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Foreword

It is with great pleasure to publish the first volume of the Journal of Environmental Management in Zimbabwe (JEMZ).This is a great step in ensuring that environmental information is scientifically documented and made accessible in line with the dictates of our Constitution. Our first issues focuses on stakeholder participation, environmental policies, laws and regulations, waste management, environmental and human health risk, environmental degradation assessment, water resources management, as well as earth observation techniques in environmental management. This journal has been published in collaboration with technical partners from the University of Zimbabwe and Chinhoyi University of Technology and would like to applaud them for a job well done. This journal is partly a culmination of a long journey the Agency has taken sponsoring research at Masters level in Zimbabwe and it also documents several self-sponsored research.

The journal is open to all. JEMZ offers a window to scientists to publish research that can influence policy. We are in an era where decisions should be science based. The country is currently grappling with challenges from Veld fires, land degradation, wetlands degradation and invasive alien species. Through this journal l call for new technologies and novel approaches for restoration of degraded lands, dealing with emerging invasive alien species such as vernonathura polynthes, air pollution abatement and efficient waste to energy solutions. The focus of research has to shift nationally, the focus should be on applied research that can uplift our communities. The journal is a challenge to all scientists to get their work documented and go through the rigours of peer review.

A Chigona

Director General

Preface

An overview of environmental management in Zimbabwe

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This first issue of the Journal of Environmental Management in Zimbabwe (JEMZ) is a compilation of selected papers that were presented at two research symposia hosted in 2016 and 2019 by the Environmental Management Agency (EMA) in Harare, Zimbabwe, as well as contributions from multi and inter disciplinary studies carried out in the country in the last five years. It is our sincere hope that this issue marks the beginning of a new era in environmental research and dissemination in the country and beyond. JEMZ aims to offer researchers not only an opportunity to publish their work but also establish the current status of the environment and environmental management the country. More importantly, JEMZ aims to be an authoritative source of environmental data in the country, and provides the basis for policy crafting and analysis.

This inaugural volume contains 17 peer-reviewed papers related to integrated environmental management in Zimbabwe and are a culmination of extensive research in six broad themes, namely, (1) stakeholder participation (2) environmental policies, laws and regulations (3) waste management, environmental and human health risk (4) environmental degradation assessment (5) water resources management, as well as (6) earth observation techniques in environmental management. As an environmentally concerned Southern African Development Community (SADC) member, Zimbabwe has endorsed concepts of Environmental Management, thus making these thematic areas critical for sustainable development. Issues addressed in this

journal also contribute towards building knowledge to facilitate sustainable environmental actions aimed at fulfilling objectives of the Africa We Want (Agenda 2063). Furthermore, by virtue of being a full member of the UN, Zimbabwe subscribes to the ideals of the Sustainable Development Goals (SDGs), and these thematic areas were selected in the light of their importance to sustainable development.

Zimbabwe, currently faces wide range of environmental challenges ranging from pollution (air, water, soil) from both point and non-point sources, environmental, wetland destruction and degradation, veld fires, invasive alien species, deforestation, illegal harvesting and trade in natural resources such as fish and wildlife, sand mining, soil erosion, rampant artisanal gold panning, waste management and inappropriate agricultural practices. The country just like the rest of the world also suffers from a surge in plastic pollution. These environmental threats are on the increase in the country and have important implications for human welfare including public health. The aforementioned environmental threats are exacerbated by rapid population increase, illegal land occupations, human displacement and resettlement, urbanization, as well as climate change. These challenges require that the country join hands with the global scientific community, to find sustainable solutions. Therefore, this journal offers an opportunity for researchers to explore these environmental issues and contribute towards providing science based environmental solutions that are complemented by stakeholder engagement.

The volume provides a platform to share knowledge on contemporary environmental issues, not only for academics, but also for policy makers, local authorities, industry and relevant stakeholders. Ultimately the journal aims at contributing to knowledge and innovative approaches and models in environmental sciences that facilitate informed decision-making and policy formulation by environmental managers and practitioners in the region. Whist the research themes have a wider scope to cater for diverse environmental aspects, the review process is stringent, rendering the papers and the research credible.

The editors wish to thank all the contributing authors for their efforts, EMA which facilitated and funded some of the research presented in this volume and the numerous reviewers who provided insightful comments made the production of high-quality papers and this journal possible.

JEMZ Editorial Committee

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PEOPLE'S ATTITUDE AND PERCEPTIONS TOWARDS BIODIVERSITY AND ECOSYSTEM SERVICES IN COWDRAY PARK, BULAWAYO.

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Abstract

As urban areas in Zimbabwe continue to expand, biodiversity and ecosystem services have been exposed to unsustainable exploitation as citizens strive to earn a living. This study sought to investigate people's perceptions of ecosystem services in Cowdray Park because it is one of the biggest high-density suburbs in Bulawayo, Zimbabwe. The study used mixed methods of collecting data from 160 randomly selected residents of Cowdray Park and stratified according to age for easy focus group discussions. Participants from Bulawayo City Council, Environmental Management Agency and National Parks and Wildlife shared their knowledge on the current environmental issues in Cowdray Park through semi-structured interviews. Inspired by the Theory of Planned Behaviour (behaviours are determined by attitudes) the assumption was that a positive attitude should be indicative of sustainable environmental behaviour and practices. However, it was discovered that perceptions do not necessarily indicate behaviour. Results from the focus group discussion revealed that 51% of the participants value ecosystem services for their utilities more than one's willingness to conserve them. In as much as ecosystem services are meant to be a source of livelihood in Cowdray Park, they are unsustainably exploited. Sand abstraction, quarry pounding and firewood selling have dominated the market while urban farming is done to fight poverty. The study, therefore, recommends a reaffirmation of social norms and strengthening of both formal and informal institutions to improve environmental management strategies.

Key Words: Biodiversity, Cowdray Park, Ecosystem Services, New Environmental Paradigm, Perceptions.

Introduction

Pinpointing the exact dates when the environment conservation debate started is very difficult but Nhamo and Inyang (2011) acknowledge that efforts to conserve the environment started as early as the 1880s. The first recognized effort was made by Switzerland to establish a regional agreement on the conservation of migrating birds and later in 1886, an agreement on regulating salmon fisheries was signed between The Netherlands, Luxembourg, Germany and Switzerland (Nhamo and Inyang, 2011). The internationalization of environmental management gained prominence in the 1970s stretching to the 1990s through the enactment of various conventions inclusive of Convention on Wetlands of International Importance (1971), Convention on International Trade in Endangered Species (1973), Convention on Biodiversity as well as Convention to Combat Desertification (1994), (World Bank, 2014).

The inevitability of urban expansion and development have subjected biodiversity and ecosystem services to stress as urbanites have proven to be the most consumers of ecosystem services, (Grimm *et al* 2008, Folke *et al*, 2011, Kay 2016,). In 1987 the Bruntland Commission published a report, *Our Common Future,* addressing the clashes between economic growth and environmental stability. It was underscored that development should meet the needs of today without compromising the needs of tomorrow, (Stoddart, 2011). In substantiation, Elmqvist *et al* (2013) observe that research has been silent on the governance of urban biodiversity and ecosystem services yet ignoring proper management of biodiversity and ecosystem services negatively affects the world which has been seen through climate change.

Biodiversity and Ecosystem services management in Zimbabwe is also informed by the need to balance it with economic growth and development. Mawere (2013), states that environmental conservation in Zimbabwe is disturbed by many factors inclusive of the introduction of scientific methods instead of indigenous knowledge systems. In aggravation, urban planners seem to be turning a blind eye towards the environment, (Chirisa and Matamanda, 2014).

In support of the above, Banga (2013) opines that not only does the environment suffer the aftermath of urbanisation, biodiversity is also lost due to unsustainable urban farming and animal husbandry. In as much as urban agriculture mitigates poverty, its contribution to depletion of biodiversity is worth noting. This is an emphasis on Elmqvist *et al* (2013)'s argument that urban ecosystem services and biodiversity suffer a lot from human errors and actions. It was at the centre of this study to investigate the people's position in this environmental management discourse for the conservation of biodiversity and ecosystem services in Cowdray Park. The study was guided by the following objectives

Objectives

1. To investigate people's perceptions of the environment in Cowdray Park.
2. To assess people's value for ecosystem services in Cowdray Park
3. To establish methods to promote behavioural change in environmental management in Cowdray Park.

Literature Review

The Convention on Biological Diversity (1992), defines biodiversity as the diversification of living organisms and the complexities of the categories in which they are part. Mace *et al* (2012) observe that this definition leaves room for actors to set standards that differentiate human beings from the rest of biodiversity. In as much as research acknowledge that there is a difference between biodiversity and human beings, Houde (2007), is of the view that ecological

complexities are further widened by social constructs. Bastian (2012) simply refers to biodiversity as a variety of life on earth, ranging from plants, animals or any other microorganisms, thus, biodiversity is all about life.

According to the CBD (1992), biodiversity is categorised in three main groups inclusive of genetic diversity, species diversity and ecosystem diversity. Under the genetic, all species are believed to be connected one way or the other through genes (Bastian 2012). Species diversity is a variety within a particular habitat or region (Bastian, 2012). These species vary depending on the conduciveness of the carrying environment. Ecological diversity has to be protected to maintain a healthy network, (Constanza *et al* (2007, Rhodes and Hockings, 2014).

Biodiversity and ecosystem services are intertwined concepts that are hard to study in isolation of each other, (Mace, 2012). MEA (2005), states that ecosystem services (*cultural, provisioning, regulatory and supporting services*) are benefits that individuals obtain from the environment. The link between the two is anchored on biodiversity as a facilitator of the provisioning of ecosystem services, thus ecosystem services are largely dependent on biodiversity.

The United Nations Earth Summit of 1992 has been credited for proposing the need to conserve the environment at three levels inclusive of species, ecosystems and genetic diversity, (Kay, 2016). In Zimbabwe, the Environmental Management Agency was enacted in line with the provisions of Rio de Janeiro to facilitate the management of the environment and ecosystem services nationwide. Before that, numerous Acts were put in place to manage natural resources in Zimbabwe through the Natural Resources Board. Some of these include Natural Resources (1942), Forest Act (1948), Parks and Wildlife Act (1949), Parks and Wildlife Act (1975), (Murombedzi 2003). These Acts were blamed for inefficiency because of their lack of

communal involvement in managing natural resources which later on necessitated the birth of Communal Based Natural Resources Management in line with the Kyoto Protocol Agenda 21.

In 2002 the Environmental Management Act (Chapter 20:27) was enacted and it annulled The Atmospheric Pollution Prevention Act (Chapter 20:03), The Hazardous Substances and Article Act (Chapter15:05), Natural Resources Act (Chapter 20:13) (Mutambara, 2005). This new Act ushered in an environmental management approach that is centred at 'intergenerational equity', harmful-free and clean environment through working together with all relevant stakeholders.

The State of biodiversity and urbanisation in Africa

Africa is believed to be rich in biodiversity with its living organisms constituting almost a quarter of global biodiversity, (UNEP-WCMC, 2016). However, a decline in species has been recorded in 2014 where it was noted that 6 419 animals and 3148 plants were under threat of extinction according to the IUCN Red List (UNEP-WCMC, 2016). 21% of freshwater species are also recorded to be under threat where 45% of freshwater species and 58% of freshwater plant species in Africa are also under threat due to overexploitation. These declines are said to be more in Western and Central Africa than in Southern or Eastern Africa, (Craigie, *et al* 2010). Although experienced at different levels, biodiversity loss is a common challenge in Africa.

The growing demand for biodiversity and ecosystem services is attributed to population growth in Africa. World Bank (2011) projected that the population of Africa would grow at 2.3 % by 2015. Although Africa is still largely rural, it is urbanising faster with its urban population expected to triple from 395 million in 2010 to at least 1.339 billion in 2050, (Burak *et al*, 2017). Urban expansion in Africa is said to be associated with "unplanned and unregulated" growth further aggravated by "weak planning institutions" resulting in biodiversity loss, (Pieterse and Parnell, 2014 cited in Burak *et al* 2017: 2). Biodiversity loss negatively affects the availability of ecosystem services which consequently affects people at large (Cardinale *et al.* 2012).

Brawn (2017) summarises the causes of biodiversity loss as climate change, invasive alien species, pollution and habitat loss caused by the transformation of the natural environment to meet the needs of the people. In a research done in Cape Town, South Africa, Holmes *et al* (2012), note that biodiversity in the low land was at the verge of getting extinct due to agricultural habitat loss, urban development, mining, invasive plants as well as land degradation.

The same was also confirmed in a study conducted in Harare on *The effect of land-use change on the quality of urban wetland,* where Murungweni (2013) noted that housing development and crop cultivation in Harare have led to 13.4 % loss of wetland area in Monavale. This has consumed water logging areas that are used by wetland birds during breeding time. The scenic view is also affected when reeds, trees and grass are cleared destroying habitats for many bio-organisms. Murungweni (2013) further states that the Environmental Assessment Impact was not done because the Environmental Management Act was not yet in enacted, ironically the city was rapidly expanding to meet the government's target on housing for all by the year 2000. Both mentioned studies show a nexus between urban expansion and biodiversity loss aggravated by weak planning institutions.

Understanding Perceptions and Attitudes

Perceptions are a general overview of a particular object that determines an individual's attitude and ability to make a meaningful interpretation of the world, (Tanner-McAllister, 2014, Fischer *et al*, 2011). Psychologists argue that there is a tissue-thin difference between attitudes and perceptions. Perceptions determine one's attitude towards a given object. Attitude reflects the readiness of a person to act and hints on the manner one is to act. Similarly, Gordon (1935: 810) in Milfont and Duckitt (2010) defined attitudes as a '*mental and neural state of readiness, organised through experience and exerting a directive or dynamic influence upon individual's response to all objects and situations with which it is related*'.

A conclusion is, therefore, made that attitude is all about intention and behaviour. Regarding the environment, the behaviour is how people, either value or abuse their natural resources (Eden, 1993). Environmental behaviours are indicators of people's interaction with their environment and they are an outcome of attitude and perceptions, (Milfont and Duckitt 2010, Fischer, *et al.* 2011, Buckton 2014). They predict the future sustainability of the entire environment.

The Theory of Planned Behaviour (Ajzen and Fishbein, 1980)

This study was anchored on Ajzen and Fishbein 1980's Theory of Planned Behaviour. According to Ajzen and Fishbein (2012), an individual's behaviour is an output of a combination of attitude towards behaviour, subjective norm, and perceived behavioural control. Ajzen (2005) believes that when people have control over the performance of the behaviour, they tend to act per their intentions. Applying this theory, understanding people's subjective norms, attitude, behaviour as well as their ability to control perceived behaviour determined a general overview of people's attitude towards their environment.

Given that attitudes are a scale that weighs the behaviour of people, relevant and positive attitude results in a favourable behaviour, (Ferdous, 2010). Kim *et al.* (2013) argue that subjective norms include one's social beliefs on the limits one is expected to participate. This means that there are guiding social norms within every society which influence people's behaviour. To Fishbein and Ajzen (1980), beliefs or norms are acquired through direct observation, information received from external forces or by inferences made at personal levels. One can, then, argue that beliefs or norms are social constructs that individuals repeatedly consume until they become part of their everyday life. The third predictor of intention in this theory is perceived behavioural control, which gives an understanding of people's perceptions of their ability to partake in a behaviour (Ferdous, 2010). Sven (2010)

posits that external hindrances can impede the performance of any behaviour. It is within an individual's capacity to control and suppress these impediments. Likewise, the study was based on the notion that he who has positive thoughts about the environment should have a positive attitude towards conserving it.

Methodology

Area of Study

The study was carried out in Cowdray Park, a high-density suburb of Bulawayo, the second-largest city of Zimbabwe which is also the capital of Bulawayo Metropolitan Province. Bulawayo falls under Ecological Region IV which is characterised with very low rainfall of between 450 and 600 millimetres per year. Its vegetation is dominated by acacias and mopane woodland. According to EMA (2018), this region is experiencing overexploitation and deforestation as people exploit Mopane trees for firewood and fencing poles around their properties. Bulawayo's population was on the rise since 1952 and the highest growth rate of 9.02% was recorded in 1962. As the economy dropped in early 2000 there was an increase in emigration which saw a decrease in the population. As of 2017, it decreased by -0.47% leaving it at 642000. Cowdray Park is located about eighteen kilometres north-west of Bulawayo Central Business District. The suburb was developed in the early 1990s and it is one of the largest high-density suburbs of Bulawayo, (Manyepa, 2014). In 2005 Cowdray Park experienced a massive extension due to the Live well/Garikai/Hlalani Kuhle housing scheme which was meant to accommodate the victims of Operation Restore Order (Murambatsvina) which saw the demolition of informal houses around urban cities of Zimbabwe. About 700 by 200m^2 houses were built which translates to the exploration of around 14 hectares of virgin land and since then the suburb has been expanding, (Gumbo, 2014; Manyepa, 2014). It is

because of this rapid and continuous growth that this study sought to investigate the state of biodiversity loss and ecosystem services in Cowdray Park.

Research Design

The study used a case of Cowdray Park. A case study was chosen because it is explorative and allows an in-depth investigation of the subject matter based on real-time experiences. Data were collected using both qualitative and quantitative methods to cure bias that usually emanates from the interference of the researcher's preconceived insights. Using a mixed-method approach helped in complementing the weaknesses of both methods, thereby giving holistic findings.

Population, Sample Size and Sampling Methods (Stratified and Purposive)

Figure 1: Map of Zimbabwe and Bulawayo

According to ZIMSTAT (2012), Cowdray Park has approximately 45,115 residents which constituted the target population for this study. In determining the sample size, Sekeran (2003)' sample size table was adopted where it was argued that for a total population of 50 000, the sample size should be at least 357 however the saturation point was at 160 participants. The population was stratified into four as follows: 19 – 29 years (Young), 30 – 39 years (Middle Age), 40 – 49 years (Adults) and over 50 years (Older adults). Per each stratum, 40 respondents were randomly sampled to give a total of 160 participants. Six key informants (two from each) were purposively sampled from Bulawayo City Council (department of housing and planning), the Environmental Management Agency and National Parks and Wildlife Management based on the researcher's judgement that they had professional knowledge required for the study.

Data Collection Methods and analysis

Data was collected using semi-structured interviews with Key Informants from BCC staff, EMA and Parks officials. Questionnaires were distributed to gather information from the residents of Cowdray Park. Three focus group discussions were convened in Cowdray Park where participants had an opportunity to discuss their opinions on the current environmental debate. It was justified to use focus group discussions in this study because they used open-ended questions which facilitated the gathering of more useful data. Quantitative data were analysed using SPSS while ATLAS. Ti was used for qualitative data analysis and presented thematically.

Results and Discussion

Respondents' general environmental attitude and perceptions

To gather data on perceptions, the New Environment Management Paradigm (NEP) scale constituted the greater part of the questionnaire. The NEP was developed by Dunlap and Van Liere (1978) and has its roots in the United States of America's environmental movement of the 1960s-1970s (Anderson, *et al*, 2012). It shifts from the Dominant Social Paradigm's core

principles of treating human beings as independent from nature and envisions human beings as integral and dependent on the entire environment. This scale has15 statements which participants are expected to give their opinions on. Responding 'yes' to eight statements shows a positive attitude while responding yes to the other seven speaks of the negative perceptions towards the environment. Statements in red font confirm 'anti-environmental' attitude while those in black are pro-environmental management.

The NEP Scale Statements

1. *We are approaching the limit of the number of people the earth can support*
2. *Humans have the right to modify the natural environment to suit their needs*
3. *When humans interfere with nature it often produces disastrous consequences*
4. *Human ingenuity will ensure that we do not make the earth unliveable*
5. *Humans are seriously abusing the environment*
6. *The earth has plenty of natural resources if we just learn how to develop them*
7. *Plants and animals have as much right as humans to exist*
8. *The balance of nature is strong enough to cope with the impacts of modern industrial nations*
9. *Despite our special abilities, humans are still subject to the law of nature*
10. *The so-called 'ecological crisis' facing humankind has been greatly exaggerated*
11. *The earth is like a spaceship with very limited room and resources*
12. *Humans were meant to rule over the rest of nature*
13. *The balance of nature is very delicate*
14. *Humans will eventually learn enough about how nature works to be able to control it*
15. *If this continue on their present course, we will soon experience a major ecological catastrophe*

Collected data were coded into five main themes inclusive of Human Dominion (statements 2,7,12), Ecological Limits (1,6,11); Balance of Nature (5,8,9,13), Science and Technology (4,14) and Ecological Catastrophe (3,10,15).

The table below presents scores as per participants' responses.

Table 1: Respondents' scores to the NEP Scale (Number of participants-100)

	strongly agree		Agree		not sure		disagree		strongly disagree	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Humans have the right to modify the natural environment to suit their needs	8	5.0%	77	48.1%	0	0.0%	75	46.9%	0	0.0%
We are approaching the limit of the number of people the earth can support	28	17.5%	100	62.5%	0	0.0%	32	20.0%	0	0.0%
The balance of Nature is strong enough to cope with the impacts of modern industrial nations	0	0.0%	82	51.2%	0	0.0%	78	48.8%	0	0.0%
Human ingenuity will ensure that we do not make the earth unlivable	0	0.0%	80	50.0%	23	14.4%	57	35.6%	0	0.0%
If this continue on their present course, we will soon experience a major ecological catastrophe	32	20.0%	106	66.3%	14	8.8%	8	5.0%	0	0.0%

Summary of results per age group (Agree/Strongly Agree)

	The young (19-29 years) N=40	The Middle Age (30-39 years) N=40	Adults (40-49 years) N=40	Older Adults (above 50 years) N=40
Human Dominion	19	13	17	36
Ecological Limits	40	40	20	8
Balance of Nature	15	18	20	25
Science and Technology	28	23	2-	9
Ecological Catastrophe	40	40	40	28

Opinions on Human Dominion over ES in Cowdray Park

53% of the participants agreed that humans had the authority to modify natural resources to meet their needs. It was noted that the Older Adults (Above 50 years) had the highest respondents who acknowledged human dominion over the environment with a total of 36, 8 of which strongly agreed. This was attributed to their belief in biblical teachings that people were given authority to rule nature. Ecosystem services are perceived as a gift from God awaiting people to consume them for their benefit.

Opinions on Ecological limits and Ecological Catastrophe in Cowdray Park

78% (n=128) of the participants acknowledged that the earth was fast approaching the limits of its carrying capacity. The greater percentage of this came from the age groups 19-29 and 30-40 years where all 80 participants agreed. This was attributed to their exposure to current environmental debates presented via formal education, social platforms as well as electronic and print media. On the other hand, the older adults (above 50 years), dismissed the idea and argued that the earth was big enough to accommodate everyone and most people within the ages 40 and above 50 expressed interest in acquiring more land for building their houses. This

speaks to a pro-development attitude at the expense of the environment. It also shows ignorance of the dangers associated with environmental degradation in the area. In support of this, BCC acknowledged the inevitability of development and stated that '*we cannot stop development, we can only try to control it'*. This response, however, is silent on the implications of continuous development on the environment.

Opinions on the Balance of Nature and faith in Science and Technology

With regards to the balance of nature, people expressed ignorance of the catastrophic consequences of human interference with nature. 82 people (51%) agreed that the balance of nature was strong enough to cope with the impacts of modern industrial nations. This shows the distance that exists in Cowdray Park, between people and environmental management efforts. Failure to realise catastrophic results of human error and actions explains continuous depletion of biodiversity in Cowdray Park. Furthermore, people indicated their trust in modern technology and science to mitigate the effects of biodiversity loss within the area and the country at large. 78 (49%) people agreed that human innovations or ingenuity can mitigate the effects of environmental loss and make the earth liveable. It is important to note that the NEP scale was a bit confusing to the participants such that in some instances they either agreed or disagreed to contradicting statements. To address this gap, FGDs were convened and results are presented below.

ES Obtained in Cowdray Park and their value

The first FDG focused on ascertaining the ecosystem services derived from the surrounding area. It was discovered that provisioning (*Urban farming, sand abstraction, quarry pounding and firewood*) and cultural ES (*Aesthetic and recreation, spiritual fulfilment*) dominated the list of ecosystem services obtained as presented in the graph below.

