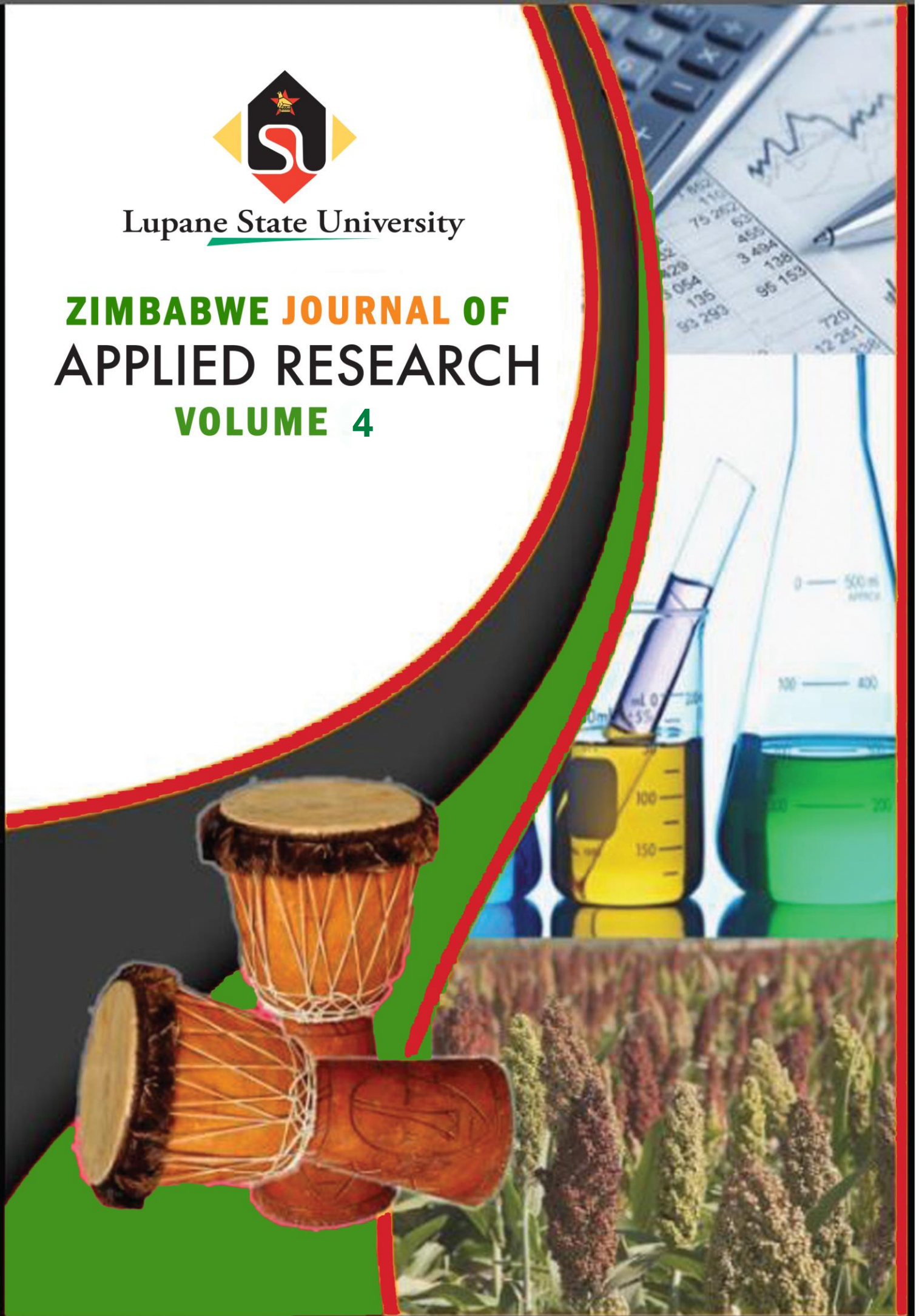




Lupane State University

ZIMBABWE JOURNAL OF APPLIED RESEARCH

VOLUME 4



NOTE FROM THE EDITOR

We are delighted to publish the 4th volume of the Zimbabwe Journal of Applied Research. The Journal continues to grow and to mature with contributions coming from different thematic areas which include the Covid-19 pandemic, food insecurity responses, counselling under the Covid-19 pandemic, cultural and linguistic studies, water resources management and quality assurance in Higher Education as an emerging theme.

The paper by Rashidi, Jingura, and Kamusoko uses a qualitative approach to explore pragmatic ways of overcoming resistance to Quality Assurance (QA). The paper outlines the reasons for resistance to QA based on the historical context of academic freedom and self-governance as cornerstones of a university. The paper discusses strategies to overcome resistance to quality assurance in the Higher Education sector.

The research article by Dube et. al, examines the impact of Covid-19 on household food insecurity in Bulawayo, Zimbabwe. Using a qualitative approach, the paper examines cases studies of household responses to the Covid-19 induced food insecurity. The study established that the lockdown disrupted food supply chains in various ways. Several coping strategies were employed by households to withstand food insecurity. The paper makes recommendations for preventing food insecurity in similar future emergencies.

A similar study by Yusuf et. al examines counselling as a helping profession under the Covid-19 pandemic. They observe that many individuals and the general public were fearful (or may become fearful) of contracting the novel virus. The psychological reactions to Covid-19 pandemic in terms of mental health may include stress, anxiety, depression, fear, uncertainty, panic behaviour, feeling of hopelessness, depression and suicidal behaviour. The paper discusses various counselling approaches applicable to victims of Covid-19 anxiety.

Moyo, Dahwa and Moyo's study sought to determine water resource suitability in Makoholi Research Institute, Zimbabwe using the FAO land suitability classification method of 1991. The water points were identified through the use of a scanned map in a Geographic Information System (GIS) environment and ground verification. Physio-chemical characteristics of water were tested through a laboratory procedure. The General Linear Model (GLM) was used to establish differences in water physio-chemical parameters due to sampling site and season.

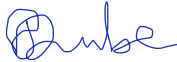
The study by Ekedo et. al was conducted to evaluate the insecticide resistance status and the frequency of L1014F *kdr* mutation in malaria vectors within Abia state, Nigeria. Immature stages of *Anopheles gambiae* (s.l.) were collected from Umudike, Agalaba, and Ebem communities and reared to adulthood. Among other findings, the worrisome resistance to Bendiocarb in Agalaba suggests existence of metabolic resistance that needs to be clarified, and the high occurrence of L1014F resistance mutation calls for urgent implementation of integrated vector control strategies in Abia State.

The article by Mukonzvi explores different communicative modes hypertextually interacting with each other in a music video by a Zimdancehall musician Jah Signal. The music video which is titled 'Stand Up To Vandalism' advocates behavioural change against vandalism of Zimbabwe Electricity Transmission and Distribution Company (ZETDC) infrastructure. The article advances

the argument that the selected video is promoting a quasi-government advertising discourse operationalized through a public entity, ZETDC.

A similar cultural article by Dube examines the historical bearing and ideologies in the naming of streets and townships in the city of Bulawayo in Zimbabwe. This study provides background analysis about how township and street naming was done in Bulawayo. The paper discusses the use of iconic leaders such as Mzilikazi, Lobengula, Nkulumane, Nguboyenja, Joshua Mqabuko Nkomo, Joshua Tongogara, Robert G. Mugabe and others in the naming of townships and streets in Bulawayo and other Zimbabwean towns.

Dr Thulani Dube



Chief Editor

Journal Objectives

The Zimbabwe Journal of Applied Research aims to publish peer reviewed articles that employ Scientific Research Methodologies to generate applied knowledge in the fields of Agriculture, Engineering, Commerce, Social Sciences and Humanities. The journal seeks to give its wide readership evidence-based knowledge that bridges the gap between theory and practice. It also offers academia and practitioners across disciplines a platform to share their work with the international audience.

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RESISTANCE TO QUALITY ASSURANCE IN HIGHER EDUCATION: OVERCOMING THE CHALLENGE

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ABSTRACT

Contemporary quality assurance (QA) practices represent neoliberal managerialism in higher education institutions (HEIs). Staff resistance to managerialism in HEIs is well documented. This paper uses a qualitative approach to explore pragmatic ways of overcoming resistance to QA. The paper outlines the reasons for resistance to QA based on the historical context of academic freedom and self-governance as cornerstones of a university. A typology of discursive and behavioural forms of resistance is provided in order to enable IQA practitioners to identify overt and covert modes of resistance. Diffusion of innovation (DOI) theory is used to outline attributes of QA that can be used to enhance its adoption. The attributes considered are compatibility, relative advantage, observability, complexity and trialability (CROCT). Structural and systemic decentralisation of QA mechanisms are suggested as critical factors for adoption of QA. It is concluded that resistance to QA can be minimised by leveraging its CROCT attributes for higher education.

Keywords Higher education; quality assurance; resistance; diffusion of innovation

Introduction

Contemporary quality assurance (QA) practices in higher education are underpinned by new public management logics of accountability, transparency and performativity (Jarvis 2014; Morrissey 2013; Blackmore 2009). Morley (2003, p. 100) states that 'for both the state and at the level of the individual institution, quality assurance has become a form of governance'. Resultantly, quality has become a marker of distinction in international higher education markets (Blackmore 2009). QA is an umbrella term that can be broken down into external quality assurance (EQA) and internal quality assurance (IQA). EQA refers to supra-institutional policies and practices whereby the quality of higher education

institutions (HEIs) and academic programmes is assured (Dill 2007). The International Network of Quality Assurance Agencies in Higher Education (INQAAHE) defines IQA as 'the process, supported by policies and systems, used by an institution to maintain and enhance the quality of education experienced by its students and of the research undertaken by its staff' (INQAAHE 2018). IQA practitioners work within the realm of the IQA and EQA ecosystem in higher education.

Extant literature shows that QA is not a neutral practice nor a benign managerial tool (Stensaker 2008; Rowlands 2012; Morrissey 2013; Jarvis 2014). QA has been described as a form of power within HEIs (Rowlands 2012; Jarvis 2014; Engebretsen et al. 2012). Several studies

describe power dynamics derived from the regulatory and performative logics of QA in HEIs (Morley 2003; Worthington and Hodgson 2005; Stensaker 2008; Rosa et al. 2007; Blackmore 2009; Lucas 2014; Engebretsen et al. 2012). QA has disrupted power systems in higher education in as far as they have been historically organised (Engebretsen et al. 2012; Cheng 2011; Rowlands 2012). The traditional notion of an academic is underpinned by the venerated principles of academic freedom, self-regulation and autonomy rooted on the Humboldtian model of a university (Ylijoki and Ursin 2013). This state has been disrupted by the QA (Cheng 2011; Jarvis 2014; Lust 2018).

QA subjects academics to performance targets, measurement, comparison and judgement through use of various processes and tools (Ball 2003; Worthington and Hodgson 2005; Blackmore 2009; Todd et al. 2015). Under most QA regimes, performance is measured against bespoke indicators, standards, criteria and fitness-of-purpose (Blackmore 2009). Power is seen to shift from academics to management (Engebretsen et al. 2012; Morrissey 2013; Lucas 2014). This has been resisted by the academe in various ways (Worthington and Hodgson 2005; Anderson 2006; Teelken 2012; Lucas 2014; Shahjahan 2014; Cardoso et al. 2018; Lust et al. 2018). Resistance is a major challenge to QA (Stensaker 2008; Blackmore 2009; Brown 2013; Lucas 2014; Lust et al. 2018).

The narrative on resistance to QA in literature has largely focused on the reasons and forms of resistance. Extant literature provides much less information on how to overcome resistance to QA. There is a gap in terms of a comprehensive approach to overcome resistance to QA at institutional level. Approaches to managing resistance to QA have not

leveraged much the power of innovation adoption theory and the possibilities it offers for enhancing adoption of QA. This paper seeks to fill this gap by using Rogers' (2003) diffusion of innovation (DOI) theory to propose an approach to overcome resistance to QA in higher education.

This paper seeks to make a number of contributions. The first contribution is to cumulate knowledge on resistance to QA. Secondly, the paper seeks to provide a typology of resistance that enables IQA practitioners to recognise resistance in its disparate forms. Finally, the paper suggests an approach to embolden adoption of QA. These contributions are envisaged to enhance the capacity of IQA practitioners to overcome resistance to QA.

