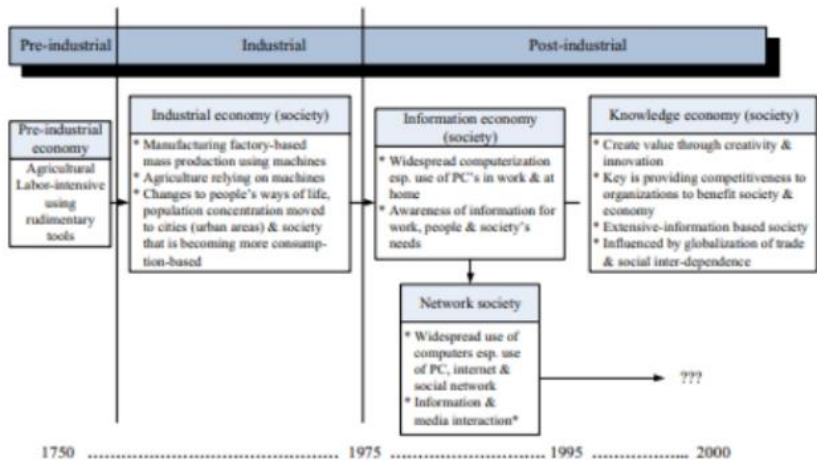
According to Pastor and Serrano (2016), there is a direct relationship between a country's ability to create wealth and its ability to generate scientific research.

Performance of educational institutions, universities, in particular, which produce knowledge, skills and capabilities, can be linked to investment in national human capital and enhanced development (Sebola, 2022).

If one is to interpret this view, knowledge can be equated to minerals during the era of resource-based economies.

Universities are incubators of innovation where knowledge is created and disseminated through research, teaching, training and collaboration with industry (Abbott and Doucouliagos, 2004; Pastor and Serrano, 2016; Mahala and Singh, 2021). In Botswana, this role is now more crucial as the Southern African country is striving to attain a knowledge-based economy. Over the years, the Government of Botswana has been investing heavily in the higher and tertiary education sectors through scholarships and sponsorship of tertiary students (Government of Botswana, 2015; Samboma, 2017; Moremi, 2018). This is a testimony that the government acknowledges that these educational institutions are the drivers of the planned knowledge-based society.

Choong and Leung, (2022) are a conceptual framework that summarises the evolution of economies from a resource based into a knowledge economy as shown in Figure 2.



**Figure 2:** *The evolution of economic and social development* (Adopted from Choong and Leung, 2022:1590)

As shown in Figure 2, the transformation from where Botswana is now (resource-based) into a knowledge-based economy is a process that might take years. Universities exist as catalysts of social and economic development in countries and regions (Daneykin *et al.*, 2021). Therefore, in the case of Botswana, if they play their role, they can speed up the transformation. According to Pastor and Serrano (2016),

Higher education institutions (HEIs) produce knowledge through research, they disseminate it by training graduates and postgraduates and by publishing the results of the research and they transfer it via collaboration agreements with companies and institutions.

Schiliro (2012) points out that the four pillars of a knowledge economy are: "education and training, innovation, information infrastructure and institutional regime". It can be inferred that the first two pillars are within the constituency of higher and tertiary education providers. Leydesdorff (2010:367) argues that:

Three sub-dynamics are reproduced as functions of a knowledge-based economy: (1) wealth generation in the economy, (2) novelty generation by organized science and technology and (3) governance of the interactions among this two sub-dynamics by policy-making in the public sphere and management in the private sphere."

If one looks at the preceding position of Leydesdorff (*ibid.*) with a magnifying glass, one can note that the author's second sub-dynamic is within the mandate of universities known as engines of innovation.

Furthermore, Schiliro (2012) postulates that the number of graduates produced in a country is a key indicator of transformation towards a knowledge-based economy. In this case, it can be argued that the more graduates (highly skilled human resources) are produced, the more a country is moving towards attaining a knowledge economy. If a country is not producing a skilled workforce, it might be trailing behind in terms of moving towards a knowledge-based economy. According to Chikafalimani (2020), there is a relationship between teaching and research output that are key indicators of knowledge generation.

Griliches (1997) points out that productivity growth is the consequence of expenditures on research and development. The author adapted Solow's neoclassical theory of growth model that determines the sources of economic activity are productivity, capital accumulation and population and modified the model to add research and development as central determinants of growth. Research and development contribute greatly to output, leading to spillovers caused by knowledge creation. Griliches (*ibid.*), regards research and development as central determinants of growth because of the technological change resulting from the conscious economic investment in education. Therefore, if investment in research and development is increased, there will be a consequent increase in productivity (*ibid.*).

Blanco, Prieger and Gu (2016) researched the impact of research and development on economic growth and productivity in the United States of America. They concluded that the impact of research and development on total factor production is positive in that it leads to improvements in technology through industrial innovation, which has been the driving force behind inexorably rising standards of living in the developed world over a long time. The researchers posited that research and development led to new ideas, intermediate goods, cost

reduction methods, and ultimately profit. Positive spillovers help not only the original goal of the research group, but also other industries and regions. They also noted that knowledge generally cannot be contained within national borders and firms in one country benefit from industrial knowledge produced by research and development performed in another. In their study, they attempted to quantify the effects that research spending has on economic growth and productivity, thus understanding the role that research plays as a determinant of productivity and, consequently, economic growth

Toutkoushian, Porter, Danielson and Hollis (2003) have pointed out that most studies on the productivity of universities focus on teaching while neglecting research output. The difficulty of measuring research output (Mooya, 2007) and the lack of a universally accepted standard for measuring research output (Abbott and Doucouliagos, 2004; Madue, 2006; Gralka, Wohlrabe and Bornmann, 2019) may be a reason teaching is so important. Teaching productivity can easily be measured using performance indicators like enrolment and graduation rates (Toutkoushian, Porter, Danielson and Hollis, 2003).

Some of the measurements used to calculate research output include calculating the average number of publications by academics at a given tertiary institution or research grants attracted by a university 'quantitative' as well as citation weighting of publication numbers 'qualitative' (Abbott and Doucouliagos, 2004; Madue, 2006; Gralka, Wohlrabe and Bornmann, 2019). According to Qonde (2018), in South Africa, the measurement of research output is guided by the Research Output Policy Act of 2015 and is done through the Research Outputs Submission System an electronic platform/system normally used to capture research publications submitted by universities.

### **RESEARCH IN REAL ESTATE EDUCATION**

Mirembe and VIRULY (2018) demonstrate that RF knowledge has developed over decades to reflect the functions of specific market structures that characterise RF markets in different countries. Kim and Pior (2018) also point out that RF science has helped in bringing solutions to dynamic and complex RF



problems. However, Chikafalimani (2010) noted limited research output in RF.

Azmi *et al.* (2015) defined knowledge as a subset of data and information that has been interpreted, reflected on and contextualised. They alluded to the fact that knowledge can be divided into tacit and explicit knowledge. However, Pawlak (2019) argues that knowledge has three categories: tacit, explicit and implicit. Tacit knowledge is embedded in someone through the internalisation process and is highly personal (*ibid.*). It can be expressed only through actions and skills. Meanwhile, explicit knowledge is formal and written knowledge, which somehow can be extracted through a certain process (*ibid.*9). The combination of the above types of knowledge, through the implementation process will create additional knowledge that can be separated from functional knowledge and procedural knowledge.

People are becoming more sensitised to RF and it has shown great development over the years. Moreover, it is reflective of the maturity of RF markets and the tools developed reflect specific market structures. According to Kim and Pior (2018), RF education has been the focus of academic debate from as far back as 2000. Many scholars note an increase in studies on RF education in the African context (Cloete, 2002; Chikafalimani and Cloete, 2006; Jay, 2011; Chikafalimani, 2013; Serfontein and Boshoff, 2014; Ashaolu, 2015; ; Kampamba, Nkwae and Tembo, 2015; Osmond, Adesiyan, Olusola and Daniel, 2015; Kampamba, Nkwae and Tembo, 2017; Paradza and Cloete, 2016; ; Gavu, 2018; Kim and Pior, 2018; Mirembe and Viruly, 2018; Paradza, 2021). This trajectory is commendable considering that RF education was in its infancy stage about two decades ago (Cloete, 2002; Kim and Pior, 2018).

Real estate analysts are becoming increasingly interested on the RF markets in emerging economies (Mirembe and Viruly, 2018). This has been visible within the Botswana RF market. There has been an emergence of many RF agencies and learning institutions that saw the need to introduce programmers concerning this case. Kampamba, Nkwae and Tembo (2015) postulate that the variation in the curricula taught by the two

universities is significant and somehow concludes that educators have not agreed on common topics and courses that should be included in the syllabus. This then makes graduates lack some of the principles and necessities of RF education and productivity. This poses a gap in the industry and many discrepancies within the local RF industry.

Medina (2020) posits that knowledge creation is an important activity for every society and economy and further alluded to the fact that the creation and application of knowledge enable economies and individuals to be prosperous in the market. Knowledge is a fundamental factor that improves the quality of the main drivers of productivity in economic business (*ibid.*). Understanding the implications of knowledge creation in a knowledge economy is critical not only for a certain segment of the population, but also for high education providers, graduates and academic pedagogues. These individuals are always engaged in research to expand the RF arena and come up with strategies to drive it to the top.

Kapamba, Nkwae and Tembo (2015) reveal that due to the realisation of the importance of research and knowledge dissemination, countries took to creating programmes in their universities to facilitate growth and development. Botswana started having RF programmes offered at the university level in 2011. However, since the inception of such programmes, there has never been any curriculum evaluation, defying the principles of epistemic function that provide that knowledge creation is continuous. A non-stop knowledge creation process works as a crucial function in assuring organisational performance improvement (Nonaka and Toyama, 2005).

Kapamba, Nkwae and Tembo (2015) proceed to compare the content of the RF programmes offered by the BIU, being Bachelor of Commerce (B Comm) in Real Estate and Bachelor of Science in Real Estate, respectively. Both programmes are accredited by the Botswana Qualifications Authority (BQA). In Botswana, RF practice is governed by two regulatory bodies, namely the Real Estate Institute of Botswana (REIB) and the Real Estate Advisory Council (REAC). These bodies are tasked with the responsibility of licensing RF practitioners in

Botswana. Over the years, the South African Qualification Authority (SAQA) and the National Qualifications Framework (NQF) have tried to get RF practices to be more uniform

Kampamba, Nkwae and Tembo (*ibid.*), further analyze the curricula of the two degree programmes offered by the two respective universities. The study revealed that the curriculum differs in content. The BIU has a commercial approach to study, while the the UB curriculum is anchored on a scientific approach. It was noted that at the degree level, the parity of the curriculum is at 61% between the two universities. These variations turn out to affect the quality of RF production in Botswana meant for the same market industry. Bodies such as the SAQA and the NQF) exist to try and establish unison in curriculum development. These bodies advocate for similarities in the curriculum at different universities, suggesting that the basic elements of RF, including property investment analysis, RF finance, property market analysis and policy and law, should be included in the curriculum as the basis of RF education (Kampamba, Nkwae and Tembo, 2015; 2017).

Koto, Syukri and Arief (2018) allude that, in an analysis of higher education institutions, research output reflects knowledge levels as well as the potential economic growth of a country. Education and research are thus used as an element for measuring the economic development of countries (*ibid.*). Research output is one of the tools used to rank universities, providing a platform for knowledge dissemination (*ibid.*). Usually, standardisation of RF curriculum is more of a far cry, as the course curriculum is normally tailored for a specific market or economic environment, whether it be for scientific or commercial purposes.

With the vast growth realised as RF blossoms over the years, the creation of knowledge dissemination is imperative to facilitate discourse and the mobilisation of informed opinions to influence practice. This has become evident as world organisations have taken to creating symposia to further education, chief among them being the educational proceedings and conferences facilitated by the African Real Estate Society (AfRES). Chikafalimani (2020) argues that the RF curriculum

in South Africa is diverse, depending on the university under study, though there are similarities in content, particularly in property development, property finance, property investment, property valuation, property management and property law.

Property, being an integral aspect of economic growth and development, countries like Botswana are mostly vested in exploring RF for GDP improvement (Delmendo, 2017). It is worthy noting over the years that Botswana has been battling with a plethora of RF-related challenges, including, but not limited to, the mushrooming of unregistered estate agents ‘commonly known as fly-by night estate agents in Botswana’ (Mosimanegape, 2018), a ballooning housing backlog ‘especially for the urban poor’ (Moshia, Sungirirai, Dick and Paradza, 2022) and lack of relevant RF data needed for ancillary RF services and decision making (Kampamba, Kachepea and Kgalaletso, 2022).

The government of Botswana (2015) bemoaned a lack of research output in terms of quality and quantity, as shown in Box 2.

**Box 2: Lack of Research Output in Botswana** (Government of Botswana, 2015)

High-quality tertiary education provides the backbone for knowledge creation and its strategic application. However, there is a lack of research and research outputs in sufficient quantities and quality to generate new knowledge. Equally, the small number of candidates in graduate studies leads to lower research output. Again, research impact is dependent on publication and dissemination. Botswana is well below optimal performance levels in terms of both research output and human capacity development in research.

Concerning Box 2, Kampamba and Munshifwa (2021) somehow explain the reasons behind the lack of research output by academics. They singled out teaching load as one of the main factors limiting research output among RF academics. It is worthy noting that the report by the Government of Botswana (2015) is almost seven years old and was done when RF education in the country was introduced just three years prior. Is the situation still the same, or has it changed with the maturing of RF education? This, therefore, justifies the importance of this study which seeks to provide an updated RF-specific picture of research and graduate output in Botswana.

The next section discusses the research methodology used in this study.

## **RESEARCH METHODOLOGY**

This study was qualitative in nature, based on a case study of three purposefully selected REHETPs. The study was done online, where data was collected from various websites. A list of accredited higher education and training providers was obtained from the website of the BQA. Data from BQA was then used to check programmes offered by the three HETPs (UB, BIU and GUC). Data on enrolment and graduates' output was obtained from the website of the Human Resources Development Council (HRDC) and data only from 2011 to 2019 was available. Also, data on the full-time faculty was found on the websites of the three universities.

A systematic review of the publications was conducted, followed by content analysis. Publications were quantified and classified by institution, type, year of publication and research focus. Also, a standard yardstick to calculate per-capita research output for full-time academics was adopted by the Department of Higher Education and Training (2021) where the total number of publications was divided by the number of full-time faculty. Furthermore, to avoid inflating research output, publications that were co-authored were attributed to only one author. Findings are presented in the form of descriptive words supported by tables and figures and are critically analyzed in the next section.

## **RESULTS**

According to the BQA, currently, there are a total of 178 registered tertiary HETPs in Botswana (<https://www.bqa.org.bw/he-etps/>) and, as highlighted before, only 0.02% (three HETPs) are offering RF. This section analyzes the contribution of RF HETPs in terms of programmes developed and offered, student enrolment, several graduates and research output.

### **PROGRAMMES OFFERED BY REHETPS IN BOTSWANA**

This study established that currently, HETPs in Botswana are offering RF programmes at National Certificate (National Qualification Framework (NQF) Level 5), National Diploma (NQF Level 6) and bachelor's degree (NQF Level 7) as summarised in Table 1.

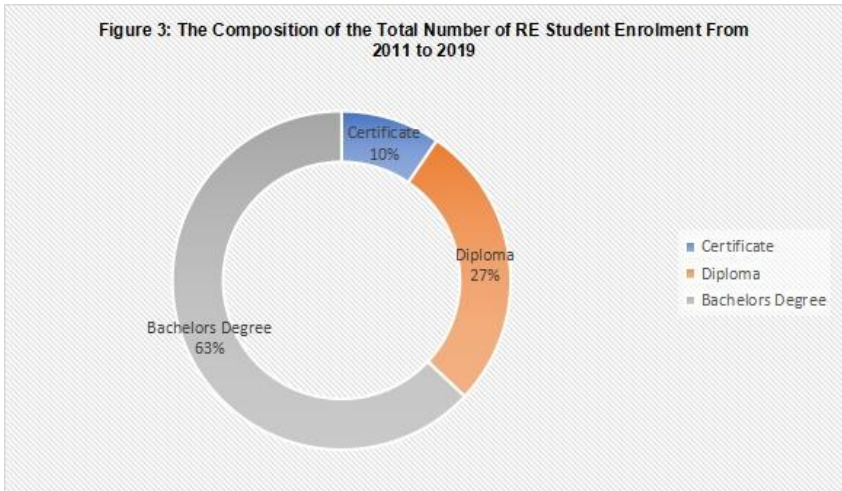
**Table 1:** *RE Programmes Offered by HETPs in Botswana* (<https://www.ub.bw/discover/faculties/engineering-and-technology/architecture-and-planning> (Accessed: 27-06-2022), <https://www.guc.ac.bw/programme-streampage> (Accessed: 27-06-2022), <https://baisago.ac.bw/faculty-of-the-built-environment-arts-and-science/> (Accessed: 27-06-2022)).

<b>Institution</b>	<b>Number RE Learning Programmes Offered</b>				
	<b>National Certificate</b>	<b>National Diploma</b>	<b>Bachelor's degree</b>	<b>Master's degree</b>	<b>Doctoral Degree</b>
<b>GUC</b>	1	0	0	0	0
<b>BIU</b>	1	1	1	0	0
<b>UB</b>	0	1	1	0	0

As shown in Table 1, RF is offered at NQF Level 5 by two ETPs the (BIU and the GUC) and the same number of REHETPs offer property programmes at NQF Levels 6 and 7. This can be a positive contribution by local REHETPs, given the fact that a decade ago, local students had to go to foreign countries to pursue RF education. However, it must be noted that a postgraduate qualification is yet to be introduced locally, hence graduates who want to further their studies still face the same predicament. Also, it was not clear why all RE programmes offered by REHETPs in Botswana were not appearing on the list of BQA-accredited learning programmes (<https://www.bqa.org.bw/learningprogrammes/> (Accessed: 27-06-2022)). Furthermore, only the BIU Certificate in RE appeared on the BQA list of registered qualifications (<https://www.bqa.org.bw/qualifications/> (Accessed: 27-06-2022)).

### STUDENT ENROLMENT BY RE ETPS IN BOTSWANA 2011-2019

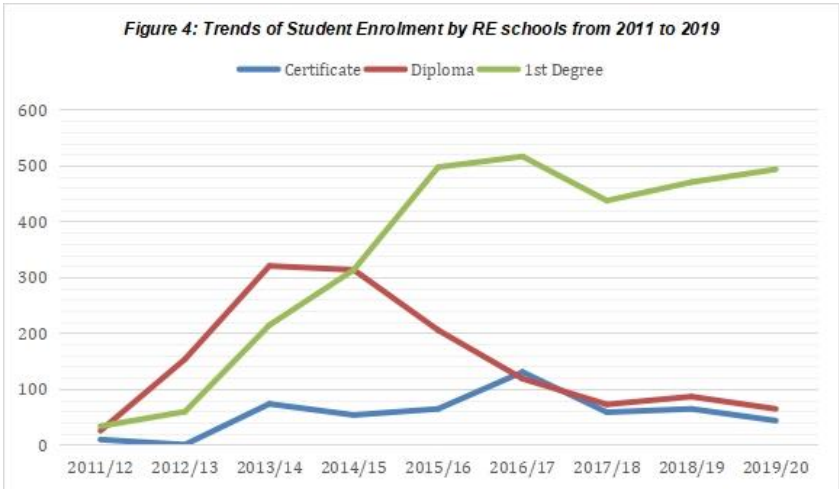
It was established that a total of 4 733 students were enrolled in RE programmes during the study period. More than half (63%) were enrolled in bachelor's degree programmes, while 27% were enrolled in NQF Level 6 programmes and 10% were enrolled in certificate programmes (Human Resource Development Council, 2015; 2020; 2021) as shown in Figure 3.



Human Resource Development Council, 2015; 2020; 2021

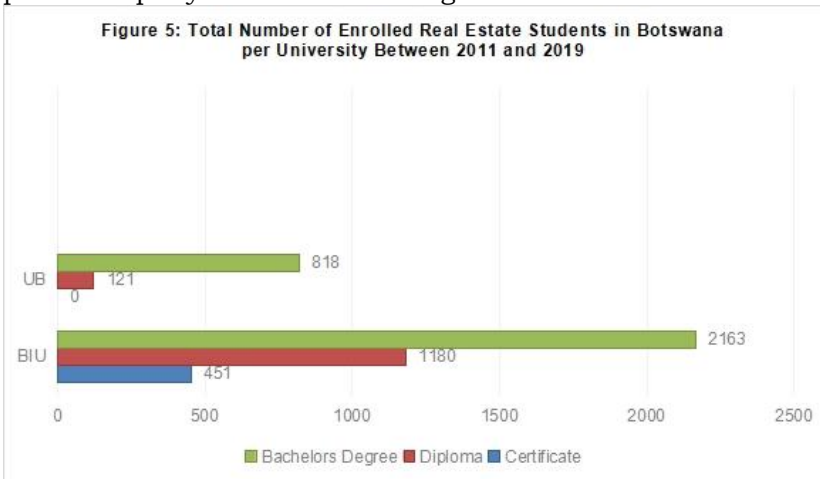
Student enrolment by RE universities in Botswana has been fluctuating, a peaking in the 2016/17 period as shown in Figure 4. However, the number of students enrolled in degree programmes keeps on increasing. It must be noted that tertiary education in Botswana is mainly government-sponsored. Over the years, the government has reduced the number of students and programmes under government sponsorship. As such, both the diploma and certificate programmes in RE were affected and most of the current students are self-sponsored. The reason enrolment by degree students keeps on increasing is that it is still under government sponsorship. Hence, REHETPs can attract and maintain large numbers of new students. Also worthy noting is that the GUC's RF programme is new, hence

its enrolment data is not available since it was introduced after the period covered by this study.