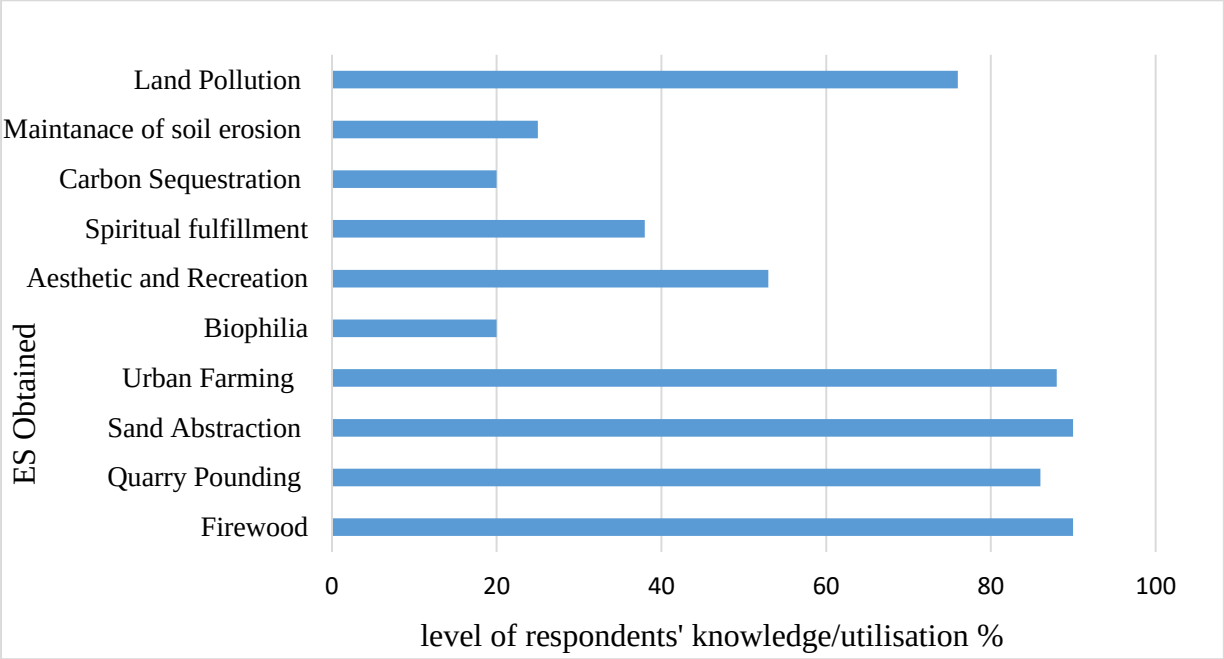

Figure 2: Ecosystem Services obtained in Cowdray Park

The graph above shows less interest in the connection people have with nature (*biophilia*), knowledge on the maintenance of soil erosion as well as knowledge on carbon sequestration. Building on Milfont and Duckitt (2010)'s argument that environmental attitudes are either utilitarian or preservation, results show that perceptions in Cowdray Park are biased towards the utilitarian approach. Most participants mentioned that they built their houses using sand abstracted from surrounding places in Cowdray Park. Some residents have since identified a business opportunity in sand abstraction where they sell it to other people within Bulawayo, but are very discrete to evade the law.

The FDG also gathered that construction has led to quarry pounding in Cowdray Park. However, it has exposed soil to erosion during rainy seasons which exposes biodiversity to more risk. It was revealed that one can pay from as little as US$3 per wheelbarrow of the quarry

to US$180- $200 per 7 tonnes which is far less than the official market price of US$250-US$320 per 7 tones. With the increasing construction taking place in Bulawayo, the worst is feared in sand abstraction and quarry pounding. Although BCC revealed that there are designated places from which people can legally abstract sand only if they are licensed, EMA stated that people are not forthcoming in terms of applying for licenses, probably because they want to avoid payment of taxes involved to maximise on their profits.

Unavailability of electricity in new parts of Cowdray Park leaves residents with no choice but to solely rely on firewood for energy. Some participants in areas with electricity preferred firewood to electricity "……*because it is cheaper and readily available'* and has also turned into a source of livelihood as they sell it for survival. Urban farming and allotment gardens are also rampant in the area. While Mabhena and Sithole (2014) argue that urban agriculture is a master weapon adopted by women to fight poverty it causes more damage to biodiversity than good.

People's value for Ecosystem Services in CP through a willingness to pay

FDG 2 and 3 investigated people's willingness to pay for ecosystem services. Participants were asked to choose a method of payment suitable for them from the following; (a) *Pay monthly tax* (b) *pay as they use* (c) *pay through donations to EMA* (d) *pay annually*. Results were as follows,

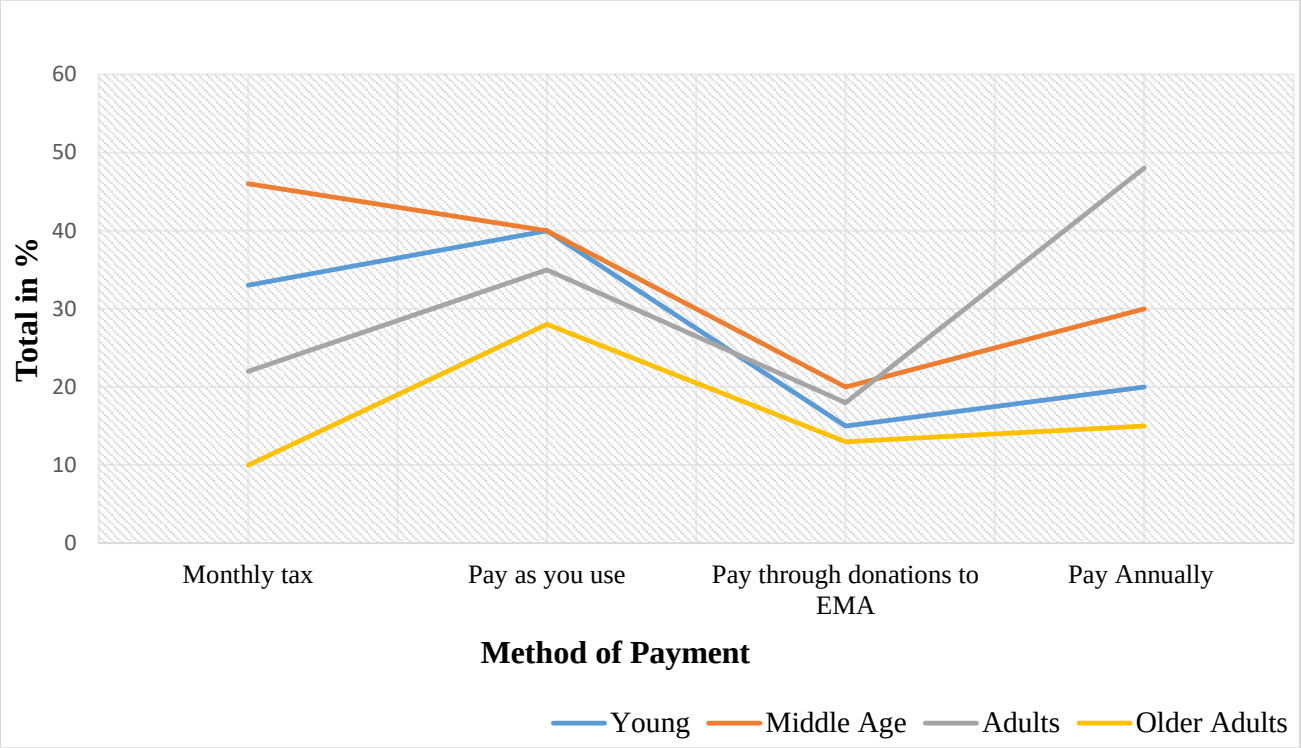

Figure 3: Preferred payment methods for Ecosystem services

The above graphical presentation shows that the majority of the residents of Cowdray Park are not willing to pay for Ecosystem Services. Respondents failed to understand why they should do that as they believed that natural resources were free so no one should claim ownership. The highest percentage was 48 (N = 19) of adults willing to pay tax annually to relevant authorities. Results reveal that older adults above the age of 50 years are less interested in paying with only 12.5% of the sampled willing to make donations to EMA towards environment management projects, only when they have something to donate. These results confirm the information given by BCC and EMA interviewees that people in Cowdray Park are not willing to pay as indicated by their defaulting in paying monthly stipulated rates of $10.00 per household. This money was meant to carter for refuse collection since water is not yet connected rather people preferred dumping garbage within the area. Results from this study agree with James (2015)'s view that valuation of ecosystem services has a monetary connotation such that people risk

selling nature and further states that confusion in valuing ecosystem services arises when trying to account for non-monetary value services. Similarly, people failed to express the monetary value of various benefits they get in Cowdray Park. Therefore, conserving ES from a utilitarian viewpoint stood out to be a complex and less effective method because it focuses on attaching value to a selected few aspects considered important to individuals.

Conclusion and Recommendations

Participants argued that people lacked knowledge of environmental management issues because of limited communication between relevant authorities and the residents. Bylaws and social norms are undermined thereby worsening the situation. Awareness and dissemination of knowledge were suggested cited as major strategies that can promote behavioural change in Cowdray Park.

From the Theory of Planned Behaviour, perceptions should determine behaviour, that is, positive attitude should, ultimately, indicate one's willingness to value and conserve the environment. As such, with an average of 51% pro-environment perceptions, one would expect to have more or less the same percentage of people willing to pay for ES, however, only 22% were willing to pay for the main ecosystem services enjoyed in Cowdray Park. Therefore, it is concluded that perceptions are not necessarily predictors of behaviour. There is a significant gap that exists among perceptions/attitudes and behaviour while utilitarian framing has proven to be less credible in determining the value of ecosystem services. The study recommends that,

- Future research should consider focusing on quantifying and characterising ES across Cowdray Park through keeping an ES inventory using tools such as Ecological Footprint to assist in keeping track on the utilisation and conservation of ES for sustainability.

- Local authorities should be given autonomy to run and deliver services without outside influence.
- Policies made should be implemented and practised as per their provisions. Information should be effectively disseminated to people using relevant channels to improve awareness.
- Deterrent penalties should be charged to promote biodiversity conservation.
- Affirmation of social norms and the establishment of viable formal and informal institutions is encouraged. A four-step-path towards **Sustainable Behaviours** is proposed: (1) ***adequate and comprehensible knowledge*** – an individual should know the benefits of managing the environment as well as dangers associated with mismanagement of ES. (2) ***viable formal and informal institutions*** – An individual should be governed by viable bylaws, policies and social norms to maintain sanity and these should be complementary (3) ***stimulus*** – knowing the benefits of conserving the environment, an individual is motivated to use natural resources sparingly and have (4) **positive *attitude/ perceptions*** *towards the environment.*

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Profit versus environmentalism: A study of policies and institutional framework affecting wetland management and conservation in Harare, 2000-2017

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ABSTRACT

This article investigate and analyze policies and institutional frameworks affecting the management and wetland conservation, trace the debates between capital and environmentalists and answer the question of whether economic development and environment protection are compatible in Zimbabwe using Harare, the capital city of Zimbabwe (member of the Ramsar Convention on Wetlands) as a case study. A mixed research methodology, comprising review of literature, interviews and document analysis forms the key methodology used in this study. The research made two important findings. Firstly, wetlands in Harare have been severely degraded by anthropogenic activities, with housing and commercial development as the major contributors to this degradation. Secondly, the research found that wetland degradation is closely linked to a lack of clear and harmonized policies and institutional framework both at national and local level which is caused by overlapping roles and functions among the various institutions and legislations. The study concludes that clear boundaries and harmonization of key policies and institutional arrangements is needed to promote the sustainability of wetlands in Harare.

Keywords: *Wetland management and conservation, Institutional framework, Wetland Governance, Harare.*

1. Introduction and Background

Wetlands are among the most productive ecosystems on earth and functions as the "kidneys" of the earth, which play an important role in maintaining ecological service functions. They offer important functions for hydrological and biogeochemical cycles. They are also among the world's most productive environments in terms of biodiversity and primary productivity and, therefore, offer natural resources that are often directly or indirectly exploited by humans for economic benefit (Barbier, 1993). Important ecosystem services provided by wetlands include storm prevention, flood control, water supply, maintenance of the water table and groundwater recharge as well as nutrient and pollution retention in flood-plains (Barbier, 1993). Wetlands also support rich wildlife, fisheries, fertile soil for agriculture, timber and energy supply as well as recreation and tourist opportunities. In the context of climate change, natural wetlands may act as important carbon sink, while the degradation and draining of wetland areas generally increases greenhouse emissions and accelerates global warming further (Barbier, 1993).

In spite of the important role of wetlands to the planet, it is clear that these ecosystems have been forgotten and often been abused. They are under intense pressure from anthropogenic factors that lead to their exploitation and, quite often, degradation. Some wetlands have been degraded by either reclaiming or changing the ecosystem to other land uses. Economic development and inconsistencies of the policies of the government also play an important role in this regard.

Kristen D. Schuyt (2005), R.K. Turner (1998), and other researches on wetland loss have concluded that wetland loss and degradation are due to economic development and inconsistencies of the policies of the government. Their findings reveal that over the past 40 years, approximately 90 percent of wetlands have been changed to other land-uses such as agriculture, residential complexes and industrial areas. In developed places such as California, New Zealand and Australia, it is estimated that socio-economic developments such as the erection of different infrastructure have damaged more than 90% of the wetlands (Chiras, 2001). Africa is also estimated to have lost more than 30% of these ecosystems (Chenje and Johnson, 1999). In Harare, over 30 wetlands have come under threat due to different uses such as housing, waste dumping, infrastructural development and agriculture

(*The Daily News*, July 20, 2014). However, some countries through the Ramsar Convention[1] have realized the potential of wetlands to the environment. For instance, Uganda, a developing country, values wetlands for the products they offer such as green bananas and wild fruits and have instituted policies that favour the management and conservation of these ecosystems (Emerton et al, 1999). In Rwanda, the government made a decision of relocating an industry that was constructed on a wetland area in order to rehabilitate and protect wetland areas (Mbambazi, 2011).

In Zimbabwe, many wetlands have been lost despite the commitments and obligations under the Ramsar Convention which clearly advocate the wise use and avoidance of wetland loss and degradation in the first instance. Across the country, there has been an illegal invasion of wetlands by groups and individuals who have ignored a statutory requirement to carry out an Environmental Impact Assessment (EIA) before any development takes place in the country. In most urban centres such as Harare, iconic wetlands have been turned into residential areas with some now a hive of commercial activities such as service stations and shopping malls. In most urban centres such as Harare, iconic wetlands have been turned into residential areas with some now a hive of commercial activities such as service stations and shopping malls. In Epworth, for instance, a wetland area has been invaded by a population of up to twenty thousand and put up very substandard residential structures, not even meeting the minimum of the expected standards and without proper infrastructure (Chirisa, Matamanda and Skiyi, 2016).

Environmental organisations in Harare such as Local Environment Action Plans (LEAP) and the Harare Wetlands Trust have been constantly complaining about the construction of

[1] The Convention took place in 1971 in the Iranian city of Ramsar. The Convention on Wetlands' broad aims were to halt the loss of wetlands and raising awareness about the important role that wetlands play in the economy, climate change and survival of humankind in general to enhance their wise use.

shopping malls and residential housing on wetlands, which they say will affect water supplies in urban areas in the future. In actual fact, the effects of wetlands loss are already taking place. For instance, the city of Harare is constantly experiencing water shortages with some areas going for more than two months without water since the city's major water source originates from the vleis (Birdlife Zimbabwe, 2015). Another effect that can be seen is the constant change in climate. Since wetlands act as a carbon sink,[2] their constant loss and degradation has accelerated global warming and in turn changed the weather patterns of Zimbabwe. Also, over the past years, rapid population growth in Harare has made people see wetlands as food security nets, readily available to the urban poor and this has resulted in the change of municipal responses to urban agriculture from making it illegal, to supportive programs resulting in establishment of domestic gardens on wetlands (Mandishona, 2011).

Environmentalists have become concerned about the disappearance of wetlands, but without the tools to enforce by-laws, treaties and conventions which Zimbabwe is signatory to, they cannot do much to protect these cradles of biological diversity that provide the water and productivity upon which countless species of plants and animals depend on for survival. Against this background, the thrust of this research sought to investigate and analyze policies and institutional frameworks affecting the management and wetland conservation, trace the debates between capital and environmentalists and answer the question of whether economic development and environment protection are compatible in Zimbabwe using Harare as a case study. The research also focused on determining possible intervention measures to minimise loss of these wetlands. This was done by examining policies and actions implemented by the Environmental Management Agency, the government and other institutional frameworks vis-à-vis the initiatives by capital. The nature and extension of contribution of ventures embarked on wetlands was also investigated. The study of institutional frameworks and policies in wetland management is of significance in maintaining and reinstating wetland integrity as appropriate measures can be put in place to improve the existing institutional and policies structures as expected under Ramsar guidelines for wise use of wetlands.

This article is structured as follows: Section 1 is an introductory and background which highlights the importance of examining institutional frameworks and policies affecting wetland conservation and management in Harare. Section 2 gives a description of the study area and outlines the methods of data collection and analysis. In Section 3, the research findings are presented and discussed. Finally, Section 4 concludes the research and highlights the implications of the research for wetland policy, especially in Zimbabwe. Other developing countries where wetlands are managed under multi-institutional systems should also benefit.

[2] A carbon sink is a natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period.

2. Materials and Methods

2.1 Description of the study area

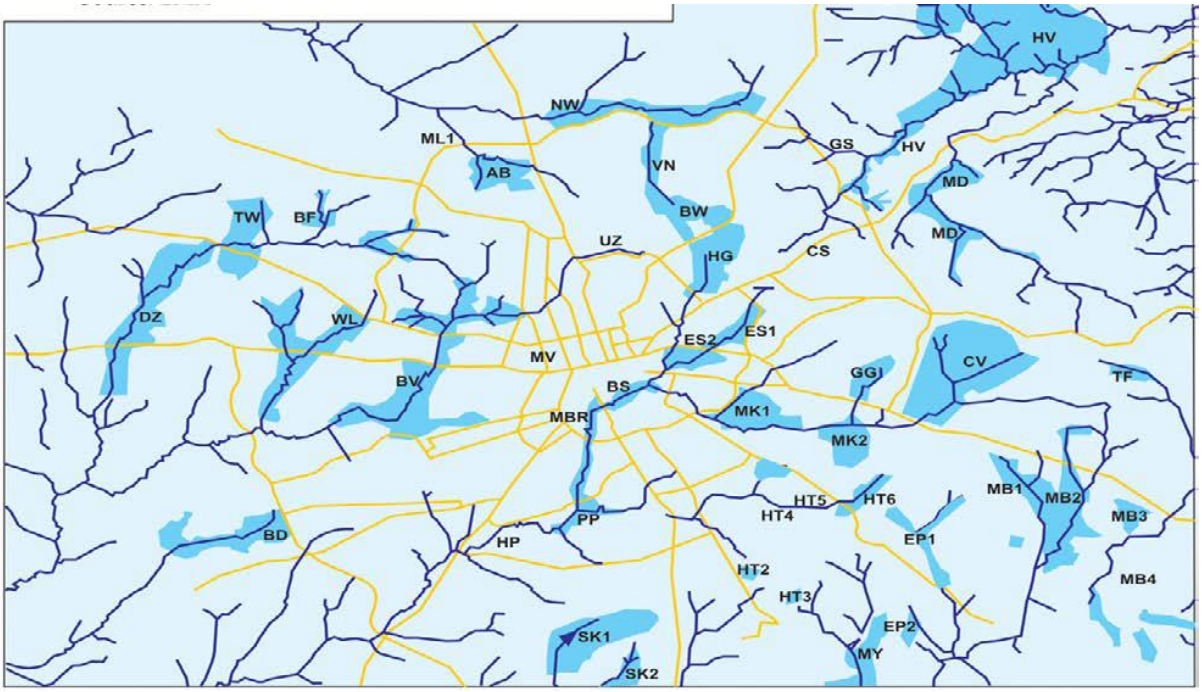
The study focuses on Harare wetlands. Harare is in the middle veld with an elevation of 1488m (T. Muronda, 2008). Founded in 1890 as Salisbury by Cecil Rhodes' mercenary[3] group (the Pioneer Column), Harare became a city in 1935. The area is covered by greenstone (Harare Shamva greenstone) and is surrounded by granite from which greyish brown sandy loams and coarse textured sandy soils are derived (Nyamapfene, 1991). The study area has a tropical climate and lies in agro-ecological region 2 with the total rainfall for the year ranging from 800-1000 mm (Nyamapfene, 1991). Temperatures for the day range between 7-22ºC especially in winter and 15-29ºC in summer (Nyamapfene, 1991). Different types of wetlands are found in the study area. Riverine and palustrine are most common and these include floodplains, riverine systems, dambos, vleis, pans, swamp and artificial impoundments such as Lake Chivero (Matiza and Crafter, 1997). The main riverine systems include Mukuvisi, Manyame and Marimba rivers (Matiza and Crafter, 1997). Vleis which are waterlogged seasonally are the most common wetlands in Harare.

Over the past decades population growth in Zimbabwe has inexorably increased the demand of land. According to Mr Mhofu (a worker at Mabelreign Municipality), Harare's population has more than doubled in the past years and is now estimated to be more than 2 million. This population growth has put pressure on Zimbabwe's urban land posing a threat to wetlands as people build on wetlands. Houses and upscale shopping malls have covered swampy areas (The Chronicle, 17 December 2016). For example, in Harare areas such as

[3] A small military force of the British South Africa Company.

Kuwadzana, Glen Norah, Waterfalls, Belvedere, Borrowdale and Malbereign have housing developments on marshlands (The Chronicle, 17 December 2016).

Harare has a large inventory of wetlands of which 26 were declared as protected areas through the Government Gazette 380 of 2013. However, the gazette is constantly withdrawn by the government due to its interest in socio-economic development rather than wetlands protection and conservation. In brief, the study included wetlands showing different ecological states, that is, relatively pristine wetlands and those that are degraded. The focus is on understanding how policies and institutional frameworks have affected wetland conservation and management in the urban area with different ecological conditions and trace the debates between capital and environmentalists. Wetlands being affected by policies and institutional framework in Harare include Monavale wetland, Borrowdale wetland (opposite race course), Budiriro 3 and 4 wetlands, Tynwald, Eastlea, Chisipite, Glenview, Glen Norah, Kuwadzana and Belvedere wetlands and these areas are shown in figure 1.



WETLAND CODE

AB – Ashbrittle	**CV – Cleveland**	**HP – Houghton**	**MD – Mandara**
TF – Tafara			
BD – Budiriro	**DZ – Dzivarasekwa**	**HT – Hatfield**	**MV – Monavale**
TW – Tynwald			
BF – Bluffhill	**EP – Epworth**	**HV – Helensvale**	**MY – Manyame**
VN – Vainona			
BS – Braeside	**ES – Eastlea**	**MBR – Mbare**	**NS – National Sports**
WS – Westlea			
BV – Belvedere	**GG – Greengrove**	**MK – Mukuvisi**	**NW – Northwood**
BW – Borrowdale West	**GS – Greystone Park**	**ML – Marlborough**	**PP – Prospect**
CS – Chisipite	**HG – Highlands**	**MB – Mabvuku**	**SK – Seke**

figure 1: wetland map of Harare
Source: EMA

2.2 Data Collection

The lens through which my analysis was made was largely informed by economic history. Economic history is the academic study of economies or economic events of the past focusing on the institutional dynamics of systems of production, labour, and capital, as well as the

economy's impact on society, culture and environment. It is both a quantitative and qualitative discipline which elevates economic processes and places premium on case study analysis. For this particular study, qualitative research methodology was employed. The qualitative methodology involved the use of interviews, government documents, policy documents and newspapers.

Documents produced by various sources were reviewed and analyzed. The review considered information relating to the use and management of wetlands. Content analysis was then used to analyze the information from the document review. The documents that informed the study include The Constitution of Zimbabwe (CoZ) Amendment No. 20 of 2013, Environmental Management Act (EM Act) [Chapter 20: 27], The Regional, Town and Country Planning Act [Chapter 29: 12] (RTCP), and Urban Councils Act [Chapter 29: 15] (UCA).

Structured in-depth interviews were held with key informants to collect information on conflicts and discord between institutions involved in wetland management and conversation due to divergent institutional mandates torn between socio-economic and environmental considerations. Key informants were selected from the Ministry of Environment, Climate Change, Tourism and Hospitality Industry, local authorities, environmental management officers, community leaders, and The Harare Wetlands Trust.

3. Results and Discussion

3.1 Institutions Governing and Managing Urban Wetlands in Harare (Zimbabwe)

Wetlands management and conservation in Zimbabwe since independence has been exposed to multi- institutional management. Central government departments, local district authorities,

private players, Non-Governmental Organizations (NGOs) and local people participate in wetland management as shown in figure 2. The participation of the institutions is mainly influenced by their diverse institutional mandate.

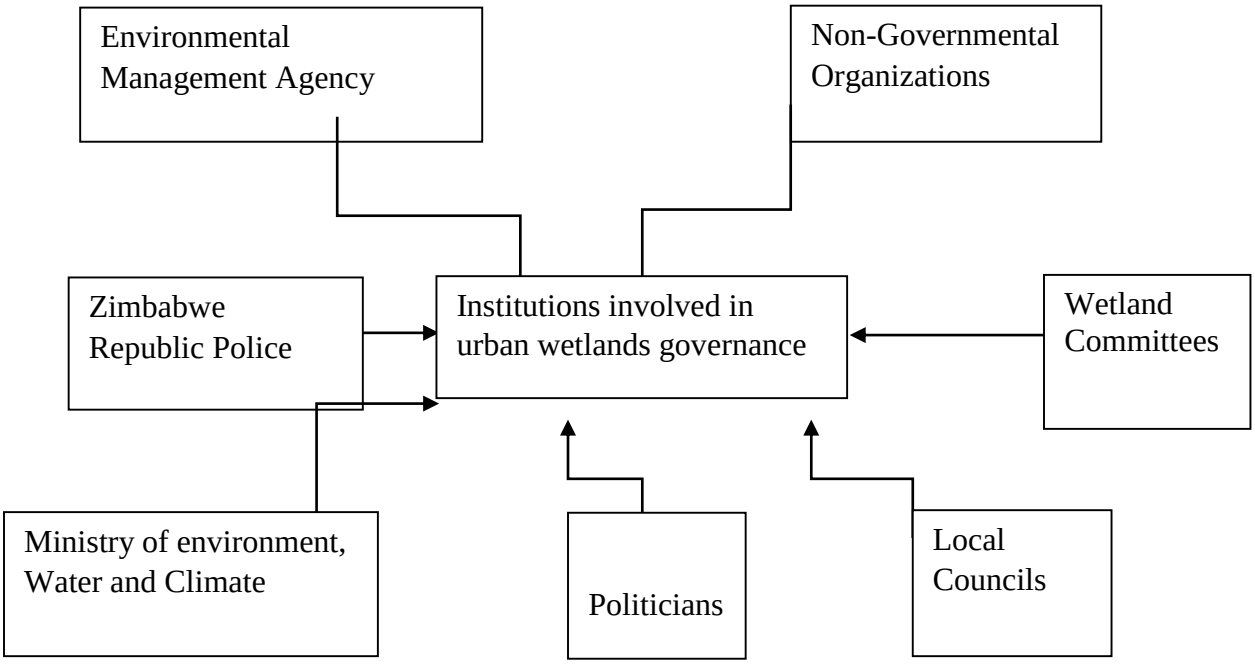


figure 2: institutions involved in urban wetlands governance.

