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From research to policy ...and practice

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FSNet-Africa aims to strengthen interdisciplinary food systems research and the translation of evidence into support for food-related Sustainable Development Goals.

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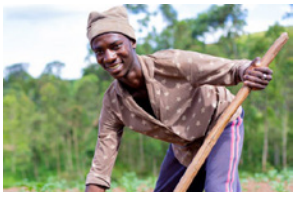


Introducing the FSNet-Africa model

Strengthening African capacity to tackle Africa's wicked development challenges

– By guest editors
Elizabeth Mkandawire, Melody Mentz-Coetzee, Frans Swanepoel, Andy Dougill, Claire Quinn, Tshilidzi Madzivhandila

The challenges inherent in the Sustainable Development Goals (SDGs) are interconnected and complex (United Nations, 2018). Overcoming these challenges requires adopting solutions that transcend conventional silo approaches and actively promote inclusivity (El-Jardali et al., 2018). However, these approaches are not the norm, and deliberate efforts are needed to disrupt traditional approaches to development. Research activities also need to adapt so that they are underpinned by capacity development, knowledge management, and partnerships of co-production, communication and coordination (Lamptey et al., 2024).

Introduction

Academic institutions and researchers are facing increased pressure to demonstrate the social and economic impact of their research (Păunescu *et al*., 2022). However, formal training on the skills required to achieve impact, for example through influencing policy or practice, are not provided in typical Master's or PhD curricula (Mentz-Coetzee & Sienart, 2022). A new cadre of researchers with different and more diverse skills who are able to collaborate across disciplines and outside of academia is needed.

Background

FSNet-Africa was funded by the Global Challenges Research Fund (GCRF) through the partnership between UK Research and Innovation (UKRI) and the African Research Universities Alliance (ARUA). The lead partner institutions were the University of Pretoria (South Africa), the University of Leeds (UK) and the Food and Natural Resources Policy Analysis Network (FANRPAN) (pan-African). The project was implemented from January 2021 to December 2023.

FSNet-Africa aimed to conduct research that was relevant to African food systems and could translate into tangible outcomes and impact. The project aimed to strengthen the capacity of African early career researchers to conduct the transdisciplinary research that could achieve these changes. It also aimed to enhance the networks of researchers: between disciplines, across career phases, across Africa, between Africa and the world, and between academia and society.

Twenty early-career researchers (within ten years of their PhD) from six African countries (Ghana, Kenya, Malawi, South Africa, Tanzania and South Africa) were selected to participate in a two-year structured fellowship programme. Each Fellow was employed at one of ten academic partner institutions. Fellows came from diverse research disciplines with the prerequisite that their research within the fellowship should focus holistically on African food systems.

Why focus on African food systems?

Food is central to development, and food systems are interlinked with multiple SDGs. One of Africa's key challenges is ensuring that there is adequate, safe and nutritious food for the world's population that is produced in an environmentally and economically sustainable manner (Ingram *et al*., 2023). In 2022, 735 million people were reported to be in a state of chronic hunger, and an estimated 2.4 billion people were unable to afford safe and nutritious diets (FAO *et al*., 2023). Following the Covid-19 pandemic, which exacerbated pre-existing vulnerabilities within food systems, calls were made for urgent and coordinated action (FAO *et al*., 2020).

Designing for impact

The FSNet-Africa fellowship was designed as an experiential research capacity development programme where capacity strengthening was undertaken whilst research project implementation was ongoing. Structuring the programme in this way facilitated learning through practice. Fellows could apply newly acquired skills and knowledge in real-world research settings, better positioning them to retain and build upon their competencies over time (Kolb *et al*., 2017).

The capacity strengthening aimed at embedding five key skill sets: project management, responsible research, research methods, research impact and

communication. These competencies are essential for conducting research across disciplines and with stakeholders outside of academia (O'Donovan, 2022; Guimarães *et al*., 2019; Jackson *et al*., 2022).

There were seven primary interventions where Fellows' capacities were strengthened, including summer schools and a stakeholder engagement dialogue. Additional training was provided online as needed. The content of the different training events was aligned with the phases of the research project cycle – conceptualisation, implementation and dissemination. For example, orientation was targeted at helping fellows conceptualise their ideas. A summary of the skills areas, fellowship events, and the fellowship timeline is shown in Figure 1.