Human Resource Development Council, 2015; 2020; 2021

It is also crucial to discuss the number of enrolled RF students per HETP per year as shown in Figure 5.



Human Resource Development Council, 2015; 2020; 2021

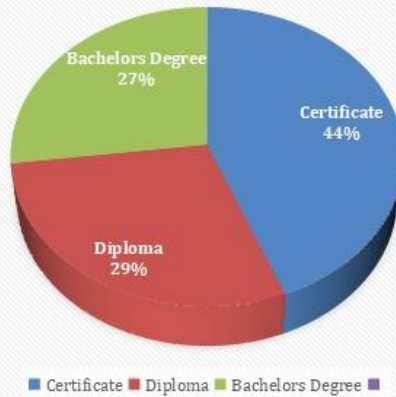


As shown in Figure 5, the BIU has been playing a leading role when it comes to training RE students. The RE school at the BIU is bigger (in terms of the size of faculty and number of campuses) when compared to the one at the UB. At the BIU, the RE department has a total of 11 academics stationed at its three campuses (Francistown, Gaborone and Maun) (<https://baisago.ac.bw/about-us/> (Accessed: 27-06-2022)) whilst at the UB, RE is a section under the Department of Architecture and Planning and it has a complement of four academic staff, less than half that of the BIU. RE at the UB is taught only at its Gaborone campus (<https://www.ub.bw/discover/faculties/engineering-and-technology/architecture-and-planning> (Accessed: 27-06-2022)). This might have given the BIU a comparative advantage in student enrolment. Another possible explanation is that the UB, as a public university, might be restricted to enrolling a limited number of students per academic year, while the BIU, as a private university, might be seeking to maximise its enrolment numbers for revenue purposes. However, what is important for this discussion is that the BIU is playing a leading role in terms of contribution to knowledge, specifically in student enrolment figures.

### **REAL ESTATE GRADUATES 2011 – 2019**

This study established that during the study period, a total of 856 graduated in RE programmes offered by local REHETPs. Therefore, the graduate-to-lecturer ratio as of 2019 was 57, meaning that, on average, each teaching academic has assisted 57 students through to graduation over a period of eight years. The bulk of these locally trained REgraduates (44%) are certificate holders. As shown in Figure 6, graduates with diplomas constituted 29% and those with first-degree qualifications made 27%.

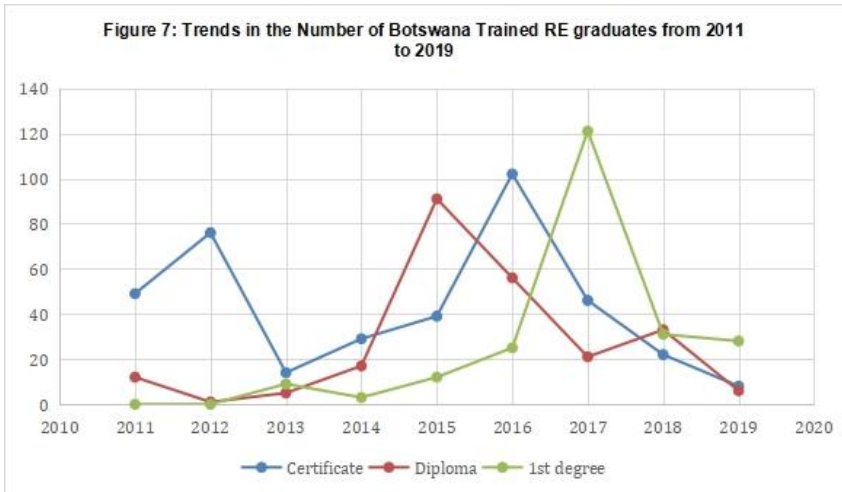
Figure 6: Number of Locally Trained RE Graduates in Botswana in 2019



Human Resource Development Council, 2015; 2020; 2021

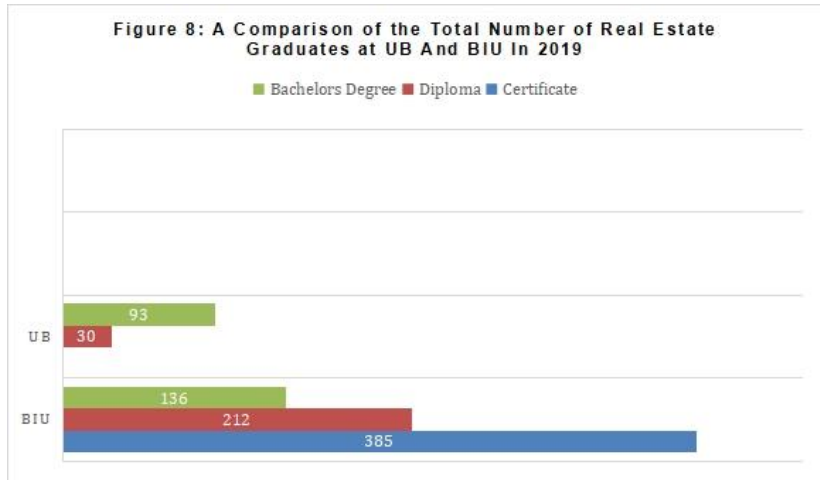
It can be noted from Figure 6 that most locally trained RE graduates can qualify for registration and practice only as estate agents. Certificate holders cannot practise as property valuers, property auctioneers, or property managers in Botswana as stipulated by Section 20 of the (*Real Estate Professionals Act (Chapter 61:07)*, 2003). They can qualify to be registered and practise only as estate agent,s subject to fulfilling the requirements of the Act, REIB and REAC.

One might be tempted to argue that tertiary RE education institutions in Botswana are not doing enough since 856 seems to be a very small number. However, if one takes a closer look at the Botswana market, it can be notde that the market is relatively small. With an estimated total population of 2 346 179 people (Bank, 2018; Statistics Botswana, 2022), 856 graduates constitute 0.0004% of the total population. Having managed to increase the cohort of locally trained RF graduates from 0 to 856 over a period of eight years is a commendable contribution of skilled human resources to the job market. Figure 7 is a summary of how many graduates of local REschools there were from 2011 to 2019.



Human Resource Development Council, 2015; 2020; 2021

As shown in Figure 7, the number of locally trained RE graduates in Botswana has been fluctuating over the period of study. The highest number of certificate graduates was registered in 2016, while for diplomas it was in 2015 and the number of graduates with a first degree reached its peak in 2017. These results relate to the admission data presented in Figure 2. The two graphs for certificate programmes on student enrolment and graduates (Figures 4 and 7) show most of the enrolled certificate students managed to finish their studies and graduate. The relationship between enrolment and graduation for certificate programmes can easily be noted because the programmes are done within one academic year. It is also important to narrow this discussion of student output down to the university level. Figure 8 shows the number of graduates per university per year.



Human Resource Development Council, 2015; 2020; 2021

From Figure 8, it can be deduced that the BIU is leading in terms of the production of RE graduates at all levels as compared to the UB. As earlier mentioned, it is also of paramount importance to note that the RE school at the UB is less than half of BIU in terms of staff establishment. At the BIU, RE is a stand-alone department under the Faculty of Built Environment Arts and Science (FBEAS) and it has 11 lecturers, including the head of the department (<https://baisago.ac.bw/faculty-of-the-built-environment-arts-and-science/> (Accessed: 27-06-2022)). On the other hand, at the UB, RE is a section under the Department of Architecture and Planning and it has a staff establishment of only four lecturers (<https://www.ub.bw/discover/faculties/engineering-and-technology/architecture-and-planning>).

Research is also one of the expected key contributors to institutions of high learning. As highlighted before, universities as engines of ideas are expected to occupy the driver's seat in a knowledge-based economy.

## **RESEARCH OUTPUT OF RE TERTIARY EDUCATION INSTITUTIONS IN BOTSWANA 2011-2019**

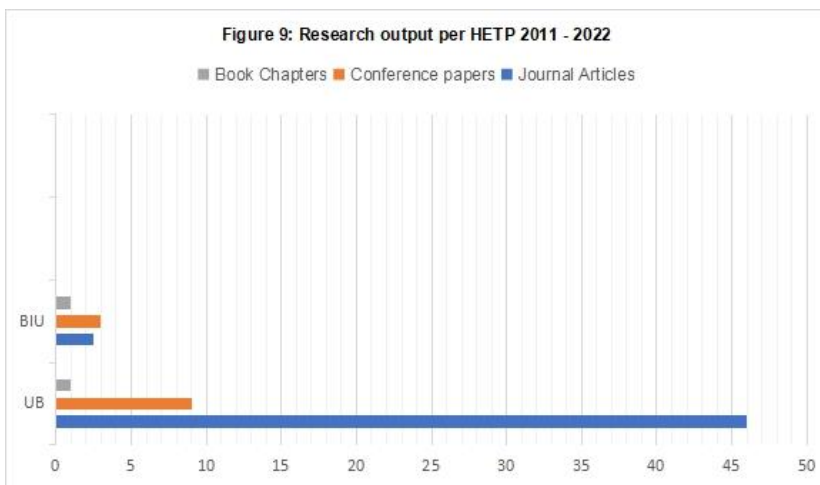
A search on Google Scholar revealed that a total of 69 peer-reviewed papers (journal articles, book chapters and conference proceedings) were published by local RE academics at REHETPs in Botswana as shown in Table 2.

**Table 2:** Per-Capita Research Output of RE Faculty in Botswana 2011 - 2022

<b>University</b>	<b>Number of Publications</b>	<b>Number of full-time Faculty</b>	<b>Publications to Full-Time Faculty Ratio</b>
UB	56	4	14
BIU	13	11	1.18
Total	69	15	

Table 2 shows that 81% of the publications were published by UB and the remainder (19%) were published by academics at the BIU. The published full-time faculty ratio for the UB is 14 and for BIU it is 1.18. This means that, on average, at the UB, each academic published 14 research papers between 2011 and 2019, whereas an average faculty at the BIU published 1 publication over the same period. It is important to note that out of the 11 academics at the BIU, only four were found on Google Scholar and the researchers assumed that those not on Google Scholar did not publish between 2011 and 2022. However, this assumption might not be true, as highlighted by the fact that Google Scholar might not provide an exhaustive list of all publications.

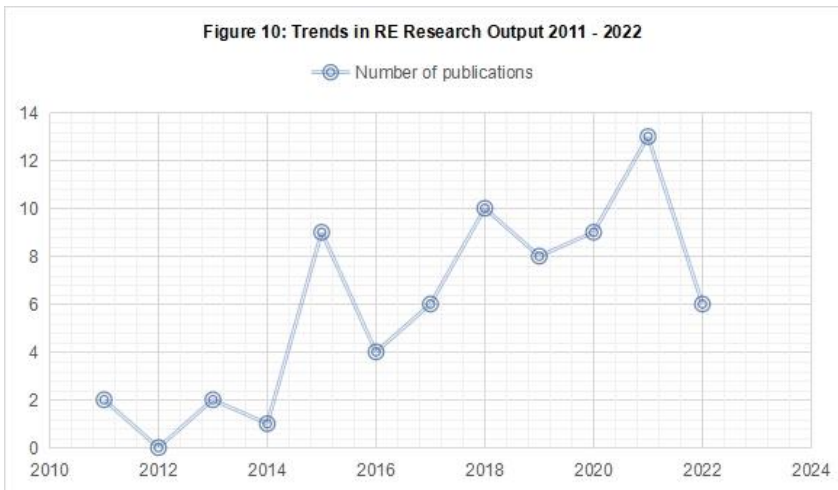
A closer analysis of the data revealed that there are very few active researchers at both institutions who are doing extremely well on publications and there is a sizeable number of faculty who are not on Google Scholar and were therefore considered to not have published anything over the eight years. Figure 9 is a summary of the total RE research output in Botswana by type of publication per REHETP from 2011 to 2022.



(Accessed: 27-06-2022)

If one refers to Table 2 and Figure 9, it can be inferred that the UB is championing RE research in Botswana. This can be attributed to the presence of senior academics among its staff establishment that they have established a research culture. A significant difference in research output can also indicate the philosophy of the two universities, with the UB being more research-oriented and the BIU being more teaching-oriented. This is supported by the previous discussion that shows that the BIU produces a fair number of students at certificate, diploma and first-degree levels. This can also be explained by the difference in philosophies. The UB, as a scientific-based university, might be attracting scientific research-oriented academics, whereas the BIU, as a commerce-based REHETP, might be attracting commercially-minded faculty. Chances are that the titles of programmes offered by these two REHETPs are testimony to this view. At the UB, the RE programme is a Bachelor of Science Degree, but at the BIU it is a Bachelor of Commerce Degree. Furthermore, one might be justified in assuming that since the UB enrolls a limited number of students, the teaching load of academics might be lower than that of the BIU academics; hence they (UB academics) might have more time dedicated to research.

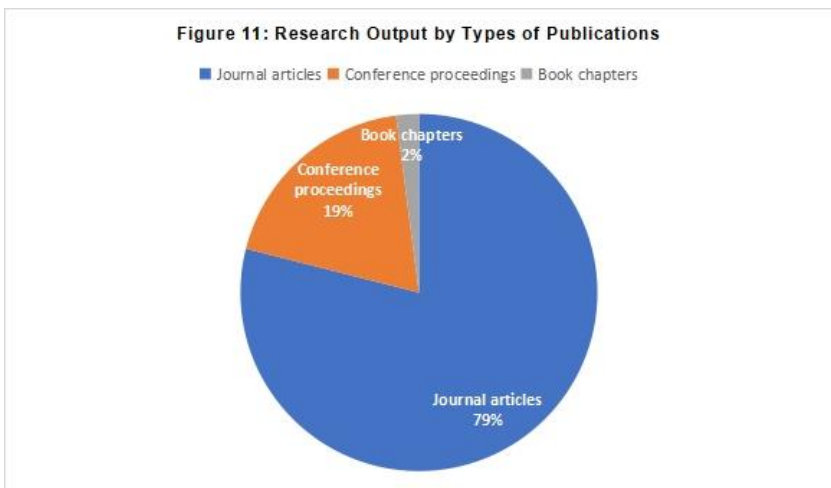
It can be inferred from this discussion that the two REHETPs in Botswana somehow complement each other as one contributes more through research and the other through teaching towards meeting the country's quest to achieve a knowledge-based economy. A good number of the papers were co-authored, with the majority of the the UB faculty writing the majority of their publications together. There was also evidence of academics in Botswana publishing with other researchers outside Botswana, for example, those in South Africa, Zambia, Nigeria and Zimbabwe. This is commendable as it promotes the cross-pollination of ideas. However, there was limited collaboration on research between academics at the UB and the BIU. Only one paper was co-authored by academics from the two institutions. Figure 10 shows trends in research output by RE faculty at the two RE HETPs in Botswana from 2011 to 2022.



(Accessed: 27-06-2022)

It was established that research output by RE faculty in Botswana has increased by 97% between 2011 and 2022. Furthermore, generally, research output has been increasing over the past 11 years with a sharp increase being recorded in 2015 and 2021. It is also important to note that several

research articles were expected to be published in 2022, given the fact that at mid-year, the papers published were equal to the total number of papers published in 2017, slightly half of the ones published in 2021 and more than the total number of papers published in 2011, 2012, 2013, 2014 and 2016. This is a positive trajectory that if maintained, there is no doubt that RE faculty in Botswana might make a valuable contribution towards meeting a knowledge-based economy. However, as discussed before, this study did not consider the total amount attracted by RE academics at RE schools and, citations of the published articles were not taken into consideration which are important parameters normally used to measure the quality of publications. Figure 11 shows the RE research output in Botswana by type of publications.



(Accessed: 27-06-2022)

As shown in Figure 11, journals are the most preferred platforms for communicating research findings by RE faculty in Botswana, followed by conference papers, and book chapters are the least used vehicles for communicating research findings. Table 3 is a list of journals where academics at RE schools in Botswana published their papers.



**Table 3:** Number of publications per journal (Accessed: 27-06-2022). (Accessed: 27-06-2022)

<b>Journal</b>	<b>Number of papers published</b>
1. <i>American Journal of Social and Management</i>	2
2. <i>Advanced Research in Scientific Areas</i>	1
3. <i>Civil and Environmental Research</i>	1
4. <i>International Journal of Civil Engineering, Construction and Estate Management</i>	2
5. <i>Research Journal of Finance and Accounting</i>	1
6. <i>Int. Journal of Engineering Research and Applications</i>	1
7. <i>International Journal of Civil Engineering, Construction and Estate Management</i>	2
8. <i>International Journal of Finance and Accounting (IJFA),</i>	1
9. <i>Mediterranean Journal of Social Sciences</i>	2
10. <i>Global Journal of Advanced Research</i>	1
11. <i>International Journal Advances in Social Science and Humanities</i>	5
12. <i>Tropical Built Environment Journal</i>	1
13. <i>International journal of development and economic sustainability</i>	1
14. <i>Property Management</i>	2
15. <b>International Review of Education Journals</b>	3
16. <i>Iconic Research and Engineering Journals</i>	1
17. <i>Journal of Property Tax Assessment &amp; Administration</i>	1
18. <i>International Journal of Housing Markets and Analysis</i>	2
19. <b>PM World Journal</b>	1
20. <i>Real Estate Finance</i>	2
21. <i>British Journal of Environmental Sciences</i>	3
22. <i>Current Urban Studies</i>	1
23. <i>Journal of Advances in Economics and Business</i>	1
24. <i>International Journal of Project Management and Productivity Assessment</i>	3
25. <i>Journal of Real Estate Finance</i>	2
26. <i>American Research Journal of Civil and Structural Engineering</i>	1
27. <i>Environmental Review</i>	1
28. <i>International Journal of Housing Markets and Analysis</i>	2
29. <i>Analysis</i>	
30. <i>International Journal of Science and Research (IJSR)</i>	2
31. <i>Journal of Economics and Sustainable</i>	1

<i>Development</i>	
32. <i>Journal of Urban Systems and Innovations for Resilience in Zimbabwe-JUSIRZ</i>	1
33. <i>International Journal of Innovative Research in Science, Engineering and Technology</i>	1
34. <i>Journal of African Real Estate Research</i>	1
35. <i>Journal of Property Research</i>	1
36. <i>Real Estate Management and Valuation,</i>	1

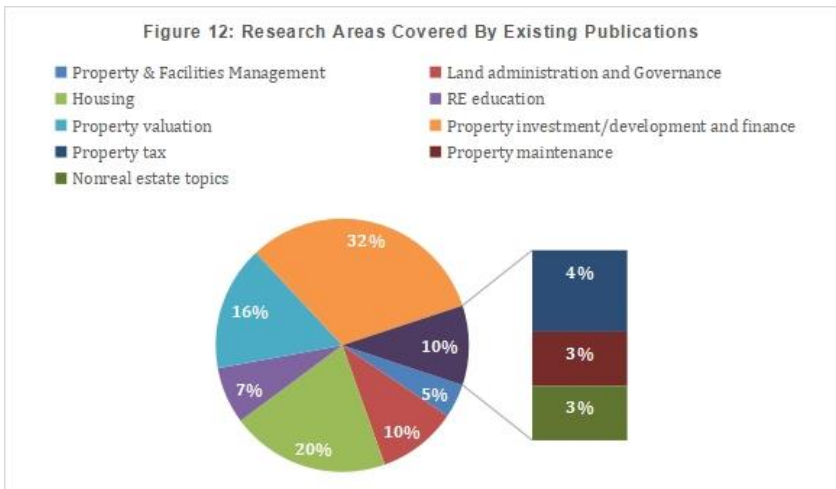
As shown in Table 3, RE faculty in Botswana publish in various journals, with most papers being published in the *International Journal of Advances in Social Science and Humanities*. It was also determined that all journals in which RE faculty in Botswana published appear to be internally reputable peer-reviewed journals, indicating that the published work is of internationally acceptable quality. Table 4 shows conferences where RE faculty in Botswana presented papers.

**Table 4:** Number of publications per conference (Accessed: 27-06-2022)

<b>Conference</b>	<b>Number of papers presented</b>
FIG Conference	1
African Real Estate Society (AfRES) Annual Conference	6
National Conference of the School of General Studies	1
The Commonwealth Association of Surveying and Land Economy (CASLE)	2
Southern African Development Community (SADC) International Conference on Postgraduate Research for Sustainable Development	1
Namibia University of Science and Technology (NUST)/Network of Excellence on Land Governance in Africa Conference	1

One can see from Table 4 that most publications by RE academics in Botswana were presented at the AfRES Annual Conferences. AfRES is a regional voluntary association of RE academics and practitioners in Africa and most of the papers presented during its annual conferences are subject to a double-blind peer-review process. Other conferences were also done by regional institutions like SADC and NELGA. This might

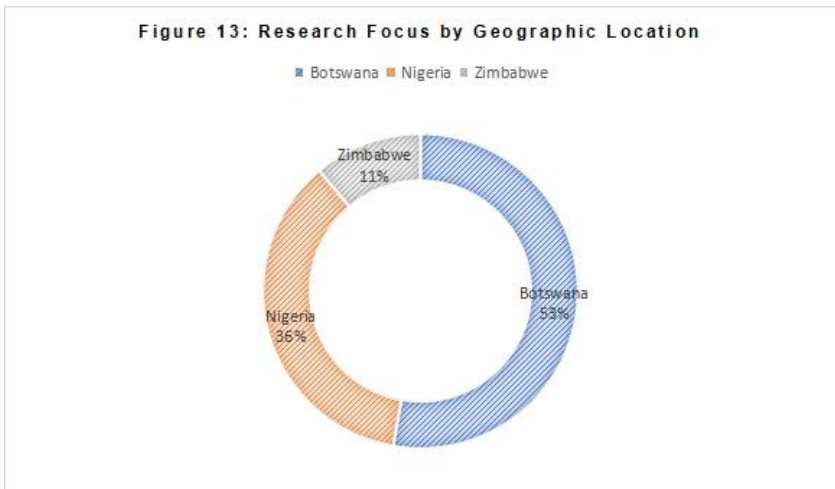
be translated to mean that the research output of RE scholars in Botswana is shared beyond the national spare. In retrospect, over the years only a few papers of research have seen the light of publishment at external fora from universities within our country's boundaries. However, it suffices to note that it was not clear why conference papers presented by RE scholars during international conferences hosted by BIU and UB in 2019 and 2021 respectively, were not on Google Scholar. As highlighted before, this means that this study was not based on exhaustive research output of RE faculty in Botswana. Figure 12 shows the percentage contribution of research publications by research area.