The Ministry of Environment, Climate Change, Tourism and Hospitality Industry has overall responsibility for the environment, water and climate related issues in the country. MEWC aligns its aims and its objectives with the provisions of the Ramsar Convention of 1971. The management of wetlands is mandated to Environmental Management Agency (EMA), which is responsible for ensuring sustainable use of the country's natural resources for the benefit of all Zimbabweans. To fulfill its responsibility, the Agency plans, formulates, reviews, coordinates policy with a view of achieving sustainable development in the country. The Agency environmental responsibility also includes wetland conservation. One official from the Ministry reinforced this in a statement:

> "This Ministry is interested in the conversation and management of wetland ecosystem and tries to create policies that integrate these ecosystems so that they are effectively utilized to mitigate problems such as food shortages and stabilize climate as well as promoting tourism."

EMA is a statutory body whose mandate is to provide the sustainable management of natural resources and protection of the environment, the prevention of environmental degradation. EMA was designed to give implement the concept of "intergenerational equity," with reference to the 1987 Brundtland Commission's definition of sustainable development and petitioning current generations to consider the impact of their actions on future generation. In relation to wetland governance, the Agency is responsible for executing environmental policies, promoting wise use of wetlands, providing environmental awareness campaigns, education, and training, and undertaking any works deemed necessary or desirable for the protection or management of wetlands ecosystem where it appears to be in the best interest of the public or where in the opinion of the Agency (Moyo et al, 1991, p.31). In undertaking its mandate, EMA is obliged to maintain its core values which include stakeholder participation, transparency and professionalism.

Local authorities such as the Harare City Council (HCC) also play a part in wetland conservation and management. The HCC is responsible for governing the development in Harare. Through local development plans, HCC determines the land uses which may be approved in the city as mandated Urban Councils Act [Chapter 29.15]. The council is mandated to conserve the environment, and this is usually achieved through preserving specific sites such as wetland areas from further development projects.

The Harare Wetlands Trust, the Conservation Society of Monavale (COSMO), Environment Africa and BirdLife International are some prominent civic environmental organizations responsible for the conservation and management of some wetlands in Harare. In 2017, the Harare Wetlands Trust and COSMO managed to stop housing development on a piece of wetland in Monavale Vlei East through protests (The Herald, February 20 2017). The Monavale Vlei East is located on the Monavale Wetland Ramsar Site which is of global importance and one of the primary water sources in Harare (The Herald, February 20 2017). Likewise, BirdLife International and COSMO advocate for the wise use of wetlands in Harare. These organizations raise awareness on the importance of wetlands in urban environments.

3.2 Policies and legislation on Wetland Management in Harare (Zimbabwe)

Zimbabwe is a signatory to a number of international policies and multilateral environmental conventions related to wetlands. These include: the Ramsar Convention on Wetlands, the Convention on Biodiversity (CBD), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on the Conservation of Migratory Species of Wild Animals, Sustainable Development Goals (SDGs), and the Montreal Protocol. The most relevant conventions to wetlands in Harare are the Ramsar Convention, CBD and SDGs.

The Convention on Wetlands of International Importance more commonly known as the "Ramsar Convention" was adopted in Ramsar, Iran on 2 February 1971 and entered into

force in 1975 (Ramsar Convention Secretariat, 2016). However, Zimbabwe only ratified the convention on 3 May 2013 and seven wetlands were designated as RAMSAR Sites – Monavale Vlei, Cleveland Dam, Lake Chivero and Manyame (all in Harare), the Chinhoyi Caves, Mana Pools National Park, Victoria Falls National Park and Driefontein Grasslands near Mvuma in the Midlands (as shown in figure 3). The Ramsar Convention since its conception promotes and seeks for commitment from member countries to ensure wetlands are sustainably utilized and that these wetlands are planned for. EMA is responsible for localizing the provisions of the Ramsar Convention in Zimbabwe, and they partner with some institutions to ensure that such wetlands are well managed.

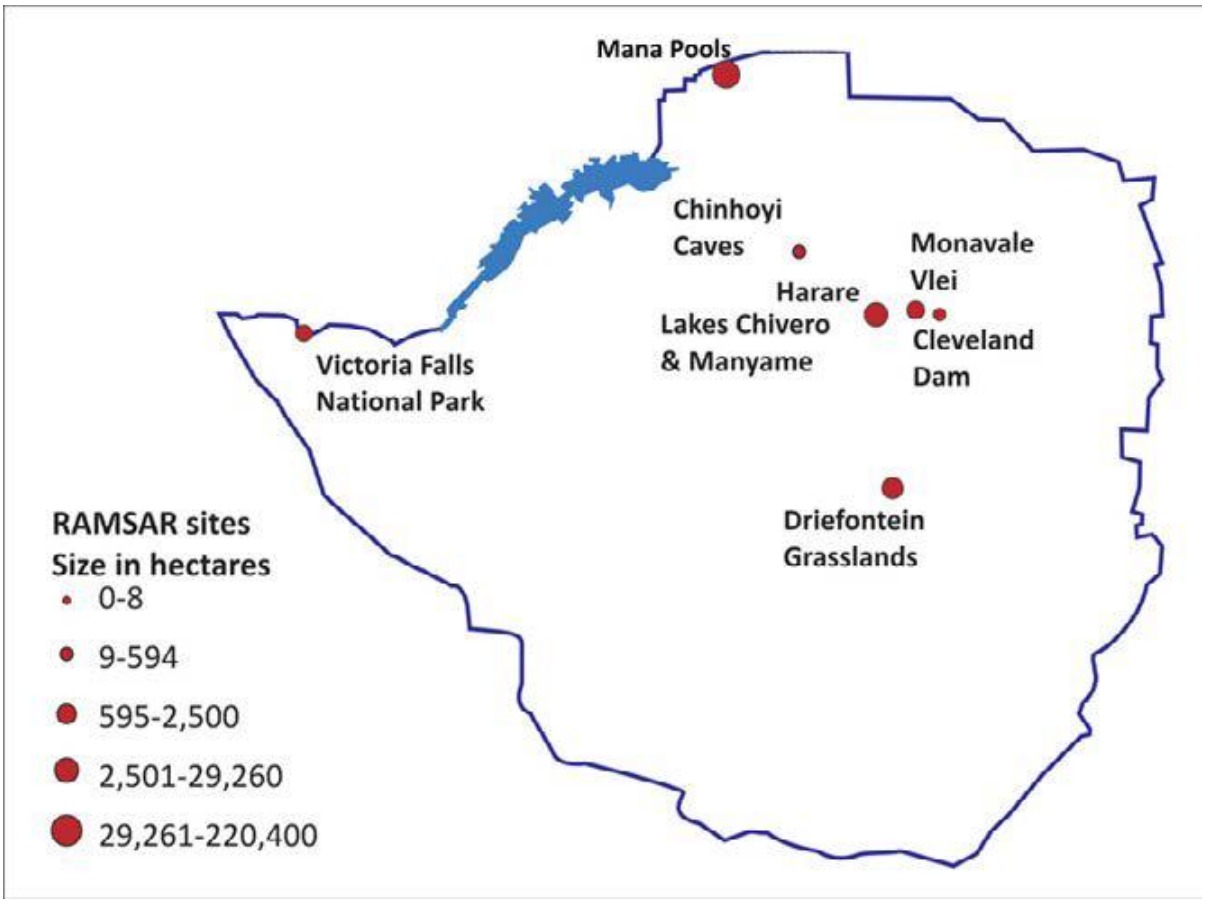


figure 3: Zimbabwe's Ramsar sites

SOURCE: EMA

Taking into view that Zimbabwe is a signatory to the SDGs, the management of wetlands is also informed by these goals. The conservation of wetlands is considered as a great milestone in achieving the SDGs (Wetlands International, 2017). The relevant SDGs that relate with the wetlands are Goal 2, 6 and 11 which envisages ending all forms of poverty

and hunger, ending water supply issues, and creating sustainable human settlements by 2030 (*Secretariat of the Convention on Biological Diversity,* 2015).

The CBD was adopted by global leaders in 1993 as a convention focusing on the conservation and sustainable use of biodiversity. The convention covers all levels of biodiversity and it includes possible domains that are directly or indirectly related to biodiversity. Taking into view that biodiversity is related with wetlands, the CBD is an essential convention in the wise use of wetlands. In 2010, the Aichi Biodiversity Targets (ABT) was set with the view to conserving biodiversity. From the 20 targets of the ABT, target 14 is especially applicable for the wise use of wetlands as it envisages that by 2020 ecosystems that provide important services, including services related to water, and contribute to health, livelihoods, and well-being are restored and protected, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable (*Secretariat of the Convention on Biological Diversity,* 2015).

Zimbabwe in its endeavour to protect the environment and to support the Ramsar Convention has put the provisions for the management of environment including wetlands under the Environmental Management Act (Chapter 20:27) enacted in 2002 (Act 13 of 2002) (Mutambara, 2005). The Act creates a framework for environmental management, makes provision for the formulation of environmental quality standard and develops the National Environmental Action plan.The act also encourages sustainable use of wetland resources by incorporating the public in the use and conservation and management of wetlands. Section 113(1) of the Act directly states that: "The Minister may declare any wetland to be an ecologically sensitive area and may impose limitations on development in or around such area." This section empowers the Minister of MEWC to decide on the use of certain wetlands and this shows that the decision of the Minister is usually final and

legitimate. Section 113(2) of the Act shows the activities which shall not be undertaken in wetlands and these include reclaiming or draining wetlands; disturbing wetlands in a way that degrades them, and introducing alien flora and fauna into wetland ecosystems. Accordingly, section 113(3) provides for the measures to be undertaken for those who fail to conform to subsection 113(2).

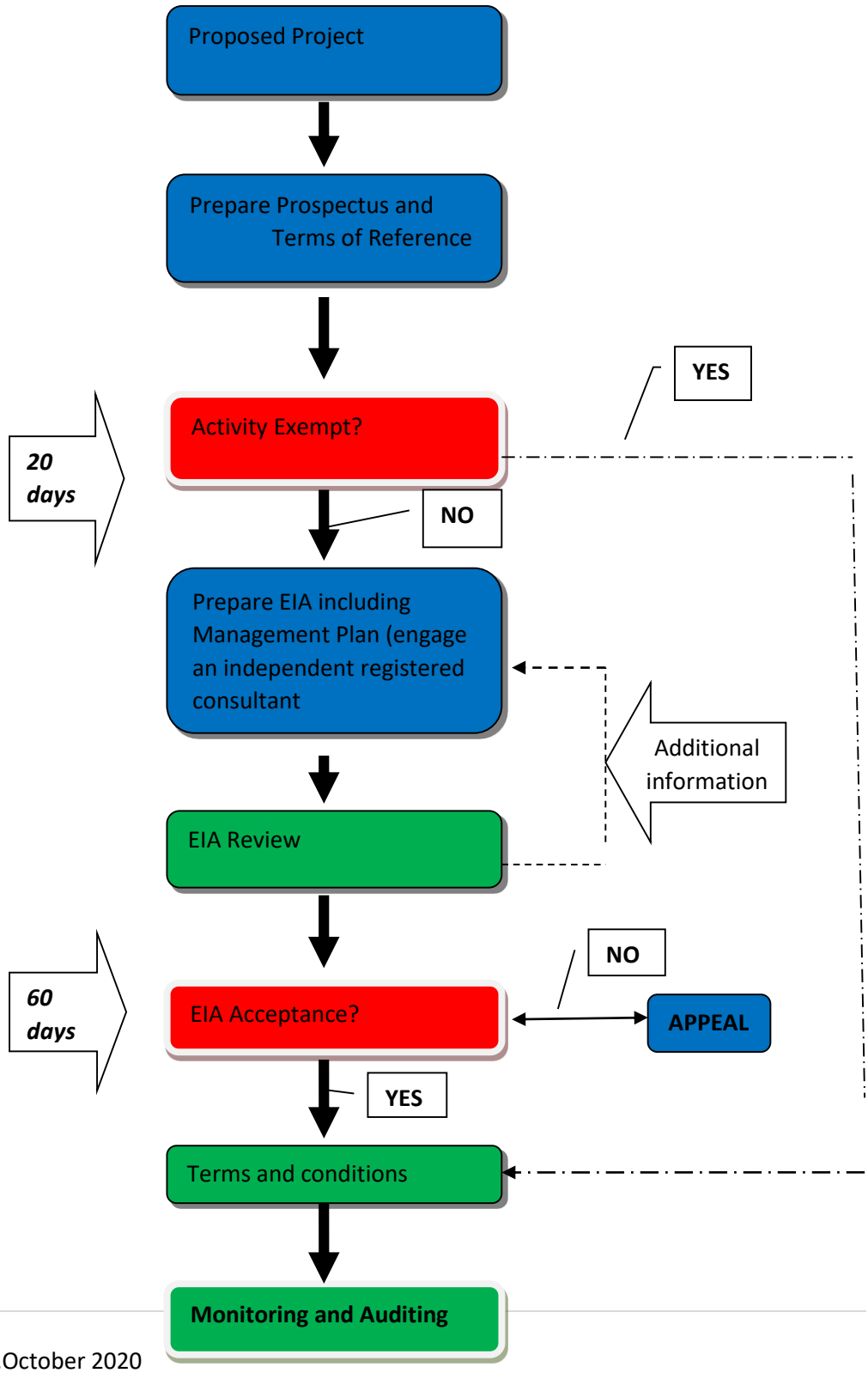
The statutory instrument 7 of 2007 is one of the policies that have placed more focus on wetlands management in Zimbabwe. According to an EMA official the statutory instrument offer for the prevention of veld fires, protection of wetlands and public streams. The statutory instrument provides licenses to wetlands users with a clear wetland management plan. According to EMA, any person who disregards the statutory instrument shall be on the wrong side of the law and will be liable to fine not exceeding six months or both such fine and imprisonment.

The Statutory 7 of 2007 comprise of the Environmental Impact Assessment and the Ecosystems Protection Regulations. The Environmental Impact Assessment (EIA) is a planning tool used to identify, predict, and measure potential impacts either negative or positive that may arise from planned projects, and come up with ways with which to minimise negative impacts and enhance positive ones. The EIA is used in wetland management and conservation. The Ministry of Environment and Climate Change published guidelines that would cover; mining and quarrying, forestry, agriculture, transport, energy, water, urban infrastructure and tourism (*The Herald*, January 29 2014). For each of these sectors, the guidelines shown in figure 4 provide examples of major activities that are likely to be undertaken for projects in the sector; the type of environmental impacts; possible

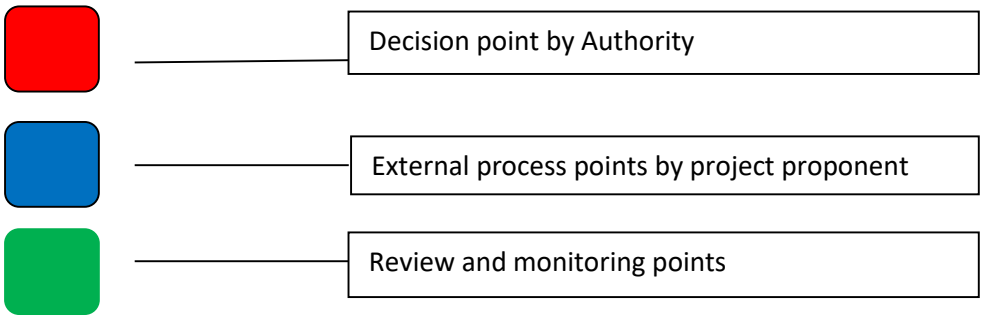
measures for managing such impacts; sample terms of reference and sources of information for use in an EIA study.

Figure 4: The EIA Process flow chart in Zimbabwe

Source: EMA



KEY


Decision point by Authority
External process points by project proponent
Review and monitoring points

The Regional, Town and Country Planning Act (RTCP) [Chapter 29: 12] guides and controls any form of planning and development in the country. The RTCP's objective is to plan infrastructure and other development with the aim of conserving and improving the physical environment so as to promote health, safety, order and general welfare. The Act provides for the protection of urban and rural amenities and the preservation of buildings and trees. Thus, indirectly, it stipulates that urban wetlands are part of the urban structure and forms part of its green and brown infrastructure. The RTCP Act Section 31 states that the local planning authority has the responsibility to serve the owner of the land with a preservation order of forests, water sources, and woodlands within its area of authority.

Urban Councils Act [Chapter 29: 15] provides for the administration of municipalities and towns through vesting powers in the local authorities. As one key informant from the HCC said during an in-depth interview, this Act legitimizes the management of wetlands by the HCC although the Act does not refer to use and management of wetlands. Municipalities and city councils own land within their boundaries and can dispose the land to prospective developers and generate revenue (Chakaipa, 2010). Section 181 in the Act empowers local authorities to control public streams by giving water rights and authority within the council's area.

DISCUSSIONS

3.3 Analysis of the Effectiveness of Existing Policies and Institutional Frameworks on Wetland Status and Trends

Harare is a wetland city, yet its wetlands are under immense pressure and their future sustainability is highly compromised. Top among the threats to wetlands in the city is the encroachment by infrastructure development, commercial activities, urban cultivation and urban population growth. From the review of existing policies and institutional frameworks governing wetlands in Zimbabwe and analysis of their effectiveness suggest that four key

interrelated factors contribute to the status quo of wetlands in Harare: institutional dynamics, political interference, corruption and nepotism, and poor knowledge of wetland law.

3.3.1 Institutional Dynamics

From the findings of the study, it was found that the major bottleneck to wetland management and conservation in Harare is the current institutional structure lack of co-ordination and the dominance of some institutions. The current institutional framework is riddled by confusion which originates from differences in institutional dimensions. Some institutions have seen other economic projects as more valuable and beneficial than protecting natural ecosystems, for example, the government and Harare City Council. Several schemes targeting residential and commercial property developments on wetland have been and continue to be approved by the HCC and the government of Zimbabwe according to Mhlanga, Maruziva and Buka (2018). The HCC has issued many land developers land on wetlands in the face of EMA notes one resident in an interview made by the researcher. An example of such developments is the construction of a vast hotel and shopping mall on a designated wetland adjacent to the National Sports Stadium in Belvedere. The facility was established by a Chinese company in the year 2013. Tsveta notes that the environmental agency and wetland committees are said to have backed down from taking legal action against the Chinese due to political pressure.

> The HCC and the Government of Zimbabwe are not doing a good job of governing and conserving the wetlands in Harare. According to the laws and policies listed on paper everything looks pretty good, but there are "flaws and inconsistencies" and policies and some statutes falter as policymakers miss the key variable which is the voice of some stakeholders at the grassroots level. Such was the case with the project of developing cluster homes on the wetland ecosystem of Monavale which was contested EMA and Harare Wetlands Trust. However, despite such contestations, the development of the cluster homes was undertaken on some of the wetland ecosystem mainly due to political intervention.

> The HCC and the government of Zimbabwe has high ambitions but economic pressure wins when it comes to wetlands conservation. This was elaborated on further by an official from HCC who explained the following:

> > "Our mandate is to conserve the environment when planning and designing the city. We try, by all means, to conserve wetlands by leaving them in their natural state. This is seen in the local development plans of the city where you can see that all the major wetlands were zoned as areas not to be developed. However, despite such efforts to conserve and manage the city wetlands, there are some political and economic factors that are now compromising our efforts. Furthermore, rapid urbanization in the city has forced the council to allow development in some of these wetlands."

From the foregoing quote, it can be deduced that in as much as the local authority feels the need to conserve wetlands, there are instances when they are rendered powerless owing to political and economic interference in their mandates. Furthermore, the pressure from urban growth has also increased the need for more land for urban development, and this has resulted in wetlands being sacrificed. Therefore, the institutional framework system for wetland management and conservation fails to embrace and localize the international conventions on wetlands, which then stifles the success of the localization of the initiatives.

3.3.2 Political Interference

Political interference has resulted in the belittling of wetland management and conservation as revealed by officers from government agencies. Political leaders have pursued populist policies to win the hearts of the electorate thereby allowing illegal use of the resource. Politicians have taken advantage of the poverty stricken environment and they have allocated land politically to the benefits votes. Part of this land is wet in nature. As a result of ZANU-PF dangling land as a carrot to woo urban voter, dozens of informal settlements have sprouted in the city with many of them allocated on wetlands. The use of land as a carrot to woo urban voters can be traced after the failure of the 'Yes' campaign[4].ZANU-PF undertook a number of state actions and strategies to ensure it remained in control. Understanding the role of land within the Zimbabwean society, Mugabe and his government tacitly allowed invasions of land occupied by white people in an attempt to gain support in the run-up to the 2000 parliamentary and 2002 presidential elections. Land provided a central organising theme for the 2000 and onwards ZANU- PF election campaign. Campaigning under the slogan "Land is the Economy and the Economy is Land", ZANU- PF emphasised land "as the sole authentic signifier of national belonging (Raftopolous, 2001)." As a result available land spaces in Harare which were mostly wetland areas were distributed to ZANU- PF supporters and thus undermining the effectiveness

[4] The 'Yes' campaign was introduced when the National Constitutional Assembly had responded with a national vote 'No' campaign in the run-up to the constitutional referendum in 1999. The constitutional reform was to make sure ZANU PF remained in control of the state and ensure that the opposition party would not take over the state. The Yes campaign was used by ZANU PF to win votes for the constitutional reform and the 'Yes' vote was largely hinged on land.

of institutional frameworks and policies in conserving and managing wetlands in the city. Wetlands in Harare that have been allocated as stands by politicians in order to gain votes during elections include those in Budiriro 3 and 4, Prospect, Tynwald, Glen Lorne, Eastlea, New Marlborough and that which is opposite the National Sports Stadium.

3.3.3. Corruption and nepotism

Corruption and nepotism are a stumbling block to effective implementation of the wetland legislation and policies. In practice, rules and existing sanctions around the Harare wetlands are selectively applied and corruption is rampant (Mutyavaviri, 2006). Bribes are sometimes paid to officers from government agencies by those who want to evade prosecution. This has left law-abiding citizens and the poor with no capacity to pay bribes displeased and not co-operating with environmental agencies in wetland protection. The need to preserve social relations has further weakened the ability of institutional leaders to monitor local people's adherence to law (Madebwe V and Madebwe C, 2005). The mere fact that these institutional leaders live with the people means that they have cordial social relations to maintain beyond natural resources conservation; hence they sometimes turn a blind eye to offences committed by relatives and friends. Interestingly, the authors of these wetland housing projects go unpunished, while the country bears deep scars arising from their selfishness. EMA argued that even if they fine the politicians they simply escape the fines and the punishment because they call the shots and not environmentalists. An example which can support this was given by one of COSMO officials who alluded that when one of the politicians (cannot be named) was slapped with a US$15 000 fine by the Environmental Management Agency (EMA) for conducting himself in a manner that endangered the environment by giving out wetland to gain support, the politician simply ignored the fine and continued to allocate land in Westlea wetland areas.

3.3.4. Poor knowledge of wetland law

Lack of understanding and appreciation of wetland law by local communities continue to foster poor wetland management and conservation in Harare. The majority of the households (74%) were not aware of the permitting system (EIA) and that wetland draining for cultivation was forbidden. Instead they were surprised to be prosecuted for such practices. The effect of such ignorance about wetland laws was also pointed out by Mutisi and Nhamo who stated that ignorance of the law was a common problem which resulted in illegal occupation of wetlands by urban dwellers. Therefore, as long as local communities are not privy to provisions of the law, defiance is likely to continue at the expense of wetland existence (Mutisi and Nhamo, 2015).

3.3.5. Effects of institutional dynamics, political interference, corruption and nepotism on wetlands

Inadequate policies and poor co-ordination of institutions have jeopardized the sustainability of ecosystem services provided by wetlands in Harare as there seem to be a lack of transparency, legitimacy, or accountability in relation to the use and management of wetlands. Overall, institutional dynamics, political interference, corruption and nepotism have had negative impacts on wetlands in Harare. These three key factors have resulted in land uses (infrastructural development, agriculture and waste dumping) that have had detrimental effects on wetlands ecosystems. The land uses have resulted in the alteration of water quality, indirect modification of the hydrological system and loss of habitat.

Wetlands in Harare have been under pressure due to infrastructural development. Examples of such developments are the construction of Sam Levy, Avondale pick n pay (supermarket) and Long Cheng Plaza. The infrastructural developments led to the clearing of the wetland vegetation on the construction sites and the subsequent was cleared thus distorting the ecosystem functions. Moreover, the flow of water in the wetland areas was disturbed as

buildings were erected during construction. Commenting on the amount of water found on the Belvedere wetland, one respondent said:

> In early 1970 when I started cultivating on this wetland there was a lot of water and this street was named Watermeyer because of too much water which was on this wetland. The wetland is now drying up because of these buildings (people's houses and Long Cheng Plaza mall).