Mentorship for enhanced networks within academia

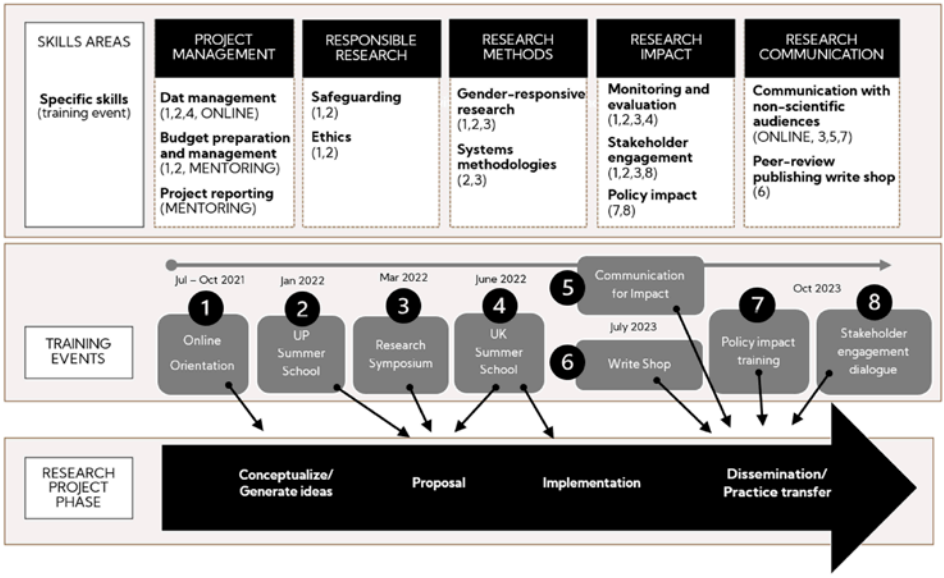
Mentorship and enhanced networks play a critical role in the professional development of early-career researchers, particularly in the context of an increased emphasis on collaboration. By fostering mentorship and building robust networks, early-career researchers can expand their career prospects, increase visibility and leverage these connections to access funding opportunities. Networking facilitates the exchange of knowledge and collaboration across disciplines, institutions and regions, promoting a culture of shared learning and innovation (Jackson *et al*.,, 2022; Termini *et al*., 2021).

Each Fellow was supported by at least one mentor from one of the African academic partner institutions and one from the University of Leeds. The two mentors were chosen in combination to provide different disciplinary insights into the team. Each Fellow was also supported by a University of Pretoria researcher whose primary role was to expand the Fellows' networks within the institution. Each research team represented between three and five research disciplines. The structure supported intra-Africa networks, as the African mentor was not from the same institution as the Fellow, and enabled networking across career phases.

Networks beyond academia

A critical feature of the fellowship was the stakeholders' role in the research process. From orientation, when fellows were conceptualising their research ideas, they were tasked to collaborate with food systems stakeholders to define the research they would undertake. Engaging stakeholders throughout the research project implementation cycle, from inception to dissemination of research findings, has multiple benefits (Boaz *et al*., 2016), enabling greater potential for uptake into policy and practice (Warren *et al*., 2020).

Figure 1: Illustration of Fellows research project implementation with capacity building interventions



Throughout the research process, there were specific points at which Fellows were able to receive feedback from stakeholders. FANRPAN was primarily responsible for facilitating these engagements as a boundary-spanning organisation. Boundary-spanning organisations operate at the interface between different sectors, disciplines or communities. They facilitate collaboration among diverse stakeholders, bridging gaps and facilitating communication, knowledge exchange and cooperation across various boundaries (Christ *et al*., 2018).

In three specific projects stakeholders have committed to integrating the research findings into policy and practice. After FANet-Africa's initial project ended, additional funding was committed by the universities of Leeds and Pretoria to support five Fellows in collaborating with stakeholders in the implementation of their ongoing activities. For most Fellows, involvement with stakeholders reshaped their research practices, prompting them to incorporate these approaches into their training of PhD and Master's students.

Lessons learnt

Analysis of project-level monitoring and evaluation indicates the fellowship helped Fellows develop a wide range of skills required for transdisciplinary research. Comparing skills levels prior to and after the fellowship, results show that 80% of

Fellows improved their capacity to conduct gender-responsive research, 75% improved their capacity to engage stakeholders in research and monitor research impact, and 60% improved their ability to engage with policy audiences.

These individual-level capacity changes are now influencing institutional changes. For example, one Fellow lobbied to integrate science communication into the PhD curriculum at their institution. The institution has taken this forward, and the Fellow will deliver the course in the 2024 academic year. In another example, researchers used their training on ethics and safeguarding to champion policy changes within their institutions. Three institutions are currently implementing these changes.

While ongoing stakeholder engagement throughout the research cycle is ideal, research can still yield benefits and impact if stakeholder perspectives are considered at some point in the process. At the stakeholder engagement dialogue, the final event of the fellowship, farmers who had not previously been involved in the fellowship expressed the view that the research that was shared provided valuable insights that will inform their operations.

FSNet-Africa aimed to conduct research that ... could translate into tangible outcomes and impact.

The FSNet-Africa model is transferable to other development challenges and can be applied in PhD and Master's training programmes. Critical features include the integrated experiential capacity strengthening and project implementation approach, the mentorship model, the focus on research and complementary skills, the focus on communication outside of academia and the engagement of stakeholders throughout the research process. Projects of such intensity ideally require at least three years of implementation and depend on a skilled project management team.

Conclusion

The FSNet-Africa model is one of many science-policy interface models that can enhance collaboration across disciplines and between academia and broader stakeholders. Early evidence suggests that specific capacities have been strengthened within the FSNet-Africa project to conduct research across disciplines and with stakeholders outside academia. The model was presented during a side event at the World Food Prize Borlaug Dialogue and has been taken up as a case study in the FAO Guidance On Strengthening National Science-Policy Interfaces For Agrifood Systems. With the growing demand for collaboration and partnerships, such models need to be institutionalised to disrupt the silo mentality and advance collective action. FSNet-Africa has created a critical mass of researchers equipped with the tools to advance this approach and reshape development across Africa. NA94

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Towards integrating the WEF nexus into food systems thinking

A case study of the Philippi Horticultural Area

– By Amiena Bayat and Mark Volmink

In a case study of the peri-urban Philippi Horticultural Area (PHA) outside Cape Town, South Africa, AMIENA BAYAT and MARK VOLMINK uncover the many issues and racial legacies that negatively impact the security and equitable distribution of water, land and energy resources and suggest how the embryonic water, energy and food or WEF nexus applications, already prevalent in the PHA, could strengthen food production and security.