(Accessed: 27-06-2022)

If one analyzes Figure 12, it is glaring that 32% of publications by RE faculty in Botswana focused on property investment/development and finance and the least RE-related research area was property maintenance (3%). There was also a very small percentage (3%) of research areas that were classified as not RE-related. A good example of one research paper that was classified as not RE-related is the one focusing on local governance during the COVID-19 era. It was also of paramount importance to classify the research focus by considering the

geographic location of the study. One might be tempted to challenge any research output that was done outside Botswana not to be a contribution to the local market. However, this line of thinking might be challenged because academics usually contribute to the international body of knowledge and with globalisation, the contribution of universities can no longer be limited to within national boundaries. Figure 13 is a summary of the research focus of RE faculty in Botswana by geographic location.



(Authors, 2022)

As shown in Figure 13, Botswana took a lion's share (53%) of research publications done by RE academics at its universities. This is an encouraging picture where most of the studies are done locally, but at the same time, some of the publications are also done in other countries. Thirty-six per cent of the publications were done in Nigeria and studies focusing on Zimbabwe constituted 11%. If one is to consider publications only done in Botswana and exclude those done in other countries, the total research output from 2011 to 2021 will be reduced from 69 to 37 and the total per capita research output will be 2.5 for the same period. Figure 13 is a visual representation of the research focus of Botswana's RF faculty by geographic location.

## **DISCUSSION**

Teaching productivity was measured in this study using the performance number of RE programmes, students' enrolment and graduation rates in line with Toutkoushian, Porter, Danielson and Hollis (2003). It was established that there are currently three REHETPs providing RE programmes in Botswana, namely the UBthre BIU and the GUCs at national certificate, national diploma and first-degree levels. This shows that a new player (GUC) came in as an RE school after the publications of Kampamba *et al.* (2015 and 2017) posited that the variation in curricula taught by the universities is significant and somehow concludes that educators have not agreed on common topics and courses that should be included in the syllabus.

This study also established that there are 856 graduates, 44% being certificate holders, 29% being diploma graduates and 27% being degree graduates (231 graduates). Certificate and diploma graduates are not capable of undertaking research studies. With respect to the curriculum of RE, only degree students and above \carry out research. The study picked out that more is expected from the few degree graduates, but research output cannot be significantly recognised due to this factor. Only degree and above graduates understand composites of research and in this study, there is only a handful of them. Therefore, not much RE research output is expected from from the few degree graduates. However, considering the population dynamics in Botswana, the number of graduates can be considered sufficient since the degree programme is relatively new in the country. Schiliro (2012) affirms that the number of graduates produced in a country is a key indicator of transformation towards a knowledge-based economy.

There is a paradigm shift from a situation where research, in general, was low, as shown by the Government of Botswana (2015) to a steady increase in research, especially journal articles. This is a positive move, especially considering the importance of knowledge generation and dissemination in the much-aspired knowledge economy as noted by Choong and Leung (2022). The key factor in this economy is being able to provide competitiveness to benefit society and the economy. In

this case, if RE faculty in Botswana create and transfer knowledge, they can bring innovative solutions to its RF problems and help improve the attractiveness of Botswana on the global property market.

The research also established that there are 69 research outputs published by local RE scholars, 81% of these are from the UB and the remainder (19%) from the BIU. Journal articles account for 79% of research output, conference proceedings account for 19% and book chapters account for 2%. The researcher picked out that the UB could be producing more output as it has a wide array of senior academic staff who have a high level of educational background. Another contributing factor could be the availability of resources because it is a public-based institution, thus having a robust backup from the government. The results of the study concurred with that of Chikalafami (2010) that there is limited research output in RF.

The research study identified the research areas of published journals. It was noted that the majority of the research is on property investment, development and finance (32%), housing (20%), property valuation (16%) and land administration (10%). Property investment has been on the rise as many people are now investing heavily in property. Investors are now investing in RF, for example the emergence of CBD and CBD 2 which is being built in Gaborone Block 8. As a result, more research will be done to find out what is the attributing factors towards property investment. In other areas, housing has always been a challenge in Botswana, thus there should be more research on it to bring light to this crucial matter. This is another area that is more researched in Botswana's RF sector. Botswana has been shifting to property as a form of investment, hence property investment, housing and valuation form part of the most researched areas.

It is notable that with the steady growth of Botswana's RF profile, RF education is seeing a growth in academic societies/clubs, that is the recent establishment of educational societies such as the the BA ISAGO University Real Estate Society as well as the University of Botswana Real Estate Society that help nurture RF education to maximum heights. It

is worth noting that there were several conferences where scholars were able to present their research papers to build a research culture in Africa. These are inclusive of the AfRES Conference and SADC International Conference where most of the local publications were presented. Investments and efforts are being made akin to RF, for instance, institutions turn to host annual research days in attempt to encourage and yield education and knowledge transformation at different themed topics as seen at the BIU. This is done to drive to knowledge-based economic system spearheaded by the government.

It is also vital to note that even though three REHETPs contributed meaningfully towards the targets of the tertiary education policy of 2008 in terms of the graduate and research output, challenges noted by Mosimanegape (2018), Moshia, Sungirirai, Dick and Paradza (2022) as well as Kampamba, Kachepa and Kgalaletso (2022) have not lessened. Instead, challenges keep on changing their colour and texture, thereby becoming more complex. The complexity of Botswana's RF challenges is compounded by the new dimensions brought by a spike in inflation and unemployment, inequality, climate change and corruption.

## **CONCLUSION**

This study was done based on the case study of three REHETPs teaching RF in Botswana. The researcher managed to answer the research question: What has been the contribution of REHETPs in Botswana over the past decade? It was concluded that currently, RF schools in Botswana have played a critical role in terms of producing local graduates and publications as a contribution to the development of the country and the region at large. However much more still needs to be done on postgraduate research programmes and graduates. An increase in postgraduate programmes and students can also have a direct impact on the increase in research publications. Current students (undergraduate) do not normally publish the findings of their research projects (dissertations).

Even though no relationship analysis was done, it is surprising to note an increase in graduate and research output by REHETPs does not seem to have reduced the challenges that

were faced before their existence. This might be an indication that there is need for a shift in the impact of higher education in society. An important question for academics and policy-makers should be: After publishing tonnes of papers and graduating multitudes of graduates, what is the real impact on challenges currently ravaging the communities?

Further studies can be done on the competitiveness of “home-made” graduates on the regional and global job market. Other important areas that were left out by this study are the contribution of REHETPs to community engagement/service and registered patents, hence future studies might need to focus on this area as well. Limitations of this study, as discussed in the methodology section, can be addressed in future studies by triangulation where a combination of the archival approach is supported by surveys.

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# Fabrics of the Future: Economics, Environment and Equity as Calls for Critical Thinking

EMILY MOTSI<sup>1</sup> AND FLORENCE SEBELE<sup>2</sup>

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## Abstract

*This article explores the general future position of the textile fabric sector on how it can contribute to sustainable production and consumption of fabrics in the coming decades. Using a futures studies perspective, the article examines the drivers, practices and barriers impacting the fabric production and consumption landscape at global and local levels. Findings identified textile innovations as key drivers positively revolutionising the next generation of fabrics though barriers hinder their uptake in emerging economies; practices within the global fabric production industry continue to show a heavy reliance on non-renewable resources and linear economy models that result in the depletion of natural resources and excessive accumulation of fabric waste. The “throw-away” culture and “fast fashion business model” are two drivers fuelling over and wasteful consumption of clothes, with fast fashion negatively contributing to unjust systems of production and consumption.*

**Keywords:** sustainable production and consumption, inclusive circular economy, futures studies, sustainable development.

## INTRODUCTION

Textile fabrics have long been a vital part of daily life and society. The largest area of fabric used is apparel which accounts for approximately 60% of the global demand for fibres, with household/interior and technical textiles taking up 20% each of the global demand for fibres (Mackenzie, 2016). Before the introduction of synthetics, the textile industry relied on four bio-based fibres i.e. flax, cotton, silk and wool. Synthetic fabrics were a later innovation developed to overcome some of the

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inherent limitations of natural fibres such as the excessive wrinkling of cotton and linen, shrinkage and irritation of wool. Synthetic materials were valued for their better desirable performance properties such as greater tensile strength, abrasion and wrinkle resistance, colourfastness, as well as lower cost. The discovery of in the 20<sup>th</sup> century of novel technologies led to the development of fabrics with impressive performance characteristics and functionality, thus providing added value to textile fabrics. This new generation of fabric, which includes ‘smart textiles’, was developed through a convergence of different disciplines such as polymer science, electronics and computing science. In the 21<sup>st</sup> century fabric, manufacturers continue to respond to consumer demands for fabrics with enhanced functionality and performance. This has resulted in the development of the next generation of ‘smart and e-textiles’ for millennials that are functional and responsive.

Despite the remarkable achievements of this earlier generation of fabrics, today there is growing concern over increasing pressure on resources, negative environmental and social impact and climate change effects brought about by the production and consumption of textile fabrics (Steffen *et al.*, 2015; UNEP, 2020). The textile industry is important to economic and social development in emerging and mature economies. The global significance of the industry is seen in its contribution to high employment levels, the generation of foreign exchange revenue and the design of products crucial for human well-being (UNEP, 2020). The textile industry also facilitates access by developing and emerging economies to the global supply chains and export market (ILO, 2019). However, the industry is bedevilled by criticism of being a resource-intensive and inefficient system utilising a linear textile value chain offering limited potential for re-use, re-purposing and recycling of textile materials (UNEP, 2020).

## **CONCEPTUAL FRAMEWORK**

The transitioning of the textile industry to a more sustainable circular economic system has become more desirable as reflected in the discourse regarding prospects of fabric production and consumption. Two concepts, “sustainability” and “circularity” are thus explored to understand their



relationship and significance in addressing the environmental, economic and social challenges of current fabric production and consumption practices.

### **SUSTAINABILITY IN FABRIC PRODUCTION**

The concept of sustainable business provides insights into what can be done in producing fabrics for the future without harming its environment . It is befitting that before we delve into this concept, we conceptualise and contextualise sustainability in the context of the textile industry. For instance, as defined by Fletcher (2009), a sustainable product is produced in such a way that it has the lowest possible adverse effects on the environment by utilising resources such as water and energy most effectively. This definition is further expounded by Hethorn and Ulasewicz (2008), who view sustainability in the context of fashion as the development and use of a thing or process, without harming people or the planet and once put into action, can enhance the well-being of the people who interact with it. In this article, we adopt and adapt Gardetti and Torre's (2012)'s definition of sustainability in producing fabrics for the future as reducing water use and wastage across the supply chain, reduction in chemical pollution and minimising the use of non-renewable sources without any anti-social means. The textile industry is subject to severe ecological problems in most of the phases of the supply chain. Sustainability issues concerning the textile supply chain are related to energy efficiency, water management, waste management and logistics from raw material procurement to textile production until fabric finishing. As per Chen and Burns (2006) assessment, the full environmental impact of any textile product may be broken down into those associated with its production (renewability of raw materials and chemicals released during production and processing), maintenance (quality and nature of chemicals used for laundering and dry cleaning) and eventual disposal (products recyclability and biodegradability). This indicates that making the production process sustainable can help to reduce resource consumption, waste generation and other associated costs for textile firms.

Scientific literature in the field of design research claims that designers play an important role in sustainable transitions. To

mediate this transition, the role of the designer has become more diverse as they find themselves filling multiple roles as creators, researchers, facilitators and process managers in the product design process (Atkinson, 2011). According to Ramani *et al.* (2010), product design is one of the most important sectors influencing global sustainability, as almost all the products consumed by people are outputs of the product development process. Charter and Tischner (2001) estimated that the product design and development phase carry approximately 80% or even more of the environmental and social impacts of the product, including the manufacturing, use and disposal phases. As Niinimäki, (2011) observes, decisions made during the design process tend to affect the environmental impact of the product during its whole life cycle. Designers are, therefore, key to sustainable product development through eco-design (Luttrupp and Lagerstedt, 2006). Furthermore, Luttrupp, (2006) emphasises that environmentally driven demands must enter the early phases of design and be included in the specifications as early design decisions can have a very significant impact on sustainability.

### **CIRCULARITY IN THE TEXTILE VALUE CHAIN**

The circular economy (CE) is applied in diverse fields and is an extensively researched topic that is also widely discussed outside academia. The CE has been presented in literature as a solution to sustainability challenges brought on by the linear economy (Marjamma and Makela, 2022). A systemic shift to a CE is a process receiving a lot of attention in business, manufacturing, agendas of policy-makers as well as the textile industry (Brennam *et al.*, 2015; Kirchherr *et al.*, 2017). The concept of CE has been criticised in literature for having significantly varying definitions with a systematic and comprehensive study by Kirchherr *et al.* (2017) identifying 114 CE definitions. The most prominent definition has been developed by the Ellen MacArthur Foundation describing a circular economy as an ‘industrial economy that is restorative and regenerative by intention and design’, (2013b:14). This definition focuses on three principles which relate to the elimination of wastage and pollution through reduction (resource use is minimised), re-use (of products and components is maximised) and recycling (raw materials are re-

used); circulation of materials and products in a long-lasting and high-quality way and emphasising the restoration of the natural system while creating conditions for regeneration. Of the three principles, ‘reduce by design’ is the overall principle upon which circularity is built (UNEP, 2020). Embedded into the early stage of a product’s design, ‘reduce by design aims at reducing the number of raw materials and hazardous chemicals used during production and use (*ibid.*).

Circularity’s underlying objective is that of maintaining the value of materials as they move and keeping them for the longest possible time within the textile value chain (*ibid.*). As UNEP (*ibid.*) explain, this reduces the use of natural resources and the environmental impacts of the economic activity of the textile industry, while enabling improvements in human and ecosystem well-being. To achieve this, three elements are emphasised, closed material cycles (a system of closed loops where raw materials, components or products lose as little value as possible by not having wastage and having every residual stream turned into a new product), use of renewable energy (the circular economy must be fed by renewable energy sources that, just like raw materials, components and products, should last as long as possible) and systems thinking (the system is viewed as a network with several actors where the individual actions of one have short-term or long-term consequences on others (Ellen MacArthur Foundation 2015a; Korhonen *et al.*, 2018).

A circular economy challenges innovative solutions that result in the generation of new insights and interdisciplinary cooperation between designers, producers and recyclers (Kraaijenhagen *et al.* 2016). The production of new innovative fibres is essential in the new circular textile economy, particularly those fibres that can be used for longer or re-used or those that do not shed microplastics (PACE, 2020). Replacing fossil-based synthetics with biosynthetic and using biofabrication to produce natural biofabrics, has the potential to limit global warming. Biosynthetic are made from a variety of biomass feedstock with the most common source being high-sugar or starch-containing crops such as corn, sugar beets and sugar cane. The extraction of sugars from lignocellulosic plants

(e.g. timbers and elephant grass) is currently being explored as future feedstock for biosynthetic. Concerns have, however, been raised over the use of food crops for biosynthetic and how this may impact food security (Textile Exchange, 2022). Biofabrication technologies are evolving and extending into applications in textile fabrics where living organisms such as yeast or bacteria are used to produce natural-based biofabrics. For example, a yeast cell may be used to produce silk protein (fabricated silk) or a bacterial cell might be used to produce biofabricated cellulose (Biofabricate-Fashion for Good, 2020). Examples of successful innovations utilising secondary material for the production of plastic-based fibres include NuCyl Envrn, a fibre made from discarded clothing and Repreve Unifi, a high-performance fibre made from plastic bottles (<https://www.evrnu.com/nucyl>; <https://www.repreve.com>).

To accelerate the transition to a circular economy in the textile industry, several action points have been suggested in the literature. For example, UNEP (2020) calls for a life-cycle thinking approach that enables the identification of strategic intervention points along the textile value chain and the engagement of all stakeholders in the processes in the textile value chain. Schroder (2020) calls for circularity that is socially inclusive and is concerned about the well-being of everyone and is aimed at a just transition that potentially reduces inequalities within and between countries, communities and sectors as they mediate the systemic process to a CE. PACE (2020) proposes several action points, which include supporting and incentivising the design of textile products that last long and have built-in recyclability features, encouraging the sustainable production of virgin natural fibres (e.g. cotton) through the use of regenerative agricultural techniques, making the recycled fibre market competitive so that the practice can be adopted on a significant scale and integrating and advancing decent work in the transition to a circular textile economy.

## **LITERATURE REVIEW**

To envision a future for fabrics an exploration of the current status of fibre and fabric production is necessary to build a case for transformation. This section of the literature review sought to establish the positive and negative features of fibre and fabric

production documented in the literature to determine the trajectory proposed for the future. Two points pursued in detail in the review of current developments in the global textile fabric production landscape are; first, the production of fabrics has been influenced mainly by the linear economic system, globalisation and innovations with consumption of fabrics being accelerated by fashion trends such as ‘fast fashion’; secondly, there are widespread economic, environmental and social costs involved in textile fibre and fabric production.

### **CURRENT DEVELOPMENTS IN THE GLOBAL TEXTILE FABRIC PRODUCTION LANDSCAPE**

The current system for producing textile products is made up of five broad areas of activities which encompass fibre production, yarn and fabric production, textile production, consumption (distribution, retail and use) and end-life. The system is usually graphically depicted and described as a linear production and consumption system. It is often labelled as a ‘take-make-dispose’ model where the focus of operations is on resource extraction, production of goods and disposal of post-consumer waste (Ellen MacArthur, 2017; UNEP, 2020; Mellick *et al.*, 2021). Value in this economic system is created by producing and selling many products as compared to the circular economy where value is created through value preservation. As an economic model, there is growing consensus that its production and consumption practices are unsustainable, leading to environmental destruction and social inequality and causing long-term economic instability (Korhonen *et. al*, 2018; Millar *et. al*, 2019). The linear model is considered inefficient in the way it handles raw materials as the value of the material is not fully exploited but is lost after use and does not circulate in the system long enough for it to offer its highest possible value (UNEP, 2020). The model has also been criticised for resulting in high levels of textile waste due to overproduction (Mellick *et al*, 2021).

The current model of production and consumption of textiles fabrics and clothing is greatly influenced by globalisation. Globalisation has brought changes in where and how textile products are manufactured and consumed (ILO, 2019; EPRS, 2020). Textiles and clothing supply chains have gone

international due to the rise of globalisation and the growth of the global economy. This has caused the cultivation of fibres, the manufacturing of textiles and the construction of garments to shift to areas with cheaper labour (Bick *et al.*, 2018). Several countries in Asia have experienced rapid growth in their textile and clothing industries through the offshoring and outsourcing model that emerged with the trade liberalisation system and the end of the textile quota system (ILO, 2019). Inexpensive clothing becomes available to consumers in the global north because prices are kept down by outsourcing production to low and middle-income countries (Bick *et al.*, 2018; EPRS, 2020). Uneven distribution of environmental consequences has resulted due to the globalisation of the textile and fashion system as developing countries (who produce the textiles and clothing) are bearing the burden for the developed countries (who consume them) (Carbon Trust, 2011).

Textile fabric consumption has accelerated due to such global trends as 'fast fashion'. The key features of fast fashion are high production, low cost, trend-led fashion and availability of the latest fashion styles to all classes of consumers (Anguelov, 2015; Remy *et al.*, 2016; Bick *et al.*, 2018; Niinimaki, 2018). Fast fashion has emerged as a leading business model, through which large quantities of inexpensive clothing are sold with their widely available of-the-moment garments changing the way people buy and dispose of clothing (Anguelov, 2015; Remy *et al.*, 2016; Niinimaki, 2018). This has caused garment consumption to skyrocket, resulting in millions of tonnes of textile waste being disposed of in landfills and unregulated settings (Chen *et al.*, 2012). Much of this waste also inevitably ends up in second-hand clothing markets in low and middle-income countries (Bick *et al.*, 2018) As Chae and Hinstroza (2020) point out, growth in consumption dictates the amount of energy used in production, the number of materials in circulation and handling means of materials during usage. In addition, threats to access to safe and decent work are a possibility as workers face pressure to meet production timelines and expected high outputs.

The profound transformation in the global textile sector in the last two decades has been reported in literature (Fashion for

Good, 2020; EURATEX, 2014; Textile Exchange, 2022). This has resulted in the development of a diverse range of fibres and textile fabrics, technologies and an increased number of areas for applications for both conventional and technical textiles. The EURATEX (2014) study notes that this growth and development was spurred by a strong push for collaborative research and innovation activities by research centres, universities, the textile industry and consumers. Impressive performance characteristics have been engineered in modern fabrics to meet the demands of various applications and contexts. These performance gains have, however, come with serious costs to the environment and people as several major drawbacks in fibre and fabric production have been highlighted in the literature (Ellen MacArthur Foundation, 2017; Global Fashion Agenda & Boston Consulting Group, 2017; UNEP, 2020).