Infrastructural developments have also resulted in pollution of water resources and reservoirs over time. Pollution of underground water has the potential of affecting the health of the city residents over time (Mandava, 2012). This is because the quality of water would have been altered due to introduction of foreign chemical components. For instance, one resident in Belvedere noted that during the construction of Long Cheng Plaza mall an excavator operating on the construction site spilled lubricants on the ground due to technical problems and thus this contributed in the deterioration of water quality in the wetland area. Malfunctioning sewer reticulation systems are a further source of pollution that has ended up in wetlands in urban areas. Harare has been experiencing sewer bursts due to the fact that the sewer system is old, overloaded and has not been maintained over the years (Moyo, 2005). The wetland areas therefore become sinks to the sewage that would have been directed into wetland areas. According to Mutisi and Nhamo, sewage components have eutrophication effects to wetlands that eventually accumulate nutrients which increase chemical oxygen demand in the water quality (Mutisi and Nhamo, 2015).

Further to this, infrastructural developments have resulted in the loss of beneficial habitats, loss of biodiversity and increase of run off on open surface areas. On the other hand, the increase of run on open surface areas has the potential of flooding the suburbs in Harare. Most respondents (90%) agreed with the fact that building houses and cultivation have destroyed the habitats of animals. One respondent said: *"*Most animals like warthogs have since left this wetland after the destruction of their habitats when this Chinese mall was built."

Human health has also been negatively impacted due to housing developments in wetlands. Goredema and Sithole (2013), show that diseases have emanated from the construction of houses due to the presence of water. They indicated that wetland areas have become waste dumping areas as these are deemed open and disused areas. This waste attracts scavengers and flies and as such, disease emanate from the dumping of waste. Diseases common in waterlogged areas are dysentery, cholera and diarrhoea amongst others.

Lastly, urban agriculture has contributed to wetland degradation. In instances were land is allocated in areas that overlook streams, cultivation of maize, sugarcane and vegetables have taken place. The application of fertilizers onto the wetlands has resulted in the

eutrophication and high acid content due to reactions that occur between chemicals and water present in wetlands.

The land uses have negatively impacted the wetland environment and attainment of wetland sustainability is now a "pie in the sky" meaning that the idea as noble as it is, it cannot be achieved. Overall, the ultimate goal to stifle the persisting degradation and loss of wetlands in the country is to reverse current trends of gradual and persistent reduction of wetland area in Harare and degradation of its ecosystem service functions by drastic changes to the existing wetland governance system.

Conclusion and Recommendations

This case study demonstrates how sound policies and institutional frameworks do not necessarily lead to successful management and conservation of natural resources and they can be rendered unimportant or even obsolete if they are not backed up by strong environmental institutions that can apply coercive measures uniformly across offenders, and curb power dynamics and political interference in decision making. Harare's wetlands are embroiled in a complicated matrix consisting of dysfunctional policies and institutions which all complicate the set objectives of attaining wetland sustainability. International treaties approved by the Government of Zimbabwe to protect and conserve wetland areas, carry little weight, questioning their significant and effectiveness not only in Zimbabwe, but anywhere else with somewhat similar conditions. Top-down determination of rules and exclusion of environmentalists, and those who live closest to the resource from deciding what the rules should be has created a perfect storm for a tragedy of the commons. To reverse the current trends of gradual and persistent reduction of wetland areas in Harare and degradation of its ecosystem service functions, extreme changes to the existing governance system is required. My findings and analysis lead me to make the following recommendations for wetlands management in Harare:

- In order to eradicate problems in wetland governance and conservation which emanate from institutional dynamics, there is need to reform the current institutional set-up. This

can be achieved by creating a framework to facilitate institutional meetings where common goals and work plans are drawn up so that unity of purpose in wetland conservation can be promoted between all institutions involved in wetland conservation and management. The country can achieve this by drawing lessons from Uganda whose system in wetland governance and conservation has been improving over the years. In Uganda, there is a highly structured institutional arrangement for wetland management, as this responsibility is vested in the Wetlands Inspection Division (Moses, 2008). Furthermore, given multi-institutional involvement in wetland management and conservation, for co-ordination purpose, the National Wetlands Inter-Agency Co-ordination Committee was established in Uganda and it operates at district and local levels (Moses, 2008). The establishment of wetlands inter-agency co-ordination committee in Zimbabwe would improve dissemination of wetland management and conservation information as well as monitoring of unsustainable practices in wetlands using sustainable land management tools just like in Uganda.

- Formulation of a single policy that specifically addresses wetlands and the ecosystem services they provide. The development of a national wetland policy, which recognizes indigenous practices, would encourage the adoption and adaptation of guiding principles on the utilization and management of wetlands in Harare. The country can achieve this by drawing lessons from Rwanda. The government of Rwanda in collaboration with the Ministry of Environment drew up a National Wetland Policy which pointed out the necessary procedures to be applied in the implementation of the policy into action (Twesigye and Mulisa, 2006). The government of Rwanda identified the institutions that are responsible for the management and conservation of wetlands and these institutions collaborated with each other and worked together especially in managing Gikondo wetland. Such a policy in Zimbabwe would be the go to point for

all wetland related issues and would preside over any other policies that directly or indirectly address wetlands.

For these recommendations to bear fruit, however, more coordinated collaboration is needed among local stakeholders interested in conserving and managing Harare's wetlands. Moreover, better science is needed to generate the economic and environmental justifications for wetland conservation and management. Ecosystem service valuation studies will definitely reveal that Harare's wetlands are probably one of the city most valued natural assets and that the future cost to the city and her residents for obtaining clean water and avoiding flooding are monumental compared to the cost of conservation.

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THE MANAGEMENT OF ELECTRONIC WASTE IN INSTITUTIONS OF HIGHER LEARNING IN GWERU, ZIMBABWE

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Abstract: *The usefulness of Information and Communication Technology (ICT) has led to an overwhelming elastic demand for electronics most computing devices and learning institutions are adopting ICTs at a fast pace. Widespread consumption has resulted into huge amounts of e-waste generated from non-usable or old electronics. Electronic waste (e-waste) comprises of electronics and electrical goods no longer fit for their originally intended use. Apart from the e-waste produced by use of electronics, African countries are on the receiving end of Western e-waste. Presently, Zimbabwe despite being recipients of ICTs, does not have e-waste disposal mechanisms or legislation in place. Having realized that large institutions are major consumers of electronic products, this research seeks to assess the management of e-waste in institutions of higher learning in Gweru namely; Midlands State University, Gweru Polytechnic College and Mkoba Teachers College. The research employs a survey research and comparative study with the main data collection instruments being questionnaires, interviews and observations. Through purposive sampling, ICT heads and other stakeholders in association with e-waste management have been selected as sample respondents. This study explores the background to e-waste, accounts for the chemicals and hazardous substances in e-waste and the impacts they can have on the environment and human health, evaluates the existing institutional policy, the type and quantity of e-waste generated by institutions of higher learning in Gweru, the methods currently employed in e-waste management, challenges faced and recommends strategies that may be used to improve management of e-waste by the institutions.*

Keywords *- Electronic waste management, Institutions of higher learning.*

Introduction

The exceptional growth in electronics production has led to the rapid generation of electronic waste globally. About 44.7 million tons of e-waste were produced in 2016 and this amount may rise to 52.2 million tons by the year 2021, (Balde et al, 2017). Institutions of higher learning are recognised as part of the great contributors of electronic waste in the urban environment. As advanced models of electronics enter the market over the years, older models are deemed technologically obsolete thereby contributing to the institutions electronic waste stream. Managing the electronic waste sustainably is proving to be an important task for academic institutions, not only due to its rapidly increasing volume, but more importantly because of its hazardous nature. Electronic waste contains numerous hazardous substances which may pose a threat to the environment and human health in the institutions if they are not disposed of in the correct manner. On average, about 9% of the weight of electronic waste is made of hazardous substances such as lead, cadmium, arsenic, chromium, mercury and dioxins, (Sarkar, 2008). However, the internet is now used by about half of the world population and most individuals own several Information and Communication Technology (ICT) devices yet the lifecycles of these products are becoming shorter over time, (Balde et al, 2017).

Developing countries unfortunately lack proper systems of electronic waste management nor the enforcement channels of electronic waste regulation, (Nnorom and Osibanjo, 2007). Hence, this study aims to identify the different types and quantities of electronic waste generated, assess the management of electronic waste and the challenges associated with the sustainable management of electronic waste at three institutions of higher learning in Gweru.

Literature Review

Electronic waste is posited to refer to old end-of-life electronic equipment that include phones, cameras, CD players, TVs, radios, fax machines, photocopiers, printers, toners, ink cartridges, laptops, CRT monitors, desktop computers and their accessories which are disposed of by the original users, (Balde et al, 2015). Electronic waste is currently the fastest rising type of waste in most developing countries but there is however a challenge in managing the electronic waste as most developing countries lack the capacity to professionally recycle the electronic waste, Puckett et al, 2002). These regions are however overwhelmed with electronic waste due to receiving donations of used electronic equipment dumped on them by developed countries. Most developing countries are not supported by formal electronic waste management mechanisms such as the following up on used electronic equipment by producers and this is further aggravated by the lack of direct electronic waste management legislation, (Nnorom and Osibanjo, 2008).

Most electronic waste in Zimbabwe is not associated with local production but importation of refurbished electronic products from developed countries that have significantly raised the quantities of electronic equipment with very short lifespans thereby creating grave challenges in managing the electronic waste, (Mutsau, 2015). Moreover, Zimbabwean legislation does not clearly present how electronic waste should be managed as there is stated to be only the prohibition of discharging hazardous substances into the surrounding environment, EMA Act (20:27). There is also a great awareness lacking in Zimbabwean manufacturing and also among legislators, environmentalists as well as consumers on how to improve electronic waste management thereby creating great environmental and health challenges, (Mutsau et al, 2015). However, refurbishment for reuse is considered to be the most suitable method to handle discarded computers and other electronics, (Microsoft, 2008).

Methodology

The researcher purposively selected Gweru as the area of study basing on the on the proximity of his institution to other higher tertiary institutions in the Midlands region. The research therefore targeted institutions of higher learning such as Midlands State University, Mkoba Teachers College and Gweru Polytechnic College which all have electronic waste management activities from handling, storage, recycling to disposal. The case study approach was employed for in-depth, detailed research that explored the management of electronic waste in institutions of higher learning in Gweru. The exploratory descriptive survey research design allowed primary information to be obtained through interviews of stakeholders associated with electronic waste and observations.

Questionnaires were self-administered by the researcher to the ICT, Stores and Administration heads of departments to attain sufficient information on the quantities of the different types of electronic waste generated, waste management practices and challenges faced in the management of electronic waste in the three institutions. Closed ended questions only allowed respondents to give their response by choosing from the given options on the types of electronic waste, sources and disposal methods. Open ended questions enabled respondents to air out their own views on the challenges of electronic waste management in the three institutions from generation, storage, handling to disposal.

Key informants included Heads of Departments, in all three institutions, Gweru City Council Cleansing Superintendent, Environmental Management Agency Environmental Quality Officer, Midlands Technologies Chief technician and Greenworks Recycling Zimbabwe Manager. Diversification of key informants was essential so as to gain varying perspectives on the challenges associated with electronic waste management in the three institutions of higher learning and possible strategies that could be effected. The semi structured interviews allowed the researcher to probe, clarify and exchange ideas with key informants on electronic waste management in institutions of higher learning.

Moreover, direct observation enabled the researcher to interact with the electronic waste as the object of investigation. Types of electronic waste, quantities, generation rates, and handling and disposal methods were observed in the field thereby increasing validity and reliability of the research. The researcher had several ground visits to Midlands State University, Mkoba Teachers College and Gweru Polytechnic College as he captured spatial temporal data and used photography to give a clear representation of the electronic waste management.

Institutional data was also taken into consideration so as to study existing documents on the management of electronic waste in institutions of higher learning and this was also effective in supporting the research with the best possible electronic waste management initiatives that could be used. Existing institutional data included records on the management of electronic equipment and electronic waste as institution assets under the Administration departments. These sources gave a detailed account of the situation in all three institutions of higher learning.

Results and Discussion

The study established that all sampled institutions of higher learning in Gweru use electronic equipment in their academic setup. Figure 1 below depicts the types of electronic waste sampled from stored or discarded waste. The most common electronic waste was desktop computers and their accessories which are being used in all departments and the high usage can be attributed to the fact that it is an age of constantly changing Information and Communication Technology. The types of electronic waste in Gweru institutions of higher learning ranged from desktops, photocopiers, printers, laptops and computer accessories such as keyboards, mouse and toner. Observations at Midlands State University confirmed that desktop computers and their accessories contributed the highest volume to the electronic waste stream. It was however observed that electronic equipment such as computers have limited lifespans of about eight years but toner as a consumable continuously accumulates due to a shorter lifespan of about two months.

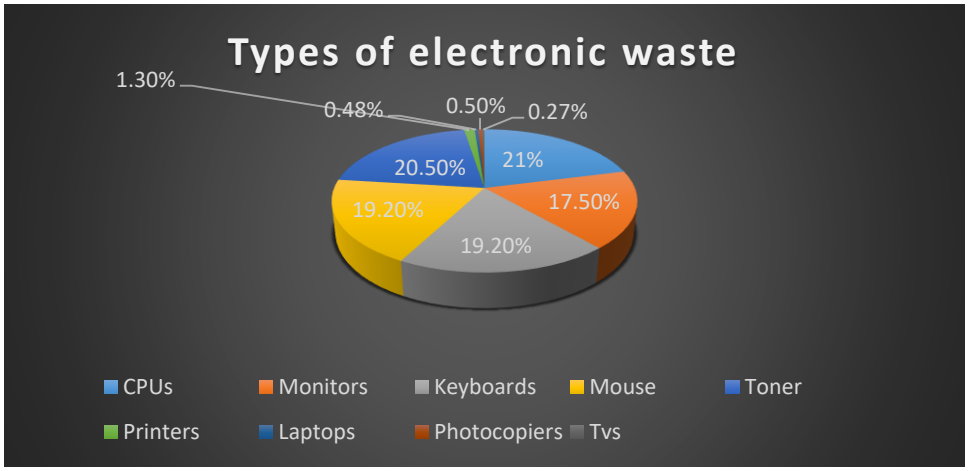

Figure 1 showing the types of electronic waste in Gweru institutions of higher learning.

Table 1 below shows the quantities of the different types of electronic waste in the institutions of higher learning in Gweru between the period of 2013 – 2018. Midlands State University was highlighted to have the largest amount of electronic waste with a total of 5202 units due to the high population of students and staff within the institution, Mkoba Teachers College with 505 units and Gweru Polytechnic College with the least amount of electronic waste at 154 units. However, from the interviews conducted at Midlands State University, the high rate in electronic waste was due to the fact that electronic waste had been stored for over 10 years and was only donated to Greenworks Recycling and Midlands Technologies in the year 2018. Findings on Gweru Polytechnic College and Mkoba Teachers College presented similar characteristics due to them sharing the same system as they are both managed under the Ministry of Higher and Tertiary Education. Information from interviews at these two institutions reflected that efforts are made to auction electronic waste almost every five years thereby minimising the amounts being stored.

Electronic waste type	**MSU**	**Gweru Polytechnic**	**Mkoba Teachers College**
	Number of electronic equipment disposed in the last 5 years	Number of electronic equipment disposed in the last 5 years	Number of electronic equipment disposed in the last 5 years
CPUs	1200	40	47
Monitors	1000	36	43
Keyboards	1100	36	43
Mouse	1100	36	43
Toner/ cartridges	680	280	300
Printers	58	5	16

Laptops	30	0	0
Photocopiers	22	1	8
Tv/ radio	12	0	5
TOTAL	**5202**	**434**	**505**

Table 1: Quantities of electronic waste in Gweru institutions of Higher Learning

Table 2 below shows electronic product weight estimations that were utilised by the researcher to calculate the average tonnage of electronic waste within the institutions. These average weights were acquired in the field survey through weighing with an analog scale.

Electronic waste	**Average Product Mass (kg)**
CRT Monitor	18.14
CPU	9.98
Keyboard	0.5
Mouse	0.1
Toner/ Cartridge	0.5
Printer	14
Laptop	3.5
Photocopier	45
CRT TV	30

Table 2: Showing electronic product weight estimations

Table 3 below shows electronic product weight estimation calculations of total tonnage that reveal Midlands State University to be contributing the highest of 33.63 tons into the electronic waste stream of Gweru. The equipment mainly comprised of CPUs, monitors, keyboards, printers, photocopiers, cartridges and televisions. These findings support the view of (Balde et al, 2015), who states that electronic waste is in categories that include screens, monitors, televisions, laptops, notebooks, and tablets.

Computers and their accessories were presented to have the highest rates of electronic waste in the Gweru institutions of higher learning. The study highlighted the types of electronic equipment that are brought into the institutions to be both new equipment and also refurbished equipment donated from other developed countries through government donation schemes. Attaining of used equipment has however led to the increase in electronic waste due to shorter lifespans of electronic products as highlighted in an interview with Midlands State University Information Technology Services Head. The ICT departments presented to be the lead departments in producing electronic waste in all three institutions of higher learning presenting

only 25% of electronic waste being produced from other departments. This is due to most electronic waste emanating from ICT products such as computers.

However, the three institutions of higher learning may not be ranked and compared at the same scale due to their differences in population. Midlands State University has a population of about 22 000 as compared to 2000 students at Gweru Polytechnic College and 1600 students at Mkoba Teachers College.

Electronic waste type	**MSU**	**Gweru Polytechnic**	**Mkoba Teachers College**	
	Average weight of electronic waste (kg)	**Average weight of electronic waste (kg)**	**Average weight of electronic waste (kg)**	**Total (kg)**
CPUs	11976	399.2	469.06	**12844.26**
Monitors	18140	653.04	780.02	**19573.06**
Keyboards	550	18	21.5	**589.5**
Mouse	220	7.2	8.6	**235.8**
Toner/ cartridges	476	196	210	**882**
Printers	812	70	224	**1106**
Laptops	105	0	0	**105**
Photocopiers	990	45	360	**1395**
Tv/ radio	360	0	150	**510**
TOTAL	**33.63 tons**	**1.39 tons**	**2.22 tons**	

Table 3: Weight quantities electronic waste in Gweru institutions of higher learning

Electronic waste management practices

All institutions of higher learning in Gweru keep records of the electronic waste they discard. The three key informants interviewed within the institutions included Administration department Heads and they all concurred that they are responsible for management of electronic waste as assets in their institutions and had inventories available. Interviews conducted at Midlands State University highlighted that it is the duty of the Assets department through the Director of Information Technology Services, at Gweru Polytechnic College it is by the Administration department through the ICT department and at Mkoba Teachers College

it is by the Administration department through the WEE ICT and Research department. It was observed that disposal of most electronic equipment such as computers was due to the end of lifespan of about eight years as well as introduction of newer technologies.

All three key informants from all three institutions concurred that they mainly partner with their institution ICT department and Stores department in identifying the types and quantities of electronic waste within their institutions. Midlands State University Assets department however stated to be a notch ahead as they also partner with their Risk Management Office which gives them advice on how best to manage their electronic waste.

Moreover, Midlands State University Assets department Head concurred with the view of Information Technology Services department that there is an ICT policy and asset disposal policy that complement each other in promoting recycling and reuse of electronic waste in the institution. However, Gweru Polytechnic College and Mkoba Teachers College Administration department Heads made it clear that their asset disposal policy does not properly support electronic waste management through initiating Integrated Solid Waste Management but merely treats the electronic waste as basic assets that have lost their value in the institution. There was a general representation of awareness of electronic waste management with only Mkoba Teachers College representing 33.3% having revealed that there was no awareness of the possible effects of electronic waste. (Mutsau et al, 2015) however states that there is generally lack of awareness amongst Zimbabwean consumers and manufacturers on sustainable electronic waste management thereby creating a great challenge in electronic waste management.

Electronic waste storage

Information from interviews presented that storerooms are utilised for electronic waste storage but small units of electronic waste such as cartridges may be stored in offices or labs thereby making it difficult to manage their proper disposal. The researcher took a tour around the three institutions of higher learning to identify the electronic waste management practices. Observations of the dominant computers as electronic waste went were noted and went hand in hand with what the Administration departments outlined in interviews. The researcher observed a lot of electronic waste mainly comprising of ink toners at Mkoba Teachers College stored randomly in offices and laboratories thereby causing an environmental eyesore.

Electronic waste separation in the institutions

All three institutions are involved in electronic waste separation, information from interviews reflected that Midlands State University categorises electronic waste for easier recycling and record keeping whilst Mkoba Teachers College and Gweru Polytechnic College also separate their electronic waste for record keeping but however, a small amount of cartridges are mixed

with general waste. Categories of electronic waste separation were mainly grouped into computers with their accessories, printers and photocopiers then consumables stored for disposal separately.

The researcher observed bins filled with both general waste and ink cartridges, this is against the suggestions given by Midlands Province Environmental Quality Officer in an interview as he suggested the adoption of the concept of waste hierarchy that promotes sustainable methods of electronic waste management.

Electronic waste recycling in the institutions

Only Midlands State University is involved in recycling their electronic waste amongst the institutions of higher learning in Gweru. Information from interviews revealed that they donate their obsolete computers to Midlands Technologies and they also donate their cartridges and toners to Green works recycling. Recycling has thus been proven to be a challenge in institutions and this is supported by (Puckett and Smith, 2002) who mentioned that the lack of adequate professional recyclers, refurbishers and current technology in electronic waste management is a major drawback in developing countries.

The researcher visited Midlands Technologies workshop in Gweru and observed the refurbishment of MSU electronic waste which comprised of obsolete computers being re-established to value. The electronic waste was donated to the refurbishers so as to benefit other communities without the intention of gaining profit.

The idea is supported by Microsoft (2008), as they state that the most sustainable means of managing electronic waste such as computers is through refurbishment and reuse and the refurbished computers promotes spreading of Information and Communication Technology to less fortunate communities that may not afford new computers.

MSU electronic waste management and disposal mechanisms

Figure 2 below shows that Midlands State University sends about 60% of its electronic waste to recyclers that include Greenworks and Midlands Technologies. 30% is repaired by technicians within the institution and only about 10 % is stored awaiting consideration of disposal. This procedure is in line with following the hierarchy of waste management as supported by (Raina, 2010) who posited that the concept of following the hierarchy of waste management is to promote recovery and reuse of products.

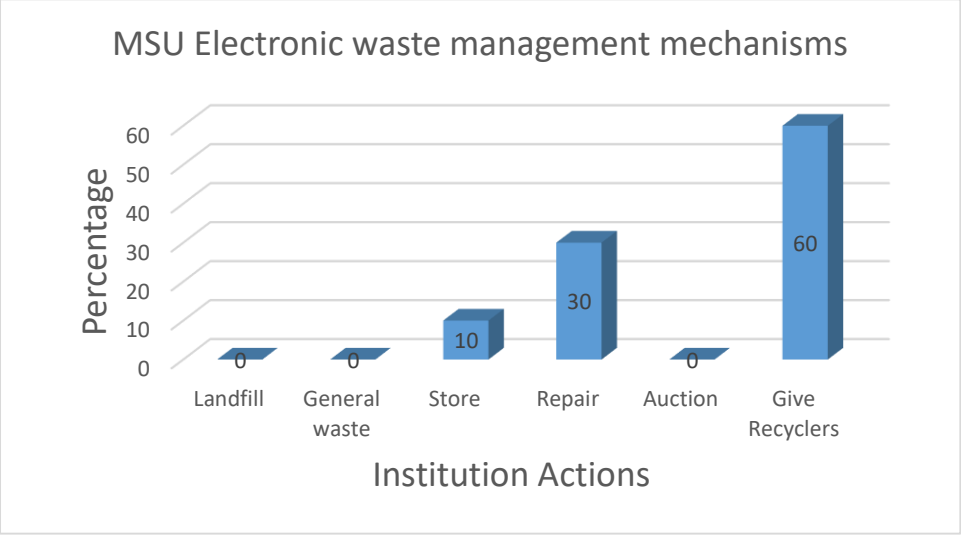

Fig 2: MSU electronic waste management and disposal mechanisms

Gweru Polytechnic College electronic waste management and disposal mechanisms

About 50% of electronic waste at Gweru Polytechnic College is auctioned as illustrated in Figure 3 below. Information from interviews revealed that public auctions are held in line the Procurement Regulatory Authority Company on assets that have been deemed obsolute by the Board of Survey. 30% of the electronic waste is being stored within the institution and information from interviews highlighted that it is due to the long procedures required before being granted permission by the Ministry of Finance to hold a public auction. 10% of electronic equipment in the institution is repaired and restored to value by technicians in the IT department. However, 10% of the electronic waste is disposed as general waste and information from interviews and observations revealed that the electronic waste comprised of used up ink toners and cartridges. However, according to (Lundgren, 2012), due to the inadequate technology and unprofessional management of electronic waste within developing countries, the environmental and human risk is far reaching.