All photos are of the Philippi Horticultural Area. Source: Maryatta Wegerif, GroundUp

Introduction

The need to transform food systems is gaining traction with the spotlight on the hunger crisis in Africa (British Red Cross, 2023). However, developing and sustaining resilient food systems in Africa is extremely challenging within the context of climate change and the need to protect the livelihoods of the poor. For food systems to be sustainable, better governance and a more integrated approach to their implementation are required (May, 2021). The incorporation of water, energy and food (WEF) nexus thinking into food systems presents one opportunity for greater synergy. FAO (2014) shared the perspective that the food system should be viewed as a sequence of nexus dynamics (such as the water-energy-food or water-land-food nexuses), each denoting complex, inter-related synergies and trade-offs.

The WEF nexus concept (explained in more detail below) essentially requires the recognition of the interdependence of the key elements impacting food systems and food security. One of the challenges to implementing the WEF nexus approach in South Africa (Mabhaudhi *et al.*, 2018) relates to resource management and policy development being mostly focused on individual sectors with minimal links made to other relevant sectors. Despite this and other challenges, there are opportunities to apply the WEF nexus concept effectively in the management of resources. For example, Botai *et al.* (2021) suggest future participatory research studies to illustrate the relevance of the WEF nexus at a community level, with an emphasis on the poor. This article offers solutions premised on a WEF nexus approach that addresses concerns related to food systems and food insecurity in the Philippi Horticultural Area (PHA) in the Western Cape.

Defining the WEF nexus concept

The word nexus means "to connect" (De Laurentiis *et al.*, 2016). This word conveys the interactions between two or more elements, whether they are dependencies or interdependencies. Nexus thinking was first proposed by the World Economic Forum in 2011, which highlighted the close connections between the use of resources to ensure that the basic and universal rights of all people to food, water and energy security (Pandey, 2018) are upheld (Biggs *et al.*, 2015). The WEF nexus can be described as a system that connects the water, energy and food sectors. It includes interconnections and trade-offs within the three sectors and is premised on the productive use of water in agriculture, cohesive water resources management, and the efficient use of energy (Mohtar, 2022). In essence, the WEF nexus concept suggests that if water is required for food, water for energy, and energy for food, etc. you can't fix a problem in one sector without considering its role in and impact on the others. In the context of this study, the explanation of Biggs *et al.* (2015) of understanding interconnections as a means of addressing the basic rights of the poor, is a plausible nexus approach.

Theoretical perspectives on the relevance of a WEF nexus approach to food systems thinking

A body of literature has emerged on how WEF nexus thinking should be aligned with food systems thinking. Hogeboom *et al.* (2021) maintain that WEF nexus thinking has created awareness of how water, energy and food systems are intricately linked and should be viewed collectively and holistically to attain security (Bleischwitz *et al.*, 2018; Liu *et al.*, 2018, cited in Hogeboom *et al.*, 2021). Correlating with this perspective, Naidoo *et al.* (2021) argue that the WEF nexus advocates a transformative and cohesive approach for directing other modern-day transformative systems, such as sustainable food systems. Discourses across sectors will validate technological innovations that

strengthen nexus planning, creating different alternatives such as the circular economy and sustainable food systems. These systems explore the interconnections among resources more efficiently. This approach could significantly strengthen the probability of achieving the Sustainable Development Goal (SDG) 2 target of doubling food production to meet the global demand for food by 2050 (Agathón, n.d.). Furthermore, Mantlana *et al*. (2023) opine that there are increasing demands on limited resources, and that water, energy and land issues are intrinsically linked. Addressing these rising demands sustainably necessitates the implementation of a nexus approach to recognise and implement synergies of water, energy and food systems and direct the development of cross-sectoral policies.

Sustainable food systems: A prerequisite for food production and food security

There are scholars who present arguments for developing an efficient, sustainable food system as a mechanism for enhancing food production and security. For example, Çakmakçı, Salik and Çakmakçı (2023) maintain that sustainable food systems emphasise strengthening food production and processing the food supply needs of the present, without causing environmental damage that impacts the capacity of future generations to meet their needs. According to the United Nations (2023), a sustainable food system provides food security and nutrition for everyone. It's a system capable of adapting and mitigating the effects of climate change and producing adequate, healthy, safe and nutritious food. Within the confines of these definitions, this article considers the application of a nexus approach for better food production and enhanced food security for the poor.