Textile production (the process by which natural fibres and synthetic fibres are made) is the first step in the global textile supply chain. Literature generally confirms that the textile production stage and use stage contribute the highest impact for different impact categories i.e. economic, environmental and social (Moazzem *et al.*, 2021). Production of fibres has been identified as having a negative environmental impact due to its intensive use of natural and fossil-derived resources. Cellulose fibres such as cotton use high volumes of fertilizer, pesticides and water during farming (De Felice *et al.*, 2013; Gassert *et al.*, 2013; FAOSTAT, 2016). Production of polyester is heavily reliant on a non-renewable resource such as oil. Impact on land use is another issue raised in the literature, particularly the concerns over the high land footprint, habitat loss and soil degradation emanating mainly from cotton cultivation (UNEP, 2020). The land is a critical resource for the production of food and the concern is that the world's growing population finds itself in competition for arable land and water resources with cotton and wool farming (Ellen MacArthur Foundation, 2017).

Concerns have been documented in literature over how fibre production and fabric wet processing activities (sizing, scouring, bleaching, dyeing and printing) impact negatively the quality of the ecosystem (UNEP, 2020). The high use of toxic agricultural and fabric processing chemicals is reported as posing a

significant threat to environmental quality (Rehman *et al.*, 2022). Toxic effluent generated from fabric wet processing activities is discharged into local rivers and dams, thereby posing a risk to flora and fauna (Shahid and Mohammed, 2013). The impact of the global apparel value chain on the climate is quite substantial with textile production accounting for significant greenhouse gas emissions (IAE, 2016; Das *et al.*, 2021). The burning of coal to generate electricity and heat during fabric treatment and finishing processes lead to the emission of greenhouse gases that have a severe impact on the climate. An evaluation of the climate impact across the global apparel value chain has shown that the energy-intensive wet processing stage involving the dyeing and finishing of fabrics constitutes the highest contribution to climate change (Quantis, 2018; UNEP, 2020).

The textile value chain also has multiple negative social impacts. Key social issues of concern constantly raised in literature are the working conditions, occupational safety and health of workers and infringement of workers' fundamental rights and principles at work (ILO, 2019; UNEP, 2020). Many textile workers face dangerous working environments due to the hazardous chemicals they encounter during fabric production. Most of the chemicals used in fabric processing and finishing are highly toxic and are known to harm health (Niceforo, 2021). Exposure of workers to unsafe workspaces was brought to global attention by the collapse of the Rana Plaza factory in Bangladesh on 24 April 2013 (ILO, 2019). This event, described by the Clean Clothes Campaign as “the worst ever industrial accident to hit the garment industry” raised global attention to the appalling working conditions of many workers in the textiles industry (Clean Clothes Campaign, 2016). However, as noted earlier by Taplin (2014), such disasters have not demonstrably changed safety standards for workers in low- and middle-income countries. Growing concerns over labour rights abuses continue to bedevil the textile industry, particularly in countries with ineffective implementation and enforcement of national labour laws or fundamental principles and rights at work and other international standards (ILO, 2019). Issues regarding long working hours and low pay with some evidence of unacceptable



working conditions such as child labour and modern-day slavery have brought global attention to unsafe and undignified work textile workers are subjected to (SOMO 2014; ILO, 2019).

The economic concerns that are raised in literature are generally linked to the linear economic model. The key economic impact on textile fibre production is that it jeopardises the supply of materials through fluctuations in raw material prices, scarcity of materials, geopolitical dependence on different materials and increased demand (European Commission, 2014; Circle Economy, 2018;). Volatility in raw material prices has been experienced over time, creating risks in the textile supply chain (Koszewska, 2018). The geopolitical interconnectedness of products due to the increase in trade on the international markets has been rising over time. It is now a commonplace phenomenon for the scarcity of one raw material to have a widespread effect on the prices and availability of many more goods (European Commission, 2014). The demand for textile fibre raw materials is likely to increase as the global population increases. The growth in the upper middle class in emerging economies and the expanding demand for quality products are expected to increase the demand for textiles in the future. This growing demand has adverse effects on the environment and people since this is expected to boost the demand for textile chemicals (Ahmed *et al.*, 2022). Because cotton is competing with food crops for limited arable land, the large majority of additional fibre will have to be met by man-made fibres.

### ***THE IMPETUS FOR THE TRANSFORMATION OF FABRIC PRODUCTION (THREATENING FUTURE)***

A future that threatens the environment, businesses and people if the current unsustainable practices of producing fabrics continue, is what is envisioned in some of the literature. For example, Ellen MacArthur (2017) cautions that if things continue on this path, the negative environmental impacts such as greenhouse gas emissions and pollution of the world's oceans (through plastic microfibrils), could become unmanageable. In addition, the potential risk of business disruption is envisioned when inputs into fibre and fabric production, such as fossil feedstock and water, become difficult

to source due to scarcity. Fabric waste, increasingly accumulating in landfills throughout the world, would also become a serious global challenge to manage. Businesses with branded products that fail to respond to the call to find solutions to the negative environmental and societal impacts run the potential risk of tarnishing the reputation of their brand.

Maintaining current approaches also raises economic risks for the textile/fashion industry as there can be a potential decline in earnings, leading to a reduction in profits and threats to the viability of the industry (Global Fashion Agenda and Boston Consulting Group, 2017). Global trends, such as fast fashion that fuel overconsumption of textile products, need to be controlled and cannot be let to continue at the current pace as it poses a negative impact on the environment, resources and people involved (Moorhouse and Moorhouse, 2017; Chen *et al.*, 2021). The multiple environmental, economic and social concerns raised concerning the linear economic model have fuelled calls by governments, businesses, civil society and other actors for a systemic change as continued use of this model and approaches is viewed as leading to potentially catastrophic consequences in the future (Ellen MacArthur Foundation, 2017).

***FUTURE VISIONING (PROBABLE FUTURE) REGARDING PRODUCTION AND CONSUMPTION OF FABRICS IN THE NEW MILLENNIAL AND BEYOND***

Recognising the challenges of unsustainable production and consumption practices in a linear economic system, scholars, researchers, business leaders, NGOs, the textile industry and global governments have supported the vision for a transition to a circular economy as a pathway towards sustainability in textile/clothing production. One of the key publications that set the tone for this new vision for the textile industry is the Ellen MacArthur Foundation (2017) report. The report outlines a future in textile production and consumption that is based on the principles of a circular economy. Other significant publications such as the UNEP (2020), Chen *et al.* (2021) and PACE (2021) also present a similar vision which proposes a move towards the production of sustainable and circular textiles. According to Ellen MacArthur Foundation (2017), the

core vision of a CE is for the development of a textile and clothing system that is restorative and regenerative by design and is beneficial to business, the environment and society). Similar sentiments are expressed by PACE (2020) as they consider circularity as an important pathway to achieving planetary and human well-being as described by the UN Sustainable Development Goals (SDGs).

The aim for fabrics of the future can be condensed into two key processes, the first relates to the development of sustainable fibres and fabrics and, second, getting fibres back into the circular loop. To reach a CE, a shift towards the use of renewable resources and energy sources is essential for textile production inputs/materials (Ellen MacArthur Foundation, 2017; UNEP, 2020). Strategies that are recommended include the use of renewable feedstock or secondary/recycled materials for the production of plastic and bio-based fibres (*ibid.*). Renewable feedstock using bio-based feedstock is gaining traction in a move to find alternatives to traditional materials such as polyester and cotton through the adoption of innovations such as biosynthetic and biofabrication. Biofabricate and Fashion for Good (2020) observe that the increasing demand for fabrics with reduced negative environmental and social impact, along with ethical concerns from consumers, is driving innovations in the search for these sustainable alternatives. As the Textile Exchange (2022) notes, biosynthetic and biofabrication technologies are thus part of a broader sustainability journey towards a regenerative and circular future. Besides renewable resources inputs, renewable energy sources are also vital in the new textile economy. The use of renewable energy sources limits global warming and reduces dependence on fossil fuel energy sources and, this, in turn, creates a resilient system, a key element in sustainability (Ellen MacArthur Foundation, 2017; Textile Exchange, 2022).

In a new circular textile economy, material inputs are expected to be safe and healthy for both workers and consumers to allow them to cycle in the system and avoid impacts during production, use and after use (Ellen MacArthur Foundation, 2017; PACE, 2020). This means substances that cause harm to health and the environment are eliminated. Action required

includes scaling up the use of existing alternative technologies to create safe material cycles and the development of new materials and production processes that prevent the release of microfibres (Ellen MacArthur Foundation, 2017). Innovations are thus being developed to devise alternatives to conventional wet processes through the creation of fabric technologies with minimal adverse impacts on the user and environment (Rahman *et al.*, 2020). Consequently, bio-based processing or green chemistry has created a new approach utilising biotechnological advances in the development of alternative green and biodegradable chemicals usable as wetting, washing and finishing agents (Gulzar *et al.*, 2019).

The use and after-use phase have special consideration in the new circular textile economy as it enables the principle of the closed loop to function where materials circulate in the system and considerations are made for the two cycles of the circular economy, i.e. the biological cycle and the technological cycle. During the use phase, textile products must be kept in use for longer in the cycle through repeated use of clothing items and avoiding premature disposal of clothes. The fast fashion model tends to encourage consumers to view clothing as disposable (Bick *et al.*, 2018). Ways of reducing this wasteful nature cited by the Ellen MacArthur Foundation (2017) and PACE (2020) is through increasing the number of times clothing is worn and discouraging the premature disposal of clothes. This is viewed as the best way to capture value, reduce pressure on resources and decrease negative impacts such as excessive pollution (*ibid.*). In the after-use phase, the textile is expected to be recyclable and recycled at end of use with upcycling being prioritised over downcycling (*bid.*). Two upcycling initiatives currently in use include mechanical recycling where fabrics are deconstructed into fibres that can be used to make new yarn and chemical recycling which uses chemicals to dissolve natural and synthetic fibres and use them as new feedstock (PACE, 2020).

Transitioning to a circular economy for textiles is cited in the literature as having a positive impact on the economy, environment and people (Ellen MacArthur Foundation, 2017; PACE, 2020). Ensuring that textile inputs are safe, recycled or

renewable, may result in lower resource use through shifting from using virgin cotton as well as reducing greenhouse emissions by shifting from high carbon footprint textiles such as cotton and wool to recycled materials (Global Fashion Agenda and Boston Consulting Group, 2017). A healthy environment and biodiversity are the benefits of moving towards the use of safe materials and the elimination of toxic chemicals in textile fibre production and fabric processing. Safe and decent work for workers can be achieved by reducing exposure to toxic substances (Schroder, 2020). Sodjuniu *et al.* (2015) note that switching to renewable inputs through the growing of cotton using regenerative agriculture may lead to more jobs and increased economic independence for women.

Moving to a circular economy in textiles is approached and integrated differently across the globe due to the different contexts countries are operating in. ILO (2019) reiterate that any strategies, actions and policies to advance circularity must consider the realities of each country and be aligned with the priorities of the SDGs. Most research and ideation about the new circular economy models take place in and for developed country contexts (Kirchherr and van Santen, 2019).

## **METHODOLOGY**

To explore the broad topics of sustainable fabric production and consumption, a narrative approach was adopted. Academic writing, studies and reports from global community leaders and business groups (working together to drive the agenda and transitioning to a circular economy in textiles) were examined. Patterns and themes emerging from the literature review were identified, analyzed and reported using contentment analysis. The content analysis was useful in synthesizing the negative environmental, economic and social impact on the current global textile fabric production landscape, the factors driving the thinking around changing how textile fabrics are produced and consumed and future visioning for the production of textile fabrics in the years to come.

## **RESULTS**

The findings synthesized from the narrative review are presented in this section. The findings relate to the following

aspects, similarities and differences between sustainability and circularity, the role of innovation in sustainable fabric production, the negative environmental, economic and social impact of fibre production and fabric processing and the future vision of transitioning the textile industry to the circular economy.

### **RELATIONSHIP BETWEEN SUSTAINABILITY AND CIRCULARITY**

There is a close connection between sustainability and circularity even though they are different concepts (Walker *et al.*, 2022). Sustainability is broader and focuses on the three pillars undergirding sustainable development relating to the environment, economy and people while circularity is concerned with maintaining resources in cycles. Circularity is a pathway to achieving sustainability in the textile industry, particularly in addressing the environmental and economic concerns of the textile value chain. However, discussions on circularity tend to focus less on social opportunities and consequences of transitioning. Adoption of a circular economy in textiles is also a pathway to the attainment of SDGs, particularly SDG 6 (clean water), SDG7 (affordable and clean energy, SDG 12 (responsible consumption and production) and SDG15 (life on land).

### **NEGATIVE ENVIRONMENTAL, ECONOMIC AND SOCIAL IMPACT OF FIBRE PRODUCTION AND FABRIC PROCESSING**

The current production of fabrics is not sustainable and the problems arising from this expanding industry are threefold: pollution, anti-social and higher prevalence of inequality. The worldwide textile fabric sector results in material depletion, toxic emissions and socio-economic exploitation. The leading environmental snags allied with this industry comprise water body pollution instigated through the absorption of unprocessed emissions. During production, the fabric passes through numerous processes and chemical operations like bleaching, de-sizing, dyeing, printing and other finishing methods desired in quality fabric production. This results in environmental degradation as it is unlikely that the effluent is treated before disposal. The cotton production processes similarly generate air pollution in the course of spinning and weaving. It can then be seen that during fabric production, there is heavy pollution and depletion of non-renewable resources. The social ills of the

textile industry include long working hours and low pay with some evidence of unacceptable working conditions such as child labour and modern-day slavery. The economic concerns against textile fabric production are generally linked to the linear economic model adopted in the textile industry which results in volatility in raw material prices, scarcity of raw materials and increased demand for specific raw materials.

### **TRANSITIONING TO A CIRCULAR TEXTILE ECONOMY**

Transitioning to a circular textile economy is envisioned as the preferable future for textile fabric production because of its several economic and ecological benefits. It is being regarded as a substitute for the linear economy currently prevalent as a textile manufacturing model across the globe. The take-make-dispose mentality of the linear economic model assuming that natural resources are infinite, is being replaced by the reduce-re-use-recycle approach that aims at displacing production and keeping resources in the textile loop for longer. As noted in the literature, moving to a CE is a complex task that takes several years and requires a shift in attitudes and mindsets of manufacturers, businesses and consumers. Most countries in the Global South have large-scale textile industries still basically operating on a linear economic model and require a lot of support in establishing circular economy practices and policies in their manufacturing systems.

### **DISCUSSION**

Notwithstanding that the textile industry contributes immensely to the national economy, it is, on the other hand, considered the most ecologically and socially harmful the world over. The eco-problems in the textile industry occur during fabric production processes and are carried forward right to the finished product. Fabrics produced should have the lowest possible adverse effect on the environment, respect the social elements of fair trade and the human rights of the people involved and be able to compete effectively on the global marketplace against less sustainable products. The present system in the textile and clothing industry is based on fast cycles of fashion trends that aim to continuously produce new consumer needs and products. Product lifecycles are shortening and companies want to substitute their products at an increasing pace. To date, the

fast fashion concept continues to dominate in Europe and the United States and has been introduced over the past decade in emergent economies in the Middle and the Far East.

The textile and apparel supply chain is not optimised to prioritise sustainability. There are multiple barriers embedded within the supply chain which makes it difficult for the industry to adopt more environmentally friendly practices, the first and foremost among them being financial and technological barriers. The cost of raw materials is a massive burden for apparel manufacturers, especially in countries where they have to import raw materials. The high costs combined with problems like inflation make it difficult for them to afford sustainable practices. Here, lack of adequate infrastructure and skill also adds to the problems. In developing countries, most small and medium enterprise (SMEs) (who form a large section of the informal textile industry) do not have access to advanced technology that aids sustainable production. For instance, to convert plastic bottles to fibre for clothes, one needs certain infrastructures to be in place. To reduce the use of non-renewable energy, one must switch to solar or wind power, which again demands infrastructure. The same holds when it comes to processing toxic chemicals. Added to this, is the lack of skilled labour needed to adopt new technologies to local conditions.

The circular economy introduced the body of ideas of thinking in material loops, either biological or technical cycles, including design for a long lifespan, disassembly and/or recycling as well as advocating for use of renewable inputs and energy sources in the textile industry. The CE has been inspiring many textile companies and designers worldwide, promoting clothing collection schemes and accelerating the development of textiles made from recycled materials, produced from both chemical (mainly PET-recycling, e.g. Eco-fi) and natural origin (cotton recycling, e.g. sacellum). Simultaneously, the development of modern technology has been stimulating the textile industry (both researchers and designers) to create technologically advanced and complex systems and products and creation of fabric technologies utilising green chemistry principles. While in the Global North, eco-consciousness has assumed centre stage,



in countries in the Global South, the awareness is still limited. At the same time, the demand for sustainable products is limited at the moment in our domestic markets, while consumers in countries in the Global North are driving demand for sustainably produced textile fabrics and products and are pushing textile fabric manufacturers to adopt environmentally friendly and ethical production practices and policies.

Designers and consumers may be identified as potential actors who can contribute to the transition towards a more sustainable fabric production industry, hence the call for the development of sustainable thinking in the production of fabrics. Much more recently the textile fabric industry is quickly adopting and exploring new technology and materials that are available to create fabrics that are dynamic and support the three Es of sustainability. Whilst in developed countries, there is this keen interest in advanced and smart fabrics, the growing social inequity prevalent in developing countries fails to reap this benefit. What is ideally needed is a radical new approach to defining ethical consumption in the field of fabric production in developing countries so that this market also booms.

## **CONCLUSION AND RECOMMENDATIONS**

The current production of fabrics is not sustainable and the problems arising from this expanding industry are threefold: pollution, anti-social and higher prevalence of inequality. For any product to be considered sustainable, it needs not only to be profitable, but also to take into consideration environmental and social impact during its lifetime. Strategies and actions that effectively contribute toward a more sustainable fabric production industry are those that consider the ecological, social and economic impact of fabric production in a way that will not compromise the needs of future generations. A promising strategy gaining momentum and being prioritised globally is the transition to the circular economy. The CE appears to offer a credible pathway to sustainable production and consumption of textile fabrics now and in the future. It will help create solutions for challenges such as resource depletion or scarcity, pollution and socio-economic exploitation in the

textile sector. Industry, researchers, policy-makers and consumers, have a role to play in promoting sustainable circular production and ethical consumption of fabrics equitably.

A sustainable transition to a circular economy can be accelerated in textile industries using designing distributed production systems in combination with (digital) AM technologies. A distributed production system holds promising results for the development of a sustainable production and consumption system for textile fabric production in the future. The shift from mass production in large factories towards localised small-scale manufacturing might bring positive as well as negative effects. An example of a positive effect is the opportunity for entrepreneurial SMEs to think of new business models that might better serve the customer, whereas a negative effect could be the shift of production back to highly developed countries, reducing employment opportunities in the developing world.

Communication and research are essential components of the CE transition. The unsustainable linear textile industry can be transformed into a sustainable and circular industry providing textile fabric designers with the correct information to promote the implementation of scientific Life Cycle Assessment (LCA) research and results in textile design practice. Therefore, designers (and other stakeholders) must be educated in (i) life cycle thinking, (ii) eco-design, and (iii) LCA. LCA experts/researchers must continue improving the LCA methodology (although the main building blocks are there) and producing up-to-date LCA research and (open) LCI data (of textile products). The remaining LCA issues, which could be a topic of further research are, for example, water use and land use over the textile's lifecycle; toxicity of textile materials (e.g. elastane) and additives over the textile's lifecycle.

The possible execution of the recommendations to textile fabric manufacturing companies and SMEs to transition to sustainable and circular textile production is closely linked to the political environment in which companies (and the designers) operate. It is the institutional landscape, shaped by

policy-makers, which allows the companies to act. Policy-makers at all levels need to develop an independent vision of the future direction of the textile industry and set the rules for sustainable and circular transformation. Moving this discussion to a European and Dutch level, it is observed that the (textile) research community and the textile industry are supported by many funding programmes that include sustainable development in general and, more specifically, innovative textile research focusing on stimulating research based on ‘hypes’ (such as ‘smart textiles’, ‘the bio-based economy’ and ‘bio-based materials’ and the circular economy). Such support for research and wider uptake of circular economy principles and visions in developing countries, requires partnerships and collaboration with countries in the Global North to ensure equity in the development of sustainable, low-carbon, resource efficient and competitive economy for all.

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# The Smart City Concept in Africa: Case of Zimbabwe

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## Abstract

*This article seeks to interrogate the Smart City concept and its relevance to African built environment planning and management. Like many buzzwords of times, the Smart City concept is a notion whose rooting in countries that still lag in terms of development, is an aspect of great concern and requires scrutiny before generalisation. In an ideal environment, free from many ordeals, a Smart City is one that operates like a human machine and in which artificial intelligence has become the motor-generator for urban processes. It is a robotised city, a system whose subsystems speak to each other, communicating for progress. In such a city, the sectors and subsectors are very much interconnected and can be made to modularise or assemble as defined by the purposes of what needs to happen. In such a city, land uses, population mobility, circulation and flows (energy, water, transport, etc) are both centrally and locally coordinated. Developing such a city is a function of deep study of the human and non-human needs over a period, or an artificial superimposition of a system or model learnt elsewhere.*

**Keywords:** human-machine, urban processes, urban informality, planning,

## INTRODUCTION

Africa still has several gaps, including disconnected spaces and uneconomic or mismatched space needs largely explained by rampancy of urban informality and disengagement of political,

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social and economic interests. While trying to be human, urban spaces are then marketed by district contradictions and enslaving rich versus poor, serviced versus un-serviced, politicised and neutral spaces. Without smart citizens, there are no Smart Cities.