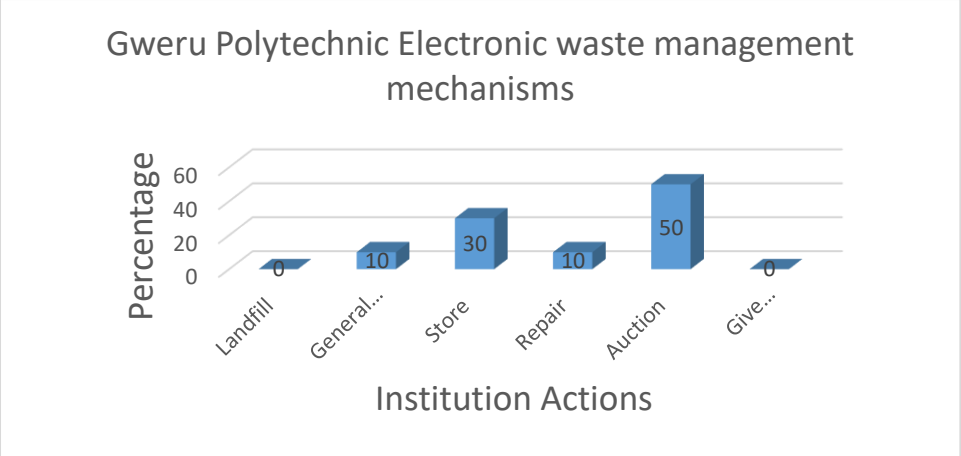

Fig 3: Gweru Polytechnic College management and disposal mechanisms

Mkoba Teachers College electronic waste management and disposal mechanisms

Figure 4 shows that about 50% of electronic waste at Mkoba Teachers College is auctioned. Information from interviews revealed that public auctions are held in coordination with the Ministry of Higher and Tertiary Education. It was observed that 35% of the electronic waste is being stored within the institution and information from interviews highlighted that it is also due to the long procedures required before being granted permission by the Ministry of Finance to hold a public auction. 10% of electronic equipment in the institution is repaired and restored to value by technicians in the IT department. However, 5% of the electronic waste is disposed as general waste and information from interviews and observations revealed that the electronic waste comprised of used up ink toners and cartridges.

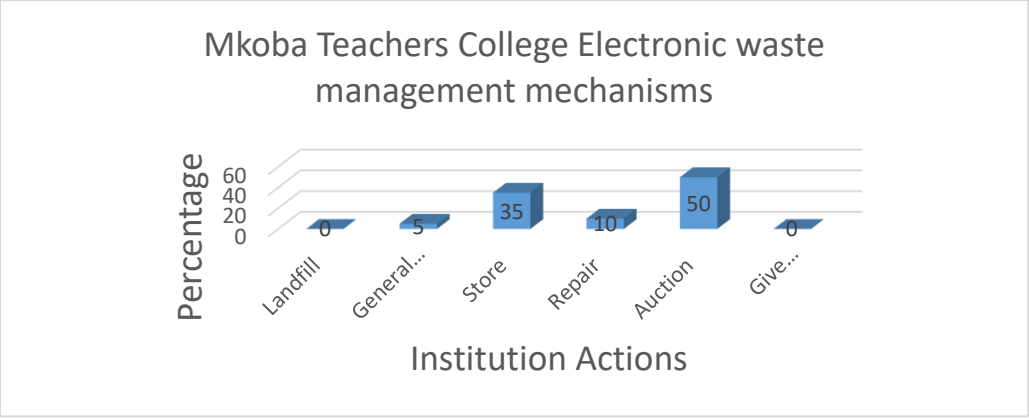

Fig 4: Mkoba Teachers College disposal mechanisms

Electronic waste management in Gweru institutions of higher learning.

All three institutions of higher learning in Gweru are not involved in landfilling electronic waste. However, a low percentage of electronic waste of 10% at Gweru Polytechnic College and 5 % at Mkoba Teachers College is mixed with general waste. Information from interviews with Mkoba Teachers College Administrator highlighted that it was a result of lack of awareness as some staff within the institution disposed old cartridges in general waste bins and this was the same case at Gweru Polytechnic College revealing about 10% of electronic waste being mixed with general waste. All three institutions evidently kept some electronic waste in storage, information from interviews with key informants revealed that the 10% stored at MSU was only awaiting collection by recyclers as confirmed by the Assets Department head whereas the 30% at Gweru Polytechnic College and 35% storage accumulation at Mkoba Teachers College was as a result of failure to auction the electronic waste such as obsolete computers as confirmed by the Administrators. Moreover, all 3 institutions add value to electronic waste through repair but MSU reflected 30% being repaired as compared to 10% in the other institutions. Information from interviews with MSU Information Technology Services department head revealed that MSU was higher in repair due to a larger workforce in the form of technicians that were ready to restore electronic equipment that would allow. Furthermore, MSU does not practice any auctioning of electronic waste but rather sends about 60% of electronic waste to recyclers. Information from interviews with Gweru Polytechnic College and Mkoba Teachers College Administrators concurred that about 50% of electronic waste is auctioned by the institutions but is however not sent to recyclers due to no standards being set by the Ministry of Higher and Tertiary Education to give away electronic waste to recycling agencies.

Challenges in lack of policy and legislation on electronic waste

All three institutions of higher learning expressed their challenge in lack of well-set Standard Operating Procedures in line with electronic waste management and they all blamed it on the absence of electronic waste legislation. This is supported by information from an interview with Gweru Municipality Cleansing Superintendent and Environmental Management Agency Environmental Quality officer who stated that there are currently no systems of electronic waste quantification in Gweru. According to the EMA Act (20:27) there is prohibition of hazardous substances discharge into environment but no direct legislation on electronic waste can be noted. However, (Sinha-Khetriwal et al., 2005) posited that the lack of reliable data poses a challenge to policy makers wishing to design an effective electronic waste management strategy. Gweru Polytechnic College and Mkoba Teachers College Administration heads however noted their own challenges in electronic waste management as they referred to too much red tape in the system. Gweru Polytechnic College and Mkoba Teachers College highlighted that there is need for policy change within their institutions due to no autonomy as all obsolete assets are auctioned on behalf of the Ministry of Higher and Tertiary Education with no returns coming back to the institutions. The process of disposing electronic waste in these 2 institutions was presented to be long and complicated as a board of survey has to be

conducted, permission is sought from the Ministry of Finance as well as the Ministry of Higher and Tertiary Education and then a committee comprising of both internal and external stakeholders decides on the method of disposal thereby losing a lot of time before decisions are made. Further information from interviews at these institutions alluded that there are bottle necks in the electronic waste management process due to no frequent disposal of the electronic waste and no well-known ready market.

Only one of the three institutions has an electronic waste management policy. This is supported by information from interviews that presented that Midlands State University uses their Asset disposal policy in conjunction with their ICT policy. Gweru Polytechnic College and Mkoba Teachers College however face a challenge of lack proper procedural guidelines on how to manage their electronic waste. This is supported by (Nnorom and Osibanjo, 2008) who posited that most developing countries lack formal systems in the assuring of extended producer responsibility in electronic waste management. Midlands State University however confirmed to having an effective policy was confident with their policy as the Information Technology Department stated that all electronic waste disposal has been smooth as a result of this policy thus it is not a challenge to them.

Electronic waste awareness sensitization challenges within the institutions

Institutions of higher learning in Gweru are failing to properly train their departments on electronic waste management thereby enabling them to be aware. It is thereby a challenge mainly to Mkoba Teachers College which has not initiated electronic waste sensitization yet. Information from interviews at Midlands State University presented that the Risk Management Office is responsible for training employees and at Gweru Polytechnic College, efforts are being made by the Administration department to train all employees on storage and reporting of electronic equipment that has lost value. Observations by the researcher have revealed that lack of awareness of health and environmental impacts has led to accumulation of electronic waste in staff offices and laboratories.

Both Mkoba Teachers College and Gweru Polytechnic College are institutions of higher learning in Gweru without awareness on what happens to their electronic waste after disposal. However, Midlands State University revealed their knowledge on how their toners and cartridges are recycled in South Africa after collection by Green works Recycling Company. Moreover, the level of awareness of surrounding electronic waste recycling companies to be at 33.3 % of all the institutions of higher learning in Gweru. Only Midlands State University has engaged Green works Recycling Company and Midlands Technologies to manage their electronic waste.

Challenges in sustainable management of electronic waste

Interviews with all institution departments revealed that there is very little collaboration between manufacturers, refurbishers and recyclers as only private partnerships are being

formed with local institutions. There are very few professional recyclers in Gweru and no local electronic waste treatment plants which thereby makes it very difficult to manage the electronic waste in a sustainable manner. Information from interviews reflected that Midlands State University faces challenges in finding more professional recyclers in Gweru. Gweru Polytechnic College and Mkoba Teachers College however face challenges of obsolete electronic equipment overstaying in storerooms as illustrated in plate 1 due to disposal approval procedures that are very long. These two institutions also face a challenge of not benefitting from the auctioned electronic waste as all returns are taken by the Ministry of Higher and Tertiary Education. However, (Ogbomo et al 2012) also reflected that unsustainable management of ICT electronic waste is a common practice in institutions of higher learning in African developing countries.

Conclusion and Recommendations

This study has shown the management of electronic waste in institutions of higher learning in Gweru, Zimbabwe. The main types of electronic waste in institutions of higher learning in Gweru comprise mostly of computers and their accessories due to Information and Communication Technology being widely used by both students and staff in all departments in the institutions of higher learning. Midlands State University as a representative of universities in Zimbabwe has revealed that universities release higher volumes of electronic waste due to their high stocks of electronic equipment as compared to other institutions such as Gweru Polytechnic College and Mkoba Teachers College. The findings of the study identified the different management practices amongst the three institutions to be a result of difference in policy and level of awareness. However, the researcher also noted various challenges affecting electronic waste management within the institutions of higher learning in Gweru and these included no direct legislation on electronic waste, policies that do not encourage sustainable management of electronic waste and lack of awareness.

Midlands State University

- Midlands State University Administration department should create innovative electronic waste policy designs and they should highlight on refurbishment, reuse, recycling, and effective electronic waste collection systems such as having particular bins for electronic waste disposal around the institutions and specific days of collection.

- Administration department should increase awareness on sustainable electronic waste management through staff training, workshops, strict procurement policies and institutional policies and awareness campaigns on reuse and the value of recycling of electronic waste.

- Technical departments such as Information and Technology within the institution should also be involved in designing electronic waste management mechanisms

- Students should develop more research on all the various types of electrical and electronic waste (WEEE) within the institution so as to design a fully guided document on electronic waste management.

- Information Technology Services department should enable all technicians to engage in serious refurbishment of electronic waste so as to benefit the institution financially and refurbished computers could be donated to Primary schools that may not afford new computers as part of Corporate responsibility.

Gweru Polytechnic College

- Gweru Polytechnic College Administration department should make efforts to Partner recyclers such as Greenworks recycling, Midlands Technologies and Enviroserve so as to promote sustainable management of electronic waste and encourage public participation.

- Administration department should adopt international standards such as only purchasing new electronic equipment and not introducing 2nd hand equipment into the institution as it has a shorter lifespan.

- Administration department should create innovative electronic waste policy designs and they should highlight on refurbishment, reuse, recycling, and effective electronic waste collection systems such as having particular bins for electronic waste disposal around the institutions and specific days of collection.

- Administration department should increase awareness on sustainable electronic waste management through staff training, workshops, strict procurement policies and institutional policies and awareness campaigns on reuse and the value of recycling of electronic waste.

- Technical departments such as ICT and WEE, Electrical and Mechanical Engineering within the institution should also be involved in designing electronic waste treatment plants as they are not locally available.

- Students should develop more research on all the various types of electrical and electronic waste (WEEE) within the institution so as to design a fully guided document on electronic waste management.

- ICT and WEEE department should enable all technicians to engage in serious refurbishment of electronic waste so as to benefit the institution financially and refurbished computers could be donated to Primary schools that may not afford new computers as part of Corporate responsibility.

Mkoba Teachers College

- Mkoba Teachers College Administration department should make efforts to Partner recyclers such as Greenworks recycling, Midlands Technologies and Enviroserve so as to promote sustainable management of electronic waste and encourage public participation.

- Mkoba Teachers College should adopt international standards such as only purchasing new electronic equipment and not introducing 2nd hand equipment into the institution as it has a shorter lifespan.

- Administration department should create innovative electronic waste policy designs and they should highlight on refurbishment, reuse, recycling, and effective electronic waste collection systems such as having particular bins for electronic waste disposal around the institutions and specific days of collection.

- Administration department should increase awareness on sustainable electronic waste management through staff training, workshops, strict procurement policies and institutional policies and awareness campaigns on reuse and the value of recycling of electronic waste.

- Technical departments ICT, Electrical and Mechanical Engineering within the institution should also be involved in designing electronic waste treatment plants as they are not locally available.

- Students should develop more research on all the various types of electrical and electronic waste (WEEE) within the institution so as to design a fully guided document on electronic waste management.

- ICT department should enable all technicians to engage in serious refurbishment of electronic waste so as to benefit the institution financially and refurbished computers could be donated to Primary schools that may not afford new computers as part of corporate responsibility.

Ministry of Higher and Tertiary Education

Ministry of Higher and Tertiary Education should revise policies on how to handle disposed assets so as to promote sustainable management of electronic waste and also benefit the institutions. The process of electronic waste management should become localised so as to promote efficiency.

Environmental Management Agency

Environmental Management Agency should draft direct legislation on electronic waste management so as to apply strict procedures that will minimise electronic waste and promote sustainable management of electronic waste in institutions of higher learning.

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WETLANDS GOVERNANCE AND THE STATE OF URBAN WETLANDS IN ZIMBABWE- Tendai Peacebe Mudombi

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Abstract

The purpose of this paper is to analyse wetlands governance and implications for the management of these ecologically fragile systems, using Harare as a Case Study. The paper argues that despite the existence of environmental management legislation and the ratification of the Ramsar convention, wetlands in Harare continue to experience massive destruction mainly due to the fragmentation of institutional frameworks. For example, the Environmental Management Act (Chapter 20:27) does not define permitted or prohibited developments and uses on a wetland. This has resulted in the rampant construction of housing estates and urban agriculture activities on the City's major wetlands. There are also a number of institutional actors involved in the management of wetlands (Environmental Management Agency, Urban Local Authorities, and Community Based Organizations like Harare Wetlands Trust). This creates 'institutional pluralism'. Despite having this colossal spectrum of players in the protection and conservation of wetlands, wetlands loss and degradation is a sad reality and remains unchecked. A case study research design was employed in gathering data for this study. Laws for wetland protection and management are sometimes conflicting and there is a high degree of fragmentation which is contributing to wetlands loss. The study noted that urban planning laws regards environmental protection, however some operative statutory plans are less attentive to wetlands protection. The study recommends legislative alignment and participatory urban planning and wetlands protection so that collaborated efforts are made to save the remaining wetlands as well as reclaiming the lost ones.

***Keywords**: Governance, Wetlands, Wetlands governance, Wetlands Protection*

Introduction

Wetland ecosystems form a very vital part of the world's most productive ecosystems (Ramsar Convention on Wetlands, 2018). Being ecologically sensitive areas, multiple institutions, laws, policies, systems have been put in place to ensure that wetlands are protected and conserved. These institutions and systems create the wetlands governance suite which is a group of stakeholders who employ different tools and methods to protect wetlands. The sum total of ways, means and processes by which organisations, private or public, formal or informal apply policies, laws, and systems in determining how wetlands are to be used, protected and conserved is called wetland governance. Governance also entails a continuing process through which conflicting or diverse interests may be accommodated and cooperative action can be taken (UN HABITAT 2002). Ramsar Convention on Wetlands operates at the apex as a global institution on wetlands protection while the Environmental Management Agency and its allied institutions are locally based institutions operating in the confines of Zimbabwe. Although there are multiple organisations and institutions responsible for protecting wetlands in Zimbabwe, cities like Harare continue to face widespread wetland loss due to human activities. This further highlights the ineffectiveness of organisations in curbing unfavourable human activities on wetland ecosystems. The paper seeks to understand the missing link between Zimbabwe's wetlands governance systems and the protection of wetlands in Zimbabwe, using Harare as a case study. A question is raised "*Why do wetlands continue to suffer despite having institutions at all levels whose focus it to save and protect them*?" The paper is organised as follows: -

- Background of the Research
- Literature Review
- Emerging Issues
- Methodology
- Discussion
- Conclusion and Recommendations

Literature Review: An Overview of Wetlands and Wetlands Governance

The Government of Zimbabwe through the Environmental Management Act (Chapter 20:27) of 2002 defines wetlands as water body systems such as marshes, ferns, peat lands, pans, swamps, streams and lakes, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres. This definition was derived from the Ramsar Convention on Wetlands of International Importance (Article 1.1) which Zimbabwe subscribe to. Harare Wetlands Trust (2015) define wetlands as areas where water is the primary factor controlling climate, environment and associated plants and animal life in an area. Loosely defined, they are areas which are waterlogged perennially or seasonally (Kecha et al, 2007). In Southern Africa wetlands are generally known as *vleis* (*Afrikaans*), *dambos* (*Chichewa*), *matoro / mapani/ machakwi* (*Shona*) or *amaxhapozi* (*Ndebele*), meaning inland wetland systems. These are approximately 1271 wetlands and are covering approximately 3% of the total land area (Chakanyuka, 2019). In Zimbabwe, wetlands cover approximately 4.6% of the land. The Harare Wetlands Trust (2015) suggest that wetlands in Zimbabwe include springs, pools, vleis, dambos, streams, rivers, lakes, floodplains, plans, farm ponds, reservoirs, irrigation canals, gravel, mine pits and sewage ponds. Vleis are the most dominant covering 3.6% of the areas (Sithole and Goredema, 2013). The wetlands that are designated as Ramsar Site include Victoria Falls, Drifontein Grasslands, Lake Chivero, Middle Zambezi/ Mana Pools, Chinhoyi Caves, Monavale Vlei and the Cleveland Dam (Harare Wetlands Trust, 2015). These wetlands cover an approximated space of 28582.40ha (EMA, 2019).

Wetlands Governance: A Global, Regional and Local Perspective

At a global scale, the Ramsar Convention on Wetlands of 1971 is an intergovernmental treaty whose directive is "to conserve and wisely use all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable

development throughout the world" (Ramsar Convention Secretariat, 2010). It is from the convention that the 2nd of February was set as the World Wetlands Day. This day was first celebrated in 1997. Wetlands are also protected by the Convention of Biological Diversity. The United Nation's Millennium Development Goals (MDG's) and Sustainable Development Goals (SDG's) also contribute to wetlands protection but at a broader scale of protecting the natural environment. Millennium Development Goals has to dedicate Goal 7 to Ensuring Environmental Sustainability at a global level which was aimed at integrating the principles of sustainable development into local policies and programmes and reverse the loss of the environmental resources (United Nations, 2014). This was followed by Sustainable Development Goal 15 named Life on Land whose aim is to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forest, combat desertification; halt and reverse land degradation and biodiversity loss (UNEP, 2017). Environmental sustainability has become the centre for the SDGs considering that about half of the SDGs are directly focusing on environmental issues and address the sustainability of natural resources such as water, wetlands, human settlements, oceans and terrestrial ecosystems (UNEP, 2017). This general trend from the Millennium Development Goals to the Sustainable Development Goals position environmental sustainability at the centre of the 21st century's goals and targets.

A Global Perspective of Wetlands Governance

Management plans have been put in place for particular categories of protected areas and certain habitat types (Shine and Cyrille, 1999). In Peru, all-natural protected areas including their seven Ramsar sites must be covered by a master and operative management plans (Solano, 1998). In Portugal, the law decree of 23 January 1993 on the National Network of Protected Areas required management plans to be developed for nature parks. Much more rarely, the law may also specify that in the event of inconsistency, such plans take precedence over other

planning instruments in the region. In Spain, the Autonomous Community of Madrid has enacted legislation for the protection of wetlands and artificial water impoundments, which specifically provides for the making of binding wetland land-use plans by the Environment Agency.138 Australia's proposed legislation on biodiversity conservation, undergoing Parliamentary consideration in 1999, would make management planning a mandatory requirement for all designated sites on Commonwealth land, including Ramsar sites: the provisions of such plans would be legally binding on all Commonwealth agencies. In Netherlands, the Netherlands environmental agency has introduced the concept of well-designed buffers and transition zones that are used as spatial tools to safeguard ecological processes essential for wetlands functions and value. In Brazil, the promulgation of the Federal Constitution of Brazil in 1988 saw the localization of conservation provisions of wetlands in state constitutions. The protected habitats where categorised into two which are permanently protected areas and areas of ecological interest (Shine and Cyrille, 1999).

Regional Perspective of Wetlands Governance.

Involvement of residents has also been a major initiative in the governance and management of wetlands in the region. This kind of involvement is often initiated on an informal basis and at this level can make an important contribution to strengthening the role of human communities in wise use. Wherever possible, the rights of communities should be formalised and given legal backing under appropriate legislation. Structures for joint management may be developed on a sliding scale of formality, depending on the institutional traditions and applicable legislation of the country or locality concerned. Legal and administrative arrangements should give local communities the right to be involved in the management of all public protected areas within their geographic area. They should also specify rights to information and participation of local authorities, local businesses, scientific institutions and conservation NGOs (Synge, 1994). Some countries already have a structure of local

government that provides for the formation of committees at the lowest level. This has been evidenced in Kenya were Lake Naivasha Riparian is Management by the Lake Naivasha Riparian Association in Kenya while Prespa in Greece is management locally by the Society for Protection of Prespa. In Uganda, the constitution adopted in 1995 makes specific provisions for wetlands conservation (Ntambirweki, 1998). Ugandan legislation supports the creation of local environment committees as subcommittees of local village committees. Local environment committees of this kind could be specifically created or mandated to address wetland management.

Local Perspective of Wetlands Governance

In Zimbabwe natural resources such as wetlands are communally owned, used and managed where the communal system of resource ownership entails that communities are in 'de facto' ownership of wetlands on behalf of the state, the 'de jure' owners (Marambanyika and Beckedahl, 2017). Traditional institutions are the oldest institutions that managed wetlands from time immemorial. Having laws, regulations and statutes that were not necessarily documented, indigenous institutions proved to be relatively effective in managing the environment and wetlands included. This resulted in sustainable utilization of natural resources (Dore, 2001). While this may be true, changes in population densities, land uses, land demand and external factors such as new markets now present a different challenge than when the environment was being managed by indigenous institutions. The arrival of colonial governments interfered and disrupted indigenous institutions that were into natural resource governance and management and this weakened their capacity. Post-colonial governments then inherited and adopted colonial institutions set up to manage the environment. These largely ignored indigenous knowledge and common best practices.

Post-colonial, the Ministry of Environment, Water and Climate; Ministry of Lands and Ministry of Agriculture administered management of the environment on behalf of government

(Sithole and Goredema, 2013). The Environmental Management Act (Chapter 20:27) of 2002 is the primary law that governs the natural environment. It is through this act that the Environmental Management Agency (EMA) was formulated. The Environmental Management Agency is the overall body that oversees issues of the Environment in Zimbabwe. In managing wetlands specifically, subsection 113 of the Environmental management Act (Chapter 20:27) of 2002 state that wetlands utilization for cultivation or construction is only permissible upon receiving a permit. Statutory Instrument 7 (S.I.7) of 2007 speaks to the need for Environmental Impact Assessments prior to development. The Constitution of Zimbabwe also state in section 73 the need to protect the environment and wetlands are also included. Urban Councils also administer policies and regulations to protect the environment through the authority that is seeded to them through the Urban Councils Act and the Regional Town Country Planning Act (RTCP Act). Traditional authorities and rural local authorities use the Communal Lands Act and the Rural District Councils Act respectively. The challenge with these legislations of development is that they are silent about the specific land uses that can be designated for wetlands hence the uses assigned on them are very detrimental to the environment (Chirisa et al, 2016).

Area of Study: Harare

Harare is the capital City of Zimbabwe with a population of 2 123 132 million (ZIMSTATS, 2012). It falls under UTM Zone 36 South on area bounded by the following coordinates using the Arc 1950 UTM zone 365 coordinate system: Minimum X 275021.634m and Maximum X 311501.8158m and Minimum Y 8009041.4914m and Maximum Y 804600.6733m. It falls in the catchment area of Manyame and Mukuvisi River. It is situated at an elevation of 1483m above sea level (Muronda, 2008). Generally, the topography of the city is flat. The city lies in the tropics and has a mild and cool climate with wet hot summers and dry cold winters. The locality map is shown on fig 1 below highlighting the selected wetlands.