Profile of the Philippi Horticultural Area (PHA)

The focus area of this article is the PHA, a peri-urban agricultural area located within the City of Cape Town metropolitan municipality in the Western Cape province of South Africa. The PHA is a unique peri-urban agricultural environment that is estimated to provide a significant portion of Cape Town's fresh vegetable produce. The area encompasses more than 3,000 hectares, but the farmland has been reduced to

approximately 1,884 hectares (Human, 2021) by industrialisation, new formal housing and the encroachment of informal settlements (Setplan, 2017). A body of literature (Safcei, 2017; Open Green Map, 2010; PEDI, 2018 and Haysom, 2019) suggests that the PHA is agriculturally significant because: it provides 80% of Cape Town's vegetables; it is located in the Cape Flats Aquifer (CFA), which potentially supplies 30% of Cape Town's potable water; it generates R484million of economic output annually and it is one of the last remaining agricultural and natural landscapes within the City of Cape Town. According to Indego (2018), there are about 35 farmers (commercial and small-scale) active in the PHA. On the strength of a report by Seeliger (2020), farmworkers had not been given tenure of security despite generations of working with the commercial farmers. Farmers in the PHA produce for their own consumption (small-scale farmers) and commercially (large-scale farmers). Sixteen different types of vegetables are produced in the PHA. Cabbage, carrots, lettuce, herbs, leaks, spinach and cauliflower are produced by the majority of the farmers (Indego,2018).

The literature indicates that the City of Cape Town's management of the water for the poor requires significant improvement.

With the nine informal settlements (Setplan, 2017) contributing a population of more than 500,000 people (Indego Report, 2018), the local unemployment rate is roughly estimated to exceed 60% (PHA Food & Farming Campaign, 2020). This untenable situation presents significant challenges for food security and poverty in the PHA. With the neighbouring community of Philippi's significant proportion of overcrowded informal dwellings and high unemployment, the food security and sustainable livelihoods of people in the area are increasingly impacted by the loss of land, environmental degradation and rampant crime. To further exacerbate food security concerns, the PHA is also riddled with controversy. Contrary views on land use in the PHA were uncovered which have far-reaching implications for food security and sustainable livelihoods for the poor. There are those such as the PHA Campaign (Ellis, 2020) who support the preservation of land in the PHA exclusively for agriculture, as an absolute necessity for food security and job creation. Then there are advocates of multi-purpose land use (Govender and Mammon, 2020), who believe that poor communities in the PHA will experience greater benefits from a nexus of affordable housing and agricultural development. These conflicting views from key stakeholders could determine the future potential of food production in the PHA.

Methodology

This article adopted a descriptive case study approach, a study premised on a thorough and meticulous empirical investigation of a specific experience in which one determined

case is studied within its context (Onghena and Struyv, 2015). Qualitative research methods were used to collect primary data through semi-structured key informant interviews and a focus group discussion (FGD), as well as available secondary data in the form of literature, various official reports and statistics. The sample that was studied was selected out of choice and purpose. Sample selection was premised on the researchers' knowledge of the population, its components and the primary aim of the study. The research participants comprised senior officials of the provincial and local governments in the Western Cape, as well as other key informants such as leaders of non-profit organisations (NPOs), senior academics, farmers and community activists who have an interest in the PHA.

A total of 12 key informants were interviewed: six government officials, one NPO leader, one academic, one farmer and three community activists. One FGD consisting of three farmers was conducted. These key informants were selected on the basis of their interest in and expert knowledge of the PHA, and because of their extensive experience with farming in the PHA. The FG was not stratified by gender as the vast majority of the farmers in the PHA are male. All the interviews and FGDs were conducted by one of the authors of this paper, and included questions such as: (i) What has your department/organisation done to address affordability of WEF resources for the poor? (ii) How could the WEF sectors work together more efficiently to improve food security and sustainable livelihoods for the poor? and (iii) How would you rate the reliability of the municipal services in terms of water and electricity supply in the PHA? All the interviews and FGDs were recorded and later transcribed for accuracy. There were no ethical issues associated with the data collection.

The researchers applied content and thematic analyses to different parts of the data collected from the interview questionnaires. Data analysis involves the collection, modelling and analysis of data to obtain an understanding that enhances the decision-making process (Calzon, 2021). Using both content and thematic analysis made the identification of themes possible in the responses of the participants during the interviews and FGDs. To analyse the data, the six phases of conducting thematic analysis devised by Braun and Clarke (2006: 89-96), were implemented.

Findings

The study collated the responses from key informant and FGD participants to questions designed to ascertain their understanding of resource security and inequality concerns in the PHA with the additional personal insights they provided in the discussion of possible ways to enhance food security. The resultant findings are discussed below.

Resource security and equity concerns in the PHA

In the discourse on the allocation of resources, the lack of inclusivity for the poor has been highlighted by several scholars. For example, scholars at the Bonn 2011 Conference (cited in Leese & Meisch, 2015) questioned whether the WEF nexus model prioritises the achievement of water, energy and food security for the poorest of the poor. These scholars further raised the need to determine whether the real objective of the WEF nexus approach was the survival of humankind or the preservation of economic setups. Given this resource security concern, respondents were asked their views on resource security and the equity challenges of the poor in the PHA. Serious concerns were expressed by respondents about WEF resource insecurities and inequalities that exacerbate hunger and malnutrition among the poor in the PHA.