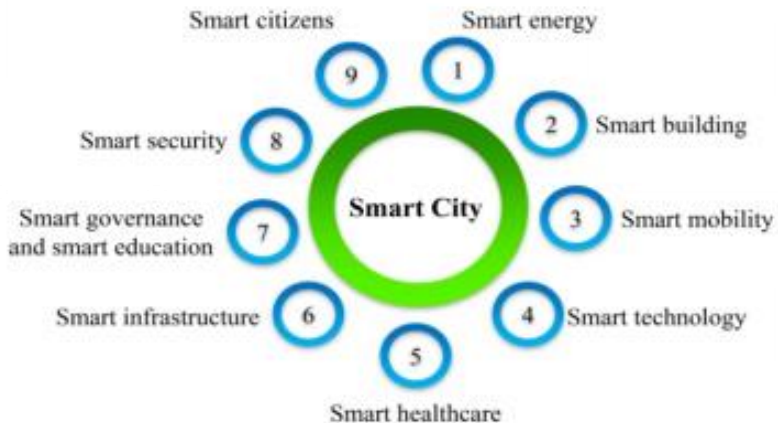
This article seeks to interrogate the Smart City concept and its relevance to African built environment planning and management. Like many buzzwords of times, the Smart City concept is a notion whose rooting in countries that still lag in terms of development, is an aspect of great concern and requires scrutiny before generalisation. In an ideal environment, free from many ordeals, a Smart City is one that operates like a human machine and in which artificial intelligence has become the motor-generator for urban processes. It is a robotised city, a system whose subsystems speak to each other, communicating for progress. In such a city the sectors and subsectors are very much interconnected and can be made to modularise or assemble as defined by the purposes of what needs to happen. In such a city, land uses, population mobility, circulation and flows (energy, water, transport, etc) are both centrally and locally coordinated. Developing such a city is a function of deep study of the human and non-human needs over a period, or an artificial superimposition of a system or model learnt elsewhere.

Playing a central role in the behaviours that underline present-day life, information and communication technologies (ICT) are at the heart of this knowledge-driven economy. They provide opportunities for reducing distance and time constraints by facilitating information exchange and knowledge sharing and they also promote the development of networks, hence fostering social, economic and territorial cohesion (Santinha and de Castro, 2010). Mitchell (2007) argues that the new intelligence of cities resides in the increasingly effective combination of digital telecommunication networks, ubiquitously embedded intelligence, sensors and tags and knowledge management software. The development of Smart Cities enables the global functioning of local innovation clusters and regional systems of innovation. The growth and expansion of cities in Africa are essentially uncontrolled, thereby compounding hitches in the region (Mabogunje, 1990). Among these problems is poor

housing that is also inadequate to cater for the existing population, slum areas with inadequate water supply, poor solid waste disposal, traffic and human jamming, high unemployment rates, poverty, crime and other social problems. These problems have been related to issues of poor planning and ineffective governance at all levels (Ogbazi, 2013).

### CONCEPTUAL FRAMEWORK

The focuses of Smart City development are improvements in citizens' life (Neirotti *et al.*, 2014), environment efficiency, security and sustainability (Niaros *et al.*, 2017) with centrally controlled and monitored technological infrastructures. A Smart City integrates ICT and the Internet of Things (IoT), entrenched into most of the sectors of urban development such as government functionality, city operations, services deliveries and intelligent analytics to maximise services, production and usability. Although there is no agreement on the exact definition of a Smart City, several main dimensions of a Smart City have been given in the literature (Giffinger *et al.*, 2007, Fusco Girard *et al.*, 2009; van Soom 2009) and these include smart economy, smart mobility, smart environment, smart people, smart living; and smart governance.



**Figure 1:** The main aspects of a Smart City (Arasteh *et al.*, 2016)

A city is a huge human settlement that has an extensive system for housing, transportation, sanitation, utilities, land use and communication. Its density facilitates interaction between people, government organisations and businesses, sometimes benefiting different parties in the process (Cohen and Garrett, 2010). The concept of Smart Cities has always been attributed to the individual, characterising outstanding human mental accomplishment. Smart cities belong to an emerging movement targeting the creation of settings that expand intellectual skills and abilities to learn and innovate (Komninos, 2006). As a result of this new terminology, that is the concept of Smart City surfaces, considered a place that assembles organisational capacity, institutional leadership and creativity, combined to produce innovation, the main driver of increased competitiveness. Smart Cities constitute a new planning paradigm pertinent to both the fields of urban-regional development and innovation management (Komninos, 2009). The initiative for smart cities was launched in the late 20th century to help communities globally to better understand the important role of technology, economic development and prominently, creativity and innovation in success and survival in the new global economy (Smart Communities, 2008). In Canada, Smart Cities succeeded through a top-down planning proposal that went through a process of covering the entire city. The concept of a Smart City ascends in search of a remedy to the increasing challenges that were haunting the urban areas, for which purpose these new model cities are being created. Innovations through the establishment of Smart Cities are being integrated for generations yet to come.

The major idea of a Smart City is to offer efficient organised services, improve the safety of the people who reside in the city and provide a good quality working and living environment. A Smart City has good e-governance systems, street lighting and good water and waste management. There is need to link power consumption, digital communication, internet connectivity, energy efficiency and other digital infrastructure components to achieve this. A Smart City, according to Giffinger *et al.* (2007), is  
“A City performing in a forward-looking way in economy, people, governance, mobility, environment and living, built on the smart

combination of endowments and activities of self-decisive independent and aware citizens.

A city is believed to be smart when investments in human and social capital, transport and modern ICT communication infrastructure accelerate sustainable economic growth, high-quality life, participatory governance and wise management of resources.

To put the idea of Smart Cities in perspective, it is useful to go back to the beginning of a long evolutionary process. The physical fabric of earliest cities, long before the industrial revolution, consisted essentially of skeleton and skin columns, beams, walls, floors and roofs. Its functions were to provide shelter and protection and to intensify land use. The inhabitants, sometimes assisted by domestic animals, provided their mobility, performed social and economic transactions face-to-face and supplied the coordinating intelligence needed to make the city function as a system. Then, with industrialisation, cities started to acquire, increasingly extensive artificial physiologies. Now there were water supply and liquid waste removal networks, energy supply networks, transportation networks and heating and air conditioning networks in buildings. Food processing and supply networks extended human alimentary canals at one end, while sewers extended them at the other. Inhabiting a city meant being continually plugged into these networks and dependent upon them survival.

Cities extended the capabilities of the human in more comprehensive and sophisticated ways and took over more of the functions traditionally performed unaided by the human body, so the cyborg condition intensified. Finally, in the latter half of the 19th century, cities began to add artificial nervous systems to their fabrics of skeleton, skin and supply, processing and removal networks. This process began with the construction of telegraph, telephone and radio communication systems, picked up momentum through the first half of the 20th century and then accelerated extraordinarily after the introduction of digital telecommunications in the late 1960s, eventually producing today's pervasive connectivity through the

internet and mobile wireless networks. The pioneering media theorist Marshall McLuhan presciently hailed these new networks as extensions of human nervous systems. At the dawn of the 21st century, cities possessed all of the crucial subsystems of living organisms: structural skeletons; input, processing and waste removal networks for air, water, energy and other essentials; and multiple layers of protective skin.

## **LITERATURE REVIEW**

Cities have always been at the centre of important social and economic changes, but more new expectations, ambitions and needs have been raised by people and institutions concentrated in these localities. Apart from the need to stay safe, the establishment and importance of sound, which has been regarded as a major birthplace of knowledge for people about the environment, have been observed. Sounds were a means of communicating and transferring information to members of society. The development of building clusters also moved in line with the developed role of sound (Lubman and Kiser, 2001; Mourjopoulos, 2015). Despite a positive correlation between the cities and ICTs, widen the gap between the rich and the poor in economic terms. In Sub-Saharan Africa and in Zimbabwe, primarily, ICTs have gained impetus during the past decade, diffusing from the first-world countries where they have already taken supremacy.

Rawte *et al.* (2017) argue that:

...We will not have Smart Cities without Smart Citizens: the citizens need educated and helped to be Smart. We will not have Smart Cities without Smart Buildings as the Smart Building is our most fundamental component.”

“A smart approach is an opportunity for knowledge integration, necessary to solve crucial problems of contemporary societies” (Nižetić *et al.*, 2019:2). Connecting everything to the internet where they can be regularly supervised by users has become to be known as the IoT (Atzori, *et al.*, 2010). The concept has been used in various sectors and Smart Cities are not an exception. The impact of the IoT has been predicted to be extensive in the promotion of Smart Cities, particularly with the use of smartphones. The idea of a city able to be smart and digital,

that is, to use technology and, ICT especially, to improve the quality of life in urban space, is quite old.

In Smart Cities, the smart grid is associated with the issue of smart meters and smart energy, *inter alia*. Danielly *et al.* (2019) provided a review of the literature related to smart metering to ensure smooth functioning and secured smart grids. The paper discussed the main challenges associated with smart metering, drawing from the currently available smart metering technologies on the market. The paper recommended the use of the internet of digital technologies to solve the identified challenges. Mkireb *et al.* (2019) carried out a study that establishes the development of a smart and sophisticated water control management system that is controlled through digital methods. Hussain *et al.* (2019) explored the use of smart grids in the management of wind energy. The study developed an effective model for energy management modelling in the concept of Smart Cities. Smart grids are reliable, cost savings and have energy independence.

These grids should also be extended to densely populated cities that will host ICT devices and where data collection will be done for policy making (Zedadra *et al.*, 2019). Those who reside and work in Smart Cities benefit from better city planning, faster delivery of service and economic development. There is need to generate great infrastructure in Smart Cities due to the extraordinary data that needs to be generated (Gharaibeh *et al.*, 2017). In the future, Smart Cities will not only hold most internet of things devices, most of the users and applications will be used for solving several problems that are related to modern cities (Nizetić *et al.*, 2019). Marques *et al.* (2019) noted that digital technologies are important in smart waste management systems. The study identified it as a long-term proposed solution for waste management in Smart Cities. The availability and quality of the IT infrastructure are not the only definition of a Smart City (Caragliu *et al.* 2009). Transportation are one of the non-separable sectors of society Mathew and Rao (2007). Ajayi (2021) identified the concept of Intelligent Transportation Systems as one of the key concepts of Smart Cities that have developed rapidly across the globe. Rapid global development has been witnessed much in the western world.

Conversely, the study revealed that Africa and Asia have not witnessed much growth in the deployment of smart transport systems. These regions have witnessed dilapidating road infrastructure, poverty and poorly maintained mass transit vehicles as major concerns. It was revealed that the importation of western technologies cannot overlook in this respect. Through westernisation, smart technologies have found their way into African cities. The study systematically reviewed literature to determine the state of the art of these technologies in African countries. It concluded that African particularities impeding the common implementation of smart transport systems were discussed, followed by the development of a conceptual architecture for an integrated intelligent transport system for African cities. Mitchell (2007) asserts that the City Car is one example of the comfortable, cheap and sustainable contributions that a Smart City can make to improve citizens' mobility.

In another study, concentrating on transport as a major component of the intelligent city concept, Madihlaba (2019) asserts that transportation is a key portent that directs an increase in population, investments and the use of land in cities. The study revealed that secondary cities in particular lack a firm future strategy for transportation when it comes to planning for development. This plunges such cities into transport challenges, leave them with ageing transport infrastructure, traffic jams, lack of parking spaces and high risks of accidents, *inter alia*. Secondary cities, particularly those in sub-Saharan, are ignoring the use of technologies in managing transport challenges for which the remedy is vested in the establishment of smart ITS.

Kaźmierczak *et al.* (2021) did a subjective review of the glitches that should be carefully considered when planning and designing smart urban areas in the context of the presence of sounds in the smart city structure. The study found that the inhabitants of the city under research were willing to change their city into a modern Smart City. The results of the research revealed that city sounds matter to most people, with only a few giving negative answers. The majority were willing to change city sounds in the city. The study concluded that the topic of



eliminating, improving and boosting urban sounds is worth exploring. Although there is no agreement on the exact definition of a Smart City, several main dimensions of a Smart City have been identified through a literature review (Giffinger *et al.*, 2007, Fusco Girard *et al.*, 2009; van Soom 2009) and include smart economy; smart mobility; smart environment; smart people; smart living; and smart governance.

Kenya has an extensive experience in the use of digital technologies to include slum areas such as Kibera in the planning and land administration. Real-time data also allows better planning and management of service facilities as was observed in Kenya, where health workers use mobile phones to report counterfeit drugs and stock-outs. In the city of Lilongwe in Malawi, sanitation data collection through mobile phones, along with web-based sanitation monitoring systems, enabled real-time sanitation information that could guide timely responses. Mora *et al.* (2017:20) argue that “...the knowledge necessary to understand the process of building effective Smart Cities in the real world has not yet been produced, nor the tools for supporting the actors involved in this activity.”

The government should be clear in its transactions, digitalise its records and run an open data system and allow citizens to participate (Gaza, 2018; Ghosal and Halder, 2018). Smart living should be given great attention since the whole idea of attaining a Smart City revolves around the creation of better living conditions for the city’s citizens (Aghimien *et al.*, 2019; Macke *et al.*, 2018). This should not exclude the provision of a good healthcare delivery system, an innovative educational system to shape innovative thinking and creative thinking (Giffinger *et al.*, 2007), improved security (Colldahl *et al.*, 2013) and advance the quality of housing.

## **RESEARCH METHODOLOGY**

The article engages documents and literature reviews compiled from case studies and anecdotal evidence from various stakeholders to the Smart City race in Zimbabwe and beyond. It was done using desk research and involved the reviewing of relevant literature and drawing useful insights from other available Smart City studies from Sub-Saharan Africa and the

rest of the world. In addition, extensive and detailed document analysis was also done, in a way that provided the study a good framework for properly analyzing the study issues. The desk research, therefore, included a literature search and review of existing academic and non-academic documents, that included written and unpublished papers, journal articles, reports and case studies. Documents for the literature review were identified mainly through searches on various websites of international publishers and organisations.

## **RESULTS**

A Smart City has good e-governance systems, street lighting and good water and waste management. The deployment of renewable energy mini-grids promotes the global goal of achieving clean energy for all, while providing an economically feasible solution. Some African countries like Kenya, plan to achieve 100% electrification by 2030. Senegal sought to achieve 62% rural electrification by 2022. This gives a reflection of the targets of the countries in the sub-Saharan region. Zimbabwe targets to electrify most of its growth points through the rural electrification programme. The National Development Strategy 1 targets improving access to electricity for both rural and urban areas from 44% in 2020 to 54% by 2025. Besides the need for broadband networks and digital spaces, the objective of Smart Cities is to enhance innovation of the respective city or region rather than to offer digital services. Nearly a third (65%) of the Sub-Saharan African population lacks access to clean energy, is an essential service.

## **CASE STUDIES**

### ***EGYPT***

In Egypt, the current development of ICT can enable new kinds of thinking regarding the development of urban areas, allow a larger set of input data and much wider resources for assessment and prevent or reduce central decision-making. Currently, smart solutions in urban design are not widely used in Egypt. There is a big demand for raising public awareness of smart techniques and their benefits for quality of life. The Smart City agendas should have a central place in urban development projects. Although those projects need huge

investments, they can contribute to making areas such as heritage areas and university campuses more attractive and usable with a focus on future generations' demands. Egypt, as one of the most strategic countries in Africa, has no cities that can be classified as Smart Cities. It is observed that there are only three Smart Cities in Africa. In Egypt, the concept of smart urban design (SUD) is addressed through government and private companies that use smart information systems. The Egyptian government currently is focusing on delivering more efficient services to citizens through e-government but, unfortunately, without considering improving the quality of current infrastructure and creating more attractive usable urban areas.

It should be taken into account that present and future generations are looking for data, services and dynamic and changing urban spaces. Although Egypt set a vision for sustainable development by 2030, making the development of information technology a priority, smartness is still represented only by technical projects such as the establishment of a few Smart Villages. But the systems for water, energy, garbage and transport management are not effective enough to be smart. Although Egypt is one of the countries with many highly educated people, with an increasing number of internet and computer users and many government services are currently delivered electronically, there is no Egyptian city that can be considered a Smart City. The future vision 2030 for sustainable development supposes that comprehensive urban development cannot be achieved without improving the ICT sector because data lead to the right vision and the right vision leads to the right actions. Additionally, this sector should play an important role in the Egyptian economy. Egypt's ICT 2030 strategy includes the development of ICT for education, ICT for health, ICT for government, green ICT and legislative services. Another potential is the current great interest in establishment of ICT corporations in Egypt. Some challenges counter the achievement of a smart governance approach in Egypt. The current administrative systems lack flexibility and adaptability. Most governmental action plans cannot adapt to changing conditions in terms of social and economic circumstances. There is a gap between the administrative system and citizens

because of the absence of communication techniques required to engage citizens in the decision-making process. Weak regional cohesion leads to the difficulty in regional collaboration in the fields of investment and marketing to support the infrastructure and facilities.

### **NIGERIA**

Nigeria's quest to plan and prepare for her ever-growing human population and to solve a myriad of economic, social and environmental challenges within her major cities, highlights the importance of a Smart City for the country. There are over 200 million people currently living in Nigeria of which the overall size and geographical landmass are approximately 924 000 km<sup>2</sup>. Nigerian cities are now a major hub of economic survival for many families which is why Akujobi *et al.* (2017) and Kadiri *et al.* (2019) were of the view that Nigeria's highly complex characteristics regarding human behaviour, conflicts, variations and adaptation that sit in the demographic and socio-economic profile of the citizens also account for the proliferation of settlements, crimes, urban distortions and other social problems. Nigerian cities often succumb to fragility, evidenced by many urban dwellers living in overcrowded and under-serviced slums, while a good number of the citizens trek to work or travel in highly congested buses due to a lack of affordable alternative transport. To avoid the risk of Nigerian cities becoming both unbelievable and indebted, requires a change of mindset from traditional agglomerations to Smart Cities. Smart Cities for Nigeria would address most of the challenges facing the traditional agglomeration, typically evidenced in the growing number of urban dwellers outpacing the present urban governance plans and efforts. Smart Cities for Nigeria will aid in solving the many challenges that confront the country's traditional agglomerations, including power supply challenges (Patrick *et al.*, 2013; Dada, 2014; Monyei *et al.*, 2018), housing, urban poverty, inadequate formal land development, urban decay and fragility, slum settlements and absence of essential services (Ogbazi, 2013) and encourage sustainable development, limitations with realising a Smart City in Nigeria interrelated with governance, economic, social, technological, environmental and legal issues being the dimensions of the challenges the country must deal with in actualising a Smart

City. Adejuwon (2018) examined how Nigeria is leveraging emerging technology to improve efficiency in public service delivery. In Nigeria, the challenge of urbanisation includes urban poverty, inadequate formal land development, squatter and slum settlements and the absence of essential services (Ogbazi, 2013). These problems are associated with poor planning and ineffective government at all levels (Egbu *et al.*, 2008; Ogbazi, 2013). These crises in the Nigerian urban setting are due mainly to corruption, lack of human and material capital and the absence of harmony between the federal and state governments and local and state governments. The crisis of urbanisation in Nigeria was exacerbated by a lack of data and outdated city plans (Aribigbola, 2007), lack of coordination amongst planning institutions (Ogu, 1999), failure to execute detailed land-use plans (Gandy, 2005; Bloch, 2014; Sawyer, 2014), absence of cutting-edge technology to facilitate planning and land administration processes (Akingbade *et al.*, 2012), lackadaisical attitude to new knowledge in the field of planning and poor urban coordination and corruption, (Ogun, 2010; Idemudia, 2012), as a result of the failure of the government to utilise the huge oil returns that have attracted the citizen to urban centres not adequately prepared to cope with the influx, leading to increased pressure on existing infrastructure.

### **SOUTH AFRICA**

In South Africa, several measures are being considered to propel city smartness. By adopting diverse digital technologies (DTs), ICTs and broadband connectivity, it is believed that a Smart City that adopts intelligent services in achieving innovative environments can be achieved. Ghosal and Halder (2018) describe it as the proper management of energy, water and waste. This is one crucial aspect also being championed in South Africa with the National Development Plan of 2030 which is geared towards ensuring a sustainable environment with an adequate supply of needed infrastructures and wise consumption of energy. Respite is not in sight in terms of this rapid urbanisation, as it is projected that by the year 2050, over half of Africa's population will be living in cities (United Nations, 2017). Although not the worst among developing countries, especially in Africa, South Africa suffers this same fate.

Most cities in South Africa are described as transitioning cities because they have a high urbanisation rate (Deloitte, 2014). In South Africa, the NPC (2012) notes that for improved unification of urban districts and citizens, change, update and allowance for increased basic service supplies and development of areas set aside for civic use is necessary. ICT and related industries in the cities of South Africa will revitalise the economy of the cities which might lead to a smart economy, an essential element of a Smart City (Das, 2019). The economy should moreover be inclusive, safe, resilient and sustainable (Allam and Newman, 2018; Kummitha, 2019), needing to be at the forefront of city development in South Africa. Low carbon emissions, traffic safety, use of economical and low-carbon emission cars are important determinants of smart mobility in a city (Emuze and Das, 2015), which are major challenges in South Africa (Das, 2015).

### **ZIMBABWE**

The introduction and advancements in information and communication technologies (ICTs) have not benefited the generality of the poor in the cities of Zimbabwe. In sub-Saharan Africa and in, primarily, Zimbabwe, ICTs have gained impetus during the past decade, diffusing from first-world countries where they have already taken supremacy. The creation of Smart Cities moves in line with the expansion of ICT. Zimbabwe's telecommunications service providers, Econet, Netone and Telecel, have worked hard to increase network coverage in the country. The Ministry of Information Communication Technology has been striving to iron out challenges in ICT but unless the issues of tariffs and income are addressed, the challenge will remain. This puts such cities into transport challenges that leave them with old transport infrastructure, traffic jams, lack of parking spaces and high risks of accidents in particular. The secondary cities, particularly those in Sub-Sahara, where Zimbabwe is not an exception, are ignoring the use of technologies in managing transport challenges for which the solution is in the establishment of Intelligent Transport Systems (ITS).

Almost two thirds (65%) of the Sub-Saharan African population lacks access to clean energy which is an essential service. This

is a reflection of what is happening in Zimbabwe where the population in the rural areas depends on charcoal, kerosene and other resources that result in pollution and poor quality of life. Zimbabwe is one of the countries that has experienced an information class struggle as the marginalised population is excluded in terms of accessing this important service of information while a few have the preserve to access and use it.