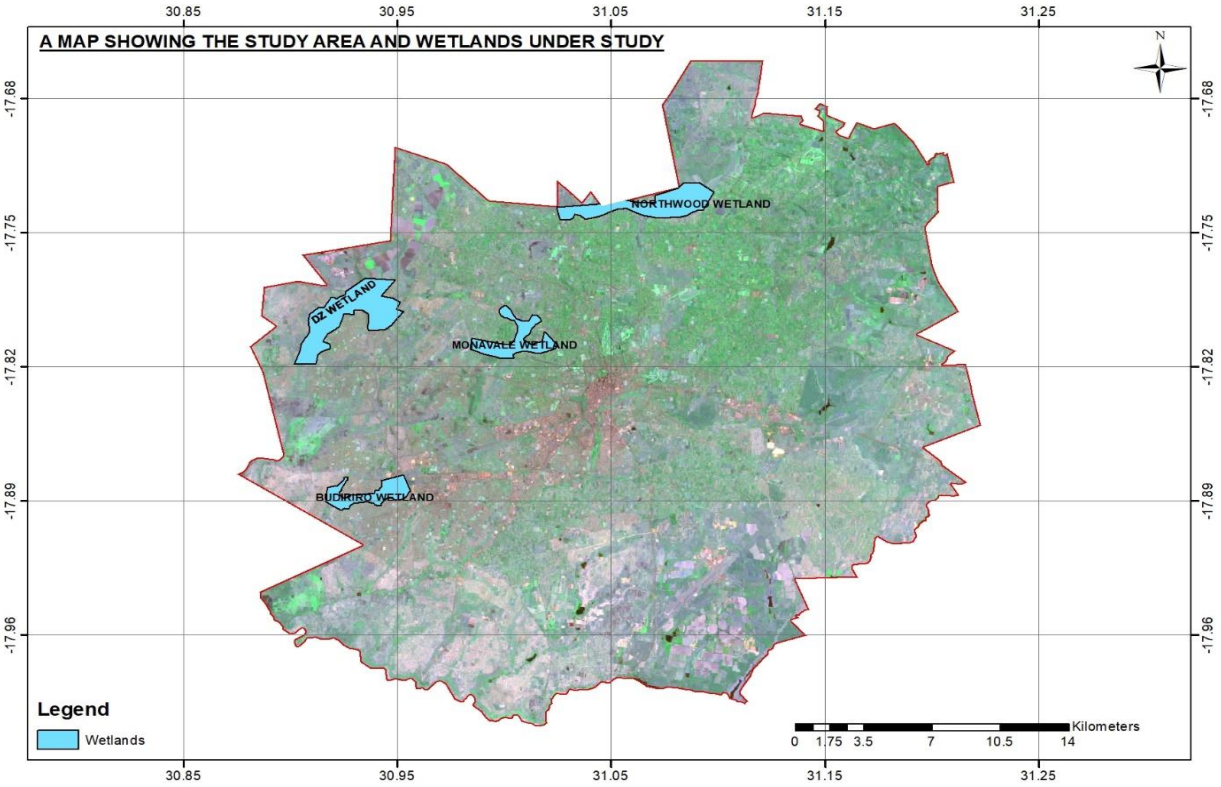

Figure 1: Showing the 4 wetlands selected from the 29 wetlands in Harare, Source: Author

Methods and Methodology

This research employed the case study research method which is an in-depth investigation of a few selected units of study to represent an entire research population. The case study approach was selected for this study because it places more emphasis on the full in-depth analysis of a unit of study than the breadth which is not comprehensive enough. Harare was chosen specifically for this research because of its fair share of wetlands in Zimbabwe in relation to widespread developments. According to EMA's wetlands map, Harare has 29 wetlands that cover a hectarage of 23 229. According to Chakanyuka (2019), 13 of Harare's 29 wetlands have already been overtaken by construction activities which makes Harare an important research area as far as the protection of wetlands is concerned. The case study research design sought to address the "what" and "why" questions concerning wetlands plight in the face of a multifaceted wetlands governance system. The case study research design used a descriptive approach to describe the state of wetlands and the wetland governance framework. A mixed method approach was used in this study which involved the collection and analysis of

qualitative and quantitative data (Denzin, 2010). Qualitative data gathering methods used include interviews, document analysis and observations. These methods were selected because they enable the researcher to gain an understanding of underlying insights and meanings over the research problem which may not be explained by the quantitative research. The quantitate method used was a questionnaire survey. The researcher chose this method because it is more scientific, objective, fast and acceptable for the date that the research sought to gather.

A total of 182 household questionnaires were administered and analysed using the Statistical Package of Social Sciences (SPSS). Convenience sampling was used to choose respondents to questionnaires who are close to the wetlands and are most likely to have the knowledge of how the wetlands are interacting with urban development. Convenience sampling is based on the accessibility of a sampled population and the degree to which they can cooperate (Denzin, 2010). This was selected because the researcher found it feasible to administer the questionnaire to the people who were readily available on the homes in or around wetlands under study. Interviews were also done with officials from the Environmental Management Agency, Harare Wetlands Trust, Conservation Society of Monavale and City of Harare. Purposive sampling was used in this research to determine key informants based on their relevance and expert knowledge relating to this study. This technique involved the seeking out of respondents by the researcher basing on his own discretion that the respondents are knowledgeable enough in the issue under discussion (Denzin, 2010, Pande and Pandey, 2015). This method was used because it allowed the researcher to select the ideal organizations mandated to deal with issues of environment and development in the city. This meant that the depth of the data collected was sufficient for the study.

Results

This section provides the results of study as obtained through the research carried forward in the research area. Focus is mainly on the legislative framework used in governing wetlands in Zimbabwe and the current state and the plight of wetlands in the study area.

Wetlands Governance Suite and the legislative framework in Zimbabwe

Wetlands in Zimbabwe are governed through a system of local, regional and global institutional environments that are comprised of rules and organizations. These institutions are central Government Departments and Parastatals, Local Authorities, Traditional Authorities, Private Players, Non-Governmental Organizations such as Community Water Alliance and Harare Wetlands Trust, Civil Society Organizations and the local people.

At the apex, there are government ministries, departments and agencies. The Ministry of Environment, Climate Change, Tourism and Hospitality Industry is the parent ministry that deals with environmental issues. The Ministry of Local Government and Public Works through the Department of Spatial Planning and Development deals with spatial planning and hence also administer development with the environment in mind. The Environmental Management Agency which is enacted by the Environmental Management Act, Chapter 20: 27 is a government agency which regulates the use of the natural environments and manages how natural resources are used. Wetlands are administered using section 113 of the Environmental Management Act (Chapter 20:27) and Statutory Instrument 7 of 2007. In managing wetlands specifically, subsection 113 of the Environmental management Act (Chapter 20:27) of 2002 state that wetlands utilization for cultivation or construction is only permissible upon receiving a permit. This ensures that not developments are done without permission which in most cases contain development conditions especially on ecologically sensitive areas. Statutory Instrument 7 (S.I.7) of 2007 speaks to the need for Environmental Impact Assessments prior to development. The Constitution of Zimbabwe also state in section 73 the need to protect the environment and wetlands are also included. The Statutory Instrument 7 of 2007 stipulates the

need for an Environmental Impact Assessment. Other allied players are Zimbabwe National Water Authority (ZINWA) and local authorities both rural and urban. These administer acts that affect wetlands such as the Urban Council's Act, the Rural District Councils Act, the Water Act and the Regional, Town and Country Planning Act, Chapter 29:12. Public institutions such as government departments, agencies and parastatals are the custodians and stewards of wetlands and spatial development, so their main role is to create a balance between the two.

Wetlands are also protected through a plethora of plans which regulate their use as well as the development that can be allowed in them. A good example of such are National Environmental Plans, Local Environmental Action Plans (LEAP), master and local plans. These plans are responsible for earmarking wetland areas that cannot be developed as well as conditions of development if any. These plans are administered at both national and local authority level. They are also influenced by international conventions to which Zimbabwe is a member. In conjunction with these plans there is the provision of the Environmental Impact Assessment in the SI 7 of 2007 where a development can only be carried out if an environmental impact assessment has been done to highlight the sensitivity of the wetland to development. These provisions resonate well with the provisions of Section 26 of the Regional, Town and Planning Act Chapter 29:12 which states that no development shall be carried out without a permit from the local planning authority. In the case that a local authority envisages that an area is a wetland, development applications should be accompanied by an EIA certificate.

Civil Society Organizations also form a part of this process. They are associations or communities that work above and beyond the state. These CBO's raise awareness of social, political and environmental issues and advocate for change, empowering local communities over their community issues or resources. In this instance, CBO's were mainly constituted by local groups and who were mainly residents. The most prolific of these CBO's included

citywide based organisation and neighbourhood-based organisation. Citywide based organization include the Harare Wetlands trust and the Harare Chapter of Community Based Organizations. Working with the Harare wetlands Trust are community-based organization such as the Conservation Society of Monavale and the Marlborough Residents Associations. The Harare Chapter of Community Based Organization consist of neighbourhood-based organizations namely, Cleveland Action Alliance, GOSDEN Conservation Trust, Dzivarasekwa Conservation Trust, Budiriro Water Foundation, Manyame Conservation Trust, Mukuvisi Conservation Trust, Blue Agenda Trust and Greenland Conservation. These community-based organizations provide an opportunity for communities and urban residents to participate in the protection of wetlands.

The study highlighted that wetlands are a critical part of our natural environment. They reduce impacts of floods, absorb pollutants and improve water quality among other benefits to animals and plants. In this regard, the majority of research respondents that is 80.8% highlighted that due to the importance wetlands community participation is crucial in the management of wetlands. The other 9.3% of the respondents neither supported nor refuted community participation, the other 9.3% disagreed that communities should be key in the management of wetlands and 0.5% strongly disagreed with community participation. A strong inclination toward community participation of residents proves that residents are concerned over the protection and management of wetlands, even though questions can be raised that in current wetland dire situation where were they? The statistics are shown on fig 2 below.

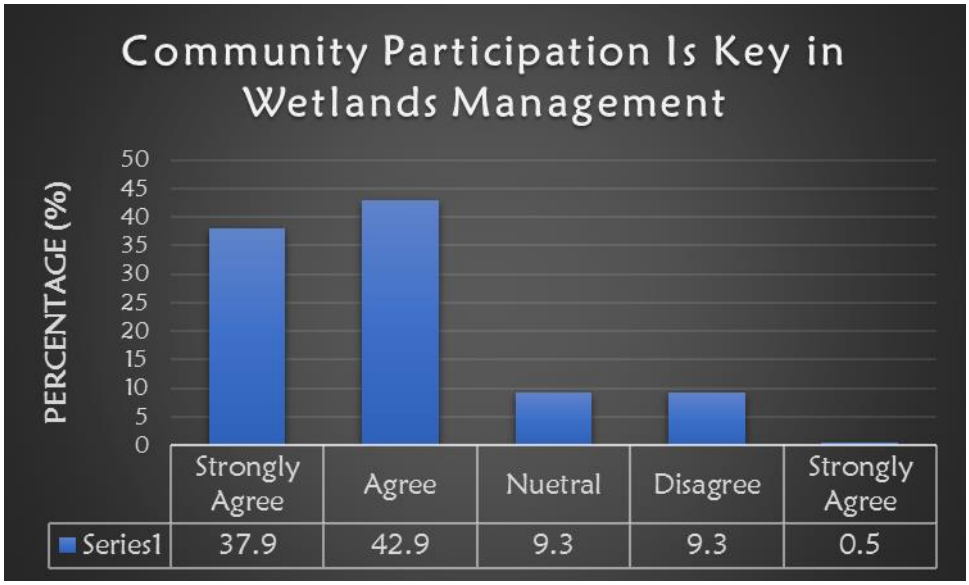

Fig 2: Scaling responses on the importance of Community Participation in Wetlands Management

The State of Wetlands in Zimbabwe: The Harare Narrative

Wetlands in Harare continue to suffer right in the face of a myriad of institutions and laws that should be protecting them. Human activities such as urban agriculture, housing developments, industrial and commercial developments and water extraction on wetlands are spreading across Harare. These are negatively impacting wetland ecosystems in terms of water availability and quality, biodiversity composition, wetlands extents, vegetation coverage and wetland/ ecosystem connectivity.

Wetlands Extents/ Coverage

Observation show that wetlands have shrunk in extents due to urban development activities. Considering that they take the character of their surroundings, development of housing and other urban development activities on wetlands has made invaded places drier thereby making them to cease to be categorised under wetlands. Although there are signs of them being wetlands, the characteristics no longer match the description of wetlands.

Findings from EMA and the City of Harare show conflicting perspectives. While EMA maps suggested a lot of developments having happened on wetlands, respondent 1 stated that only 10% of the total wetlands in Harare have been occupied by urban development and human activities. It was also mentioned that the city is still very far from reaching the maximum threshold of open spaces in terms of town planning standards. The results of interviews held with EMA indicate that 12 977.7 hectares have been built up in Harare out of a total of 23 504.9 hectares. This is more than half of the total wetlands space that Harare has. In addition to this statistic provided, the study carried out a mapping exercise of wetland using the Normalized Difference Vegetative Indexes (NDVI). The results of the mapping are presented in the following sections.

The normalised Vegetative Index Analysis of wetlands use in 2004, 2014 and 2019 is shown below. Wetlands are a dependent variable in this case and their coverage depend mainly on changes that happen in urban agriculture and construction. A general increase was recorded in construction which lead to the decrease of wetlands space. The same applies with urban agriculture except for Monavale were it decreased due to wetland restoration and protection. This is shown on the TABLE 1 below.

Table 1: Normalised Vegetative Index Analysis of Wetlands Use from 2004 to 2019

Name	**Land Use**	**2004 ha**	**2014 ha**	**2019 ha**
Northwood	Built Up or Bare	20.84	57.51	90.77
Northwood	Agriculture	144.48	270.17	301.43
Northwood	Wetland	426.24	263.88	199.36
TOTAL		**591.56**	**591.56**	**591.56**
Dzivarasekwa	Built Up	8.55	168.93	159.86
Dzivarasekwa	Agriculture	102.69	626.67	680.58
Dzivarasekwa	Wetland	874.98	190.62	145.78

TOTAL		**986.22**	**986.22**	**986.22**
Monavale	Built Up	10.8	13.55	30.56
Monavale	Agriculture	108.27	55.17	45.45
Monavale	Wetland	311.4	361.75	354.46
TOTAL		**430.47**	**430.47**	**430.47**
Budiriro	Built Up	0.27	83.16	120.76
Budiriro	Agriculture	22.14	150.48	178.23
Budiriro	Wetland	333	121.77	56.42
TOTAL		**355.41**	**355.41**	**355.41**

Source: (Remote Sensing Data, 2019)

State of Wetlands in 2004

Findings show that wetlands in 2004 were still greener and less disturbed. Although urban agriculture was evident, its impact on the natural view of wetlands is very minimal hence much part of the wetlands shows an undisturbed wetland. This is shown on the map on fig 3.

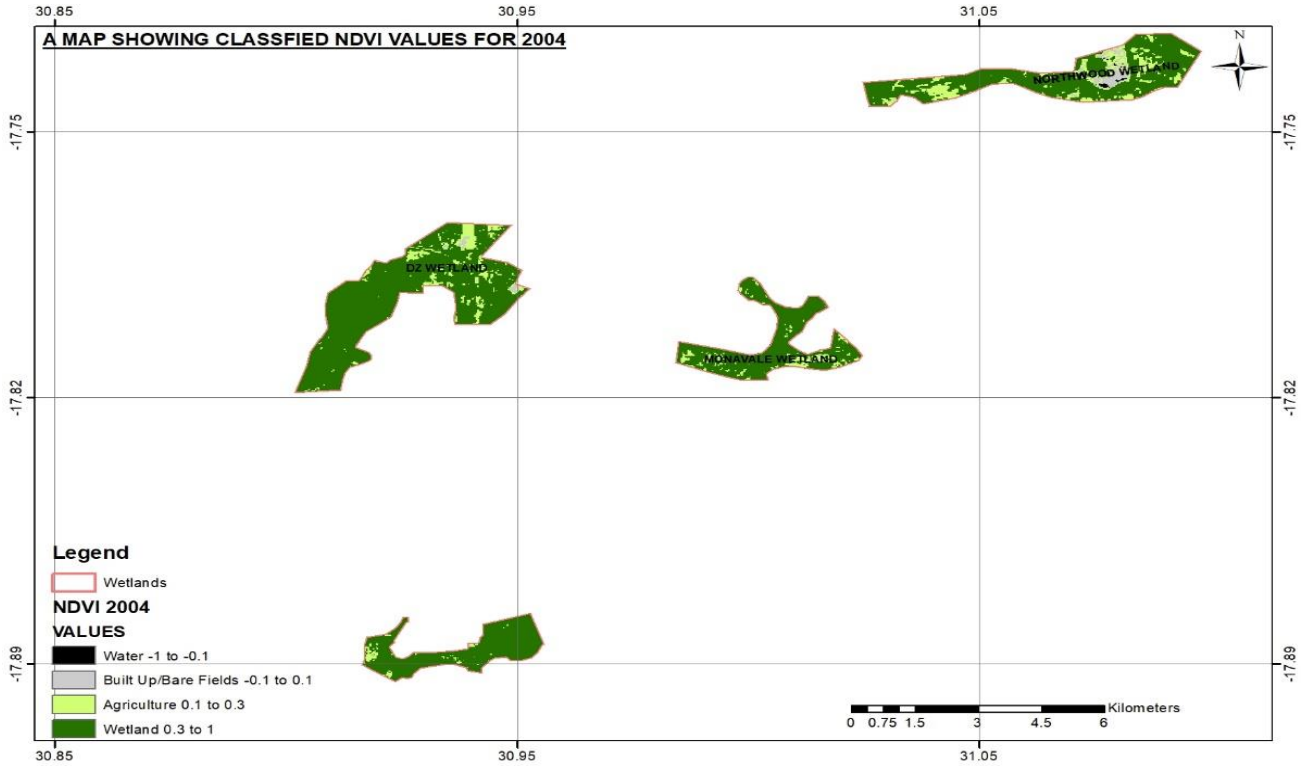

Fig 3: Showing state of wetlands in 2004 (Remote sensing Data, 2019)

State of Wetlands in 2014

Wetlands in 2014 show great disturbance as urban agriculture is now very evident. While Monavale show a greater part as a wetland in its undisturbed form, Dzivarasekwa, Budiriro and Northwood show that there is great interference in form of urban agriculture and construction which may also be bare ground. This is shown on fig. 4.

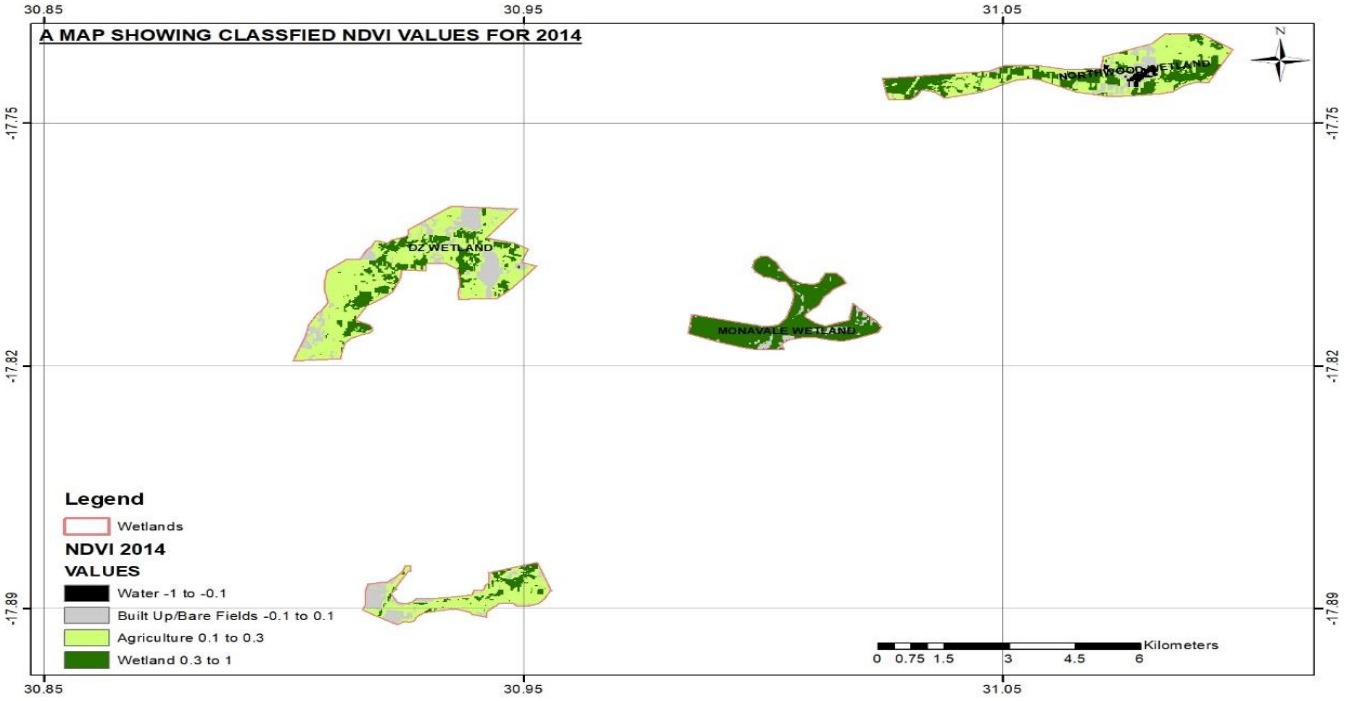

Fig 4: Showing state of wetlands in 2014 (Remote sensing Data, 2019)

State of Wetlands in 2019

Urban agriculture and construction continue to increase as shown on figure 4.10 on wetlands in 2019. Monavale Vlei is the only wetland which has much of its space covered with undisturbed wetland space of 354.46 hectares as according to the NDVI analysis. Budiriro and Dzivarasekwa wetland have been thoroughly affected by development in form of construction and wetland space has greatly shrunk. This is shown on fig. 5 below.

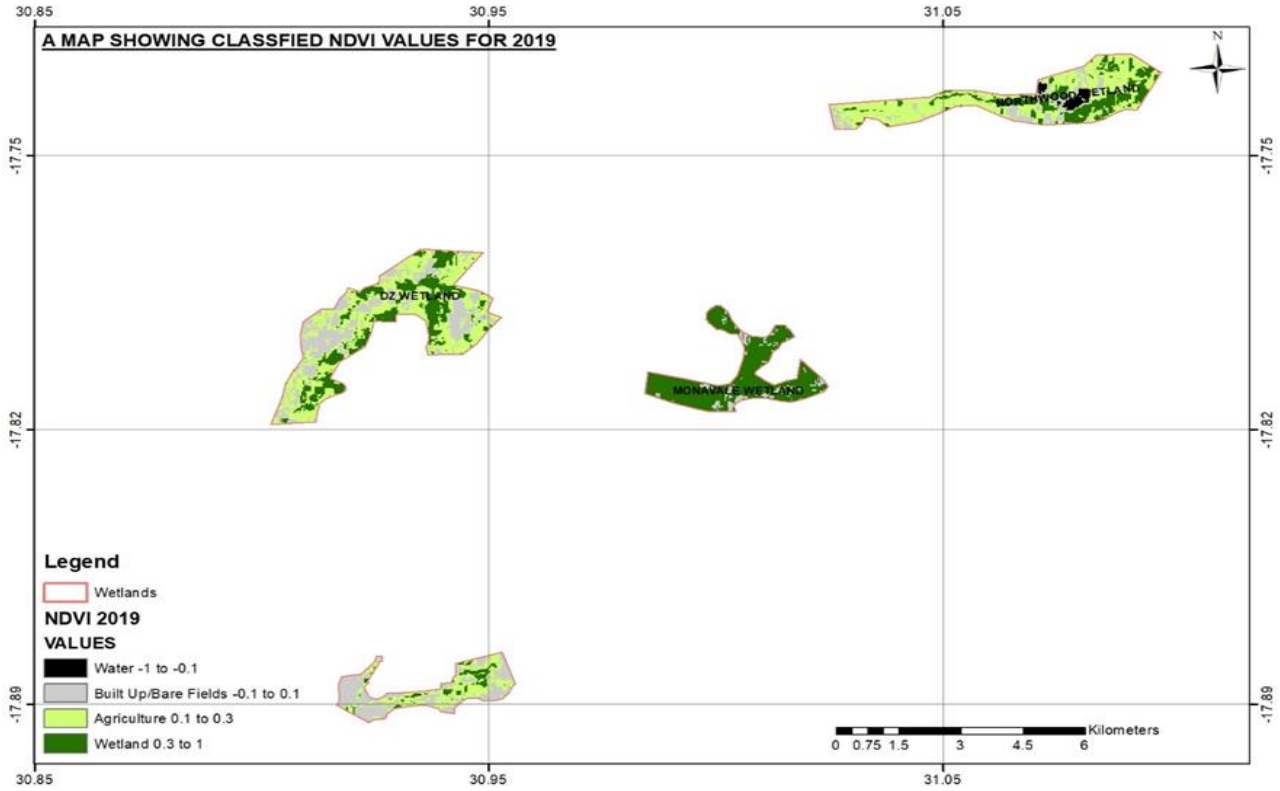

Fig 5: Showing state of wetlands in 2014 (Remote sensing Data, 2019)

Biodiversity Composition on Wetlands

The Monavale wetland is home to several animal species which includes the bush pigs, rabbits and wetlands birds such as the back headed heron and the black winged kite. These 2 bird species were observed in 3 of the 4 wetlands studied. The Wetlands have been greatly affected by urban development and subsequent human activities happening on them in terms of biodiversity composition. The major impact to biodiversity is emergence of invasive species on wetlands. Invasive plant species are those plants that are foreign to a wetland and were not naturally in existent in the subject wetland. Monavale is a treeless wetland but currently it's occupied by trees which are invasive species and foreign to the wetland. These affect the natural processes of the wetland thereby affecting the whole ecosystem. In all the four wetlands, an observation was made that there was an intentional planting of the gum trees. These are also invasive species because they are exotic to wetlands. Plant species such as the gum trees usually drain much of the water in wetlands affecting species that depend on water for survival. This

means that changes in wetlands due to invasive species lead to death or extinction of some plant or animal species in wetlands. Findings also showed that there are birds which have been recorded before which are no longer coming into wetlands because of changes in wetland composition.

Vegetation Type and Cover

Results show that Harare wetlands are treeless wetlands with short grass. However, most of these wetlands have been invaded by foreign species. One common grass species on all the 4 wetlands especially on drier edges is a long grass called the hyparrhenia. Of the 4 wetlands, the Monavale wetland is still rich in terms of biodiversity since it has been restored to its natural state. According to Conservation Society of Monavale (COSMO) (2018), there are 36 species of grass and 80 species of other plants which have been recorded in Monavale and other wetlands in Harare. Over 240 bird species, 16 reptiles and 7 amphibians have also been recorded at Monavale. Much of the space on Northwood wetlands has not been disturbed so native grass species are still very present in the wetlands. However, Budiriro and Dzivarasekwa have experienced massive urban agriculture and housing development and much of the wetland have at one point been cultivated. All native grass species have been replaced by invasive species such as the phragmites australis. A common feature on all the 4 wetlands was that they had eucalyptus plantations which on inquiry, it was learnt that they were planted to drain the excessive water that was in the wetlands. The eucalyptus, acacias and the syringa trees are invasive species that were also observed at Monavale, Budiriro and the Dzivarasekwa wetland.