Water resource concerns

Despite the abundance of water in the CFA, the main water source of farms in the PHA, different PHA stakeholders found the supply of adequate quality water for the poor disquieting. Concerns were also expressed about excessive water usage by farmers, a contention supported by several sources. A Council for Scientific and Industrial Research (CSIR) study described the CFA as being depleted due to extreme withdrawals from farmers and inadequate recharge (SAFLII, 2020). According to *GroundUp* (2017), commercial farmers in the PHA confirmed the excessive water usage. In contrast, poor people living in informal settlements and farm dwellings in the PHA have criticised the City of Cape Town for not delivering on promises of essential services, including the potable water supply (IOL, 2022).

Different stakeholder groups offer different perceptions about the causes of water pollution in the PHA. Claims by many academic and Non-Governmental Organisation (NGO) stakeholder groups, such as the PHA Campaign and Nexus Sites (2023) implicate the widespread heavy use of pesticides and fertilisers by commercial and small-scale farmers in the contamination of the CFA, while political stakeholder groups, such as the Democratic Alliance (DA), the party that governs the City, view illegal sand mining and dumping of industrial and construction waste as huge risks of contamination to the CFA (*EngineeringNews*, 2017). The contribution of informal settlers to the contamination of the aquifer in the PHA has also been accentuated in the literature (PEDI, 2014). Some of the respondents concurred with these views:

> *So, we will find, for example, historically disadvantaged communities just dumping waste into the stormwater. – Senior Manager, Government*

> *We have all these informal settlements in the PHA with one of our biggest sources of water underneath the PHA, the aquifer. So, with pollution and urbanisation, I think that is going to be a challenge. – Government Councillor*

The literature indicates that the City of Cape Town's management of the water for the poor requires significant improvement. A study on the PHA confirmed the general perception that there was no management of water in the PHA (Seeliger, 2020). There was consensus among the stakeholders that both the City and the Department of Human Settlements, Water and Sanitation disregard the importance of the PHA and leave the farmers to manage the water. The FGD participants (farmers) said that the water services provided by the City of Cape Town municipality were reliable but expressed concerns about the quality of the water.

> *Water quality in the PHA is very bad. – FGD 1, Farmer*

> *The main challenge will be the quality of the water that is deteriorating because the infrastructure of the city is too old. – FGD 2, Farmer*

Discontentment was expressed in this study about farmers' lack of support for farm workers' access to adequate water and housing in the PHA, which has been highlighted by NPOs (Maragele, 2019). Human (2022) reported claims by NPO activists that spatial developments in the PHA could dry up the aquifer and lead to the invasion of farming space, placing food production and security for the poor at great risk. Several similar sentiments were shared during the interviews:

Water quality is also threatened by developers who intend to pave over the recharge area, essentially putting concrete, stone, and asphalt across the surface of the soil. – NPO Representative

Energy insecurity and inequality

Some scholars (Cloete, 2020) sketch a positive picture of the City of Cape Town's electricity supply to the Philippi area while others are less approving. Gontsana (2020) highlights the plight of poor families in Philippi being without electricity for years, while Indego (2018) noted the impact of regular flooding of informal settlements on the electricity challenges in the PHA which compelled reliance on alternative sources of energy (wood, paraffin and coal and illegal electricity connections) that increased the probability of shack fires. Respondents noted cable theft, the City's unreliable electricity supply, and the cost as serious challenges in the PHA.

Services are unreliable, particularly energy. Also, there is a major problem with cable theft that causes the producing community and the commercial farmers to have a huge burden to carry. – Senior Manager, NPO

Electricity is unreliable. A lot of this power failure is because of cable theft and the illegal use by some of the informal settlements, which upsets the grid. There's still an issue of affordability, whether you (the poor) can afford to buy that energy. – NPO Representative

These concerns are corroborated in the literature, for example, cable theft (*CapeTownEtc*, 2019; Irish-Qhobosheane, 2023), unreliable provision of electricity with minimal support from the municipality (Seeliger, 2020), and the inability to access electricity due to very low incomes (Govender & Mammon, 2020).

Although the possibility was raised of energy being supplied to informal settlers through a biogas project situated in the PHA (Africa Green Energy Technologies, n.d.), this energy resource may not be affordable for low-income residents.

> *Solar energy is very important, but I think the initial start-up costs are a problem for the poor. So, without government support, the poor wouldn't be able to afford it. – Senior Academic*

However, there were dissenting voices on the issue of the supply and security of electricity:

> *Electricity is much more stable now these days than it was a couple of years ago. – NPO Representative*

> *They've got access to electricity and some of our poorest people have free electricity ... in the PHA. – Senior Manager, Government*

The issue of inequality in the allocation of energy resources, with farmers receiving the 'lion's share', was identified during the interviews as another challenge for poor communities in the PHA.

> *The poor community felt that services such as water and electricity were directed to farmers but not the households. – Government Representative*

Scholars such as Gontsana (2020) and Indego (2018) have captured the protracted encounter of poor households in the PHA with energy poverty.

How water and energy concerns impact food production and food security in the PHA

Despite the optimism of some scholars about the food production capacity of the PHA (Charles, 2017; Sonday, 2019) others, such as Bradley (2019), are quite perturbed about food security for the poor in the PHA, which coincides with views expressed during the interviews. Although the PHA is regarded as a 'gold mine' for food security in the metropolitan area, several external factors could jeopardise sustainable food production and accessibility for the poor.