Approach to the Study

This is a qualitative study based on review of selected literature and application of relevant theories. The study consists of three interrelated components: (1) understanding resistance; (2) mapping a typology of resistance; and (3) enhancing adoption of QA.

Understanding resistance

The study uses selected extant literature to foreground resistance to QA on the resistance theory. It uses the explanatory power of various theories such as institutional and professional theories to explore resistance to QA. Critical discourse analysis (CDA) framework proposed by Hyatt (2013) is also used to map possible reasons for resistance to QA.

Resistance typology

A typology of resistance to QA is drawn up based on empirical discourse in literature and Jeffress's (2008) four modes

of resistance. Various forms of resistance are identified.

Enhancing adoption of QA

Diffusion of innovation theory (Rogers 2003) is used as the main tool to provide mechanisms for enhancing adoption of QA. This is supported by institutionalisation theory (Colyvas and Powell 2006; Scott 2008), participatory theory (Pateman 2012) and stakeholder theory (Freeman 1984). QA in higher education is considered to be a form of 'governance' or 'managerial' innovation (Jarvis 2014; Alvesson and Spicer 2016). DOI approach has been used within the context of higher education in some studies on innovation adoption (Sujitparapitaya et al. 2012; Kasperavičiūtė-Černiauskienė and Serafinas 2018).

Theoretical Background

Neoliberal QA practices in higher education represent 'governance' or 'managerial' innovation (Jarvis 2014; Alvesson and Spicer 2016). Innovation has been conceptualised in many different ways (Rogers 2003; Damanpour and Aravind 2011; Walker et al. 2010). Innovation is defined as 'an idea, practice or object that is perceived as new by an individual or other unit of adoption' (Rogers 2003, p. 12). Adoption is the implementation of a product, service, technology or practice new to the adopting organisation (Damanpour and Aravind 2011). Rogers (2003) defines innovation adoption as a decision of 'full use of an innovation as the best course of action available' and rejection is a decision 'not to adopt an innovation' (p. 177). An innovation is implemented when users accept and use it (Walker et al. 2010). Rogers (2003) posits that an innovation provides an organisation with a new alternative and means to solve problems.

QA is a practice that has morphed from collegial to managerial modes in higher education. Managerial QA practices are 'new' to HEIs (Kasperavičiūtė-Černiauskienė and Serafinas 2018) as they are based on managerial and bureaucratic rationalities rather than collegial rationality (Luckett 2006).

Rogers (2003) identifies five attributes of innovations as compatibility, relative advantage, observability, complexity, and trialability (CROCT). Perception of the CROCT attributes by individuals explains the different rates of adoption of an innovation (Rogers 2003). Rogers (2002, p. 990) posits that 'potential adopters' perceptions of an innovation's characteristics are more important than are objective measures of them'. Rogers (2003) explains CROCT attributes as follows: 'compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters' (p. 15); 'relative advantage is defined as the degree to which an innovation is perceived as being better than the idea it supersedes' (p. 229); observability as 'the degree to which the results of an innovation are visible to others' (p. 16); complexity as 'the degree to which an innovation is perceived as relatively difficult to understand and use' (p. 15); and 'trialability is the degree to which an innovation may be experimented with on a limited basis' (p. 16).

Institutionalisation, stakeholder and participatory theories can be drawn upon to enhance adoption of QA in higher education. Institutionalisation is a process through which new, initially ambiguous, unfamiliar and resisted ways of doing things become structured, desirable, appropriate, comprehensible, commonplace and routinised (Colyvas and Powell 2006; Scott 2008). Institutionalisation is supported by

essential elements which need to be in place (Silimperi et al. 2002). As for an innovation, these essential elements pertain to its attributes (Kasperavičiūtė-Černiauskienė and Serafinas 2018). As such, institutionalisation of QA is driven by its adoption, which in turn depends on stakeholders involved.

Freeman (1984, p. 46) defines a stakeholder as 'any group or individual who can affect or is affected by the achievement of the institute's objectives'. Effective stakeholder engagement is a key feature that distinguishes successful change management (Argyris 1999). Participatory theory emphasises sustained stakeholder involvement in order for HEIs to make effective decisions (Pateman 2012).

Understanding Resistance to QA

Reasons for resistance

It is prudent for IQA practitioners to understand resistance in order to manage it effectively. Resistance to managerialism in higher education is underpinned by the twin concepts of academic freedom and autonomy (Hakala 2009; Brown 2013; Jarvis 2014). Academic freedom and self-governance are venerated cornerstones of a university that have been enshrined in higher education since 1158 when the University of Bologna adopted an academic charter, the *Constitutio Habita* which was centred on the principle of academic freedom (Jarvis 2014).

Extant literature shows that tribal academic values centred on academic freedom and autonomy are persistent and cannot be changed easily (Anderson 2008; Hakala 2009; Jarvis 2014; Lucas 2014). The regulative and evaluative logics of QA leave little space for self-regulation in the academe (Worthington and Hodgson 2005; Lust et al. 2018). As noted by Worthington and Hodgson (2005, p. 96), QA is perceived as a form of 'subtle panoptic

power, control and surveillance over the academic labour force'. Extant literature proffers a range of reasons for resistance by academics to QA processes (Anderson 2006; Worthington and Hodgson 2005; Alvesson and Spicer 2016; Seyfried and Pohlenz 2018; Lust et al. 2018). These are succinctly summarised by Anderson (2006, p. 162) as: 'the distribution and exercise of power; differences in defining and understanding the notion of quality; concerns about effectiveness of quality assurance processes; doubts about the reliance on quantification often associated with quality assurance mechanisms; and time spent complying with quality requirements'.

QA is reported to increase the power of management and diminish the autonomy of academics (Worthington and Hodgson 2005; Morrissey 2013; Engebretsen et al. 2012; Lucas 2014). Resistance to QA by academics is encapsulated by Davies (2003, p. 91) who posits that 'the locus of power has shifted from the knowledge of practicing professionals to auditors, policy-makers and statisticians, none of whom need know anything about the profession in question'. This is explained using power theories. One frequently used theory is the Foucauldian theory. This theory provides power logics that can be adapted to higher education (Morrissey 2013; Engebretsen et al. 2012). Foucault (1995, 1991) distinguishes panopticon and governmentality as two forms of modern power technologies. Governmentality is a form of power that is decentralised to individuals. Panoptic power is more centralised in management. Both forms of power interplay in QA in HEIs (Engebretsen et al. 2012). Power systems affect the functionality and effectivity of QA and give rise to resistance (Engebretsen et al. 2012; Lucas 2014; Alvesson and Spicer 2016). Foucault

(1995, p. 95) famously posited that ‘where there is power there is resistance’.

The terms ‘quality’ and ‘assurance’ have not been adequately conceptualised in higher education (Blackmur 2010; Jarvis 2014). As expressed by Blackmur (2010) and Jarvis (2014), dominant phrases that purport to define quality such as ‘fitness for purpose’, ‘fitness of purpose’, ‘value for money’ and ‘achieving excellence’ are without any solid conceptual framework. The use of these concepts of ‘quality’ is contested by academics (Anderson 2006; Blackmur 2010; Henard and Leprince-Ringuet 2008). Engebretsen et al. (2012) argue that quality is now measured by technical quality indicators and has become a quantitative concept. In addition, academics argue that with QA everything is numbered, measured and ranked. This is akin to equating quality to quantity (Engebretsen et al. 2012), giving rise to discontent in the academe.

Effectiveness of QA in general has also been questioned. It is argued that QA focuses more on inputs and processes than outcomes (Blackmur 2010; Horn and Dunagan 2018). Resistance is also driven by concerns about the impact of QA on core academic activities of teaching and learning (T&L). Arguments refer to the nature of academic teaching, which cannot be broken down into measurable units and clear cause–effect relations that indicate impact (Clark 1983; Henard and Leprince-Ringuet 2008; De Vincenzi et al. 2018). QA is also seen as burdensome, costly, and time-consuming bureaucratic work (Cardoso et al. 2013; Lodesso and Warito 2016; Stensaker 2008; Stensaker et al. 2011; Lange and Kriel 2017). This is seen as exacerbating the workload of academics, with negative impact on their core academic business (Stensaker 2008).

It should also be pointed out that staff identity issues give credence to resistance

to QA (Degn 2015; Lust et al. 2018). Academic identity is one of the main discursive resources for resistance to QA (Lust et al. 2018). It produces a repertoire of discursive means for resistance. Identity constructions affect which action patterns people deem appropriate and thereby their conduct (Degn 2015). Academic identity (full professor, associate professor, etc.) is sacrosanct in universities. As such, QA can be seen as making the professoriate ontologically insecure (Ball 2003).

Explaining resistance to QA

The reasons for resistance to QA proffered above can be explained using institutional and professional theories. Teelken (2012, p. 277) posits that ‘institutionalism is a remarkable theme, as it seems more likely to explain inertia than change’. HEIs are known to be resistant to change (Brown 2013; Lucas 2014). Powell and Dimaggio (1991, p. 14) posit that ‘neo-institutionalism emphasises the homogeneity of organisations, it also tends to stress the stability of the institutionalised components’. In this case, academic freedom and autonomy are institutionalised in higher education (Alvesson and Spicer 2016). As such, disruption to this status quo by managerialism is resisted (Lucas 2014). Professional theory offers more explanatory value for how an individual deals with change (Teelken 2012). Scholars have considered ‘professional’ and ‘professionalism’ as sources of resistance to managerialism in HEIs (Chandler et al. 2002; Kirkpatrick and Ackroyd 2003; Alvesson and Spicer 2016). It is claimed that professionals are difficult to manage because they are autonomous, self-governing and have stronger loyalty to their profession than their employers (Alvesson and Spicer 2016). Lust et al. (2018) cite professional autonomy and expertise for teaching

quality as some of the discursive resources for resistance to QA. This is buttressed by Alvesson and Spicer (2016, p. 2) who posit that 'if there is one group of professionals who are supposed to value autonomy very highly, it is academics'. One can posit that resistance to QA is a stereotypical power struggle between managerialism and the 'professional' academic.

The CDA framework devised by Hyatt (2013) is a useful lens to use to explain resistance to QA. This framework consists of two components; contextualisation and deconstruction of policy texts. According to Hyatt (2013), contextualisation refers to expressions of aims or goals of a policy. Elements of contextualisation are policy levers, drivers, and warrant (Hyatt 2013). Levers and drivers refer to logics of a policy and warrant is the justification established for an act, policy or course of action (Hyatt 2013). Lucas (2014) used this framework to explain academic resistance to QA. Lucas (2014) noted that drivers of QA and the warrant are not always understood by academics and are largely seen as managerial.

The second component of deconstructing policy texts uses four modes of legitimisation as its analytical lenses. Legitimation is the process by which policies are justified to their audience by attachment to dominant norms and values (Hyatt 2013). The four modes are authorisation, rationalisation, moral evaluation and mythopoesis (Hyatt 2013). Lucas (2014) uses the first three modes to explain resistance to QA in higher education. According to Lucas (2014), QA is undermined and revisioned by questioning its authority, rationale and moral purpose. In terms of authorisation, the argument is that the QA process is not scientific, lacks objectivity, and fails to measure and assure quality of academic activities (Lucas 2014). It is also viewed as

lacking authority to measure and assure quality (Rowlands 2012; Blackmur 2010; Lucas 2014).

The rationality logic is that QA cannot measure change because it is difficult to ascribe causality, especially with reference to T&L (Anderson 2006; Seyfried and Pohlenz 2018). Cost of the QA process, its workload and impact on staff motivation affect its rationale (Anderson 2006; Stensaker 2008; Lucas 2014). Moral evaluation is given as the most forceful mode in undermining QA (Lucas 2014). The human cost in terms of work burden arising from the QA process is seen as devaluing staff motivation (Lucas 2014; Lange and Kriel 2017). The concern is that too much time is spent on QA processes such as evaluation and audits (Stensaker et al. 2011).

Typology of Resistance to QA

It is important to be clear on that which counts as resistance (Mumby 2005). Resistance is generally framed as having specific properties that distinguish it from other forms of non-resistant organisational behaviour (Mumby 2005). A resistance typology is important for IQA practitioners because resistance can be managed when it has been identified.