...there is an increasing digital divide between the poor and the rich although the poor have relatively acquired certain ICT gadgets including cellular phones, satellite dishes and now can watch movies in the comfort of their homes (Chirisa and Dumba, 2014).

The Zimbabwe National Development Strategy 1 (NDS1) prioritises the use of smart technologies throughout the NDS1 period to enhance ICT usage. This strategy moves in line with the establishment of intelligent cities. It calls for measures to be put in place to develop smart programmes such as smart government systems, smart agriculture, smart health and smart transport and safe cities through using it. All these approaches promote the establishment of intelligent cities across the nation.

Over the past decade, Zimbabwe has climbed great ladders in the uptake and use of ICT. The Ministry of Information and Communication Technologies champions ICT literacy and the use of digital technologies in the country. The country's use of digital technology has exclusively increased recently, especially in the use of digital money. The Zimbabwe Agenda for Sustainable Socio-Economic Transformation (ZIMASSET) blueprint pronounced the use of ICT as a policy enabler to help push Zimbabwe's economy forward. ICT has been embedded in all national development strategies in the country for universal access to be attained by 2030. The country's use of digital technology has exclusively increased recently, especially in the use of digital money.

## **DISCUSSION**

While trying to be human, the urban spaces are then marketed by district contradictions and enslaving — rich versus poor, serviced versus un-serviced, politicised and neutral spaces. Dysfunctionality is embraced as the norm and serves to perpetuate certain ideological memes. Concerning Zimbabwe,

creating the idyllic Smart City would require that the colonised township mentality be erased. This would involve instituting and acknowledging urban and regional planning as critical instruments and catalysts for progressive change. It means giving planning a chance, sprucing it up to match global standards and upgrading it from colonial minimalism. Populism can be achieved by thinking of a city as an inheritable asset that needs to pass from one generation to the other sustainably. Currently, planning is used as an instrument for adhocery and is sometimes totally disregarded. When it is brought on board, it is to clear some mess or to legitimise illegality. While the instruments and tools of planning are theoretically set, they are sometimes twisted and de-sensitised to work. Above all, creating a Smart City is a function of scale, this means that the macro-micro and mesoscale of reference must 'sing from the same hymn book'.

The concept of Smart Cities has always been attributed to the individual, characterising outstanding human mental accomplishment. Smart cities belong to an emerging movement targeting the creation of settings that expand intellectual skills and abilities to learn and innovate. Innovation is a considerable piece of intelligence Smart Cities constitute a new planning paradigm pertinent to both the fields of urban-regional development and innovation management. Smart cities in Canada succeeded through a top-down planning proposal that went through a process of covering the entire city. There has been a great push and an improvement in the expansion of Smart Cities in this most precise sense. Within the context of this highly spread expression of a knowledge-driven economy, cities, as the leading centres of population, transportation networks and business transactions, shape spaces where the generation and use of information are combined to produce knowledge, thus playing a leading role in generating economic value and competitive advantages in a globalised world.

Cities have always been at the centre of important social and economic changes, but more new expectations, ambitions and needs have been raised by people and institutions concentrated in these localities. In the field of urban-regional development, Smart Cities sustain the rise of knowledge-based local and



regional economies. In the field of innovation management, they sustain the globalisation of innovation networks and the consequent opening up of innovation systems on a global scale. Bridging local resources, innovation institutions and broadband networks, Smart Cities can address the challenges of global competition faced by cities and regions for knowledge and innovation (Komninos, 2009). The environment that emerges is highly complex enabling each company to create its innovation ecosystem, combining elements of the physical, social and virtual space of the city. Playing a central role in the behaviours that underline present-day life, ICTs are at the heart of this knowledge-driven economy, providing opportunities for reducing distance and time constraints by facilitating information exchange and knowledge sharing and they also promote the development of networks, hence fostering social, economic and territorial cohesion.

Smart Cities reside in the increasingly effective combination of digital telecommunication networks, ubiquitously embedded intelligence, sensors and tags and knowledge management software. Developing countries and emerging markets have embraced the use of digital technologies, ICTs and technological innovations, *inter alia*, in their growth patterns. Smart City ascends in search of a remedy to the increasing challenges that were haunting the urban areas, for which purpose these new model cities are being created. Innovations through the establishment of Smart Cities are being integrated for a generation that is yet to come.

Despite a positive correlation between the cities and ICTs, Braga (1998) and Brown (2001) assert that ICTs widen the gap between the rich and the poor in economic terms. In Sub-Saharan Africa and in Zimbabwe, primarily, ICTs have gained impetus during the past decade, diffusing from the first-world countries where they have already taken supremacy. With all this effort that has been staged towards the creation of global Smart Cities by this technological diffusion, a new type of poverty is emerging where some marked differences in society are obvious and where quite a large population in developing countries are captured in information poverty. Zimbabwe is one of the countries that has experienced an information class

struggle as the marginalised population is excluded in terms of accessing this important service of information, while a few have the preserve to access and use it. ICTs will be harnessed to enable the fundamental ingredients of city development.

There were water supply and liquid waste removal networks, energy supply networks, transportation networks and heating and air conditioning networks in buildings. Cities extended the capabilities of human bodies in more comprehensive and sophisticated ways and took over more of the functions traditionally performed by the unaided by the human body, so the cyborg condition intensified. In the latter half of the 19th century, cities began to add artificial nervous systems to their fabrics of skeleton, skin and supply, processing and removal networks. This process began with the construction of telegraph, telephone and radio communication systems, picked up momentum through the first half of the 20th century and then accelerated extraordinarily after the introduction of digital telecommunications in the late 1960s eventually producing today's pervasive connectivity through the internet and mobile wireless networks.

## **CONCLUSION AND FUTURE DIRECTION**

Information Communication and Technology require a backup of power infrastructure that is reliable and available. Most cities in Zimbabwe occupied by poor marginalised societies are often without reliable electricity. Also, much as the poor may wish to access reliable ITC gadgets, among themselves, having advanced ICT equipment like handsets, computers and laptops is considered a luxury. A Smart City has good e-governance systems, street lighting and good water and waste management. There is need to link power consumption, digital communication, internet connectivity, energy efficiency and other digital infrastructure components to achieve this. These should also be extended to densely populated cities that will host ICT devices and where data collection will be done, for this will be done for policy-making. Those who reside and work in Smart Cities benefit from better city planning, faster delivery of service and economic development. There is need to generate great infrastructure in Smart Cities because extraordinary data needs to be generated.

Transportation is one of the non-separable sectors of society. A smart transportation system is one of the key concepts of Smart Cities that have developed rapidly across the globe. Zimbabwe has witnessed dilapidating road infrastructure, poverty and poorly maintained mass transit vehicles as the major concerns. Research needs to be done to determine the state-of-the-art technologies that are needed to improve cities in the country. The research should also bring out the particularities impeding the common implementation of smart transport systems, followed by the development of conceptual architecture for an integrated smart transport system in the country.

Smart metering is also an important component of the Smart City concept. The main challenges associated with smart metering are related to the currently available smart metering technologies in the market. It is recommended that the use of the internet of digital technologies will help to solve the challenges that are associated with challenges in smart metering.

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# Urban Expansion and its Impact on Wastewater Management in Masvingo Town, Zimbabwe: Designing for Resilience

GODWIN K ZINGI<sup>1</sup>

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## Abstract

*Rapid urban expansion has had a negative bearing on wastewater management and sanitation in developing countries, hence there is need for robust and efficient on-site sanitation facilities. The study sought to evaluate the urban expansion and its impact on wastewater management in a developing country case of Masvingo Town, Zimbabwe. The study objectives included investigating the impact of rapid urbanisation on the design capacity of the centralised wastewater treatment plant, characterisation of on-site sanitation technologies in newly built areas against the sanitation standards and to identify the impact of on-site sanitation technologies on the environment. Key informant interviews, questionnaires and secondary laboratory data on biological oxygen demand (BOD<sub>5</sub>) were used to collect the data. The population equivalence was used to determine the impact of rapid urbanisation on wastewater efficiency. Results indicate that a population equivalence of 282.86 BOD shows a decline in the efficiency of the wastewater facility that is affecting aquatic species along the Shagashe River. From a sample of 96 respondents, results indicate that onsite sanitation facilities are dominant in newly built residential areas, with limited sewerage networks and erratic supplies of water. The city is building resilience around on-site sanitation facilities within the realm of Water and Sanitation.*

**Keywords:** on-site sanitation facilities, population equivalence, Masvingo

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## **INTRODUCTION**

Developing countries are burdened with a multiplicity of problems and wastewater management is increasingly becoming a priority issue (Semadeni-Davies *et al.*, 2008). The management of wastewater systems in developing countries is exacerbated by accelerating urbanisation, inadequate management and disposal of wastewater and the implementation of sophisticated treatment technologies that are highly centralised (Chirisa *et al.*, 2017). Developing countries are at different stages of urbanisation, leading to many challenges in the development of sewer systems and river pollution control. Current wastewater management systems are riddled with a plethora of irregularities that calls for a paradigm shift from the current centralised system to the decentralisation of wastewater treatment management.

Within urban authorities, there is usually a works division with a subdivision dealing with water and sewerage. As urban space continues to expand to accommodate a growing global population, there remains a real need to quantify and qualify the impacts of urban space on natural processes. Storm drains carry runoff from streets, urban centres, industrial sites and open spaces into streams, creeks and rivers. Industrial operations are only one contributor to this problem, but they are known to be a source of heavy metals, oily wastes and other substances. Manufacturing, shipping and storage operations exposed to stormwater can be sources of pollutants. The expansion of global urban areas has resulted in marked alterations to natural processes, environmental quality and natural resource consumption (McGrane, 2016). Safady (2011) observes that expansion of urban space results in an increase of impervious landscape and expansion of artificial drainage networks that can facilitate dramatic changes to the magnitude, pathways and timing of runoff at a range of scales, from individual buildings to larger developments.

Water resources are under pressure from continuing population growth and urbanisation, rapid industrialisation and expanding and intensifying food production, particularly in developing countries and urban areas. Liao *et al.* (2021) aver that urban populations may nearly double from the current 3.4 billion to 6.4 billion by 2050. This represents a global threat to human

health and well-being with both immediate and long-term consequences. The problem of urban sanitation in Zimbabwe, unlike in other parts of Africa, is not primarily one of access to services, but one of disposal of the effluent. An alternative pollution control management approach is suggested based on shifting responsibility from government to the discharge authority. A review of this system is urgently required to create an environment where pollution will be effectively and progressively controlled. Urban wastewater is described as wastewater generated from domestic activities or as a mixture of wastewater generated by household, industrial and rainwater outflows. Urban wastewater is considered a hazardous material that has to be disinfected to support public health and protect the environment.

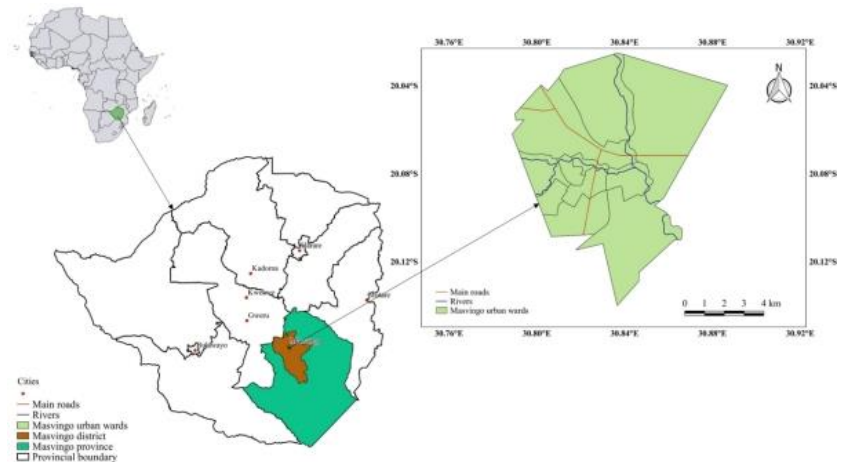
Due to rapid expansion in most urban spaces, the centralised system of waste management is affected, hence land developers take advantage of the weak regulatory framework and poor regulatory capacity of the local authorities. The current Urban Water Management (UWM) systems evolved from a situation of small populations consuming small amounts of water, the presence of only small-scale industrial activities and, thus, the release of few harmful substances into the environment and the availability of large volumes of fresh water. Consequently, neither water consumption nor the discharge of wastes had significant impacts on the environment. When urban populations increased and, specifically when nearby waste discharges resulted in unhealthy conditions and disease outbreaks, waste needed to be discharged further away from human habitats.

The inability of the City of Masvingo to extend and upgrade its water and sanitation systems and keep pace with the city's growth has led to several complex challenges. The city's ageing sewer network is poorly maintained, overstretched and needs expansion. The water treatment facilities and pipe network also need upgrading and repair but the local authority has limited financial resources. The urbanisation process generally leads to increasing loads of pollutants discharged into the river by human activities, causing serious deterioration of the quality of the water in the Mucheke River and harming the surrounding

environment as well as human health (Mapira, 2011). The challenges are compounded by the growing demand for housing in and around Masvingo. Multiple toilet systems are in use, including flush toilets connected to the city's sewer grid, pit latrines and ecological sanitation toilets. Many people still practise open defecation. There is considerable variation between the settlements profiled, ranging from well-maintained, community-managed toilets to poor, neglected and unhygienic systems. Inappropriate planning, incomplete drainage systems, as well as poor construction quality, result in large amounts of pollutant load discharging directly into rivers from the drainage systems. In many places, there is poor or erratic water supply, which leads to open defecation and failure to wash hands. Most of these local authorities have limited resources and are, therefore, unable to provide the basic amenities.

The study assesses the impact of urban expansion on wastewater management in Masvingo through investigating the impact of rapid urbanisation on the design capacity of the centralised wastewater treatment plant. The idea was to determine the characterisation of on-site sanitation technologies in newly built areas against sanitation standards and to identify the impact of on-site sanitation technologies on the environment.

## DESCRIPTION OF THE STUDY AREA



Masvingo is located 292 kilometres (181 miles) south of Harare. It is divided into suburbs including Mucheke, Rujeko, Rhodene, Target Kopje and Eastvale. The suburbs are divided into high-density, middle-density and low-density suburbs. Mucheke, the oldest township and Rujeko are the most populous high-density suburbs. Mucheke is also the site of the city's main bus terminus as well as the town's stadium of the same name. KMP and Runyararo suburbs are relatively new high and medium-density suburbs, respectively, beyond Mucheke. The city's water supply comes from Bushmead Waterworks at Lake Mutirikwi, where an average of 30 megalitres (ML) is pumped daily to the city. Water quality is excellent and meets both the World Health Organisation (WHO) and Standards Association of Zimbabwe (SAZ) standards. Current supply is at maximum capacity but is failing to satisfy water demand in the ever-growing city. Water demand is estimated at 48 ML per day. However, the city has prioritised the Central Business District (CBD) and the industrial areas in the water supply. Measures put in place by the local authority save water is a ban on the use of hosepipes, which attracts a fine. A water augmentation project is underway to increase water supply to the town. Borrowing powers and a government guarantee are being sought to carry out the project. Sewer in the city flows by gravity to raw sewer pump stations on the banks of the Shakashe River. It is then pumped to the Masvingo Sewage Treatment Works to the east of the city for treatment and safe disposal. There are two treatment plants within the premises, *viz*, the Conventional Trickling Filter plant with a capacity of 7.5 ML/d and the Activated Sludge plant with a capacity of 13.5 ML/d, to give a combined capacity of 21ML/day.

## **LITERATURE REVIEW**

### **SUSTAINABLE DEVELOPMENT GOALS AND WATER MANAGEMENT**

The United Nations Sustainable Development Goals (SDGs) provide a global framework for ending poverty, protecting the environment and ensuring shared prosperity. Goal 6 on clean water and sanitation (specifically targets 6.2 and 6.3 on sanitation and water quality respectively) and Goal 3 on good health and well-being, are particularly relevant to sanitation. The SDGs also set out the principles of implementation for

states to follow, including increasing financing, strengthening the capacity of health workers, the introduction of risk-reduction strategies and building on international cooperation and participation of local communities. Goal 1 states the need to improve the flow of information and increase monitoring capacities and disaggregation so that it is possible to identify which groups are being left behind.

### **WASTEWATER INFRASTRUCTURE AND URBAN GROWTH**

When and where sewer infrastructure is located is thought to influence growth patterns and thus the size, location and extension of sewer service areas are critical (He, Okada and Zhang, 2006). Recent examinations of land conversion processes suggest that sewer service area expansion greatly influences urbanisation. One study developed a spatially explicit model that emphasises the role of municipal services and zoning on land use change. They found that when water and sewer service areas were extended, the average probabilities that urban development would occur were very high and there was an increase in the likelihood that development would be high-density. In the Maryland context, the presence of public sewer had a very positive effect on the hazard rate of conversion for developable parcels in Calvert County (Semadeni-Davies *et al.*, 2008). Based on estimated hazard ratios, Irwin *et al.* (2003:96) state,

the mean hazard rate of those parcels with public sewer, holding all other variations constant, was 363% greater than those without a public sewer. Thus, just the provision of public sewer to a parcel increases the hazard rate of conversion by almost fourfold.

Similarly, Shen and Zhang (2007), in their study of the effectiveness of Maryland's Smart Growth policies, found that land inside the sewer service areas of selected counties in the state was more likely to be developed than land outside these areas. These studies suggest that growth is inextricably tied to sewer infrastructure.

Akin to the connection between public sewer infrastructure and urban growth, some of the same land conversion studies have also found that utilisation of on-site septic systems can lead to low-density, sprawl-like development. For instance, Foster

(2001) found that rural and exurban areas in Sonoma County received growth typically at lower densities than those areas close to the urban core. According to the study findings, this lower-density development was the result of the expansion of large lots with on-site septic systems and private residential wells. The installation of on-site septic systems requires that residents set aside enough space to provide adequate drain field size for effective effluent treatment and disposal. These systems also need to be a safe distance from any residential groundwater wells. Large lot sizes are the result. So, while urban development is likely to occur within sewer service areas, the lack of sewer does not necessarily thwart growth, especially the sprawl-like development government planners seek to prevent. This sprawl-like development can even occur within designated sewer service areas. For example, Kookana *et al.* (2020) found that large-lot residential development occurred within the Minneapolis Metropolitan Urban Service Area (MUSA) because of the availability of private septic systems and pre-existing groundwater wells.

#### **SEPTIC SYSTEMS AND SEWER SERVICE**

Developing countries always lack proper sanitation systems due to rapid urbanisation. Decentralised onsite wastewater treatment systems could provide an improvement in sanitary conditions in these countries. The simplest of such systems are septic tanks, which provide the first and very important pre-treatment. The quiescent condition inside the tank allows a portion of suspended solids (SS) to settle and floatable solids to rise and provides storage space for biological processes to occur. In some developing countries, septic tanks have become a required component in their sanitation systems and appropriate authorities monitor the operation and maintenance of the septic tanks to manage the quality of the effluent. The effluent must meet regional standards if discharged onto land or sewer systems (Semadeni-Davies *et al.*, 2008). However, in some other developing countries, the septic tank effluent quality is not regulated and the effluent could be discharged into sewers or leached into the ground. This causes serious environmental problems. The main objective of this study was to evaluate the current performance of onsite sanitation in some areas in Vietnam and Thailand to promote them as onsite

sanitation systems in developing countries. A septic tank provides the primary treatment of wastewater from a dwelling.

### **IMPACT OF POPULATION GROWTH ON SEWER**

The state of sanitation and the inadequacy of sewerage management pose a health hazard to residents. In 2005, a study by Astaraiie-Imani, Kapelan and Butler, 2013) indicated that about 50% of all preventable illnesses in Kenya are water, sanitation and hygiene-related. In Eastleigh, the sewerage system is designed as a combined system of both sewer line and storm water drainage running concurrently. The Nairobi Water and Sewerage Company is the body bestowed with the responsibility to manage the sewer line while the Nairobi City Council is responsible for the maintenance of the stormwater drainage. This poses a major health problem to the residents of the city. The sewer line was laid in 1943 to serve an estimated population of 36 616. The sewer line is nine inches wide, efficient to serve the neighbourhood that had a sparse population living in single housing units. However, due to the rapid population growth, the Nairobi North Region Sewerage Technical Officer indicated that the sewer line only has 65% capacity to be effective and efficient. The company attributes this moderate percentage to rapid population growth and physical developments in the area. Initially, the sewer line in Eastleigh had been laid to serve as a low-density area as per the infrastructure size. However, the change of use in certain areas of the neighbourhood has led to overstretching of the sewerage system and the results have been frequent bursts of the sewer line and spillover of the wastewater in unplanned areas, posing a health risk to residents. Moreover, the sewer has experienced illegal development along the way, which has been closely linked to population growth and weak enforcement of the city bylaws. This has continually hampered the efforts by the company to offer high-quality regular preventive sewerage services. In addition, in most areas of the neighbourhood, the storm drain covers have been vandalised, posing an imminent danger to road users and consequent blockage of the sewer line.

### **ON-SITE TREATMENT SYSTEM**

On-site treatment systems can be adopted when the individual houses are far apart over a large area and where there are no

centralised systems. This can also be a preliminary option in newly developing localities. However, it is emphasised here that the option of an on-site treatment system should be considered mostly as an interim solution and not a permanent wastewater treatment/management option. If improperly designed or maintained, or left unattended, on-site treatment systems can result in severe environmental hazards. Various on-site wastewater treatment systems are available. Selecting the most appropriate option requires a thorough analysis of all factors including cost, cultural acceptability, simplicity of design and construction, operation and maintenance, hydrogeological conditions and local availability of materials and skills. DWTS is an on-site sanitation system that treats wastewater (both black and grey water) mostly at community scale or even larger scale. Waste water management systems can be either conventional centralised systems or decentralised systems. Centralised systems are usually planned, designed and operated by government agencies, which collect and treat large volumes of wastewater for entire communities. On the other hand, DWTS systems treat wastewater of individual houses, apartment blocks or small communities close to their origin. Typically, the DWTS is a combination of many technologies within a given geographical boundary, one of the multiple onsite sanitation systems comprising low-cost collection systems and dispersed siting of treatment. It may also be noted that any city or town can have a combination of centralised, decentralised and on-site wastewater treatment systems, to meet the overall city sanitation requirements.