> *The impact of climate change is another major resource security concern for poor communities, due to the supply of food that will be severely disrupted. – Senior Manager, Government*

> *Weather events, flooding, droughts, etc. will also impact food security. – NPO Representative*

The harmful effects of climate change on food security in the future have been noted elsewhere. For example, Carter and Gutali (2014) state that climate change in South Africa is expected to adversely affect food security due to changes in crop and livestock productivity. Restrictions allowed by South Africa's water legislation are also concerning. The National Water Act (NWA) of 1998 prioritises the basic human need principle and stipulates that during periods of water scarcity municipalities must prioritise water for domestic purposes (RSA, 1998). The PHA may, therefore, be placed under severe water restrictions by the City of Cape Town during future droughts, which will seriously impact food production and food security in the PHA. Participants had concerns about the 'knock-on effect' of rising energy-related farming costs.

As a Department of Agriculture, we've invested heavily in solar panels. The financial impact is massive. The farmer has to cover the cost from somewhere. Our concern is the cost will be covered by the worker, who then is rendered more vulnerable because they've now lost their employment. – Senior Manager, Government

It is of some concern that the Integrated Energy Plan (IEP) of the government, which is informed by the National Energy Act, Act 34 of 2008 (RSA, 2008), does not prioritise food production and security. This Act emphasises social equity and the contributions of energy supply to socio-economic development. As the IEP does not take food production and sustainable development into account, these limitations could adversely affect food production and food security in the PHA.

A better food system informed by WEF nexus thinking

A review of the literature suggests that the City of Cape Town bears some responsibility for effective food systems governance and food security. Battersby *et al.* (2014) maintain that the City of Cape Town has provided leadership in food security through its Urban Agriculture Policy, ratified in 2007. However, as the causes and extent of food insecurity have evolved, it is incumbent upon the City to adopt a new approach to food systems management. This perspective of Battersby *et al.* (2014) aligns with the views of government stakeholders from the City of Cape Town:

The City does not have a direct mandate for food. However, we recognise that urban agriculture has a role to play in terms of poverty and making sure that there is food security. What we do to support urban agriculture and food security is to supply services, such as land, water, energy, land use management and spatial planning. One of the lessons coming out of experiences during the Covid-19 period is the lack of the city's internal coordination of urban agricultural activities. We need to get departments to work together more cooperatively. Maybe we also need a 'whole-of-government' response to urban agriculture. In terms of the WEF nexus, the bigger players are definitely water and energy. Food security is a fledgling topic that is growing. – Senior Manager, Government

Even though the City has no official mandate to address food production and security, it has performed an indirect role in Cape Town's food system, for example through policies impacting food production, processing and distribution. This should inform the long-term strategy to address the governance of improved food systems.

Some interviewees made specific comments on the significance of the water-food nexus, as well as water-energy nexus applications in the PHA:

From my perspective, the water and food security nexus in the PHA is very clear. There are certain times of the year when the PHA is the only area in the country that can feed certain markets because of the climate, giving food security for the PHA, City, and even at a national level. The water, and especially the underground water nexus is very strong. – Senior Manager, NPO

Windmills, that's a renewable energy resource, with pumps being provided to emerging farmers. So, in my opinion, there's no argument that it (energy-water nexus) is happening. – Senior Manager, Government

About the energy-water nexus in the PHA, windmills are used to operate water pumps and these are being provided to emerging farmers. Wind and solar energy are in large supply in the PHA. – Senior Manager: NPO

Respondents also referred to the benefits of a WEF nexus-driven, alien-clearing job creation initiative that could potentially enhance food security and sustain livelihoods for the poor.

To strengthen food security in the PHA, the Western Cape Department of Agriculture supported an alien clearing project (Public Works Programme), which provided stipends for the poor for a 12 to 18-month period. – Senior Manager, Government

At the end of the above project, stakeholders agreed that commercial involvement was needed for subsidising the water monitoring and clearing of the canals that were required to improve water quality in the PHA and the aquifer. The consensus among stakeholders was that employment-creating commercial activities should be supported that included informal settlers in the PHA. Three cooperatives had been established (Seeliger, 2020). This project demonstrated a food-water nexus approach intersecting the food, water and public works sectors, indicating how food production and the livelihoods of the poor could be sustained within an improved food system.

Another idea, relating to the utilisation of different energy options, was presented by stakeholders during the interviews that support the WEF nexus application to food security and sustainable livelihoods.

Biodigesters and the recycling of material can create methane as an energy source. Organic food waste can be converted into organic compost. The organic matter is recycled into food stock by way of protein, and recycled into organic compost. – Senior Manager, NPO

In the PHA, biogas (which is much cheaper than solar energy) is an important energy source for cooking. – NPO Representative

On the strength of these key informant views, it seems that a nascent food-energy nexus is prevalent in the PHA, encompassing the use of organic food for protein-based food supplies and the utilisation of waste to produce renewable energy for cooking meals. If recognised within a food system, these activities offer opportunities for improved food production and security, waste reduction and better livelihood strategies for the poor.

Divergent views on land use in the PHA were revealed in the interviews. Some respondents felt that poor communities in the PHA should have ownership of land and access to social housing if food security and sustainable livelihoods were to be effectively addressed.