Several scholars have described various forms of resistance to QA. They include Parker and Jary (1995), Mumby (2005), Worthington and Hodgson (2005), Jeffress (2008), Quin (2012), Teelken (2012), Ylijoki and Ursin (2013), Shahjahan, (2014), Lucas (2014) and Lust et al. (2018). These scholars provide descriptors of various forms of resistance. Foucauldian theory and post-structuralist understanding recognise resistance in quotidian terms (Anderson 2008). What is critical for QA are the mundane manifestations of resistance which occur every day. Scott (1986) buttresses the mundanity of resistance and posits that

‘quiet evasion’ associated with everyday forms of resistance is more widespread, and often proves more effective, than direct, confrontational modes’ (p. 8). The import of this is that resistance to QA can come in multiple forms, some of which are covert.

Different forms of resistance to QA are described below (Table 1). Resistance to QA largely comes as typologies of behavioural and discursive practices. Other examples of resistance include dithering, shirking, devolving and deceit where QA work is relegated to junior staff (Worthington and Hodgson 2005).

Ackroyd and Thompson (1999) coined the term ‘learned incompetence’ for scenarios where academics feign that QA is beyond their understanding. Morley (2003, p. 24) coins the term ‘counterfeit reflexivity’ with reference to instances where academics insincerely present themselves in the language and discourse of QA. Anderson (2008) described ‘qualified compliance’ as a case where academics complied with managerialist demands in minimal, pragmatic, or strategic ways when they actually did not support the practices with which they complied.

Table 1 Descriptors of forms of resistance to QA

Form of resistance	Descriptors	Reference
Discursive tactics	<ul style="list-style-type: none"> - Irony, cynicism, humour and jokes, mimicry, refusal, critic - Gossip, formal complaints - Replacement of QA practices 	Mumby (2005); Lust (2018); Anderson (2008); Worthington and Hodgson (2005); Degn (2015);
Behavioural tactics	<ul style="list-style-type: none"> - Retreatism, quietism, disengagement, evasion, avoidance - Minimal compliance - Pretension of enthusiasm - Grandiosity - Confrontation, non-cooperation 	Mumby (2005); Anderson (2008); Teelken (2012); Alvesson and Spicer (2016)

Jeffress’ (2008) four modes of resistance can be drawn upon to expand the typology in Table 1. The first mode is resistance as rewriting and undermining colonial narratives (cultural resistance). Shahjahan (2014) defines ‘colonial’ as anything imposing or dominating and QA can be seen as ‘imposing and dominating’ managerialism. Cultural resistance exposes and disrupts neoliberal narratives and logics that underpin managerialism and provide alternative narratives, logics and practices that replace QA narratives (Shahjahan 2014). The intention is to

portray QA as lacking authority. The second mode is resistance as subversion (Jeffress 2008). In higher education ‘it happens within the ‘cracks’ and ‘in-between spaces’ where faculty, students and administrators can contest and appropriate neoliberal authority and discourses, and refuse to buy into neoliberal personhood’ (Shahjahan 2014, p. 224). This can manifest itself mostly through behavioural practices such as refusal, avoidance and confrontation.

The third mode is resistance as opposition (Jeffress 2008). In this mode,

the collegialism is contrasted with managerialism and the former is seen as better (Shahjahan 2014). Oppositional resistance seeks to challenge QA as inimical to academic freedom. The fourth mode is resistance as transformation (Jeffress 2008). This is positive resistance which seeks to make power and resistance mutually co-productive (Shahjahan 2014). It resonates with the dialectical approach to control and resistance proposed by Mumby (2005). According to Mumby (2005), in a dialectical approach the focus is more on exploring how competing forces can shape and fix resistance. Shahjahan (2014) posits that transformational resistance is the most helpful framework for thinking through the problems of neoliberal higher education.

Enhancing Adoption of QA

Leveraging QA attributes

Given the discourse on reasons and types of resistance to QA, it is prudent to explore ways of enhancing adoption of QA. Rogers (2003) CROCT attributes are a useful tool that can be leveraged by IQA practitioners to enhance adoption of QA.

Compatibility of QA

Compatibility of an innovation is positively related to its rate of adoption (Rogers 2003). Sahin (2006, p. 18) contends that 'if an innovation is compatible with an individual's needs, then uncertainty will decrease and the rate of adoption of the innovation will increase.' The import is that QA needs to be compatible with needs of the academe (Kallio et al. 2016). Compatibility of QA with an institution's mission and vision, values and existing practices, satisfying the requirements of stakeholders has a positive effect on its adoption (Kasperavičiūtė-Černiauskienė and Serafinas 2018). One way to enhance compatibility is a more outcome-based conception of quality

((Horn and Dunagan 2018). Harvey and Knight (1996) promote 'transformation' as a good concept of quality as it accounts for education as a transformative and participative process in which the student is a participant as compared to consumer, customer or client.

Worthington and Hodgson's (2005) articulation of the purpose of QA provides a plausible way of enhancing compatibility QA. Worthington and Hodgson (2005, p. 98) posit that 'the primary role of quality assurance in higher education is to create a culture of continuous organisational and professional self-development and self-regulation that will provide a better value-for-money service that is compatible with the needs of the global (post)modern knowledge economy and learning society'. This broadens the scope of QA as focus is not only on accountability, but self and institutional improvement. Viewed using this lens, QA can be compatible with expectations in the academe.

It is also plausible that accountability be understood in its entirety. Vidovich and Slee (2001) identify four types of accountability in higher education. These are: professional accountability to peers; market accountability to markets and students; democratic accountability to community and society; and managerial accountability to government (Vidovich and Slee 2001). Such a broad understanding of accountability demystifies the common belief that QA represents managerial accountability only. Professional accountability is compatible with collegial accountability systems known to academics.

Relative advantage

Rogers (2003) presents relative advantage as measurability in respect to economic profitability, social prestige, satisfaction, convenience and efficiency/effectiveness

of the performance. In this case, QA has to show advantages over collegialism. Some studies show that QA has the advantage of enhancing an institution's image (Kasperavičiūtė-Černiauskienė and Serafinas 2018) and assuring external customers that a specific institution provides quality services, and this results in higher student numbers (Kasperavičiūtė, 2013).

EQA practices such as institutional and programme accreditation provide a label that assures students and external stakeholders about quality and standards in an institution. This has the advantage of distinguishing credible institutions from 'degree mills'. This is even more important given a plethora of regional and global networks of EQAs that promote recognition of qualifications and transfer of credit on the basis of accreditation (Jingura and Kamusoko 2018). Such advantages of QA need to be valorised and demonstrated in HEIs.

Observability

Observability is a component of result demonstrability and has a positive effect on adoption of an innovation (Rogers 2003). There are concerns about what QA actually achieves and at what cost (Brennan & Shah 2000; Stensaker 2008). Studies on impact of EQA, particularly on T&L, have been conducted by Brennan and Shah (2000), Stensaker (2003), Minelli et al., (2006), and Stensaker et al., (2011), De Vincenzi et al., (2018) amongst others. The general consensus is that not much is known about the impact of QA and available results are too variable (Stensaker 2003; Stensaker et al. 2011; Liu 2015; Lamagna et al. 2017; Daguang et al. 2017; Lange and Kriel 2017; De Vincenzi et al. 2018).

The import of variable observability is that there is need for more comprehensive studies on the impact of QA in higher

education. It should be noted that despite the variation, work continues to be done on this subject. For example, the UNESCO (2018) study shows promising results on impact of IQA on T&L, research, international cooperation, quality culture, graduate employability, community outreach, income generation, governance and management. More such work is needed in order to unequivocally show the benefits of QA.

Complexity

Complexity of an innovation is an important obstacle to its adoption (Rogers 2003). If innovation is not understood properly, it will not be properly implemented and its ability to improve organisational performance may be uncertain (Kasperavičiūtė-Černiauskienė and Serafinas 2018). There are concerns about the complexity of QA processes (Worthington and Hodgson 2005). Some resistance tactics such as 'learned incompetence' (Ackroyd and Thompson 1999) relate to perceived complexity of QA. Some quality management systems used in higher education such as the ISO 9001 standard have been reported to be complex to understand, over-technical and over-specific (Kasperavičiūtė 2013).

Generally, concerns about complexity of QA mechanisms include challenges in changing pedagogy (Sahin 2006), transforming an institution into auditable systems (Ball 2003), tools difficult to understand (Worthington and Hodgson 2005), and metric-laden evaluative processes (Kallio et al. 2016). It is prudent for QA to have interpretation ease, understandable terminology, and implementation ease to enhance its adoption. This presents a need for QA mechanisms that are well articulated, documented and well explained to staff, with IQA practitioners performing technical backstopping roles.

Trialability

Trialability is positively correlated with the rate of adoption of an innovation (Rogers 2003). The essence of trialability is that 'the more an innovation is tried, the faster its adoption is' (Sahin 2006, p. 16). Trialability enables reinvention, change or modification by the potential adopter (Sahin 2006). Trialability makes QA amenable to modification to suit higher education needs. QA in higher education is largely perceived to represent introduction of private sector management practices (Anderson 2008; Rosa et al. 2012). Its suitability to higher education has been questioned on the basis of perceived unique characteristics of higher education (Srikanthan and Dalrymple 2003; Kasperavičiūtė 2013).

Examples of the trialability of QA include development of quality management models designed for higher education such as Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (ENQA et al. 2015), model for quality management in HE (Srikanthan and Dalrymple 2004), ISO-based TQM model (Borahan and Ziarati 2002) and excellence model (Pires da Rosa et al. 2001). This provides evidence of attempts to develop QA systems suitable for higher education, making QA a trialable enterprise. There is need to continue adjusting QA systems to the changing environment in higher education and innovate new practices that account for contemporaneous trends.

Mechanism for Leveraging QA attributes

QA attributes described above can be operationalised by employing appropriate mechanisms that promote adoption of QA. The suggested mechanism is decentralisation of QA for effective stakeholder engagement. Academics are major stakeholders in QA (Cardoso et al.

2018). They have a key role in setting QA policies and implementing them (Tetteh 2018). Sense of ownership of QA by academics is essential for its successful implementation (Cardoso et al. 2018). Engagement must be buttressed by effective participation. Participation expands engagement by placing emphasis on contributions from stakeholders (Tetteh 2018). As such, QA systems must engender inclusive and participatory practices.

Staff participation in QA can be enhanced by inclusive QA structures and systems. Kaufmann (2009) cited by Niedermeier (2017) states that organisational structure and steering approach are the two main variables that determine implementation of QA. Organisational structure refers to QA arrangements in terms of allocation of responsibility and accountability in an institution. Steering approaches refer to systemic aspects of QA with reference to content specification. Content specification refers to regulative aspects such as quality policies, standards, criteria and guidelines. Both organisational structure and steering approach are mostly a question of centralisation versus decentralisation (Niedermeier 2017; UNESCO 2018). Centralised models are dominated by senior management in both organisational structure and steering approach. This gives power to senior management and can bolster resistance. Decentralisation of QA has the potential to embolden staff engagement and participation.

Decentralised models of QA can relate to content specification by senior management and independent implementation by departments or content autonomy by departments and independent implementation (Kaufmann 2009 cited by Neidermeier 2017). Decentralisation distributes responsibility and accountability for QA to staff at various

levels in an institution. Decentralised QA models are functioning governmentality where power, responsibility and accountability are distributed throughout an institution. With decentralisation power no longer acts as a limitation on individual freedom and the result is likely a stimulated academic heartland that feels buoyed by its contribution to QA. Concerns about QA as summarised by Anderson (2006) are resolved in an inclusive and participatory manner. This is possible given that Harvey and Knight (1996) distinguish two types of collegialism as: 'cloisterism' representing the traditional archetypal professor; and 'new collegialism' representing a professoriate amenable to change. Decentralisation can bolster 'new collegialism' given Miller and Rose's (1990) concept of 'governing at a distance' where decentralisation is more about influencing the actions and self-esteem of staff, with senior management 'controlling from a distance'.