A public toilet, a kind of common toilet installed in stations and on streets, is open to everyone. In contrast, a community toilet has limited users such as residents. These common toilets are controlled by local governments, residents or private sector organisations. A common toilet normally has two sections: one is for males and the other is for females. In addition, another section special to persons in a wheelchair (unisex) is sometimes provided. In general, an on-site common toilet includes a special sewage treatment facility such as a septic tank. The flow rate of sewage to be treated is derived from the total number of users based on how many toilet bowls are installed and how



frequently they are used. The toilet is equipped with a water supply unit, a ventilator and a lighting device.

Mobile toilets are temporarily installed in places where there is no toilet, such as shelters during natural disasters, venues for events and construction sites, or where the number of existing toilets is inadequate. A mobile toilet box has a tank for storing excreta in its lower part. If the tank is full, a vacuum tanker collects the stored sewage. Each toilet has a single room or multiple rooms with a hand washing unit, which is selected according to the flexibility of installation sites and ease of transport by a truck. In addition, there is a mobile flush toilet that is equipped with a water tank and a pedal. Stepping on the latter activates a manual pump to cause washing water to flow. The box is made by assembling fibreglass-reinforced plastic (FRP) side panels, so its weight is light. Local governments keep these toilets to prepare for disasters and events, or rental companies lease them. The mobile toilet features easy installation work on the ground.

In a conventional water flush latrine, the excreta is normally flushed with 10 to 14 litres of water from a cistern. In a pour-flush latrine, as the name suggests, excreta is hand flushed by pouring about 1.5 to 2.0 litres of water. These pour-flush leaching pit latrines were first developed in India in the mid-1940s with a single leach pit and squatting pan placed over it. When the pit in use gets filled up, another pit is dug and the squatting slab is removed and placed over the new pit. The first pit is covered with earth and the excreta is allowed to digest. After one or two years, the digested excreta is used as manure. In the late fifties, a modified design of the system was developed. In this system, the leach pit is kept away from the seat, instead of placing it underneath the pan. In a single pit system, desludging has to be done almost immediately after the pit has been filled up to enable its re-use. This involves handling fresh and undigested excreta containing pathogens which is a health hazard. A single leach pit is appropriate only if it is dislodged mechanically by a vacuum tanker. To overcome this shortcoming, the twin-pit design was introduced and in this case, when one pit is full, the excreta is diverted to the second pit. The filled-up pit can be conveniently emptied after

1.5 to 2 years when most of the pathogens die off. The sludge can safely be used as manure. Thus the two pits can be used alternately and perpetually. With simple care, a pour-flush water-seal latrine is a very satisfactory and hygienic sanitation system, hence it can be located inside the house since the water-seal prevents odour and insect nuisance.

## **RESEARCH METHODOLOGY**

### **SAMPLING**

The study adopted the descriptive and experimental research design. The size of the sample was drawn from the population. Sampling is the process of selecting of a subset of individuals from the population to estimate the characteristics of the whole population.. When the units being sampled (households) are not the same as the elementary units (people), to derive the average values and confidence intervals for variables describing people a different set of formulas must be used. To target the 96 sampling units in which pre-tested questionnaires were distributed, four clusters were identified, that is industrial SME (24), Clip Sham heights (24), Vic Range (24) and Garikai Housing Hooperative (24). A pre-tested open-ended questionnaire was randomly distributed targeting 30 key informants on wastewater treatment including 10 health workers, 10 officials from the engineering department and 10 officials from Zimbabwe National Water Authority (ZINWA). The questionnaire targeted key informants to obtain information on the impact of rapid urban expansion on wastewater treatment. Questionnaire was constructed from the WHO (2014) and sanitation legislation (Urban Zouncils Act, RTCP Act and the Public Health Act.

### **QUALITY CONTROL**

A structured questionnaire is used to collect quantitative data. This type of questionnaire is designed in such a way that it collects intended and specific information. It can also be used to initiate a formal inquiry, supplement data and check data that have been formerly accumulated and also validate the hypothesis. This involves giving the questionnaire to the same group of respondents at a later point in time and repeating the research and hen comparing the responses at the two-time

points. Thus, to reduce memory effects, the time between the first test and the retest was increased.

### **STATISTICAL ANALYSIS**

The regression analysis technique was used for the modelling and analysis of numerical data. Data from the Likert scale was coded into SPSS version 16.0 for regression analysis. To establish the internal consistency of the scale, we conducted a reliability analysis, calculating Cronbach's alpha coefficient for each of the factors and the overall scale.

### **POPULATION EQUIVALENT**

Population equivalent (PE) is a measure of important parameters for characterising domestic wastewater. PE reflects the equivalence between the polluting potential of a municipal area in terms of the biodegradable organic matter and a certain population, which produces the same polluting load. The formula for the calculation equivalent based on BOD is

The pollutants per capita values can be used to estimate the present and future pollution loading of wastewater produced by a population. These are also useful to estimate the equivalent population of an urban or industrial wastewater flow. By expressing wastewater pollution in terms of per capita values, the concept of pollution will be more understandable for citizens and policy-makers. The secondary data collected by the Masvingo City laboratory on the 20 August (Year) was used to calculate the population equivalence to determine the capacity of the centralised wastewater treatment plant in the face of rapid population growth.

## **RESULTS**

### **THE ON-SITE SANITATION FACILITIES IN THE FACE OF URBAN EXPANSION**

Table 1 indicates that septic tanks are significantly ( $p < 0.05$ ) site facility relative to the number of individual housing unit per household, whilst the Fossa Alterna is the least dominant within the newly built residential areas. Housing units with an average of 9-12 individuals have access to onsite sanitation facilities. Septic tank facilitates biological treatment of

wastewater in unconnected residential areas such as Runyararo West Treasure Consultancy, Victoria Range, Garikai and Klipshap Range. These findings are in line with Maira (2011) who observed that a septic tank is significantly present in small-scale decentralised units for grey and blackwater. Pit latrines and septic tanks are common on-site sanitation facilities used in Sub-Saharan Africa. This shows the resilience of the households to cope and adapt to the lack of a centralised waste management system in the face of rapid urban expansion. The ecological toilets have been adopted mainly in Victoria Range, which is unconnected to the centralised system. Ecological sanitation is a viable sanitation alternative to conventional sanitation. Key informant from the City of Masvingo noted that the Eco San project in Victoria Range was facilitated by the Shelter for Dialogue Foundation in Zimbabwe and is more convenient where access to water is limited and more effective than wet methods. Blair toilets and Fossa Alterna are pronounced in New Klipsham residential areas under construction. This is because it is regarded as stop gap measure pending completion of the structure. These housing units are inhabited by caretakers. On-site sanitation systems are more widely employed in low-income and rural areas of the world.

**Table 1:** Distribution of on-site sanitation facilities

		On-Site Sanitation Facilities				Total
		Septic Tanks	Blair Toilet	Ecological Sanitation Toilet	Fossa Alterna	
Number of individuals	0-4	8	4	2	1	15
per housing unit	5-8	11	10	3	0	24
	9-12	20	7	14	5	46
	13-15	4	1	3	3	11
Total		43	22	22	9	96

### **THE CHARACTERISTICS OF THE ON-SITE SANITATION FACILITY**

Table 2 shows that most respondents indicated that onsite sanitation facilities were durable, whilst current legal acceptance was the least frequent from the respondents. Somensite systems do not meet the structural standard within

the Urban Councils' Act and Building Standard Act and are rarely inspected by the Masvingo Department of Engineering. Housing units within the range of 200m<sup>2</sup> are dominated by eco-sanitation facilities that require no water to operate. The ecosan facilitates recycling nutrients, hence boosting soil fertility. One key informant from the Environmental Management Agency (EMA) notes that eco san toilets is effective in the destruction of pathogens than the pour-flush mechanism. Housing units with dimensions of 800m<sup>2</sup> to 1 600m<sup>2</sup> are dominated by septic tanks that require water to dispose of effluent. Klipsham residents adopted septic tanks with appropriate effluent treatment and disposal facilities. The on-site sanitation facilities can mitigate against the occurrence and emergence of pathogenic infections, especially in dry toilets that are more effective in destroying pathogens than wet methods. The toilet is elevated to ensure that water does not enter collection tanks even during flooding. Provision is also made for the cleansing water to go into the collection tank separately to ensure the drying of faeces The results also shows that one of the characters of the onsite sanitation facility is low maintenance costs.

**Table 2:** Characteristics of an Onsite Sanitation Facility

Count								
		Characteristics of Onsite Sanitation Facility						Total
		current legal Durability	Exposure to Pathogens	Control Water For Operation	Operation and Maintainance	Protects Nearby Water Sources		
Dimensions of Housing Units	200	8	2	4	2	5	4	22
	400	4	1	1	2	2	1	10
	800	7	1	3	6	5	3	25
	1600	9	4	3	5	1	13	39
Total		28	8	11	15	13	21	96

**POPULATION EQUIVALENT**

The population of Masvingo City for 2022 is estimated 110 000 people. Therefore, since research conducted on wastewater by German scientists, the average BOD for one person was found to be 54g BOD/day (McGrane, 2016) According to historic data

from the WWTP, the plant receives an average of 21 ML/day of water, hence the theoretical BOD is calculated as shown below:

$$54\text{gBOD/day} = 54\,000\text{mg/day}$$

$$21\text{Ml/day} = 21\,000\,000\text{l/day}$$

The value of theoretical BOD deviates from the experimental average value by 11.3%. The results indicate that rapid population growth is outstripping the capacity of the centralised system to manage waste, hence there is need to adapt to on-site sanitation facilities. A key informant from EMA noted that there is glaring evidence that effluent being discharged into the Mucheke and Shagashe Rivers is a leading factor in the depletion of aquatic life. Such findings are in line with Desire *et al.* (2021) who observed that in Shanghai, China, urbanisation is a trigger by increased load of pollutants derived from anthropogenic factors leading to poor wastewater quality parameters and threatening public health.

## **DISCUSSION**

The limited construction and maintenance of drainage networks in newly built areas have led to the adoption of on-site sanitation facilities as an urban resilience strategy in the face of Rrapid urban expansion. The population equivalence of 282.86 BOD shows that the wastewater treatment plant is overburdened by the amount of sewage generated per individual, thereby affecting the treatment efficiency of the centralised system. Given the background of volatile economic situations, coupled with poor planning and construction of urban drainage systems, the onsite sanitation facilities have been adopted to cope with and adapt to system failure of the centralised system to extend drainage networks to newly built areas. On-site sanitation systems are more widely employed in low-income and rural areas of the world. The septic tank treatment technologies have been designed to contain exposure to pathogenic hazards. The technical sanitary excrete disposal facility is designed to contain faeces so that the infectious pathogens are isolated from the new host. Onsite sanitation facility such as the ecosan, facilitates nutrient recycling, as it helps to conserve water and soil fertility. Human excreta is regarded as a resource rather than a waste' This is line with

sustainability and resilience in the face of rapid urbanisation. The re-use of excreta (untreated or treated to differing extents) as a fertilizer and the re-use of wastewater (including sullage water) for many purposes, but especially for irrigation, may also contribute to the incidence of excreta-related diseases (Eerikäinen *et al.*, 2020). Given that a well-functional sewage system requires access to and adequate water supplies, dry toilets facilitate sanitary conveniences in the face of erratic water supplies, this being in line with SDG Number 6 on Water and Sanitation. However the pit latrines and Fossa Alterna are used mostly in urban areas..

Order and groundwater contamination are risk factors for infectious diseases, hence there is a need to come up with standardised sanitation conveniences supported by legislation. The regulatory standards enshrined in the Regional Town and Country Planning Act, Urban Councils Act and the Housing Standards Act are rarely applied except in housing units that range from 800m<sup>2</sup> to 1 600 m<sup>2</sup>. Currently, urban authorities lack a sanitation master plan and an act of Parliament to guide the operationalisation of onsite sanitation facilities. The building inspection usually caters for the housing plans, hence little consideration for the septic tanks or eco sanitation toilets.

## **CONCLUSION**

The centralised sewer system is overburdened by rapid urbanisation, leading to the deterioration of the waste treatment efficiency of the sewer plants. Moreover, lack of a sewerage network due to high maintenance and operational costs, have led to the emergence of on-site sanitation facilities as a buffer against the challenges associated with the centralised sewer system. The onsite sanitation facilities have had a positive bearing on sustainability and resilience against a background of vulnerability. There is need to consider sanitation provisions and flexible technology solutions that promote the sustainability of the on-site sanitation facilities. Inspections are rarely done, since there is no sanitation master plan or legal provision to monitor the on-site sanitation facilities.

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# Capacity Building of Mentors in the Mentoring of Trainee Teachers

ROSEMARY MADZORE<sup>1</sup> AND SYMPHOROSA REMBE<sup>2</sup>

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## Abstract

*This study examined the capacity building of mentors in the mentoring of trainee teachers as a way of improving mentors' practices. The study employed the interpretive paradigm and used the qualitative approach and case study research design. Purposive sampling was used to select 27 participants perceived as rich informants. These participants included six mentors, 15 trainee teachers, five college lecturers, two lecturers from the teaching practice office, three senior lecturers in charge and one university lecturer who is a link person between the college and the Department of Teacher Education at the University of Zimbabwe. Data were obtained through face-to-face interviews, focus groups and document analysis. It emerged from the study that mentors were not at all being trained to become mentors, therefore, mentors needed to be trained before the mentorship programme. The study revealed that most mentors depended on the knowledge they attained from college when they were training as teachers and a few from school staff development programmes. Thus, there was a gap in the capacity building of mentors and mentor selection.*

**Keywords:** trainee teacher's practices, teaching practice, capacity, policy, management

## INTRODUCTION

Capacity building of both the mentor and the mentee is paramount and schools and colleges are expected to arrange centrally managed training and preparation programmes for all mentors in line with the needs of schools (Mohamed and Beagan, 2019). Structured evaluation with mentors and

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mentees occurs at the end of each programme and qualitative evaluation is done by staff. Sometimes, mentors are given honoraria, presents or comments on their academic transcript as recognition of their effort and contribution (Geist and Cohen, 2010; Kimmelman and Lang, 2019). E-mentoring is also used to develop and sustain mentoring relationships, linking a mentor and a mentee independent of geographical or scheduling constraints (Schofield, 2019). It is mostly for trainee teachers in remote locations, involved in distance education as well as in low socio-economic status settings (Kutsyuruba *et al.*, 2016).

Capacity building of mentors involves coaching leadership skills and building leadership capacity in individuals within institutions (teachers' colleges) through professional relationships (Robertson, 2016). Full-time mentorship programmes are affiliated with colleges or universities but, in some countries, the programmes are a project of the school or district itself. In Zimbabwe, college or university-based mentorship programmes for new teachers are based on partnership with a single large university. For example, many colleges are affiliated with the University of Zimbabwe. Mentor programmes should be sponsored by colleges and universities but the rate at which these programmes are held has been affected by some economic constraints.

## **THEORETICAL FRAMEWORK**

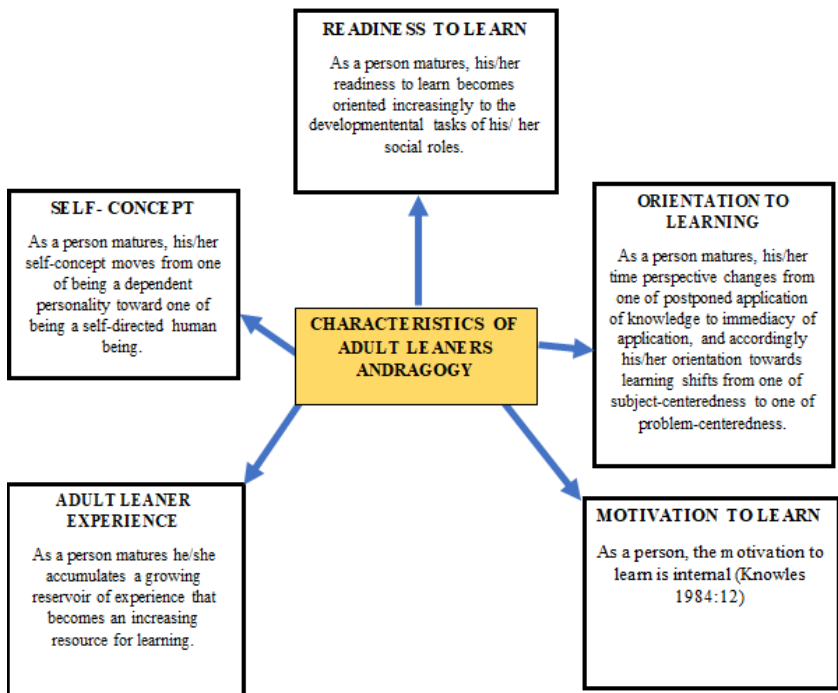
The purpose of theoretical framework is to suggest additional studies to test the theory further. However,

the main purpose of a theoretical framework, apart from informing the study, is specifically to guide the researcher in his or her analysis, explanation and interpretation of the data (Rakatsaone, 2006:14)

The theoretical frameworks that underpinned this study is Andragogy Theoretical Model of Adult Learning by Malcom Sherpherd Knowles (1980). The theory enables an informed interrogation of mentorship practices in relation to the capacity building of mentors in various sectors or organisation

## Andragogy Theoretical Model of Adult Learning by Knowles (1980)

As indicated above, the study is guided by Knowles' Andragogic theoretical model. He is well known for the use of the term Andragogy as synonymous with adult education (Knowles, Holton III and Swanson, 2014; Pappas, 2013). Knowles states that the adult learner is self-directed, is responsible for his or her learning, wants to perform real life tasks to solve problems and wants learning that is collaborative rather than didactic (Melnik and Novoselich, 2017). The Andragogic model is the most appropriate and widely used learning and teaching model when training adult learners (Brockett and Hiemstra, 2018). However, Pappas (2013) said that Knowles' model is based on five assumptions about characteristics of adult learners that are different from the assumptions about child learners (Pedagogy) as illustrated in Figure 1.



**Figure 1:** Five Assumptions of Adult Learners (Pappas, 2013)

In line with the above assumptions, Chan (2010) asserts that andragogy, as advanced by Knowles, is a well-known approach to address the distinct needs of adult learners. Knowles' concept of andragogy has been widely adopted by educators from various disciplines around the world. In addition to Knowles' (1980) five assumptions, Chan (2010) adds another assumption to the Andragogy theory of adult learning to make them six, namely; (a) self-directedness, (b) need to know, (c) use of experience in learning, (d) readiness to learn, (e) orientation to learning and (f) internal motivation.

The study placed central importance on the Andragogy adult learning theory since it assists mentors and trainee teachers to prepare themselves for their working environment. For instance, when a trainee teacher goes for teaching practice (TP), he/she is already prepared to learn and has the internal motivation or drive to pass and complete the course through working hard. The trainee teachers would have already learnt the theory part of their training at college, now they would be doing the practical teaching work. Learning by doing is emphasised by the andragogic theory of learning which stipulates that as an individual matures, the motivation to learn is driven more by internal motivators (an inner desire) rather than extrinsic motivators (external stimuli) (Bates, 2019; Steyn, and van Tonder, 2017).

Forrest and Peterson, cited in Chan (2010), further agree that:  
“modern management requires practical implementation of skills learned, not regulation of principles. Without implementation, mentors and trainee teachers cannot adapt to the ever-changing workplace (114).

Using the andragogy principles, the mentor can tailor the instruction to meet trainee teachers' interest, by involving them in planning the learning objectives and activities and solving real-world problems (Pletcher, Hudson and Watson, 2019). Accordingly, Andragogy improves communication between the

trainee teacher and the mentor. They work together as partners to design instructional content and methods to suit the learners' needs (Henschke, 2011; McCall, Padron and Andrews, 2018). As a result, the principles promote trust between the trainee teacher and the mentor and enhance self-awareness in the trainee teacher, as well as improving the mentor's practices in facilitating career development and providing psychosocial support (Pappas, 2013; Chan, 2010; Ozuah, 2016).

The adult learning theory is oriented towards explaining the reasons specific things are done (Londy, 2007). Therefore, the mentor needs to explain to trainee teachers why they are expected to use media in teaching, scheming and planning and the use of record books and other activities. Thus, instruction should be task-oriented, instead of promoting memorisation. Learning activities should be in the context of common tasks to be performed by the others (Chan, 2010). This study acknowledges the use of various strategies by mentors to provide career development and psychosocial support to trainee teachers during TP.