The main issue for me will be to provide the informal settlements and the labour tenants and farm workers who are living in informal settlements with access to decent social housing.– FGD 3, Farmer

Other stakeholders held a different view, represented in the following comment:

The PHA Campaign's objective is supported by the Western Cape Department of Agriculture, whose mandate is to protect agricultural land for agriculture. The DoA does

not support a change of land use from agricultural to residential use. – Senior Manager, Government

As key stakeholders in the PHA, these opposing views have serious implications for future land use in the PHA, that could negatively impact food production and security in the region.

Discussion

The study highlighted complex, interdependent key issues about the security and inequitable distribution of water, land and energy resources in the PHA. For example, the question of whether subsistence farmers in the PHA, informal settlers and commercial farmers have adequate and equitable access to supplies of water links to who bears the greater responsibility for the use and misuse of the aquifer, and thereby its sustainability, as well as to historical legacy issues and current human rights imperatives. Marcatelli and Büscher (2019) presented a political perspective in their analysis of water resource inequality which shows how poor black communities in South Africa have historically been "policed" about their water usage, while those who are considered to use water more "productively" have had the privilege of almost unrestricted access to water.

... Resolving issues of land contestation in the PHA is key to solving the problems of access to food and energy.

More importantly for this study, these scholars highlight the racial legacies described by Loury (1998), as the enduring effects of historical policies, practices and attitudes immersed in racism and discrimination. These legacies inhibit poor, black communities in the PHA from accessing adequate supplies of clean water, while few limitations are placed on the white commercial farmers' access to water withdrawals. The NWA privileges the water use of those who possess water licences. Older farms not only have water rights and restrictions that precede the NWA but these rights are transferred entitlements. That is, they are usually included when the farm is sold. The NWA requires that these water entitlements must be converted into water licences to comply with the Act. Many of the commercial farms, therefore, have inherited water rights that are now protected by the NWA and cannot be taken away.

Despite the South African government's support for Integrated Water Resource Management (IWRM) policies centred on principles of equity, efficiency and sustainability, inequality and a lack of social justice in water resource management thus remain entrenched in water practices (Van Koppen & Schreiner, 2014, cited in Seeliger, 2020). Given these inequality concerns, it is incumbent upon lawmakers to change the legislation to allow water licences to be revised, to ensure that poor households and small-scale farmers in the area have access to adequate water supplies. Furthermore, more efficient methods of water utilisation within its nexus with food and energy may

resolve or mitigate the impact of the potential risks associated with current legislated and regulated water use and access restrictions in the PHA.

Wingfield (2022) noted in an ethnographic study of the practices of the PHA Campaign that certain poor communities in the area have no access to electricity and water. There are parallels between this energy dilemma for the poor in the PHA and the racial-historical legacy associated with water (Marcatelli & Büscher, 2019). A related concern is the 'knock-on effect' that rising energy costs have on farming costs, food production and sustainable livelihoods for the poor. On the positive side, this study also highlighted certain energy-food nexus practices that could improve the lives of poor communities. For example, renewable energy solutions such as solar power and biofuels are being used in local agri-food systems, indicating opportunities for government departments to redress the substantial gap between the haves and have-nots in the distribution of energy resources in the PHA.

Furthermore, it is incumbent upon all three tiers of government and other key stakeholders in the WEF nexus to collaborate synergistically around more integrated, sustainable solutions to food insecurity that are incorporated into food systems. A key component of this would be for the City of Cape Town to exercise its legal mandate to protect PHA areas that are conducive to agriculture and integrate productive agricultural spaces into future food production plans.

Resolving issues of land contestation in the PHA is key to solving the problems of access to food and energy and certain respondents argued that the poor will experience greater food security benefits from the provision of both affordable housing and agricultural development. This view is supported by Govender and Mammon (2020), who maintain that a symbiotic relationship between agriculture and urban development (social housing) can be established in the PHA and they should not be considered mutually exclusive.

However, other stakeholders, such as the Western Cape Department of Agriculture and the PHA Campaign, want to protect agricultural production and believe that the land within the PHA should be used for this purpose rather than low-income housing development. Key informants in this study supported this, noting that 200 hectares of land situated near Jakes Gerwel Drive (outside the PHA) were earmarked by the government for social housing development in 2009. A government feasibility study is required, in partnership with the private sector and local stakeholders, to identify land for building decent social housing for existing labour, tenants and informal settlers currently living in sub-par housing in the PHA. These tensions among key stakeholders in the PHA clearly necessitates the adoption of co-governance in the PHA, where feasible plans are implemented in the best interests of the area, premised on WEF nexus thinking.

Conclusion

Given the increasing environmental impact of food distribution and storage and the need for affordable nutrition, having a food system accessible to the entire metropolitan population is invaluable. External factors such as climate change, higher farming input costs, affordability, and land use put food production in the PHA at great risk and have to be consciously addressed by the authorities. Stakeholder comments and the literature reviewed in this study have identified gaps in the application of water, land and energy resource practices within the PHA food system. The alignment of views among stakeholders regarding beneficial water-food, energy-food, and even housing-food (Burrows, 2019) nexus practices in the PHA is noteworthy.The challenges of

accessing adequate water and energy that poor households and small-scale farmers in the PHA face have serious repercussions for food security in the area and surrounding regions. More efficient methods of water and energy harvesting (e.g. harvesting water and energy from roofs) and its nexus with food production, could mitigate the impact of these potential risks. Seen against the complex, interwoven needs to access food, energy, land and social benefits while protecting human and economic rights, the discourse conducted through this study revealed the potential for realising food security benefits for the poor by adopting a WEF nexus approach to sustainable food production and food security within food systems. NA94

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Reparative futurities

South African food production and the climate crisis

– By Matthew Wingfield

The industrialised food system has both contributed to and will in turn be affected by the climate crisis. In South Africa, as is true globally, the way in which food production has intersected with processes of industrialisation and the green revolution has not only shaped how we relate to food production, but to nature more fundamentally. MATTHEW WINGFIELD explores the emergent possibilities of reimagining and reconstituting how food is produced, based on his case study situated in an agricultural zone on the outskirts of Cape Town called Philippi. It explores alternative ways of interacting with environmental resources that can forge "just" climate futures.