Fitting Hyatt's (2013) model to a decentralised QA system, it means that the context, authority, rationale and moral purpose of QA are set in a participatory manner. In addition the CROCT attributes of QA can be enhanced by staff engagement. This is likely to countervail what Rowlands (2012, p. 104) described as 'academics may be inclined to see QA as something done 'to them' or at best 'by them' but not 'for them'. In this case, QA will be seen by academics as something done 'by them' and 'for them'. This is a reasonable way of minimising resistance to QA.

Conclusion

It is evident from extant literature that there is resistance to QA in HEIs. IQA practitioners in HEIs need to manage this resistance in a manner that emboldens QA as a practice. The causes and types of

resistance to QA in higher education are multiple and present a challenge to IQA practitioners. It is thus worthwhile to propose plausible ways of overcoming this challenge. There are three interrelated issues that underpin such an endeavour as presented in this paper. Firstly, understanding resistance from both theoretical and empirical perspectives is critical for IQA practitioners. This can embolden their capacity to manage resistance to QA.

Secondly, there are disparate discursive and behavioural forms of resistance to QA that need to be understood by IQA practitioners. Understanding and identifying resistance to QA provide is important for IQA practitioners. Thirdly, IQA practitioners need appropriate tools to use to overcome resistance. The DOI approach provides a plausible tool for this purpose. IQA practitioners need to leverage the CROCT attributes of QA to enhance its adoption in HEIs. CROCT attributes present levers that can be used to embolden QA adoption. Decentralisation of QA is a plausible approach to adapt QA attributes to higher education through effective staff engagement.

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COVID-19 AND URBAN FOOD INSECURITY IN BULAWAYO, ZIMBABWE: HOUSEHOLD CASE STUDIES

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ABSTRACT

This article examines the impact of Covid-19 on household food insecurity in Bulawayo, Zimbabwe. The onset of the Covid-19 pandemic brought with it the implementation of compulsory lockdowns and social distancing as non-pharmaceutical interventions to contain the spread of the pandemic in most countries across the globe. The Government of Zimbabwe ordered all businesses to close except essential services that included hospitals and supermarkets. This paper examines the impact of Covid-19 on food security in Bulawayo through the application of a qualitative case study approach focusing on 10 households. Ten households were purposively selected for semi-structured interviews to understand the effects of Covid-19 lockdowns on food security and the coping strategies used by the households in the study area. The study established that household food security was affected in different ways. Some household bread winners lost their jobs due to company closures leading to a loss of income and failure to procure food. The lockdown also disrupted food supply chains in various ways. Several coping strategies were employed by households to withstand food insecurity. We make recommendations for preventing food insecurity in similar future emergencies.

Key Words: Food insecurity, Covid-19, Urban Risk, Zimbabwe, Emergencies, Vulnerability

1. INTRODUCTION

This article examines the impact of Covid-19 on household food insecurity in Bulawayo, Zimbabwe. Studies show that the emergence of the Covid-19 pandemic globally did not

only cause human deaths, but it also led to economic challenges and food insecurity (Manfrinato et al., 2021). The onset of the Covid-19 pandemic brought with it the implementation of compulsory lockdowns and social distancing as non-pharmaceutical

interventions to contain the spread of the disease in most countries across the globe (Dube et al., 2021; Hamadani et al., 2020). The strict enforcement of lockdown regulations had unforeseen damaging consequences on food security and the general functioning of economies (Mukiibi, 2020). Evidence from across the globe shows that the Covid-19 pandemic worsened an already bad situation of food insecurity in many developing countries (Singh et al., 2021). Prior to the start of the Covid-19 pandemic, the World Food Program estimated that some 821 million people were food insecure globally. It was estimated that the Covid-19 pandemic would add another 130 million people who would become food insecure (Moseley & Battersby, 2020). In the United States of America, 54 million new people became food insecure due to the implementation of the lockdown measures (Friedman, 2021). Food banks in the United States started reporting increased demand for food from vulnerable people and a failure to meet that demand (Faye et al., 2021). In most developing countries, the status of food insecurity was already quite high before the Covid-19 pandemic set in to make things worse (Mishra & Rampal, 2020). Evidence also shows that even some households that fared well in food security, fell into food insecurity because of Covid-19 (Shahzad et al., 2021). While many studies have been conducted globally on this subject, there is limited evidence in the case of Zimbabwe. Most studies in Zimbabwe have focused on the impact of Covid-19 and livelihoods in general such as street vending (e.g., Kiaka et al., 2021 & Price, 2020). Studies that attempted to examine the Covid-19 and food security nexus have tended to adopt large scale general survey approach that fails to get an in-depth understanding of household level

dynamics (e.g., Murendo et al., 2021). This study adopts above qualitative case study-based approach to understand household experiences of food insecurity in a Bulawayo suburb in Zimbabwe.

The Zimbabwe government formally instituted a near total lockdown of the movement of people beginning on the 30th of March 2020 for several months as Covid-19 cases spiked in Europe and America. As the lockdowns were implemented livelihood activities were disturbed in all sectors especially in the non-formal sector. The Government of Zimbabwe ordered all businesses to close except essential services that included hospitals and supermarkets. Essential businesses such as supermarkets and food markets were allowed to open only between 8am and 3pm, with a curfew starting at 6pm to 6am. Movement within the city was restricted. Residents were not allowed to travel for over 5 kms for shopping or any other purpose. Shopping of any sort was to be done within a 5 km radius. Cross border travel was outlawed between most countries including South Africa which is Zimbabwe's largest trading partner. All these measures had significant effects on the economy and the food environment as will be shown in the findings.

2. LITERATURE REVIEW

2.1 Definition of Food Insecurity

To understand what is meant by the term food insecurity, it is important to first define 'food security'. According to the USDA, food security is defined as "access by all people at all times to enough food for an active, healthy life" (Schroeder et al., 2015:275). The Food and Agriculture Organization defines food security as,

“... a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (Barrett, 2010:350 & Manfrinato et al., 2021:1210).

This definition of food security infers that there should be adequate food at all levels including at individual, community and global levels. However, the definition of the term ‘enough’ remains problematic (Pinstrup-Andersen, 2009). If food security is defined in terms of the adequacy of food, food insecurity has been defined by some authors as, ‘...a condition defined by limited or uncertain access to sufficient, nutritious food for an active, healthy life, disproportionately affects low-income communities and communities of color’ (Wolfson & Leung, 2020:152). In this definition, food insecurity is defined in terms of the lack of food security. Some authors define food insecurity in terms the uncertain access to food which is also often reflected in a reduction of food intake and the disruption of the usual eating patterns (Friedman, 2021). According to Schroeder et al. (2015) the factors that characterize food insecurity include the inability to procure food, feeling unsatisfied and the inability to live a healthy life due to poor nutrition. Many negative health consequences emerge from populations affected by food insecurity including compromised immune systems which make people vulnerable to more diseases (Pereira & Oliveira, 2020). In pregnant mothers, ill formation of fetuses has been reported, while stunting and anemia, anxiety and cognitive problems has been

reported amongst children (Fitzpatrick et al., 2021; Schroeder et al., 2015).

Food security and its opposite, food insecurity is defined in terms of four critical pillars namely, availability, access, utilization, and stability (Singh et al., 2021). Availability refers to the physical presence of food in a place where people can make use of it. Accessibility is a concept that acknowledges that although food may be physically available, some people may not be able to possess and make use of it due to a variety of reasons that may include the inability to purchase it (Sen, 1976). This is often the case in urban areas where access to food is based on the ability to purchase it. Food utilization refers to the way in which food is used and biologically converted to provide energy and nutrients for people. Utilisation depends on several things that include household knowledge levels about food processing, storage and nutrition value, the health status of the people involved, and the state of water and sanitation (Moseley & Battersby, 2020). Stability refers to the consistency and regularity of access to food (Moseley, Schnurr & Kerr, 2015). Chronic food insecurity is consistent and occurs over extended periods of time whereas some types of food insecurity are temporary and are related to shocks such as droughts.

2.2 The Impact of Covid-19 on Food Insecurity

Evidence from the United Kingdom shows that the number of food insecure people more than quadrupled because of the Covid-19 pandemic (Loopstra, 2020). This was driven by several factors including the lack of food in shops, self-isolation leading to failure to access food, income losses, closure of

schools and lack of access to free school meals by children from vulnerable households. Elderly people who self-isolated for longer periods of up to 12 weeks reported suffering food insecurity because they could not access shops to buy food (Loopstra, 2020).

The question of the effect of pandemics on food insecurity is not new. In 2003, de Waal & Whiteside developed a theory titled the 'New Variant Famine Hypothesis'. In this theory they argued that the new levels of food insecurity observed in Southern Africa at that time were closely attributable to the effects of the HIV and AIDS pandemic which was ravaging the Sub-Sahara region (de Waal & Whiteside, 2003). They argued that HIV related deaths led to labour shortages and loss of critical agricultural skills at the household level. They also argued that the burden of caring for the sick took away valuable time from agricultural activities and that food utilisation was compromised by the poor health status of affected populations (de Waal & Whiteside, 2003).

The main cause of food insecurity especially in urban areas in Africa was the loss of incomes related to the measures taken to control the spread of the coronavirus (Inegbedion, 2021). The lockdowns and social distancing led to the inability of people to generate incomes as some of the income generation activities required physical interaction with clients. The primary way by which people access food in urban areas is through earning a wage to purchase food (Fitzpatrick et al., 2021). While food may have been available in the shops, people were not able to afford it. This phenomenon is what Sen (1976) calls the failure of exchange entitlements. Another important way by

which Covid-19 contributed to food insecurity was through the disruption of supply chains (Mishra & Rampal, 2020). Most urban areas in Africa depend on rural farm supplies for food.

The movement restrictions initiated because of Covid-19 limited the movement of food supply from rural farms to the cities (Mishra & Rampal, 2020). It is important to understand how market disruptions were a driver of the covid-19 induced food insecurity in urban areas. On one hand, there was a disruption of the supply system which led to a rise in food prices in general as demand threatened to surpass supply (Shahzad et al., 2021). On the other hand, there was income loss because businesses closed and trade was suspended even in informal businesses (Shahzad et al., 2021). The combination of rising prices and loss of income was a double-edged sword for poor communities facing food insecurity.

2.3 Vulnerability Drivers for Covid-19 induced Food Insecurity

Understanding who is affected by food insecurity is important in developing effective interventions to reduce and eliminate food insecurity (Fitzpatrick et al., 2021). Literature shows that the groups that suffered the most from food insecurity were especially those groups that were already vulnerable prior to the start of Covid-19 (Gaitán-Rossi et al., 2021). Vulnerability factors include ethnicity, place of residence, type of employment, geographical location, sex, age and many other such factors (Singh et al., 2021). In a study in the USA, it was observed that vulnerable people were more likely to be black people who earn low incomes and do not have formal and flexible

jobs (Wolfson & Leung, 2020). Vulnerable groups include people from the lower strata of economic backgrounds who earn daily wages. Such people were not able to earn daily while businesses were closed due to lockdowns (Singh et al., 2021). People who were on temporary jobs and people whose jobs could not be transformed to work online were amongst the most affected (Connors et al., 2020). It has been argued that women and girls tend to be affected the most by food insecurity due to social norms that negatively influence feeding patterns and access to food to the disadvantage of women (Mishra & Rampal, 2020).

Social distancing disrupted available social nets which protected the vulnerable prior to poverty. Adherence to social distancing prevented families and groups from regularly visiting and sharing meals which is an important social safety net (Kinsey et al., 2020). Places such as soup kitchens also had to close in the absence of guidance from health authorities (Fitzpatrick et al., 2021; Kinsey et al., 2020). Concern has also been raised about changes in food consumption patterns during lockdowns like the one that was induced by Covid-19. It has been noted that sedentarism leads to high food consumption and may even lead to obesity in the short term and reduced access to health services (Gaitán-Rossi et al., 2021).