Wetlands Connectivity/ Ecosystem Processes.

Wetlands connectivity has been compromised on all the four wetlands by infrastructure provision. Results show that aquatic species are the most affected by wetland fragmentation. Utilities such as roads, water and sewer pipes, have greatly affected wetlands connectivity. These facilities cut through wetlands and their installation creates trenches and hard surfaces

that are difficult for wetlands insects to pass through. Roads topping the list, have been cited as the major cause of wetland fragmentation and this affect natural ecosystem processes such as water flow, animal movement and pollination in vegetation. All the four wetlands have roads passing through them. The Northwood wetland is separated from the Vainona wetland by Harare Drive as shown on fig. 6. The Dzivarasekwa wetland is separated from Kuwadzana wetland by Bulawayo Road and this is illustrated on fig. 7. Princess Road separate the Monavale wetland and the Belvedere wetland. Sherwood Road and Monavale Road cut through the Monavale wetland. Although culverts and bridges are provided, they are not enough to ensure that natural ecosystem flows continue to happen in their natural manner and pattern.

Fig 6: showing roads cutting through Monavale Wetland

Fig 7: showing roads cutting through Dzivarasekwa Wetlands

The human activities that are being practised on wetlands in Zimbabwe are detrimental to the wetlands. The way construction and urban agriculture is happening is affecting the wetlands and their associated biodiversity. The wise use of wetlands is promoted by Ramsar Convention on Wetlands (2018) which ensures that wetlands survive into perpetuity. The Centre for Watershed Protection (2005) states that humans derive positive benefits from wetlands use at the expense of the wetlands. The sustainability of wetlands in terms of water availability and quality is at stake. Harare is constructing its way out of water because the natural purifiers and reservoirs are being disturbed.

Biodiversity composition is also affected by changes in wetlands characteristics. Fresh water species that rely on wetland water are affected when the water is contaminated. When affected, biodiversity may fail to replenish or recover. This is because human activities on

wetlands such as Budiriro are so intense that they do not give nature enough time to recover. For example, it was stated that some water loving bird species no longer come to wetlands in Harare because they are degraded. Habitats for animal species have been greatly affected by wetlands invasion. This means that human activities on wetlands in Harare are highly unsustainable environmentally because they do not allow the wetlands to replenish and recover. Morelli (2011) states that uses that are intense to the extent of making it impossible for nature to replenish are very unsustainable from both the environmental and economic point of view. Wetland connectivity also matter, and it has been affected by urban utilities, agriculture and housing development. The disintegration of wetland spaces through establishment of roads, sewer and water lines affect aquatic species such as fish. This is because they cannot cross from one wetland to the next hence their food supply is limited to the wetlands they are located.

Discussion

Institutions governing wetlands are significant in maintaining and restoring wetlands integrity because they put in place appropriate measures to manage, utilize, improve and protect wetlands ecosystems. It is through these institutions that rules governing wetland resource use, control and management are shaped. The success of these institutions and legal frameworks lies in the synergy that exist amongst policies, priorities and objectives that they formulate. The effectiveness of legal and institution frameworks and systems in governing wetlands lies in their ability to effectively manage these ecosystems instead of just playing a preservation role. It is also important to note that the success of institutions is also hinged on their ability to fulfil their mandate and this largely depends on power relationships, the source of mandate and political rightness or acceptability. There is also need that actions at all levels and by all players be synthesized into the overall wetlands' management mandate if the effective protection and management wetlands is to be fully realised.

As discussed above, legislative deficiency and fragmentation is one major cause that is leading to a continued loss of wetlands right in the face of stewards and custodians of wetlands. Limited recognition of ecologically sensitive areas in the design manuals used in planning also led to all reserved land being termed open spaces. Calling undeveloped land, open spaces instead of wetlands or ecologically sensitive areas may mistakenly attract uses that are destructive to the ecological systems of the wetland. In addition to that, urban development in some parts of Harare is administered using Town Planning Schemes and Local Development Plans. These are legally binding documents and plans whose stipulations should be followed resolutely. However, most Town Planning Schemes were prepared prior to the development of the Environmental Management Act and its allied statutory instruments that's protects wetlands. This means that it was all in the hand of the then Urban Planners to protect wetlands as open spaces. This was done at their own discretion of what they would zone open spaces. This is evidenced by the fact that some of the areas that are zoned residential according to those planning schemes are actually swampy and fall into the category of what are called wetlands by the Environmental Management Act.

When development applications are made for development permits on privately owned areas marked as wetlands on the Wetlands Map of Harare but are zoned residential, commercial or industrial in the operative planning scheme, urban planners tend to incline to the dictates of the Regional, Town and Country Planning Act which is the primary act that governs planning. Also, issues of property rights come into play in reinforcing the granting of a permit to develop on controversial land. This is done at the expense of wetlands and this legislative fragmentation becomes a principal cause of the plight of wetlands. Solani (1998) argues that Peru has developed operative master plans and management plans for ecologically sensitive areas that synchronize wetlands protection and spatial development planning. This has helped to save their wetlands and ecologically sensitive areas from destruction from other activities that may

be given priority of wetlands. This is the missing link in Zimbabwe that is causing continued loss of wetlands despite the presence of wetlands governance systems.

Furthermore, there is limited legislative guidance as to what uses are permissible on wetlands. The Environmental Management Act authorizes through the Minister of Environment and Climate whether or not a wetland can be used but do not specifically state the nature of uses that can be done on wetlands in their different nature. As a result, permissible uses are not even clear. What is deemed permissible in the understanding of local authority officials is different from that which EMA or Harare Wetlands Trust believes is permissible. This is legislative deficiency which leads to issuance of Licence of Use of wetlands for highly impact activity uses that detrimentally affect the wetlands. The Brazil Federal States has countered this confusion by categorizing their ecologically protected wetlands into permanently protected areas and areas of particular ecological interest. As suggested by Shine and Cyrille (1999), this categorisation has become the first step in developing specific legislations for each category which outline specific rules with regards to permitted and prohibited activities. While Brazil has managed to categorize their wetlands, which resulted in improved protection depending on their category, Zimbabwe has not invested in this and hence wetlands or crucial importance continue to suffer at alarming rates. Besides the 7 Ramsar wetland site category, all wetlands in Zimbabwe are just classified as wetlands although they have different names and characteristics.

To add to this legislative deficiency, the Environmental Management Agency allows prospective developers of land that they deem wetlands to engage their own private consultancies to carry out Environmental Impact Assessments. This arrangement is irrational and misguiding because the consultant's hands will be tied in a manner that they won't recommend EMA to stop the development since they will be paid by the client. Conflict of

interest comes into play and normally, the consultant is forced to recommend in favour of their client who is the developer.

The discussion above shows that urban development planning and environmental protection planning are not synchronized and this causes chaos in the planning for development and protection of wetlands. Harare lacks a gazetted wetland because the one that is being used presently was challenged in court and declared short falling in terms of defining a wetland in scientific terms. To further show that there was a mixture of views and fragmentation of laws, it was opined that the Environmental Management Act (Chapter 20:27) supersedes the Regional Town and Country Planning Act (Chapter 29:12). To the contrary, this opinion was dismissed denounced in another interview where it was stated that those submissions where not supported by any legal document. Urban planners believe that the Environmental Management Act does not say that there should be no development on wetlands but rather suggest that it says development can be done on the condition that one gets a permit from the Environmental Management Agency after carrying out an Environmental Impact Assessment. On the other hand, radical protectionists disregard this claim mentioning that wetlands are natural ecosystems that form part of the urban fabric and their disturbance disturbs the whole urban ecosystems hence they should be left alone and undisturbed.

Conclusion and Recommendations

This chapter has demonstrated that there is institutional multiplicity in wetlands governance in Zimbabwe. The wetlands governance suite is fragmented because there is no clear connection and collaboration of stakeholders together with the laws that they use. The introduction of new laws of environmental protection such as the Environmental Management Act Chapter 20:27 has not been supported by the subsequent alignment to existing laws such as the Regional Town and Country Planning Act Chapter 29:12 which deals with the physical planning of cities. The miscommunication between spatial planning laws and environmental planning laws has caused

a situation where the stipulations of a Town Planning Scheme ignores processes which are prescribed as a prerequisite for development by the Environmental Management Act. Furthermore, stakeholders in wetlands protection from the highest inland office to the least have not invested much in developing master and local plans that are centred on ecologically sensitive areas but also incorporating other development plans. Lacking such plans is causing great confusions and chaos as to what should or should not be done on a particular wetland. These issue among others are causing wetlands destruction despite having a congested wetlands governance suite of professionals, residents, governments, local authorities and international organisations.

Having these conclusions, this study recommends that;

1. There be a comprehensive alignment of laws, regulations, rules and statutes that governs urban development and wetlands protection.
2. Development of nationwide wetlands protection plans and wetland specific operative local plans that specifically stipulates the activities that are permitted or prohibited on each wetland.
3. A proper wetlands governance structure or framework is developed that places all stakeholders at strategic positions in the wetlands protection hierarchy to ensure a common goal of sustainable and wise wetlands management.
4. A zoning and rezoning exercise of wetlands areas be done to ensure that the remaining wetlands are protected.

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Community perceptions and attitudes on treated excreta products in peri-urban agriculture: Case of Dzivarasekwa-extension, Zimbabwe

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Abstract: *In Zimbabwe, population growth and urbanisation are increasing the burden on metropolitan municipalities' basic sanitation. The proportion of urban population is high (66%) in Zimbabwe compared to the regional rate of 39 percent and has a significant burden on the already overstretched and limited sanitation systems. Therefore, a paradigm shift in the way human waste is managed and perceived is required as well as the provision of solutions to the challenges of poor sanitation. However, there is anecdotal evidence on farmer's attitudes and perceptions on treated human excreta fertilisers in agriculture. The study sought to unpack farmer's perceptions and attitudes towards the use of treated human excreta in peri-urban agriculture. Data were collected from 100 randomly selected individuals using a structured questionnaire. Both inferential and descriptive statistics analysed the data. The results show that 71percent of the respondents had an understanding of how human excreta fertilisers can be used to boost agriculture and ensure food security in peri-urban areas. Further analysis shows that there was no statistically significant difference (P=0.062) between the level of education and gender. However, there was a moderate association (Cramer's' V=0.62). Out of the 100 respondents, 40 percent agreed that human excreta is suitable only for disposal and not as a resource for agricultural production, while 15 percent didn't know, and 45 percent disagreed. Fear of diseases outbreaks such as cholera, typhoid, HIV and AIDS were found to be the main reasons people had negative perception towards human excreta products in agriculture. Based on the results, 49 percent of the respondents preferred to use both faeces and urine products, while 38 percent preferred faeces only, and 13percent preferred urine only. The study concluded that people are not comfortable to use human excreta products in agriculture, as human excreta is associated with dirtiness and diseases. The paper recommends that there is need to educate people about the proper handling, use and hygienic issues on the harvesting of human excreta for agricultural purpose.*

Keywords: *Attitudes, Food Security, Human Excreta, Perception, Urban farming*

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1. Introduction

The growing food demand and increase in the use of human excreta caused by the ever-growing urban population has resulted in development researchers to focus on the relationship between human excreta and human excreta derived fertilisers (Pedzisai et al., 2014). Due to rapid population growth and food demand, huge investments have been made on fertilisers in Zimbabwe. Financial constraints facing most of the poor farmers in the country makes fertilisers inaccessible, yet there is a need to ensure sustainable food and nutrition security in the country. International trends suggest the use of low-cost, ecologically suitable alternative fertilisers, such as human excreta (Moilwa, 2007).

Rapid population growth and urbanisation coupled with natural resource depletion and the need to feed the rising global population has placed resource recovery and re-use on top of the worldwide development agenda (di Mario et al., 2018). In Zimbabwe, the percentage of urban population which is 66 percent is higher than the sub-Saharan Africa rate, estimated to be around 39 percent in 2017 (World Bank, 2018). As a result of rural-urban migration and growing population, the urban population in Zimbabwe is projected to reach 71 percent by 2030 and 80 percent by 2050 (Angelopulo, 2017; CoGTA, 2016; Mlambo, 2018). Rural-urban migration often leads to overpopulation and expansion of informal settlements which have unplanned waste management and disposal practices. This leads to environmental threats in community pollution and various sanitation-related illnesses, especially among children. The growing urban population poses a threat to urban food security through increased food demand and environmental degradation through increased human excreta (Pedzisai et al., 2014; Sovereignty, 2019). This places a considerable burden on public funds whose budgets are already overstretched and inadequate to maintain the basic sanitation systems in urban areas and meet the food requirements of people.

Experiments on the effects of human excreta fertilisers on soil and yield show that human excreta fertilisers are effective alternatives to commercial inorganic fertilisers, especially when complementing chemical fertilisers (Odindo et al., 2016). Additionally, the effect of wastewater effluent on banana and taro crops showed increased crop growth, nutrient uptake, and yield (Musazura, 2018, Odindo et al., 2016). Urine is rich in nitrogen, while faeces are rich in, potassium, phosphorus, and organic matter (Simha & Ganesapillai, 2017). Therefore, a

transformation of human excreta into soil amendments and their wide-scale adoption could help improve soil health, environmental sustainability, wastewater management, food security and solve the sanitation crisis in Zimbabwe. Moilwa (2007) effectively sums up the benefits of human excreta fertilisers as; (1) improved food security, (2) increased productivity, (3) decrease in the burden of social services, and (4) enhanced natural resources such as water and soils.

Despite the role of human excreta fertilisers to food security and economic development, the social acceptability of the products is a problem (Moilwa, 2007). Across Africa, there is a perception challenge around human excreta derived fertilisers because of the harmful components they contain, such as pathogens and heavy metals (Mariwah & Drangert, 2011). Human excreta fertilisers are associated with dirtiness and spread of diseases such as cholera, typhoid, and HIV and AIDS (Mariwah & Drangert, 2011). Therefore, the study attempts to address these research gaps and give insights into the various elements of Human Excreta Derived Material (HEDM) demand such as attitudes, perceptions, and preferences of farmers and to provide essential information for agricultural policymakers.

2. Materials and Methods

Dzivarasekwa which was designed by the colonial government to introduce the home ownership scheme to African is located on the western side of Harare's Central Business District, with an estimated population of 22 324 people (ZimStat, 2012). Dzivarasekwa Extension suburb was equally established by the post independent government in the 1993 to house those who were evicted from slums in Mbare. . Till today, the suburb has remained predominantly a working-class residential area characterized with high poverty and food insecurity levels which feed into the urban and peri urban farming practice. Residents practice farming in two main ways, which are farming plots on open City Council land and cultivation within individual residential stands (Figure 1). However, there is an emerging form of agriculture which is gaining momentum, the planting on undesignated land-open space and wetlands. Farming on these illegal zones often poses serious urban planning challenges as well as environmental, social, health and infrastructural risks.

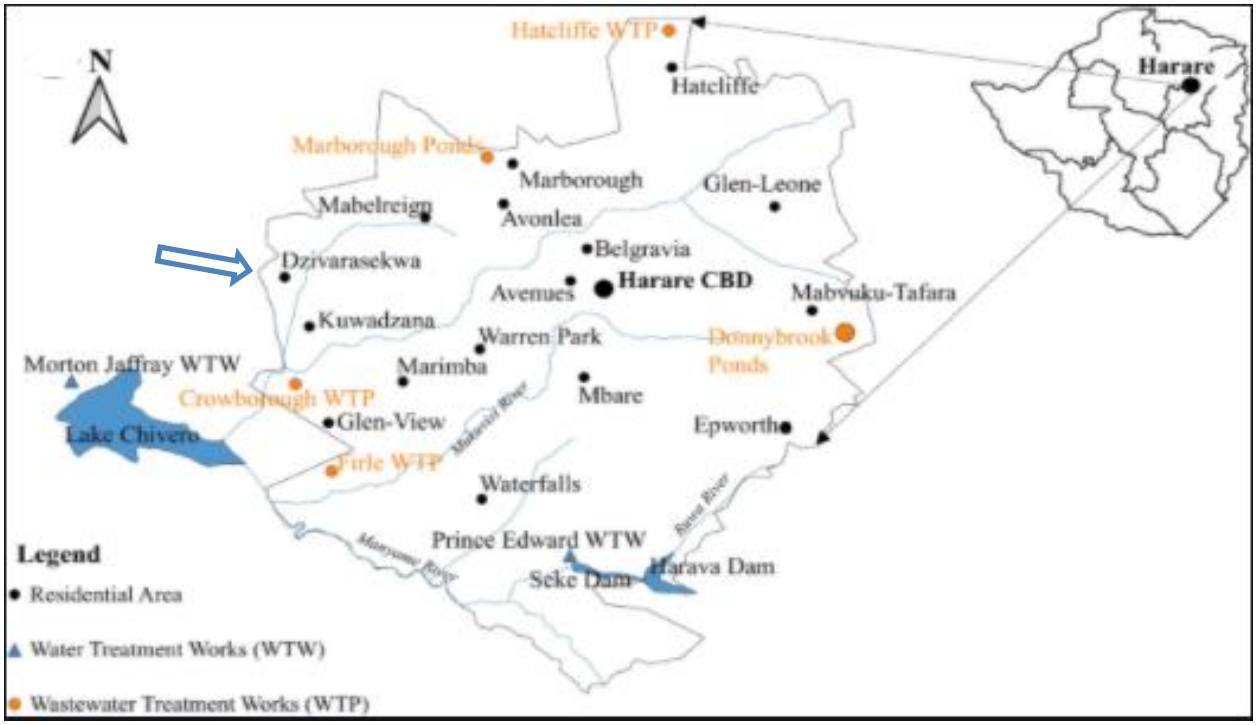

Figure 1. Dzivarasekwa Map. Source: Google Earth, November 2018)

2.1 Theoretical Framework

This study was guided by Ajzen (2002) theory of planned behaviour, which provides a framework for studying human action as illustrated in Figure 2. Human behaviour is guided by three kinds of considerations: beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes, beliefs about the normative expectations of others and motivation to comply with these expectations (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behaviour (control beliefs). The combination of the three considerations (attitude towards the behaviour, subjective norm, and perception of behavioral control) guide an individual to form a behavioral intention (Ajzen, 2002). Generally, the more favourable the attitude and subjective norm, and the higher the perceived control, the stronger should be the person's intention to perform the behaviour in question. The purpose is assumed to be the immediate antecedent of expression or action.

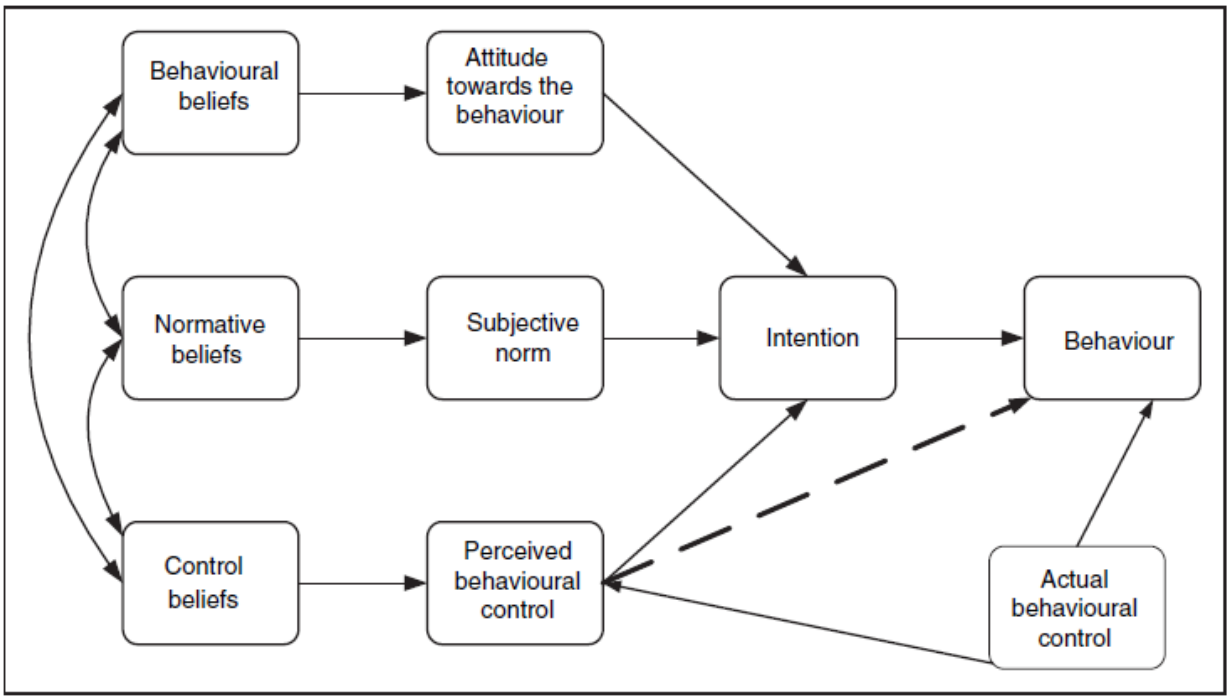

Figure 2: Theory of Planned Behavior (TPB) ***Source: Adapted from*** **(Ajzen, 2002)**

The theory of planned behaviour is useful to this study because perceptions, are influenced by one's knowledge, beliefs, values, and norms. The more knowledgeable human are about human excreta, the more precise opinion are held and the stronger attitudes and perception built. Similarly, being informed about an issue is even more likely to influence human behaviour particularly where knowledge is gained from the first-hand experience.

2.2 Research design

The data were collected between November and December 2018 using a pre-tested structured questionnaire. Enumerators with good knowledge about food systems and conversant in the local language Shona administered the questionnaire. Key Informant Interviews (KIIs) supported and supplemented the data from the questionnaire. Before the main study, a pilot study involving ten farmers checked the questionnaire for consistency, errors and ensured the enumerators familiarised with the research design. Hassan et al. (2006) argue that a pilot study is an important stage in research and is conducted to identify potential problem areas and deficiencies in the research instruments and protocol before the implementation of the main study. All this was done with in a mixed methods research design which allowed for the collection of both qualitative and quantitative data.

The study employed a multi-stage sampling technique to come up with the sample for the study. First, Dzivarasekwa was purposively selected for the study. The criteria used for the inclusion

of the suburb were (1) the unemployment rate, (2) the number of urban farmers and (3) the poverty and food insecurity levels. Second a list of the households was compiled through the assistance of the district officer. After compiling the list, the Cochran formula determined the ideal sample size given a desired level of precision, desired confidence, and the estimated proportion of the attribute present in the population (equation 1). The Cochran formula is expressed as:

$$\mathbf{n = \frac{p(100-p)Z^2}{e^2}\ equation\ 1}$$

Where n is the required sample size, p is the percentage occurrence of a state or condition, e is the percentage maximum error required and Z is the value corresponding to the level of confidence required. The top hat method randomly selected the respondents for the study. The method involved attaching a number to each of the household on the list then put the numbers in a hat and randomly select. All procedures were undertaken with formal approval from the Women University Ethics Committee. Primary data were collected using structured questionnaires. Information on basic characteristics of household head such as sex, age, marital status, education level, perceptions and attitudes were collected using the questionnaire.

3. Results and discussions

3.1 The influence of gender towards the use products derived from human excreta

The gender split of the 100 respondents in the field research was 70% female and 30% male (Figure 3). Men and women in households interviewed also had different ideas and opinions regarding human faeces. The results show that 70% of the women constituency were aware of the value of human faeces as a fertilizer while the remaining 30% were either ignorant or unwilling to appreciate issues to do with human waste. Comparably, 57% of men did not have much of an opinion, while 10% viewed human waste as a useless resource and 6% believed that it was unhealthy. Thus 60% of both men and women shared the same view that human excreta could be handled and used as a form of organic fertilizer that enhance crop production.

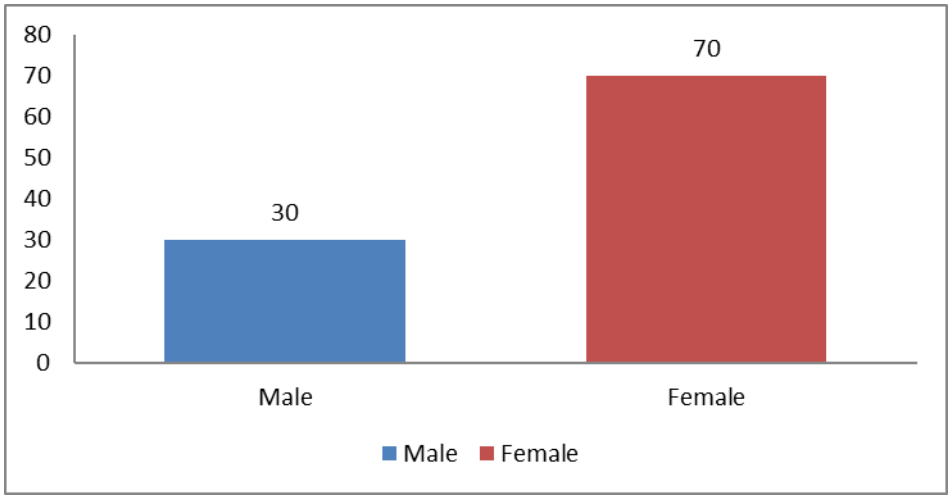

Figure 3: Gender of participants

3.2 The influence of level education towards the use of human excreta derived products

Literacy was a common characteristic among the respondents with 54% having a tertiary level of education, while 31% had a secondary level education and 11% had a primary level of education. Only 4 % of the respondents did not have any form of formal education (Figure 4). The level of education of the respondents varied from household to household. Based on a chi-squared test- χ^2 test, there was no significant difference (P=0.062) amongst education level and gender, but there was a moderate association (Cramer's' V=0.62) between gender and education. The results indicate that the level of education among farmers in Dzivarasekwa is not affected by their gender. Zimbabweans, regardless of gender are ranked as the most literate in Africa (Stewart *et al.*, 2013; ZimStat, 2012).