Bates (2019) suggests the following points to be noted by mentors when mentoring a trainee teacher. Trainee teachers, who are supposedly adult learners:

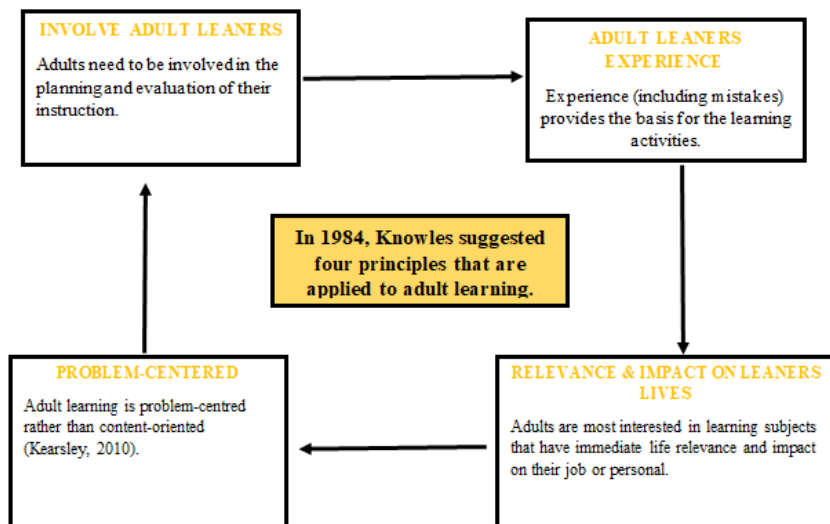
- have their own views of themselves and their needs and are goaloriented;
- bring a vast array of life experiences and knowledge which can be a valuable resource of learning;
- are more concerned with learning to complete tasks or solve problems than just learning subjects; and
- have a need to be valued and respected.

The above points are important to the mentor and Jesus (2012) suggests that mentors should also allow for different levels/types of previous experiences or individual differences to accommodate trainee teachers with different learning styles. Wilson (2019) concurs with Jesus (2012).

Since adults are self-directed, instruction should allow trainee teachers to discover things and knowledge for themselves without depending on the mentor all the time (Rishel and Hartnett, 2019). However, adult learners should be offered guidance and counselling when mistakes are made. The adult learning theory is suitable in that mentors and trainee teachers are all adults who need to learn during the TP programme. Trainee teachers and mentors are confronted with real teaching and learning challenges which they need to solve with real solutions by marrying theory and practice (Mathews and Mercer-Mapstone, 2018).

According to Hartnett (2019), Knowles' theory of andragogy maintains that trainers should recognise that the richest resource for learning resides in adult learners themselves and emphasis should, therefore, be on experiential techniques that tap into their experiences. These include group discussions, problem-solving, case study, role-play, field trips, rather than transmission techniques such as lecturing or presentations (Moxham and Moxham, 2019). Thus, in capacity building of mentors, learner-centred methods, instead of teacher-centred methods, are encouraged. Using a combination of the above methods will have the greatest impact on adult learning (Bates, 2019) Thus, the present study's objective is to establish the strategies used by trainers and mentors to provide career development and psychosocial support to trainee teachers during TP.

This study also acknowledges the contribution of the adult learning theory by Knowles (1980), which suggests four principles that are applied to learning, illustrated by Figure 2.



**Figure 2:** *Four Principles of Andragogy* (Pappas, 2013)

These principles are connected to the assumptions of the adult learning theory which have been discussed above. The Andragogy theory principles are relevant to the present study on the mentor’s practices and capacity building of mentors in facilitating career development in that, initially, the trainer of mentors is supposed to involve the mentor in planning and evaluation of all the activities to be done during TP (van Tonder and Steyn, 2018). As shown in Figure 2, the first step is to plan before conducting teaching and learning activities, just as the mentor and trainee teachers are expected to do (Green, 2018).

During TP, both the mentor and the trainee teacher experience new things. They sometimes make mistakes during the learning process, but they keep on working, doing some corrections. The mistakes are considered as the basis for new learning activities until they accomplish their goals (Pletcher *et al.*, 2019). Both the mentor and the trainee teacher value their work as having immediate relevance and direct impact on their personal lives. Finally, adult learning is more of problem-solving than content-oriented and the trainee teacher will be involved in problem-solving activities on a daily basis (Pappas, 2013).



Mentors need training to have concrete experience of what they are going to do during mentorship. Concrete experience involves scheming, planning, making media, teaching, marking children's books, managing the classroom, supervising, controlling and getting involved in co-curricular activities (Illeris, 2015). According to Defined, Goals and Content (2018), the trainee teacher observes and reflects upon the activities he or she has done and the mentor needs to undergo the same process. After the second phase, the trainee teacher or the mentor interprets (abstract conceptualisation) the events that have been done and finally experiences and modifies his/her behaviour (active experimentation), thereby improving practice. During TP, the trainee teacher is given the opportunity to give feedback to the mentor. Since TP is done with ongoing assessment, the trainee teacher gets the opportunity to go through the full cycle with the help of the mentor (Alkhawaldeh, 2017).

Andragogy theory is ideal for this study because it will equip both the trainee teacher and the mentor with strategies and methods which will enhance the trainee teacher's pedagogical development in TP. It is the intention of this study to establish the strategies used by mentors in providing and psychosocial support to trainee teachers during TP.

Knowles's theory of andragogy has, however, been criticised for assuming that adults are always self-directed (Merriam, 2013). Because of the different backgrounds, some adults may need to be self-directed as to what is to be done in the training. During TP, some trainee teachers, if not properly directed, may fail it, withdraw or defer (Cuozzo, Dumay, Palmaccio and Lombardi, 2017). In this case, mentors must assume a dominant role. Mentors may have to play a directive role. Kop and Fourand (2017) observe that some of the experiences adults encounter in the training may not be relevant to what is being taught and may, therefore, not be of any use to the learning process. For instance, some of the issues may be political, sexual abuse by supervisors or mentors, negative attitudes and misunderstanding among staff members.

Despite the few criticisms, Knowles' theory of andragogy remains one of the most effective models for adult learning and that is why this research found it relevant (Bates, 2019). Mentors should use interactive methodologies which focus on an individual's life experiences, such as discussions, case studies, problem-solving, role-play and field trips (Baron *et al.*, 2019). The model was used to ascertain whether mentors use training methods/techniques and strategies which promote effective provision of career development and psychosocial support to trainee teachers during TP.

## **REVIEW OF RELATED LITERATURE**

Capacity building of mentors involves coaching leadership skills and building leadership capacity in individuals within institutions (teachers' colleges) through professional relationships (Robertson, 2016). Full-time mentorship programmes are affiliated to colleges or universities but, in some countries, the programmes are a project of the school or district itself. In Zimbabwe, college or university-based mentorship programmes for new teachers are based on partnership with a single large university. For example, many colleges are affiliated to the University of Zimbabwe. Mentor programmes should be sponsored by colleges and universities but the rate at which these programmes are held has been affected by some economic constraints. Some institutions have stopped training mentors due economic hardships (Morrison, Ross, Morrison and Kalman, 2019)

The state is also expected to provide financial support for mentor programmes. Support seminars can be held as periodic meetings related to the teacher standards, to provide adequate training. Mentors can be trained in various ways such as:

- provision and assistance with policies and procedures by the college,
- emotional support by the college,
- introduction of school-based mentor programmes,
- use of traditional face to face classroom format,
- emails
- distance learning
- web based instruction

Basic mentor training can be done just after the selection of prospective mentors. There is no stipulated time for mentor training. Staggering training over a semester or even an entire year can be more effective when properly planned and done, but it may be challenging in terms of schedules within the situation calendar (Merriam and Grenier, 2019). The present study sought to establish whether the training of mentors is done in Zimbabwean schools and colleges, how it is done and its impact on the mentors' practices in facilitating career development and providing psychosocial support to trainee teachers during teaching practice.

Dessel, Kulick, Wernick and Sullivan (2017), in their study on the importance of teacher support. The reviewed literature on the training of mentors has not clearly explained who should train the mentor and how should it be done, to provide career development and psychosocial support.

The study wanted to establish whether mentors in Zimbabwe secondary schools are trained for the mentorship programme, how they are trained and how this impacts on the provision of career development and psychosocial support with the view to coming up with better ways to improve the mentors' practices in career development and psychosocial support. Having reviewed the literature on various aspects of mentors' practices in facilitating career development and providing psychosocial support, the next section summarises these literature findings.

## **METHODOLOGY**

A qualitative approach was adopted in this study, where the research understood the events and individuals in their natural state (Alvesson and Sköldberg, 2017). Findings by Thanh *et al.* (2015:25) show that interpretivists usually tend to use qualitative methods such as case studies and ethnography which provide rich reports to fully understand contexts. Moreover, interpretivists portray a world in which reality is socially constructed, complex and ever-changing (Steyn *et al.*, 2017).

## **RESULTS**

The training of mentors is very essential in the mentorship programme since it equips the mentor with skills necessary for the facilitation of career development and provision of psychosocial support to trainee teachers on teaching practice. Considering this, participants were requested to shed light on capacity building or training of mentors and its importance in the facilitation of career development and provision of psychosocial support to trainee teachers during TP. In response to the question, most of the participants agreed that the Department of Teacher Education (DTE) and colleges must train mentors, but mentors were not being trained at all. The participants suggested that mentors were supposed to be trained before mentorship to effectively facilitate career development and provide psychosocial support to trainee teachers during TP. This was despite some financial constraints which may hinder the training process. It also came out from the participants' responses in this study that there should be a policy on mentor selection, since it has become an issue of concern in many schools and colleges.

FGTSI had this to say,

The Department of Teacher Education is supposed to come in conjunction with the college to teach the mentors but it is very rare. The assessors from the college just come and assess their students. Sometimes, they don't even talk to their mentors. They just come and go. So, some of the mentors have not received this training. That makes it very difficult for some mentors to supervise these students.

FGT1W:

They should have some workshops before they give us students because it will be a burden for us to think about what I am supposed to do. And the students don't know what they are supposed to be doing. Mentors are not aware of what to do. So, if they have workshops before they give us their students, I think it will be very helpful to us.

FGT3T:

There are many problems encountered in the training of mentors, such as lack of resources in terms of finances and even time to conduct workshops, because the teacher at those schools will be busy with their work and the college will come with another load.

Regarding the same issue, the mentors' answers also reiterated what came out from other participants and the three focus groups. It emerged from the participants' responses that mentors needed to be trained before mentorship, to be fully equipped with necessary skills.

MS1a said,

If they train us, we are going to be aware of what to assess when assessing their students. I think if they give us the assessment documents before because sometimes the students give us the assessment documents asking us to just put our signatures, not aware of what I should be assessing.

MS1B said,

Normally, it is just once and they at times don't hold any workshops because we just see them once, especially in the Department of Teacher Education. I was not trained really, but am just a HOD. That's how I become a mentor.

MS2 said,

The government and the teachers' colleges should set a provision where there should be some workshops for the training of the mentors. The challenge is the issue of time. There is no time to spare for the training of mentors during school days. All mentors may want to be trained to be mentors. No one will want to be left out alone and in so doing, it means that this will affect the whole learning process, disturbing the teaching and learning process.

MS2B noted that,

Well, rarely, we don't get much training. It is like what happens is that they only pick one person from the school who is trained, you know, apparently attends a workshop and when that person attends workshops, brings the feedback to school and tells us what has been happening.

MS3A said,

I suggest they should come to the schools to train mentors and invite them at one central point. There are so many challenges that are faced by schools in training the mentors, such as shortage of cash. So, every institution is suffering from the economic crisis, which is facing every institution. We also do not have resources material. We also do not have human resources as well as the personnel to train the mentors.

MS3B stated,

I've not been trained. Like now, I'm mentoring students. Perhaps it is because we're in rural areas. Maybe, they do such workshops in town. So, there's no training that is being held. As for now, we are using our own experience which we acquired during the same process when we were doing the teaching practice.

MS3A said,

So, no training has been offered so far to us. I think the Department of Teacher Education, in conjunction with the college, is to make sure that they deploy the trainee teachers to mentors after training them for mentorship. It is very important and it is necessary to train mentors to equip them with adequate skills for mentorship. So, it will improve the quality of supervision that will be done by mentors to the trainee teachers.

The responses given by the lecturers in charge of the mathematics, science and physical education departments about the same issue indicated that they were also in accord with other participants' responses but they gave an excuse that the colleges could not train the mentors due to financial constraints. They also mentioned the issue of resources as a barrier to the training of mentors before TP starts. LICM noted that,

It is not being done. Overall, mentors are not being trained for mentorship. Some of the mentors leave our students with social problems and they don't assist them in any way. So, maybe training, that might help and also the training needs some resources since it is done through workshops.

LICS noted that,

For example, the college must budget for that. Yes. That's a big challenge, that of money and time to do it. Training can be done during the weekend.

LICM also observed that,

Mentor training is very important, given the technological advancements and also the change in syllabus. It is the other way around now. The trainee teacher is at an advanced stage than the mentor who is at the school because the practices that are in the school are old. Their curriculum or what they did is now outdated and new topics have been taken aboard in the schools.

LICS states that,

The major problem is the financial crisis which has struck our nation because we are looking at people from all over the country, who need to be trained. We are supposed to synchronise everything about teaching practice, including the colleges themselves. They should have a common ground on what is expected of the mentors.

LICPE also stated that,

Sometimes, the mentors will be expecting too much from the trainee teachers and there are certain misconceptions that these mentors might have in terms of how they should work with the trainee teachers. As I have alluded to earlier, some schools need somebody to work on their behalf. It is one of those challenges that colleges face in dealing with mentors. Another challenge is that of mentors not showing up for the workshops. Yes, it could be an attitude problem.

The Department of Teacher Education further explained the procedures to be followed for effective mentor training. However, it acknowledges the importance of mentor training before the beginning of the mentorship programme. For example, DTELK said,

I said we engaged aggressively with the teacher training colleges, by holding training, workshops and even presenting papers to colleges on mentorship. DTE can be invited during training to offer training on mentorship of these teachers. This is two-way but normally, the teachers' colleges train and the university is invited to be the core facilitator. So, in a way, we can say we both train, the university as well as the teacher's colleges and it cascades down even to the heads of schools who will also be monitoring the mentors to make sure that they are doing their work as per mandate.

The DTELk further explained the importance of mentor training when he said,

Once mentors are trained, they will be able to give exactly what we want. We want noble teachers and we want this profession to remain as noble as it should be. So, without training, we will not be able to catch up with the social, economic as well as cultural values.

The data presented in this article revealed that mentors were not trained at all. There was a gap in how mentors were selected. Most participants showed that mentors are supposed to be trained before they start the mentorship programme. There were challenges, such as financial constraints, that affected the capacity building of mentors. It came out from the participants' responses that Zimbabwe has been economically

crippled for a long time and as a result, it has become too difficult for the Ministry of Education, DTE and colleges to sponsor the training programme since there is no money to buy the needed materials and pay the facilitators and also to train mentor trainers. It came out as a suggestion from the participants that both mentors and trainee teachers may need to be remunerated or given any other form of appreciation to meet the cost of various commodities and materials to use during TP. It was also revealed that, without the training of mentors, the mentors' practices in the facilitation of career development and provision of psychosocial support will be ineffective. However, the findings of the study have not defined the content to be taught to the mentors during training, when and where training should take place, as well as who should train the mentors. This remains a big gap which also needs to be attended to.

## **DISCUSSION**

There is need for the training of mentors in career development and psychosocial support of trainee teachers during teaching practice. It emerged from the findings of the current study that teachers were not trained as mentors. Most mentors depend on knowledge they attained from college and a few on school staff development programmes. The above view is supported by recent studies showing that mentors are often not sure about their roles (Shumba, Rembe, Chacko and Luggya, 2016.) Regarding in-service training, the study established that some teachers in the selected schools had not received any form of in-service training,

The findings of the study showed that there was a gap in how mentors were selected. These were confirmed by recent research conducted by Maphosa and Namba (2012) which revealed that 19% of the mentors volunteered, while 81% were simply asked by school heads to be mentors. This is strongly backed by literature and documentary analysis data. It was found that there was a mismatch between the reality of today's schools, and the introduction of the new curriculum in Zimbabwe and the traditional teacher preparation paradigms still existing in teachers' colleges. This has also raised eyebrows concerning the preparation of trainee teachers in teacher education and the



type of mentors they will encounter in schools (Marais and Meier, 2004; Makura and Zireva, 2011; Mapfumo, Chitsiko and Chireshe, 2012). However, literature from the background of the study has revealed that in most African countries in the last two decades, school based mentoring has become an increasingly important component of the process by which trainee teachers begin to learn how to teach (Mpofu and Chimenga, 2016).

It was revealed in other schools that there were no stipulated regulations or a policy for mentor selection. Thus, literature confirmed that in most schools, mentor selection was done by the heads of the schools and in some rare cases mentors volunteered. On the contrary, most participants from the current study revealed that mentors are supposed to be trained before they go for mentorship. In support of the above idea, reviewed literature indicates that some institutions have automatically stopped training mentors due to economic hardships (Morrison, Ross, Morrison and Kalman, 2019).

Support seminars can be held as periodic meetings that are related to teacher standards, to provide adequate training. Mentors can be trained in various ways such as provision and assistance with policies and procedures, emotional support, introduction of school-based mentor programmes, use of traditional face-to-face classroom format and use of e-mentoring. However, literature advises that the mentors' basic training be done just after the selection of prospective mentors. There is no stipulated time for mentor training. Staggering training over a semester or even an entire year can be more effective when properly planned and done, but it may be challenging in terms of schedules within the situation calendar (Merriam and Grenier, 2019).

Ndamba and Chabaya (2011) suggest that the most effective way of recruiting mentors is by asking for volunteers. Literature review has also established that selected mentors are expected to have the following characteristics: display capability in classroom teaching, be an experienced senior teacher, be able to use a variety of teaching techniques or skills, be knowledgeable, enthusiastic, receptive, informed, eloquent, reliable, able to guide, have wisdom, be personally involved, be

people oriented, open minded, flexible, empathetic and collaborative (Freedman, 2009; Ngara and Ngwarai, 2013; Tshuma and Ndebele, 2015). However, mentor selection continues to be a challenging issue in Zimbabwe (Ngara and Ngwarai, 2013; Tshuma and Ndebele, 2015).

It came out as a suggestion from the participants' responses that both mentors and trainee teachers may be remunerated or given any other form of appreciation to meet the cost of various commodities and materials to use during TP. However, it was revealed that without the training of mentors, the mentor practices in career development and psychosocial support were inefficient. Literature suggests that mentors can be trained during the school holidays in April, August or December, which adds up to three months per annum, as an ongoing programme throughout the year (Mudavanhu and Majoni, 2003).

Literature also concurs with the findings of the study, that mentors are expected to consistently attend staff development workshops at which they must receive food and transport allowances, so that they are well informed on what to expect from trainee teachers and how to use the supervision or assessment documents used by the teacher training colleges (Asiyai, 2017). Furthermore, they are supposed to be trained in communication and active listening techniques, relationship skills, effective teaching, models of supervision and coaching, conflict resolution and problem-solving (Ndamba and Chabaya, 2011).

However, literature shows that local colleges and universities and non-profit making organisations may find it challenging to consistently conduct mentoring programmes. It also emerged from literature that mentors can also commit themselves to meet regularly with trainee teachers for a minimum of six months, to strengthen their relationship and to achieve the goals of mentoring or have a positive impact on trainee teacher achievement. Experienced teachers must help in inducting beginner teachers on mentoring programmes such as in-service training of teachers and staff development activities (Hobson, Ashby, Malderez and Tomlinson, 2009). Mentorship programmes, peer teacher mentoring and induction

programmes must be introduced to support mentorship. The results of the current study concur with reviewed literature which notes that there are also challenges such as financial constraints, negative attitude towards mentorship programme by some of the stakeholders, emotional, career and psychosocial problems, affecting the capacity building of mentors. It has been found that the major challenges relate to financial constraints. Zimbabwe has had chronic economic challenges which make it difficult for the Ministry of Education, DTE and colleges to sponsor the training programmes. Thus, experienced and qualified teachers in schools need consistent and effective in-house training in mentorship.

The crucial issues that have emerged from the discussion are that mentors' basic training can be done just after the selection of prospective mentors, since there is no stipulated time for mentor training. Staggering training over a semester or even an entire year can be more effective when properly planned.

The study also came up with recommended characteristics of a good mentor which are: displaying capability in classroom teaching, being an experienced senior teacher, being able to use a variety of teaching techniques or skills, being knowledgeable, enthusiastic, receptive, informed, eloquent, reliable, being able to guide, having wisdom and personal involvement, being people-oriented, open-minded, flexible, empathetic and collaborative (Hudson, 2017). Mentors and trainee teachers should be remunerated or given any other form of appreciation to meet the cost of various commodities and materials to use during TP. Mentors should be trained during the school holidays, which constitutes three months per annum, as an ongoing programme throughout the year. Mentors are expected to consistently attend staff development workshops at which they must receive food and transport allowances so that they are well informed on what to expect from trainee teachers and how to use the supervision or assessment critique forms used by the teacher training colleges.

## **CONCLUSION AND RECOMMENDATIONS**

It emerged from the study that mentors were not trained, therefore, mentors needed to be trained before the mentorship

programme. It came out from the current study that most mentors depended on knowledge they attained from the college where they trained as teachers and a few on school staff development programmes. Thus, mentors were to be trained to effectively provide career development and psychosocial support. It emerged from the study that mentors were not at all being trained to become mentors. Thus, there was a gap in capacity building of mentors and in mentor selection.

It emerged from the study that mentors were supposed to be trained before the mentorship programme commences. Furthermore, the study found that there were also challenges, such as financial constraints, that were affecting the capacity building of the mentors during TP.

The important issues that emerged from the study are that mentors should be well informed on what to expect from trainee teachers and how to use the supervision or assessment forms or documents used by the teacher training colleges. Mentors are supposed to be trained in communication and active listening techniques, relationship skills, effective teaching, models of supervision and coaching, conflict resolution and problem solving. Schools and colleges are expected to develop and implement an ongoing mentor training programme that continues throughout the mentoring process to produce the greatest positive effect on trainee teachers.

The colleges and schools should constantly review their codes of conduct so that they are relevant to the prevailing situation. There is need for initiation of the mentor training, staff development and in-service training programmes for school mentors since some mentors are not trained. The effectiveness of this programme is depended on a fully functional and trained staff so that trainee teachers are developed holistically. The Ministry of Primary and Secondary Education (MoPSE) and schools should reduce the workloads of mentor teachers so that they can focus more on provision of career development and psychosocial support.

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