3. SCOPE OF THE STUDY

3.1 RESEARCH QUESTIONS

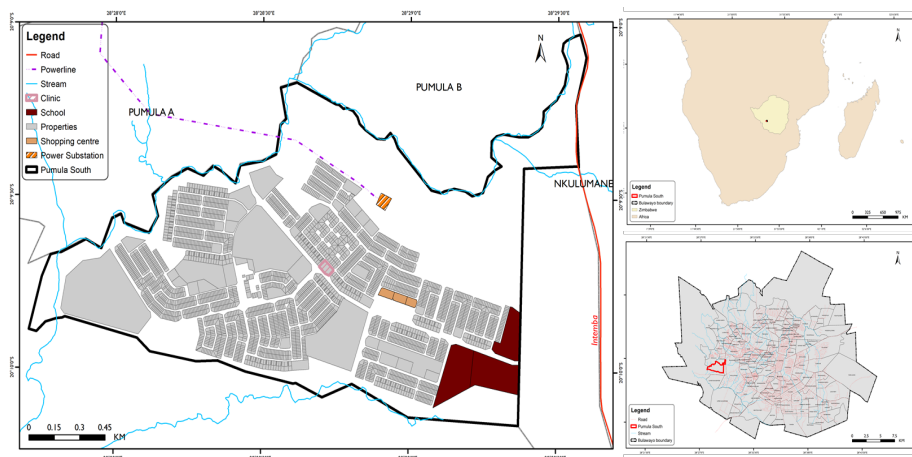
This study was guided by the following research questions:

Map of Pumula South, Bulawayo

- i. How did the Covid-19 pandemic affect food security in Bulawayo?
- ii. What coping strategies did households adopt against food insecurity?
- iii. What lessons can be learnt about managing food insecurity in similar pandemics in the future?

3.2 STUDY SITE

This study was conducted in Pumula South, a suburb in Bulawayo, Zimbabwe's second largest city. Bulawayo is located in the Southwestern part of Zimbabwe, approximately 440kms from the capital city, Harare. The city of Bulawayo is perennially plagued by food insecurity primarily because of its location in Zimbabwe's agroecological regions 4 and 5 which receive limited rainfall making rain-fed agriculture to be of limited productive value. Food insecurity is compounded by low employment levels and high poverty rates which weaken the purchasing power of city dwellers. This study focused on a section of Pumula South high-density suburb called Glendenning. This section was built in the last 12 years starting from approximately 2010. The homeowners are a mix of various types of people who include private school, teachers, some civil servants, low-income diaspora workers and some self-employed people who own small grocery or clothing shops in the CBD. Several houses are rented out to multiple families who pay monthly rentals to the owners of the houses. Several homes are headed by children or young adults because the parents work in South Africa or Botswana.



4. RESEARCH METHODOLOGY

This study primarily employed a qualitative method of study. Ten households were purposively selected for semi-structured interviews to understand the effects of Covid-19 on the food security and the coping strategies used by households in the study area. The households were purposively selected to ensure that there was diversification of coverage by type of household. The intention was to include different types of households based on the main livelihoods found in each household. Preliminary investigations showed that most households in the study site were either employed as civil servants (mostly teachers), had a breadwinner working in South Africa or another SADC country, or they were involved in informal trade. The table below shows the list of ten households that were intensively studied to understand their experiences with food insecurity during the Covid-19 lockdowns.

Wherever possible, interviews were conducted with the household head or the most senior person available in the household. The researcher physically visited the selected households to conduct interviews. Informed consent was sought from all respondents who participated in the study. All ethical standards were observed in the study. The selection of households was done in consultation with a local area leadership committee that represents residents. The study does not claim generalizability to the larger population because of the sampling frame used. However, the study does give important insights about the drivers of food insecurity during the Covid-19 pandemic in urban areas in Zimbabwe. A summary breakdown of the households that were selected is as shown on the table 1. A semi-structured interview guide was used to collect data in an organized and consistent way. Analysis was done by reading through the interview transcripts and

drawing emerging themes that respond to the research questions.

Table 1: Profile of the Households Interviewed

Household Code	Type of Household	Breadwinner's Occupation	Number of People in the Household
HH01	Child Headed	Restaurant waiter (RSA)	3
HH02	Female Adult Headed	Accountant (Botswana)	4
HH03	Child Headed	Maid (RSA)	3
HH04	Male Headed	Teacher	5
HH05	Male Headed	Teacher	5
HH06	Male Headed	Informal Brick molder	10
HH07	Female Headed	Spaza owner	7
HH08	Female Headed	Informal Trader	4
HH09	Child Headed	Restaurant Waiter (RSA)	3
HH10	Male Headed	College Lecturer	4

Source: Field Data

5. FINDINGS

5.1 loss of incomes and the experience of food insecurity due to Covid-19 lockdowns

This section presents the findings of the study. It draws key findings from households of interest that were representative of key findings within the sample of ten households that were selected for the study. Only selected households were presented in the analysis to avoid repetition of key emerging themes across households.

Household Case Study 1 – Code HH01

The interview with the representative for Household HH01 showed that vulnerability to food insecurity during the Covid-19 lockdowns was largely related to the sector in which one worked. For this household, the main breadwinner was working as a restaurant waiter in a major restaurant chain in South Africa. The lockdown in Zimbabwe happened almost simultaneously with the one in South Africa and thus the impact of the lockdown in South Africa was felt across the border in Zimbabwe. The shutdown of

restaurants in South Africa as non-essential services had reverberating effects in Zimbabwe. For HH01, the restaurant shut down in South Africa meant a temporary removal from employment of the relative who was the breadwinner in South Africa. Before the pandemic, this relative would normally send money that the family in Bulawayo would go and collect at a collection point such as the Western Union. On average this relative would send approximately 1500 to 2000 Rands (Approximately \$100 - \$130 USD) per month to cater for food, school related expenses for children, and any medical expenses. When the Covid-19 lockdowns started, the relative in South Africa was struggling for her own survival as she also needed to pay rentals and buy food where she stayed. This led to a reduction of the money that she could send as remittances if they were able to receive anything at all in a month. The flow of remittances was further complicated by the fact that most Zimbabwean migrants in South Africa preferred to send their goods (mostly food) through *omalayitsha* who are trusted quasi-

formal cross border transporters. The closure of borders made it virtually impossible for these transporters to continue with business. The family reported that they suffered greatly from food insecurity at that time. As the respondent pointed out,

We severely lacked food during the covid-19 lockdown. We did not expect that the lockdown was going to be so tough and long. My mother who is in South Africa was laid off from work as a restaurant waitress. She could not send us any food or money for a long time. If it was not for the food that we got from our church, we were really going to starve. We are grateful to our church pastor who came and assisted us.

Household Case Study Number 2 – Code HH06

In this household, the main source of income was informal brick molding and selling. In an interview with the Household Head (HH06), it was established that sales from brick molding nose-dived during the first Covid-19 lockdown because construction was classified as a non-essential service. When construction stopped, brick purchases also stopped. All non-essential services had to strictly shut down including construction. The interviewee noted that while on a good week, they could get an average of \$100 USD to feed a family of 10 people, they were now getting nothing in a whole week under the lockdown. This affected their ability to purchase food. They mostly survived by asking for food from relatives and friends. They also collected some outstanding payments which they used to purchase food. The size of the family of 10 people made them particularly vulnerable to food

insecurity in an urban environment where most of the food had to be purchased.

Household Case Study Number 3 – Code HH10

The interview with the household head for HH10 showed a rather different picture in terms of the impact of Covid-19 on incomes and food security. It was indicated that although the Covid-19 lockdown came into effect, lecturers in state funded teachers' colleges, like other civil servants in Zimbabwe continued to receive their salaries although they were not going to work. This is because they were on permanent contracts. Furthermore, the interviewee indicated that the government of Zimbabwe introduced an allowance that was termed the Covid-19 allowance for all civil servants. Over and above their salaries, civil servants received a monthly allowance of \$100 USD to cushion them during the lockdowns. Instead of a diminishment of income, households that had civil servants generally managed to sustain an income during the lockdown although most of them were not working. The respondent noted that they were eventually asked to teach their students online using WhatsApp and zoom in order to sustain their salaries. This case shows that vulnerability to food insecurity during the lockdown period was associated with the kind of livelihood activities that families were involved in. Families involved with permanent formal government employment were at a less vulnerable position than casual employees in the private sector and those who were self-employed. For this household, there were no major changes to their diet. Where food was available in the market, they indicated that they were able to add luxuries such as chicken, eggs and fish because of a slight

increase in income. The increase in income was particularly notable because expenses related to school fees and transport for children and parents was eliminated from the budget due to prohibitions in movement. The respondent noted a concern that one of their children was gaining weight rather quickly because of spending time watching TV and eating, and not being able to engage in sports at school.

Household Case Study Number 4 – HH07

This household main livelihood activity has always been a spaza shop located within their yard. Different family members take turns to sell at the spaza shop. The respondent highlighted that this has always been their livelihood that they inherited from their grandmother. They had been able to buy their current house through a previous spaza shop. When they bought the new house they continued with the shop. The Covid-19 lockdown initially seemed to present an opportunity for income growth because shops were opening for shorter hours. The local community would now resort to the spaza shop for food and other necessities. However, when the lockdown persisted, the stock was exhausted at the shop. It was not possible to restock because only people in essential services were allowed to travel. The only stock that was left available was bread because bread was being delivered by the bakery to sellers. Bakeries were allowed travel because they were considered as essential services. The failure to restock led to a sudden income drop leading to increased food insecurity within the household. The respondent outlined how they were affected:

Covid-19 really left us at a very difficult position with regards to income and food availability at home. My family depends on this spaza. So, when the lockdown came, we did not think that we would fail to restock. We continued selling what we had. Then we realized that stock had run out. The only thing we were left with was bread because it was being delivered by the bakery to us. We could not go to the wholesalers to restock because we did not have clearance letters for travel. (HH07 Respondent)

5.2 Other General Drivers of Food Insecurity During Covid-19 Lockdowns

5.2.1 Lack of access to shops

Lack of access to shops was observed as a major challenge leading to food insecurity for all households that were surveyed despite the income status. Even those households that had enough income observed that they could not always eat the food that they wanted because they were not allowed to travel to their shopping destinations of choice even within the city. Most households indicated that when the Covid-19 lockdowns were announced, they had stockpiled food in their homes in preparation for the long lockdown. However, one respondent noted that they could not stock food because they did not have the money to do so.

When the lockdown was announced, there was some time given for shopping.

But while everyone was buying food for their households, we simply did not have the money to buy and keep any food. So we went into lockdown without food, and then the we were told not to travel to far away shops but those were the cheap shops. So we ended up buying from expensive shops around here. When you have no money and you have to buy expensive things, its hard (HH08 Respondent).

5.2.2 Limited food supply

Some household respondents indicated that the prohibition of urban-rural and rural-urban travel worsened food insecurity in their households. In Zimbabwe, as is the case in many other sub-Saharan countries, rural and urban communities are interdependent. Urban households depend on the agricultural production of rural households for food supply while rural households depend on urban households for cash. Respondents observed that the lockdown rules broke down this symbiotic relationship between urban and rural households. Poor urban households who depend on rural food supplies were left stranded because of the lockdown rules. One respondent pointed out that,

Things got really bad because we could not get food from our rural home in Nkayi. Every two months or so I bring maize from our rural area for grinding here in Bulawayo. But now we could not visit our rural home. We were lucky that we had kept some maize that we harvested from our urban farming here. So, we used that. But we had to reduce the food portions to make it last longer (H008 Respondent).

5.3 Coping Strategies Adopted by Households in Relation to Food Security

5.3.1 Stock Piling

Various coping strategies were observed in the study site in relation to food security. One main strategy used by most households that could afford was stock piling. Households made an effort to ensure that they had enough food in the household to last them a long time until the lockdown was eased or lifted. However, there were several challenges with this approach. The first one is that some respondents noted that because of the physical presence of large quantities of food in the household, food consumption rates went up leading to a faster stock out time. Furthermore, poor households could not stock. The poor households mostly exercised one or more of the following coping strategies.

5.3.2 Receiving Food Handouts from Charitable Organisations and Community Members

Some poor households had to depend on donations for food sustenance. As already highlighted earlier on, Respondent HH01 noted that they received significant help from their church. The Pastor took note of some of the poor households and delivered maize meal, cooking oil, soap and other products to them on a regular basis. Although other organisations such as the United Nations World Food Program were giving food vouchers in other parts of the city, this program was not present at the study site. The Respondent H009 also indicated that they often received some food assistance from a more well to do neighbor who often checked

on how they were progressing in terms of food security.