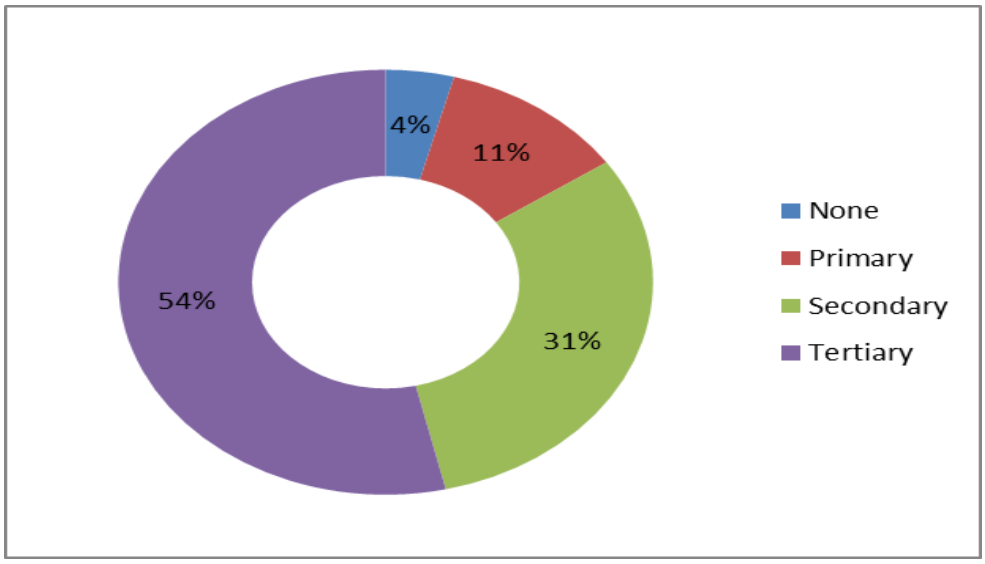

Figure 4: Level of education

3.3 Fear of Diseases

The survey indicated that 55 % agreed that to handle human excreta is a high health risk, 10% did not know 35% disagree that is of health risk. It was also noted that 40% said human excreta is a waste and only suitable for disposal (Table 1). Higher percentage said if human excreta are treated, it is not a taboo to touch it.

Table 1: Residents' attitudes and perceptions of human excreta products

Attitudes and perceptions	Agree (%)	Do not know (%)	Disagree (%)
Human excreta are a waste and suitable only for disposal	40	15	45
Human urine has no benefit to humans	34	5	61
Handling excreta is a high health risk	55	10	35
Human excreta should not be handled in any way	29	11	60
It is a taboo to handle urine	20	14	66
Human faeces have no benefit to humans	19	20	61
It is a taboo to touch faeces	38	6	56
It is a taboo to touch treated faeces or urine	23	15	62

Basing our analysis on data from able 1, it is evident that that both residents and farmers in the study site were afraid of diseases associated with the use of human excreta fertilizers. The main point they raised was that there was no guarantee that all the pathogens could be dead in the stuff. One of the greatest fears was handling a stranger's human excreta they argued that theirs and their family really bothered. Thus the majority who constituted 55% agreed that handling human excreta was a high health risk and therefore, human excreta could not be used in always. This attitude and perception also came out loudly during focus group discussions with the

farmers. They argued that improper use of human excreta causes water-borne disease like cholera and typhoid. Those with positive attitudes towards utilising human excreta argued that maintaining a high standard of hygiene worked for the good of the project. . In the discussion, one participant said "People have different health conditions and using their poop for agriculture purposes is like sitting on a time bomb". This showed that when it comes to health issues, people are not comfortable with the use of human excreta as fertilisers; Similarly, the Department of Agriculture Forestry and Fisheries (2014) in Mozambique examined the possibilities of using Human excreta in agriculture and found that most of the people feared the diseases associated with the use of such fertilizers. There were general feelings that touching or handling excreta, especially faeces, should be avoided. Some respondents also worried that the faeces could be infected with the HIV/AIDS virus. (Department of Agriculture Forestry and Fisheries, 2014).

3.4 Potential use of Human Excreta

During the study it was noted that farmers have resorted in the use of human excreta in agriculture due to the expensive and scarce fertilisers. They argue that human excreta are readily available and are good manure. The study established that 90% of the respondents were involved in urban farming and consumed agriculture from that process. The study shows that some people have knowledge that treated human excreta can be used as fertilizer successfully. Of the 200 respondents, 71% agreed that treated that human excreta can be used as a fertilizer, while 29% disagreed that treated human excreta can be used as a fertiliser, refer to ***Figure.3*** refers. The results concur with Guzha et al. (2005) who found that most farmers in Zimbabwe agree that human excreta could be used as fertiliser.

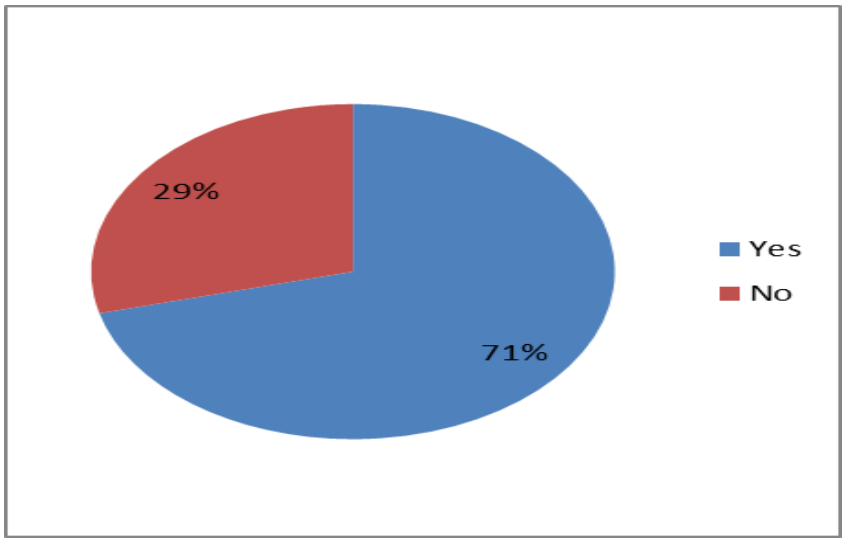

Figure 5. Knowledge of Human Excreta as a Fertilisers Source: Field Visit

The survey also shows that while human excreta is abundantly used in open space plots by farmers, it had potential of being used even in backyard gardens where vegetables and flowers are planted. The survey showed that 62 % of the farmers used the human excreta organic fertilizer on products they intended for selling despite 30% consumed the products. . This shows that farming in the area is mainly for both consumption and sale purpose, as depicted below ***Figure 4***. Like other high density suburbs, Dzivarasekwa farmers do their marketing at the local sale point. There was potential that products from the human excreta fed plots could be put on the larger market in greater Harare and the concept of converting human excreta be further refined and used on a larger scale. The study showed big potential in the project more so if the private corporates which are into fertiliser production could have the buy in.

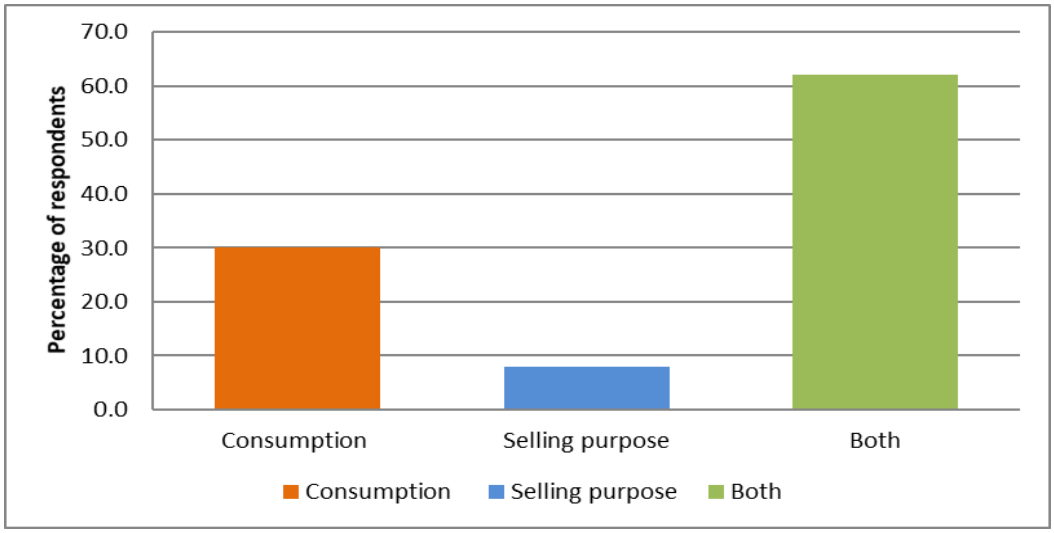

Figure 6: Consumption and Selling Percentages Source: Field Visit and Data Analysis

Attitudes and Perceptions of Farmers Towards the re-use of Human Excreta in Agriculture

Evidence from the study show that there is a lot of farming activities in the environments of Dzivarasekwa suburb which support the view that urban and peri-urban farming contributes to the uphold of urban food security. . The views of the research respondents were that this project could be supported and used for the furtherance of urban food security if done correctly. Our literature review have shown that this is a practice done in many parts of the globe. However, for Dzivarasekwa residents, due to their economic circumstances, we argue that both the consumption and selling is done out of desperation. The continuous usage of the human excreta

products eventually contributed to their change of attitude. Even the attitude of other consumers and customers equally changed to being positive. Interviews with consumers revealed that a big percentage appreciated the quality of crops and vegetables.

Table 2: Attitudes and perceptions of farmers towards the re-use of human excreta in agriculture.

Question	Agree (%)	I do not know (%)	Disagree (%)
Human excreta are a resource for the soil	77	10	13
Sanitised human excreta can be used as fertilizer	57	26	17
I will use human excreta on my crops if sanitized	53	12	35
Taste of vegetables will change when fertilised with urine	21	39	40
The smell of vegetables will change when fertilised with urine	17	35	48
Crops can be killed when fertilised with urine	8	40	52
Crops fertilised with human excreta are suitable for consumption	52	21	27
I will never consume plants fertilised with human excreta	43	4	53
Animal manure can be used as fertilizer	87	5	8
Treated human excreta can be used for other purposes like Energy, Fertilizer for forest etc	69	23	8

Consumers also indicated that at times they just bought vegetables, even excreta have been used or not they do not know. Our observation was that farmers did not raise any form of

awareness since all residents knew about what was happening in the open farming plots. Unless such services would be engaged by the relevant organisations like the Environmental Management Agency, no individual farmers would do so. However, it was cases of Cholera outbreak which forced consumers to avoid products sold on open markets and subsequently affected activities of entrepreneurial farmers in Dzivarasekwa. .

According to the survey, 77% of the respondents know that human excreta is a resource for the soil and 57% agreed that treated human excreta could be used as a fertiliser. Although most agreed that treated human excreta could be used as a fertiliser, 53% of the respondents would use human excreta on their crops as shown on ***Table 2***. This was better explained by another farmers responds who said, 'human excreta are suitable for the soil, it is manure when there are treated human excreta on the ground and crops germinate there like, amaranths, pigweed and tomatoes'. Some said they do not even care what manure is used for plants in the market, but they buy and eat, and nothing has ever happened. They also noted that those crops with chemical fertiliser, especially vegetables, taste bad than fertilised with human manure because humans eat a lot; therefore, his or her manure is rich in nutrients. This can also be supported by United States of America (USA) Experiments in the USA that found that maize, which was grown using substantial quantities of urine grew 50% taller than corn is grown using no urine at all (Mackie Jensen et al., 2008). Thus, 40% disagree that human excreta will change the taste or destroy crops; they argued that it would taste perfect see ***Table 2.*** One respondent during the survey said human excreta do not damage plants, look at public toilets crops or grass nearby seems very green and healthy and tempting to eat but due to the perception we people have towards human excreta most people do not eat such crops because it is associated with dirtiness. They argue that they are not willing to use it due to attitudes and perception they have on human excreta. Therefore, they say that there is a need for attitude change.

Some also pointed out that there are many diseases people suffer some which are contagious thus prevent people from using human excreta on crops, especially vegetables; instead, they would use human excreta on flowers. Guzha (2001) in Dzivarasekwa extension, Zimbabwe reveal that most of the residents will not use human excreta for growing vegetables as they are not comfortable eating vegetables fertilised by human manure. Other community members said they would use excreta for planting flowers, maize, and fruit trees.

3.5 Cheap Sanitation Facilities

A number of research participants in Dzivarasekwa reasoned that pit toilets were cheap sanitation facilities easy to construct, manage and extract human excreta from them. They knew human excreta could be used as a fertiliser due to the knowledge that they were given during the program (Guzha et al., 2005). A table below indicates a series of likened questions to evaluate the perception and attitudes towards the re-use of human excreta. Out of 100 respondents, 40 percent agree, while 15 percent did not know and 45 percent disagree that human excreta were not suitable only for disposal and not a good resource for agricultural fertilisers *see **Table 3*** There was variation in response to selected residents. The majority of the population of respondents constituting 55 percent agreed that handling human excreta is a high health risk and therefore human excreta should not be handled.

Table 3: Residents' attitudes and perceptions of human excreta products

Residents' attitudes and perceptions towards human excreta products	Agree (%)	I do not know (%)	Disagree (%)
Human excreta is a waste and suitable only for disposal	40	15	45
Human urine has no benefit to humans	34	5	61
Handling excreta is a high health risk	55	10	35
Human excreta should not be handled in any way	29	11	60
It is a taboo to handle urine	20	14	66
Human faeces have no benefit to humans	19	20	61
It is a taboo to touch faeces	38	6	56
It is a taboo to touch treated faeces or urine	23	15	62

In the area where human excreta was used abundantly, they used diversion canals to tape into the human waste and eventually used it as fertiliser. However, they acknowledged that was it

not for their poor backgrounds, they would have had like proper flushing toilets. They also stated that the emptying process of buckets with human excreta was laborious and cumbersome as well as tiring the mind that it was mostly done during the night.

3.6 Appearance, Religious, Fear of being Stigmatised and the Smell

Our study established that the majority of residents of Dzivarasekwa could use human excreta for fertilizing their backyard gardens and open space plots but were held buy a number of issues. Religiously, certain sects of the local religious groups believe that handling human waste on a daily basis brings and open windows for the entry of evil spirits. We argue that religion and its belief systems control a reasonable percentage of people in the context of African spirituality and cosmology. As a result, our study concluded that sections of the population that did not use human excreta despite their dire economic conditions was an outcome of religious beliefs. In that context, respondents would take up a certain behaviour for the purpose of keeping up appearance and be acceptable in the community religiously. Compounded with the issue of stimatisation as well as the issue of bad smell that comes from human excreta, many would not use the human waste for fertiliser. **Table 4** below helps illustrate the issues discussed here.

Table 4: Reasons why residents do not like human excreta.

Option why residents do not like human excreta	Per cent
Appearance, Health R, Mock, Patronage, Religious", smell	58.0
Appearance, Health R, Mock, Religious", smell	3.0
Appearance, Health R, Religious"	4.0
Appearance, Health R, Religious", smell	8.0
Appearance, Mock, Religious"	4.0
Health R, Mock, Religious"	3.0
Health R, Mock, smell	5.0

Health R, Patronage	6.0
Health R, Patronage, smell	4.0
Mock	5.0

Most people during the research argued that they fear being mocked and this prevents them from using human excreta. Women participants also pointed out that religiously, cleanliness is next to God and hence human excreta are considered very dirty. Others argued that some might not want their faeces or urine re-used fear of black magic and witchcraft. This was also noted in other studies. In Uganda, an eco-san project carried out in Kampala showed that 22 farmers had been identified and agreements signed with them to carry out demonstrations and trials on their farms. These farmers will be involved in the plot demarcation and decision making on the types of crops to be grown. One of the challenges experienced in this study was the unacceptability of using faeces products (Niwagaba, 2009). In Nigeria prohibit the collection of urine by strangers for fear that the urine may be used against the people through 'black magic' or 'evil spirits' (Akpan-Idiok, Udo, & Braide, 2012).

4. Discussion

The study sought to unpack farmer's perceptions and attitudes towards the use of treated human excreta in peri-urban agriculture. The use of human excreta for agricultural purpose internationally is an old and well-known practice. However, in Zimbabwe, the handling of human excreta and its use for food production is still generally not acceptable. In Dzivarasekwa, human excreta are seen as waste products, unhealthy, unhygienic, and detrimental to humans (Moilwa, 2007). However numerous ancient Arab, Chinese, Greek, Roman and Spanish authors extolled the benefits of human manure, and some gave specific instructions on how to process it and get a product that is odorless and useful as a fertiliser. From the survey, it can be noted that the use of treated human excreta for agricultural purposes is not widespread in Zimbabwe. Yet this essential organic manure is thrown away; the government spends scarce foreign exchange importing chemical fertiliser.

Using urine is considered harmless and inoffensive, since urine is indistinguishable from the water in the ground and stepping into it is quite different from stepping onto human faeces.

Positive attitudes towards the use of excreta need to be reinforced with practical demonstrations on the safe use of human manure. Production of human manure should be associated with the safe use of animal manure. Good agricultural practices should also be encouraged to ensure that faeces do not meet the edible portions of crops. Excreta-related diseases are prevalent in developing countries since excreta contain high concentrations of pathogens that can cause infections in humans. Therefore, there is a need to practices proper hygienic ways of handling human excreta.

The results from the research indicated that the level of education of the respondents did not have a direct effect on farmer's perceptions and views of the use of human excreta for food production. It was clear that the level of information and knowledge regarding the use of human excreta for food production had a significant impact on the views and perceptions of the respondents. The more the respondents knew about the value of human excreta, the more willing they were to use it as a fertiliser in their gardens. In general, the male respondents had a lower level of knowledge regarding the fertiliser. However, the traditional gender roles in the communities were still observed and sanitation was regarded as a women's issue. Men, therefore, did not have much of an opinion regarding the use of human excreta.

Most of the respondents said that people would change their minds and use human excreta as fertiliser in their vegetable gardens if they were adequately informed on the advantages of doing so. Some also said that to lead by example was the best way; therefore, councilors and development practitioners should fund and implement human excreta fertilizer projects in the communities. Only a few respondents said that it would be impossible to change people's minds as it was culturally a taboo to handle human excreta. There is a general norm of not handling human excreta as it is considered unhygienic is still influential among the respondents. Even though they said that they would use human excreta in their gardens and eat the food produced, it remains to be seen whether they will do so. Use of human excreta cannot be entirely accepted, understood, and preserved well without identifying peoples' attitude and perception in the community (Bryant *et al.,* 1997). For instance, the level of understanding of the use of human excreta in agriculture varies among different groups, such as farmers and end-users. This theory of Planned Behavior (TPB) maintains that an individual's intention to perform a behaviour is predisposed by a combination of behavioral attitude, subjective norms, and behavioral control (Ajzen, 2011). It postulates that attitude, norms, and perceived behavioral control, however, determine environmental behaviour. Human attitude towards the environment is centered on complex moral and social values and comprise

behavioral intention, beliefs, and affective responses people hold pertaining environmental issues and activities (Langergraber & Muellegger, 2005; Mariwah & Drangert, 2011). This is imperative in understanding how community and farmers from the valuation of a decision or an object based on their perceived attitude and participation on use of human excreta in agriculture (Mariwah & Drangert, 2011).

Key informants from Ministry of Agriculture (Agricultural Extension and Technical Services-AGRITEX), Harare City council and Environmental Management Agents (EMA) highlighted the importance of re-use of human excreta in agriculture as a fertiliser and potential use in energy. During the interviews with key informants, most of them acknowledged the importance of human excreta to circle economy, maybe a relief to poor management of sewage in urban areas and then improve agriculture production by providing alternatively treated fertilisers from human excreta. All key informants indicated the importance of a political will to take re-use of treated human excreta in agriculture. A nexus approach of including farmers, consumers, farmer's union, researchers, and government with the aid of political will help the adoption of human excreta for clean cities and improve food security. They illiterate the formation of policy which tackles health issues associated with human excreta, environmental impact assessments and social accessibility of human excreta by the communities (Gillespie, 2009). Therefore, there is a need to understand the circular economy and opportunity cost to adopt human excreta as a strategy to improve agriculture production in urban areas.

5. Recommendations

The most fundamental thing that might be needed for people to have a better understanding for the use of human excreta in agriculture is to educate them about the proper handling, use and hygienic issues on the harvesting of human excreta for agricultural purpose. In addition to this, there is a need to educate people on the safest process of changing human excreta into usable manure free from pathogens, for example, through composting and how it is appropriately done. There is also a need to teach people on ecological balance and sustainable development one that values our environment while at the same time boosting Agricultural production.

It is of great importance to change human perceptions to ensure the success of human excreta diversion sanitation technology where there are no sewers and properly serviced stands especial for illegal settlers. Education and an integrated approach where everyone is included and able to participate should be used. This can be achieved by involving all the stakeholders to participate in such projects, coupled with institutional monitoring and evaluation. There is a

need also to intensify awareness programs with practical demonstrations to show the beneficial aspects of using human excreta fertilisers. The government should play a pivotal role in widely promoting the technology through various media and ensure that there are marketing approaches that use different mediums of communication giving the relevant information that reinforces the uptake of human excreta fertilisers. Those who market and promote the use of human excreta fertilisers should be expertise with correct information and knowledge of the subject to ensure that users of this sanitation system understand it well. Furthermore, there is a need to target all farmers in urban and rural farmers and commercial farmers to promote technology through the eco-village concept will also create some "status" for the technology.

The health and hygiene education should emphasize the safe use of human excreta on food production from the start to reinforce householders' choice of re-use of nutrients. To ensure success in acceptance and marketing ecological sanitation solutions for food production requires a change in the way people think about, and act towards, human excreta. Acceptability of use of human excreta vary from one country to another and looking at Zimbabwe given issues of WASH projects there is a lot that needs to be done because people associate human excreta with diseases and is considered of significant harm and should not be handled in any way. It also should be noted that generally, some cultures do not accept the handling and direct use of human excreta. Cultural taboos indeed need to be changed for people to allow using their faeces and urine as fertiliser for food crops. Therefore, adequate education and hygiene awareness campaigns in communities should be a prerequisite for the maintenance of public health. It must be taken into consideration that for those countries that succeeded in changing people's attitudes towards the use of human excreta used demonstration toilets, peer education and peer pressure and adequate information that address people's fears towards the use of human excreta.

Local authorities spend vast sums of money to dispose of human excreta as waste yet re-using human excreta for agricultural purposes can save expenditure for chemical fertilisers, improves soil fertility, reduces poverty and ensures food security (Schouw, Danteravanich, Mosbaek, & Tjell, 2002). Therefore, the study recommends city council authorities to investigate this and establish a cheap and safe way of harnessing human excreta into agriculture. A study on the factors that are vital in changing the perceptions and views of people regarding the use of human excreta for food production will be of great value People are willing to opt for affordable fertilisers and protect the environment while at the same time boosting agricultural production. Such a study should focus on the areas where urine diversion sanitation projects were

successful, commercial farmers in major crop-growing regions (2A,2B) and sustainably implemented and where households are actively using human excreta in their vegetable gardens. There is also a need for medical assurance that the use of human excreta has been proved that it works and has been used long back in other countries which now have improved food security.

6. Conclusion

The study investigated what exactly prevent farmers and residents from using human excreta in their field and what may prevent community as consumers from eating crops fertilised from human excreta derived products. Also investigated key informants' stakeholder why treated human excreta is not used in Zimbabwe. Human excreta regarded the" dirtiest" fertiliser due to unethical issues. However, studies have shown its importance in energy, agriculture, and nutritious values to improve food security and sanitation in urban areas hence there is need to consider the use of human excreta derived products in Agriculture. A proper study on social attitudes, perceptions and preferences of farmers will provide valuable information for agricultural policymakers in the use of human excreta. People understand that organic manure is an excellent idea of re-use of nutrients and can boost agriculture. But when it comes to the use of human excreta, people are afraid of diseases such as cholera, typhoid, HIV and AIDS that may be passed to others using human excreta. Many are aware that human excreta can be used as manure, yet most of the people are not willing to use someone's poop unless it was their own. Some people (38%) said they preferred urine rather than faeces were as 18% said they preferred faeces because they view urine as having less pathogen than faeces. The survey indicated that some people are not yet comfortable in the use of human excreta derived products since they associate human excreta with dirtiness and diseases. Others feared witchcraft and black magic; thus, they would not want their faeces or urine collected. One of the challenges experienced in this study was the unacceptability of using faecal products (Niwagaba, 2009). In Nigeria prohibit the collection of urine by strangers for fear that the urine may be used against the people through 'black magic' or 'evil spirits' (Akpan-Idiok et al., 2012). Generally, faeces are perceived quite differently and are regarded as offensive and unpleasant to handle as they may contain a variety of pathogens. Generally, faeces are perceived quite differently and are regarded as offensive and unpleasant to handle as they may contain a variety of pathogens

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