5.3.3 Reducing Meal Size Positions and Eating Less Preferred Meals

Most of the poor households that were interviewed indicated that the reduction of meal sizes was strategy that that they were using often. The number of pieces of meat and the regularity with which meat was eaten was a strategy used even in the better off households. Meat was seen as luxury under the difficult food environment. In general, the size of meals was made smaller in order to go for longer periods. Eating less preferred meals was another strategy used in most households including those of civil servants. Beans and cabbage were some of the less preferred meals that were mentioned.

My children hate beans and cabbage, but I have had to teach them to get used to these things. They needed to understand that the lockdown could go on for a long time and we would end up with no food. I tried to put some spice in the beans to improve taste and they started accepting them (HH02 Respondent).

6. DISCUSSION OF FINDINGS

The findings of this study are mostly consistent with findings by researchers in other parts of the world. Consistent with findings elsewhere, this study established that Covid-19 primarily increased food insecurity amongst urban dwellers by disrupting income streams through lockdowns (Friedman, 2021; Manfrinato et al., 2021). Many households lost their income sources due to layoffs or inability to conduct

business. These findings confirm the global trend of how food insecurity was caused by Covid-19 in urban areas.

A major finding in this study which seems different from findings in Western Europe and America is the strong linkage between rural and urban households. While studies in Europe observed the challenge of supply chain linkages to markets (Shahzad et al., 2021), this study observes a challenge with supply chain linkages to rural communities which produce food for the urbanites for social rather than market related reasons. This study also established that the impact of Covid-19 on food security was especially significant amongst the urban poor. This is a consistent finding with other literature such as those in the United States of America that showed that food insecure people as a result of covid-19 were more likely to be black people who earn low incomes and do not have formal and flexible jobs (Wolfson & Leung, 2020).

While in other studies in Europe (e.g Loopstra, 2020) it was observed that isolation often led to food insecurity as persons in self isolation could not visit shops to purchase food, the situation was rather different at the study site. Due to limited space, self-isolation was impossible to implement. Therefore, no community members stayed alone in isolation. Food insecurity was a result of other factors besides being on self-isolation.

7. CONCLUSION AND RECOMMENDATIONS

In conclusion, the covid-19 pandemic and the resultant lockdown regulations had a

profound impact on food security in Zimbabwe and globally. Urban areas suffered the most due to their dependence on food purchases that originate from markets that are external to urban areas. The loss of jobs due to company closures and short trading hours affected the ability of individuals to purchase food leading to an increased food insecurity. Another important driver of food insecurity related to the Covid-19 lockdowns was the disruption of food supply chains. Urban households utilised a variety of coping mechanisms including the consumption of less preferred foods, a reduction of meal portion sizes and the consumption of own food grown in the backyard. Most of the strategies employed by these households were temporary and there was no indication that they would become a permanent aspect of their livelihoods. It is recommended that when such lockdowns are implemented in the future, they should be accompanied by a social safety package to safeguard against food insecurity in vulnerable areas. Although government introduced some safety nets through the Covid-19 allowances targeted at civil servants, these nets did not address families who did not have civil servants in their households.

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DETERMINATION OF WATER RESOURCE SUITABILITY FOR GRAZING AT MAKOHOLI RESEARCH STATION, MASVINGO, ZIMBABWE

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ABSTRACT

The study was carried out to determine water resource suitability in Makoholi Research Institute, Zimbabwe using the FAO land suitability classification method of 1991. Vegetation structure and composition assessment were done thereafter to assess its change due to water distance. The water points were identified through the use of a scanned map in a Geographic Information System (GIS) environment and ground verification. Physio-chemical characteristics of water were tested through a laboratory procedure. The General Linear Model (GLM) was used to establish differences in water physio-chemical parameters due to sampling site and season. Analysis of variance was used to test for significant differences in vegetation structure in different suitability classes. The study results showed that the range studied had no shortcomings in terms of water quality. The water physio-chemical parameters were significantly affected by season ($p < 0.05$) except for nitrates ($p > 0.05$). However, the results showed that the rangeland was limited to some extent by distance from water points. The results also revealed a significant difference ($p < 0.05$) in vegetation structure between suitability classes. The canopy cover, litter cover, soil compaction and top hamper differed significantly within suitability class or buffer distances. The grass height also differed significantly within buffer distances. It can be concluded using the limitation approach that Makoholi rangeland falls under the Suitability class S2 as far as the water resources are concerned and that vegetation near the water point is heavily utilised hence proving that water resource distribution affects rangeland utilisation.

Keywords: species composition, buffer distance, water quality

INTRODUCTION

Rangelands are an important extensive natural ecosystem as they provide forage and other ecosystem services to livestock. However, indiscriminate utilization of this

valuable resource has caused its deterioration (Javadi *et al.*, 2018). One of the major causes of this uneven utilisation of the rangeland by grazing animals is undesirable water resource distribution in many regions of the world. Grazing lands

near the water points are utilised more by grazing animals leading to a severe reduction of the decreaser grass species and undesirable changes in the plant species composition in those areas (Ayorlo, 2015 and Bailey, 2016). Moreover, this causes the elimination of some parts of the rangelands from the production cycle.

Adequate forage throughout the dry season and even a supply of water to the stock are examples of land use requirements for extensive grazing in the tropics (Arzani *et al.* 2011). Unfortunately, water quality and availability are limited in most parts of the world, Zimbabwe included. Water resource suitability can be determined through a closer assessment of the water quality, water quantity and accessibility by grazing animals (Arash and Yasari, 2013; Ariapour *et al.*, 2016). In many regions of the world like Iran, it is difficult for livestock to access water due to topographic limitations and poor rainfall distribution (Amiri, 2010). Different livestock classes walk different maximum distance to water points, any distance above that lead to loss of condition (Mesdaghi, 2018; Wright, 2018). Unfortunately in many parts of Zimbabwe, it has been difficult to maintain the standard distance to water points (Matsa and Tapfuma, 2015). According to David (2016), in the semi-arid and arid regions of the world, livestock (cattle most common) use poor or marginal quality drinking water. The sources of water are mainly poor wells, canals, streams and dams (Food and Agriculture Organisation (FAO, 2017a). In most cases, such water is high in salts which may be harmful to cattle and other livestock species. This has resulted in problems like depression, scouring and diarrhoea in cattle (Brew *et al.*, 2015; FAO, 2017a; Willms *et al.*, 2017).

Rangelands as part of the land can be the ultimate source of wealth through the provision of ecosystem service to both

people and animals. However, the indiscriminate utilisation and distribution of water resources in Zimbabwe have led to a decrease in water quality and quantity. The lack of investigations on the current status of water resources used by animals can create a situation where the decline in quality and quantity of water becomes a crisis (Amiri *et al.*, 2017). This may lead to severe economic losses as sometimes animals are found travelling long distances to quench their thirst. Therefore it was the purpose of this study was to determine the water quality for cattle within the Makoholi Research Institute farm, establish suitability classes for all paddocks concerning distance from water sources and determine changes in vegetation structure and composition as influenced by water distribution.

MATERIAL AND METHODS

The study was carried out at Makoholi Research Institute which is 30km North of Masvingo town. The area falls under Natural Region IV (NR4) of the Zimbabwean ecological classification system (Department of Research and Specialist Services [DR&SS], 2016). Altitude is 1204m above sea level on latitude 19°50' S and longitude 30° 46'E. The area is suitable for extensive farming and receives an annual rainfall of 450 to 650 mm. Rainfall is erratic and unreliable and falls between November and March.

In terms of water resources, two perennial rivers form part of the farm borders, the Shagashi and Makoholi rivers. Along the Shagashi river, there is a dam which acts as a reservoir of water in winter which is drawn to supply a weir that supplies the Station with water. As for livestock, efforts were made to provide water in each paddock through a pipeline to the troughs however due to economic hardships it has

not been easy for the station to repair the damaged pipelines and pump breakdowns. This has therefore forced the livestock to utilize natural water resources in Dams, weirs and rivers.

Identification of water resources

The identification of water resources was done through a two-way process. The first step included the use of a Geographic Information System (GIS) (Garmin, 2017). A scanned map of the study area was geo-referenced using GIS software to facilitate the identification of water points. The second step was field verification of the identified water points on the ground. Global Positioning System coordinates were taken to improve accuracy when analysing using the GIS software (Dahwa *et al.* 2013). The number of water points were identified and these included Makoholi weirs, Shagashi River, Makoholi River, two ZINWA weirs and two other weirs that were found in paddocks. The naming of the water points was through the help of the farm general hands, section supervisors and to a lesser extent, Google Earth.

Determination of the water quality for cattle within Makoholi farm

Three samples were taken from each water source, the samples were collected from the mouth, middle and end of the water source at a depth of one and a half meters using polythene bottles. However, for rivers, more than three samples were taken from sites where cattle drink. The samples were collected in the wet season (November 2016 to February 2017) and dry season (July –October 2017)., Samples were refrigerated at 3°C to preserve them before analysis (Meybeck *et al.* 2018). Laboratory analysis of Total Dissolved Salts, pH and Nitrates was done for samples from each of the main water sources at the ZINWA laboratory in Masvingo. Multi-Conductivity metre was used for Total Dissolved Solids, and a pH meter for pH

analysis (German *et al.* 2008, FAO 2007; Ariapour 2013).

Establishment of suitability classes paddocks with respect to distance from water sources

An aerial photographic map was scanned. After scanning the map was put in a GIS software for geo-referencing. The Global Positioning System gadget (Garmin, 2017) was used to take four coordinates in the four corners of the study area. o get a more accurate distance buffer, the Global Positioning System (GPS) was used to take the coordinates of water points and the cattle pens. The coordinates were downloaded into a Geographical Information System (GIS) environment which was used to make buffer distances from water resources (Amiri, 2008; Amiri and Shariff, 2011). The buffers were based on FAO standards of water distance suitability and they included one, two three and four-kilometre buffer distances.

Vegetation structure and composition in different suitability classes

A series of veld assessments based on visual assessment of different vegetation was done in the different suitability classes which were established using the GIS software. Transects of 50 meters were used and quadrants measuring 1m by 1m were used for grass assessment. Transects were laid at least 30 m from roads to minimise border effects (Dahwa *et al.* 2013). The quadrants were placed systematically along the transect at 10 meter intervals. Tape measures were used to measure these distances. Grass species, their frequency of occurrence and height were noted and recorded (FAO, 2017). The other parameters that were evaluated included basal cover, litter cover, top-hamper and estimation of soil compaction and erosion. The parameters were scored out of ten with a score of one representing a low rating and

of ten representing a high rating for basal cover and litter cover. For soil erosion, low scores mean low levels of erosion and high scores (10) mean high levels of erosion (Dahwa *et al.* 2013; Dahwa *et al.* 2014). The height of each grass species was measured and recorded in each quadrant. The grasses were then arranged according to their grazing values and ecological status that is increaser1, 2, 3, and decreasers. The vegetation assessment was done between August and December 2016. This was so because the research focuses more on the winter period when water is scarcely available.

Data Analysis

The Shapiro-Wilk test was used to assess for normality of variables of interest ie litter cover, canopy cover, top hamper, erosion, compaction and water physio-chemical parameters. Homogeneity of variance was assessed by Levene's test on SPSS version 21. Data were organized and represented in the form of descriptive tables, and line graphs to assist in the interpretation of results. The data on water quality was subjected to a Generalised linear model using Minitab version 14 to establish the variation if any in water quality from the different sources and seasons. The means were compared with water quality standards for cattle recommended by many authors including FAO. The main effect plots were done to determine the effect of season and sampling sites on the results using Minitab version 14. The data collected for distance to water resources was analysed using GIS software using the FAO Land Suitability Classification, looking specifically at livestock water

distance suitability. One-way analysis of variance from Minitab version 14 was used to check for significant differences in vegetation structural attributes between the suitability classes. The occurrence of certain grass species in distance was determined by subjecting data to ANOVA to obtain mean occurrences. Also, one-way ANOVA was used to check any significant changes in the grass in different buffer distance or suitability classes and the results obtained were presented in tables and line graphs. In terms of distance and water quality, the mean values were compared with international standards and classified according to the FAO Land Suitability classification method (FAO, 1991). The last step was to combine the two sub-models to determine the suitability of water resources in the area of study (Arash and Yasari, 2013). The limitation approach was used whereby the most limiting factor determined the overall suitability of the area in terms of water resources.

RESULTS

Water quality-Physio-chemical parameters

The water quality assessment objective was achieved by examination of the physio-chemical of water and by comparison of the results with recommended standards. Based on the water resources quality laboratory results and considering the water quality, there were no limitations in the water resources of Makoholi Research Station, and the whole station fell within the S1 suitability category (Table 1).

Table 1: Water quality and the component classification according to FAO standards

Constituents	Minimum recorded	Maximum recorded	Average	Suitability Class
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Total Dissolved Solids (mg/l)	140	282	211	S1
Nitrates (mg/l)	0.01	0.08	0.05	S1
Electrical conductivity(mg/l	0.06	0.58	0.32	S1
pH	6.7	6.8	6.75	S1

The study showed that season had a significant effect ($p < 0.05$) on physio-chemical parameters except for nitrates. The results showed that TDS were high in the dry season compared to rainy season. However, nitrates and pH were higher in the rainy season than in the dry season. There was a significant variation in the

physio-chemical parameter of water from different sources ($p < 0.05$). The TDS and nitrates were higher in the Makoholi River than in other sources. However, there were no significant differences ($p > 0.05$) in water pH among the different sources (Table 2). Turbidity was significantly affected by season ($p < 0.05$).

Table 2 Total dissolved solids, nitrates, pH, electrical conductivity and turbidity of rangeland water sources in the rainy and dry seasons.

	Total Dissolved Solids (mg/l)	Nitrates(mg/l)	pH(mg/l)	E.Conductivity (mg/l)	Turbidity(FTU)
Rainy season	200 ± 3.85	0.05 ± 0.001	7.02 ± 0.11	304.94±72.81	21.462±2.19
Dry season	231.438±11.02	0.03 ± 0.001	6.72±0.37	413.34±22.96	11.33±0.63
P-values	0.003	0.624	0.00	0.003	0.000

Distance from water resource suitability

The results of the sub-model on the distance from water resources revealed that above 80% of the rangeland area fell in the Suitable category and little of the rangeland in question fell into the moderately suitable and marginally suitable categories, in addition, no rangeland area fell into the not suitable category. However, some parts of paddock 28 (black part) fell into the S3 category (Figure 1).

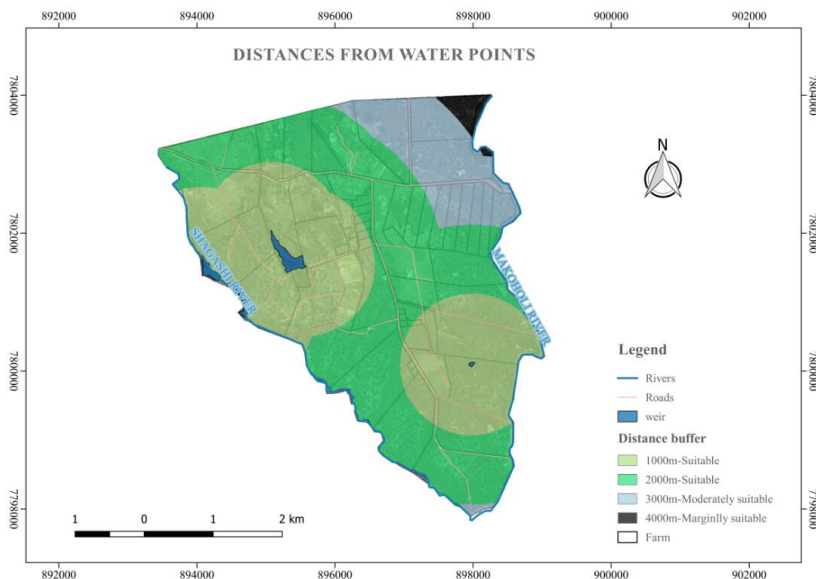


Figure 1: Water suitability map for Makoholi Research Institute

3 Influence of buffer distance on vegetation

The results from the statistical analysis show that there was a significant difference ($p < 0.05$) between different buffer distances from the water points as far as vegetation structure was concerned (Figure 2). The distance from the water had a significant effect on canopy cover ($p = 0.002$), the

canopy cover was lower in areas near the water points compared to areas further from water points. The distance from the water had also a great significant effect on litter cover ($p = 0.000$) and the top hamper ($p = 0.002$). Litter cover and top hamper were low in the 1km buffer distance. Compaction and erosion were significantly influenced by distance from the water point ($p = 0.000$). Soil compaction was high in areas near water points than in areas further from water points (Figure 3).

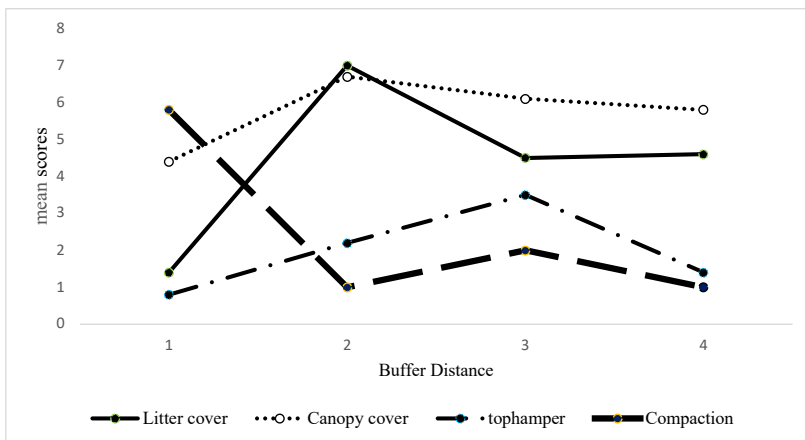


Figure 2: Changes in Litter cover, canopy cover, top hamper and compaction in relation to distance from the water source

The results showed that the area of study was mainly dominated by the Increaser II grass species. The decreaser grass species had the least proportion in all buffer distances. The results showed that there were few pioneer grass species.

Decreaser species occurrence across buffer distances

The occurrence of decreasers species was low in the 1 km buffer distance and increased with the increase in buffer distances. *Digitaria eriantha* had a low occurrence in the first buffer and increased in other distances except for the fourth distance. *Panicum maximum* had a low occurrence in the first buffer though it become moderately high in other buffer distances. *Digitaria penzti* was moderately low in all distance buffers as shown below (Figure 3).

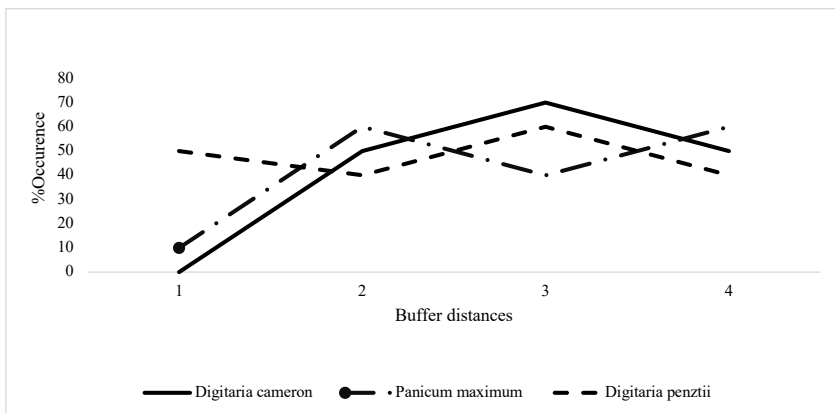


Figure 3: Percentage occurrence of decreaser grass species in different buffer distances.

The increaser I grass species

The general trend shows that increaser I grass species had a low frequency of occurrence near the water points that is at the one and two-kilometre buffer distances. However, they showed increased occurrence as one moves away from the water point. *Brachiaria brizantha* had a low occurrence in the first buffer distance and increased in the second and third buffer

distances. *Hyperthelia dissoluta* occurrence was high in the first buffer and moderately low in other buffer distances. *Shizachyrium jeffreysii* occurrence was moderately low in the first buffer and further decreased in other buffer distances. *Hyparrhenia filipendula* occurrence was high in the first buffer distance, low in the second buffer and high in the third and fourth buffer distances. This is clearly shown in Figure 4.

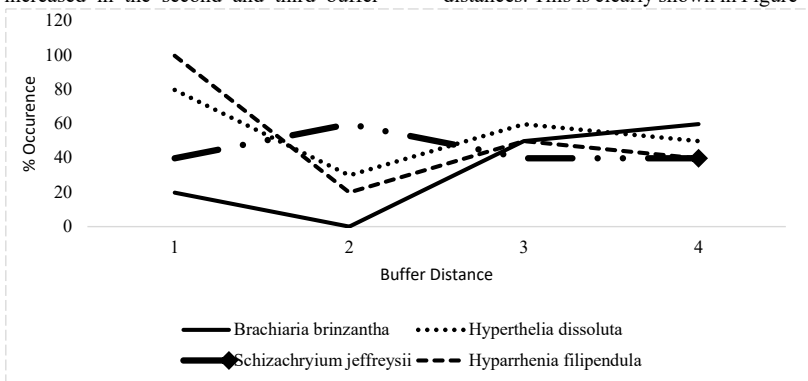


Figure 4: Percentage occurrence of increaser1 grass species in different buffer distances

The Increaser II grass species

There was varied occurrence of increaser II grass species at different buffer distances. Grasses of the *Eragrostis* genus had moderately high to high occurrence in all the distance buffers. *Loudetia simplex* and *Pogonarthria squarrosa* increased as the buffer distance increased and then declined in the 4 km buffer distance. *Aristida*

conjesta had a high occurrence in the first 1km distance and decreased in all other distances. *Urochloa mosambicensis* had also low occurrence in the first and second buffer distances. *Cynodon dactylon* had also a high occurrence in the first distance buffer and decreased up to the third buffer and increased in the fourth buffer (Figure 5).

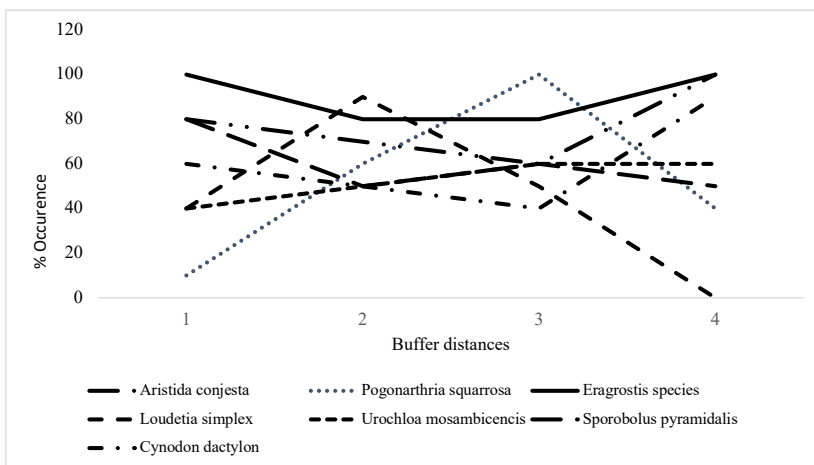


Figure 5: Percentage occurrence of increaser II grass species in different buffer distances.

The Increaser III grass species

Aristida junciformis was the only increaser III grass species recorded in the study. It had a low occurrence in the first buffer distances. Its occurrence in these buffer distances ranged from 20% to 100%. In the fourth buffer, distance is dropped to 50%.

The results on grass height showed that there was a significant difference ($p < 0.05$) in grass heights in the different buffer distances. On performing the Tukey...., the results showed that the grass height was low in the first buffer distance, second and third respectively and become high in the fourth buffer distance as indicated in Figure 6.

Grass height

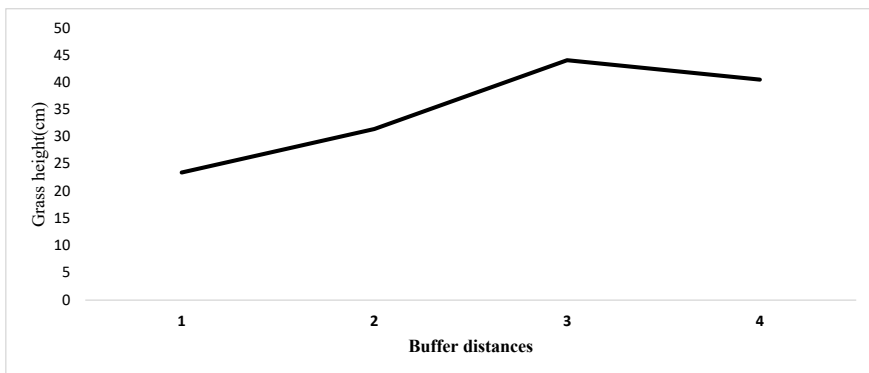


Figure 6: Average the grass height in different buffer distances.

DISCUSSION

The key factor reducing the suitability of the water resources of the range in the area studied was the distance from the water resources. However, a very small portion of the study area fell into suitability class three (S3). This means the area was 3-4km away from the water point. Distance is itself influenced by the slope of the trail the stock has to follow to reach the water resources because the access of the stock to the water resources is reduced with an increase in this slope and consequently rangeland suitability (Gerrison *et al.* 2017). At greater slopes, animals spend more energy moving and therefore cover less distances to reach the water resources (Amiri, 2008). Their results showed no limitation concerning water quality and quantity. Little of the rangeland of the region in question fell into the S2 and S3 suitability categories, no rangeland area fell N suitability category. Aripour *et al.* (2014), did a similar study, there were no limitations in terms of water quality and quantity in their study and this was similar to findings by Arash and Yasari (2013), and Amiri's (2009) work in determining water resource suitability for goats and cattle grazing in Iran. In the

studies conducted by Arzani *et al.* (2016) and Refahi (2006), water quality and quantity were not found to be limiting factors in the suitability of the water resources. It can be therefore concluded that most countries and rangelands have no limitation as far as water quality and quantity are concerned although that is not true for tropical sides of the world. Javadi *et al.* (2017) found water quality to be a limiting factor in the suitability of the rangeland in the region of Halvan of the city of Tabas in Iran.

Water physio-chemical parameters

The major water physiochemical parameters that reduce water quality in most cases are salinity, nitrates and total dissolved solids. The present study also showed no limitations in water quality. Total dissolved solids, nitrates, turbidity and pH all fell in the suitable category indicating good water quality. Good water quality might be explained by the absence of pollutants such as sewage, industrial waste, and few agricultural fertilisers and pesticides near the water resources (Szczerbinski and Gaczynski, 2015). The study area, Makoholi, is in rural area with

no commercial farmers and the population is low thus presenting little threat to water quality. Boyles (undated) indicated that the presence of industries, too much use of fertilisers near the water sources and urbanisation caused a lot of water quality deterioration in India. According to Braul and Kirychuk (2018) farmers often indulge in excess usage of fertilizers and pesticides. When these are used more than the recommended doses, they pollute water, land and air. However, the season seemed to play a role in physio-chemical parameters. Nitrate levels were high in the wet season than in the dry season and this is supported by Pandey and Devkota's findings in 2016. The higher nitrogen in the wet season may be due to the accumulation of organic matter, agricultural runoff from the catchments area, higher microbial activities or due to leaching of nitrates from nearby agricultural fields (Patterson *et al.*, 2015 Pandey and Devkota, 2016). Total dissolved solids were high in the dry season than in the wet season. The higher values during the dry season might be due to the water loss of water by evaporation in this season which increases particle concentration (Pandey and Devkota, 2016). Electric conductivity was also high in the dry season and it can be correlated with total dissolved solids. Electric conductivity depends on the presence of ions, their total concentration, movement, valences and on temperature of measurement (Pandey and Devkota, 2016). The greater amount of dissolved solid in river water indicates the greater amount of ions in the water and hence high electric conductivity values (Pandey and Devkota, 2016). In the present study, pH was high in winter compared to the dry season. This is contrary to the findings by Sharma *et al.*, (2013). The variations can be due to the method of testing used and biases in the equipment used. However in general the pH levels are expected to be high in the wet or rainy

season may be due to the heavy rainfall which is free of chemicals. Also in the present study turbidity was high in the rain season compared to the dry season. This was very evident in most of the sampled rivers than weirs. This is similar to the findings by Malla (2019). He also suggested that the high turbidity values during the rainy season can suggest that discharges from domestic effluents and runoff from agricultural activities that reach the river may be large or small particulates that are not settled to the bottom which then increases the turbidity values. In terms of the water sources or sampling areas, the rivers, that is the Shagashe and Makoholi, had general high values of turbidity and total dissolved solids. The high turbidity values can be explained by the runoff and flowing of the rivers in most of the time. The total dissolved solids can be high in the river due to the accumulation of organic matter and another mineral in the rivers. The nitrates, they were high in weirs and small dams. This can be explained by the fact that these water bodies are near crop fields which are usually heavily fertilized by artificial nitrogen-based fertilisers.

The vegetation components

The assessment of the vegetation that is litter cover, canopy cover and top hamper, grass species composition and height was done to verify and explain how water distribution in the rangeland affects forage utilisation. This was also a move to monitor the extent of rangeland degradation. Zerga (2015), argued that the major indicators of rangeland degradation are a shift in species composition, loss of rangeland biodiversity, reduction in biomass production, less plant cover and soil erosion. However, at times, other factors like soil characteristics, hydrology, and landform can influence the rate of degradation (Arnalds and Barkarson, 2003). Low canopy cover scores especially near the water resources as noticed in the present study might mean that there is too

much utilisation of that particular area by animals and may be an indication of rangeland degradation (Ahmad *et al.*, 2012). This can be caused by high intensity of grazing and long periods of stay. Zegra (2015), observed that long-term grazing intensity can alter litter cover, and plant basal and canopy cover characteristics, which can also affect soil water dynamics by altering microclimate and soil temperature and exposing land to soil erosion (Milchunas *et al.*, 2018). Moreover, the excessive removal of perennial grass species reduces ground cover (Eccard *et al.*, 2000). Litter cover which includes dead and decaying organic matter can have high scores due to mostly two factors. High litter cover can be a sign of an improvement in rangeland management. Low litter cover shows rangeland degradation. In the present study, the litter cover was low near the water points showing there may be incorrect rangeland utilisation. This clearly shows that animals spend most of their time near water resources as alluded to by Robert and Richard (2012). In terms of the top hamper, high scores (5-7 out of 10) indicate low utilisation of the area by either people or animals. Usually, high top hamper scores indicate poor utilisation of that particular rangeland. Poor grazing management can cause very low top hamper in some areas and high scores in the same piece of land (Valentine, 2017). This was in agreement with Friedel (2011) who noticed also that closer to the water points grazing is heavy and shifts in vegetation structure and composition over time can be large and tend to become less away from the water points. When it comes to compaction, high compaction may indicate high animal movement hence soil compaction. According to the research carried out by Oregon University (undated), as the size of livestock herds increases, the perennial grasses are consumed and trampled on, and their roots suffer from loss of above-ground

parts and soil compaction. However, other factors can cause soil compaction which includes rainfall intensity at times, people's movement and also the soil's physical characteristics. High soil erosion can also be attributed to notably too much utilisation of area by animals loosening the soil making it more vulnerable to both wind and water erosion. Soil erosion and compaction have a relationship. They can have a positive correlation and a negative correlation depending on the circumstances.

The ecological statuses of the grass species found in the study and their occurrence

Also studied in this study was the type of grass species occurrence in different suitability classes or buffer distances.

Decreasers

The study results indicated that decreaser grass species like *Panicum maximum*, *Digitaria penzti* and *Digitaria cameron* had a low occurrence near the water points and in whole study area. These types of grass species are more palatable and preferable grazed compared to other grass species. The low occurrence of these types of grass species can be attributed to grazing by livestock and wildlife. Hoffam and Todd (2016), argued that high intensity of grazing leads to excessive removal of the most palatable species, which are usually perennial. As this happens it opens the way for less palatable and faster-establishing annual grasses and forbs to take hold. Continuous decrease of the highly desirable species can result in rangeland deterioration (Zerga, 2015). Also, these species are usually abundant in the veld in a good condition and decrease when the veld is over utilised (Rooyen, 2002). This links with Bailey *et al.*'s (2016) findings which state that herbivores show slow movement and spend more time on

nutrient-rich areas than other areas and hence the species composition and diversity shift drastically. The aspect of selective grazing and preference can also come into play. Different animal species have different preferences for grazing material, this preference could be on plant species, plant parts, and/or grazing location within the rangeland (Zerga, 2015). Therefore due to area and species selective grazing, certain parts of the grazing area and some species will be utilized more than others. That will exert more grazing pressure on the preferred areas and species while others are not utilized (Zerga, 2015).

The Increaser I

In terms of the Increaser I grass species, the grasses like *Brachiaria brizantha* had a low occurrence in the first buffer distances. This is because this kind of grass species has average grazing values it is therefore consumed by grazers. However, grass like *Hyperthelia dissoluta* and *Hypparrhenia filipendula* showed high occurrence near the water points showing that it is not preferably grazed. This might be because of its awns and height which is undesirable for grazing. Grass-like *Shizachyrium jeffreysii* also had high occurrence near the water points may be because it has a low grazing value and hence less consumed.

Increaser II

In terms of the increaser II grass species, these grass species dominated the whole rangeland. This is also a clear sign of a rangeland that is losing condition (Rooyen, 2002). Grass like *Loudetia simplex* was an exception simply because they favour wet conditions and have low palatability and grazing value (Oudtshoorn, 1999). This explains why it had a high occurrence near the water points. *Eragrostis* species like *Eragrostis curvula*, *Eragrostis plana*, *Eragrostis chapelieri* and *Eragrostis rotifer* have usually poor grazing value

(Oudtshoorn, 2019) and also their dominance shows poor rangeland. Dahwa *et al.* (2013) noted that these kinds of grass species are associated with continuous grazing and consequently indicators of veld deterioration. The other Increaser II grass species which were found especially near the water sources were *Sporobolus pyramidalis* and *Cynodon dactylon*. Grass species like *Sporobolus spp* and *Cynodon dactylon* are tolerant to trampling and intensive grazing, therefore this explains why their occurrence was high near water points (Oudtshoorn, 1999). Moreover, these kinds of grass species are important indicators of compaction and incorrect rangeland management. The *Eragrostis* grass species also indicate veld deterioration, too much of this species compared to other grass species is undesirable because they are not palatable to animals. The replacement of palatable grass species (Decreaser) by unpalatable species can also be a good indicator of deteriorating rangeland (Ahmad *et al.* 2012).

Increaser III grass species

These kinds of grass species had less occurrence almost in the whole study area. One such species which was recorded in the study was *Aristida junciformis*. This can indicate rangeland that is slowly getting deteriorated but is almost in good condition.

Grass height

The grass height was low near water points indicating increased utilisation of the rangeland near the water resources. However, the observations during the study showed that there are other grass species whose height remained high. This might be because they have poor grazing values and palatability. In general, the present study showed that vegetation composition seemed to be changing as one moves further from the water point. The canopy cover,

litter cover, and hamper changed with the distance from water sources. Near the water points, these variables were low and increased with buffer distances, the major reason can be too much utilisation of the area by cattle especially.

CONCLUSION AND RECOMMENDATIONS

The results of the study showed that the quality of water resources were not limiting to cattle grazing. The water quality was suitable for cattle throughout the year. This was supported by a closer comparison with FAO water quality guidelines following its method of land suitability classification. The study results indicate that water resource distribution affects rangeland utilisation. The vegetation structure and composition differed from each buffer distance.

In conclusion, judging the suitability of water resources using the limitation approach of FAO suitability classification whereby the most limiting factor determines the overall suitability of Makoholi rangeland fall under the suitability class S2 which is the moderately suitable category.

As indicated earlier that a certain portion of the area falls under the suitability class three (S3) there is still a need to improve the water resources to at least the second class S2. The researchers recommend the construction of water troughs in the paddocks so that water can be pumped into them thus reducing buffer distances to within 2km to allow for more even utilization of rangeland resources.

CONFLICT OF INTEREST

The researchers declare no conflict of interest in this publication

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