Philippi Horticultural Area. Source: Maryatta Wegerif, GroundUp

Introduction

With the continued increase in the world population, which totalled eight billion on 15 November 2022 (United Nations, 2022), food supply and food security are increasingly pertinent global issues. With the concomitant burgeoning urbanisation, and the overarching context of climate change, the underlying dynamics of food production (where and how food is grown) are likely to become key concerns for governments across the world. In South Africa's Western Cape province, the dynamics of food production bring together dominant forms of analysis that speak to the broader history of the region and country. From dependence on a racially specific form of cheap labour to the continued benefit of privileged land ownership, agriculture in South Africa is dominated by historically grounded practices. Food production and its dependence on natural resources, such as soil and water, can no longer be solely read through a Malthusian lens that considers the competing dynamics of resources and growing populations (Malthus, 1798). This article offers a critical engagement with the hegemonic industrial agricultural model and a rethinking of this model through centring a slow, reparative and environmentally beneficial formulation of farming. This brings into conversation forms of historical injustice, and the socially and environmentally reparative practices that can reposition agriculture in a time when it is under intense pressure from all sectors. This article uses a case study from the Western Cape to think through the emergent possibilities of agriculture from a particular site, which has applicability across the country and globally.

This case study maps the historical formation of the industrial agricultural model. It argues that, rather than merely critiquing the role that agriculture has played in the climate crisis, it can also be repositioned to initiate alternative relations with nature and concludes with a discussion that highlights the importance of seeing soil and water not as entities to use and exploit, but rather to develop mutually beneficial relationalities with.

Industrial agriculture and its (destructive) futures

South African agriculture has largely been shaped by racially aligned privileged land ownership and management, propped up by "subsidised credit, state supplies of inputs and controlled marketing since the 1930s" (Hall & Cliffe, 2009:4). Such financial support provided by the apartheid state faced a range of cutbacks in the 1980s and 1990s as South Africa moved toward a politically democratic dispensation in 1994. The post-apartheid government, through its ambitious project of redress, paid particular attention to land ownership and control after almost a century[1] of repressive legislation and violent dispossession (Walker, 2008; Hall, 2014; Ngcukaitobi, 2021). The untethered hopes laid upon the post-apartheid state around land ownership and the overhaul of the political economy of land brushed up against significant and systemic administrative, bureaucratic and economic restraints (Walker, 2008), leaving the form of the agricultural sector largely unchanged. Not only was the agricultural sector grossly unjust through the lens of land ownership, but the model and scale of farming, shaped through the mechanisation and rationalities put forward through the "Green Revolution" (Patel, 2013), led to the exploitation of both labour and land (read soil and water).

As Mather envisaged in the wake of the post-apartheid transition, "a new culture of democracy in South Africa will lead to the reformulation of environmental policies and the development of a more vibrant and all-encompassing environmental consciousness"

(1996:41). Almost three decades after this hopeful prognosis, South African agriculture by and large is dependent on the exploitation of human and environmental resources to address local and international demands for produce. Not only have labour conditions failed to transcend their historically exploitative conditions (Levine, 2013; Hart & Aliber, 2012; Cousins, 2019), but the environmental and ecological limits of the industrial agricultural model are well documented (Satgar, 2011; Hetherington, 2020). With the South African government's focus on creating a class of "Black" emerging commercial farmers (Hall, 2004), it has also bought into a framework which "envisions a more capital-intensive approach to agriculture involving supply chains, increasingly large producers, agro-processors, expanding international markets, and farming with intensive – and often expensive – inorganic fertilisers, pesticides and seeds" (Moseley, 2017:187). When read in a context of increasing food insecurity, with 2% of South Africans having inadequate access to food (Statistics South Africa, 2023), high unemployment, and the positioning of industrial agriculture as one of the core contributing industries to climate change (Trisos *et al.*, 2022), not only the "who" but the "how" of food production in South Africa requires urgent attention. As Patel (2013) urges "Climate change has already been deployed as an alibi for the spread of the New Green Revolution" (Patel, 2013:51) which takes seriously the political ecology[2] of food production, and offers fertile ground for the reexamination of historically grounded farming models across the world, and in South Africa more specifically.

The widespread dependence on inorganic fertilisers cuts across small-scale and commercial agriculture in South Africa (Rother *et al.*, 2008). South Africa is one of the largest importers of pesticides in Africa (Quinn *et al.*, 2011) which has profound impacts both on the mode of agriculture production and the environment more broadly. Not only do such inorganic materials have widespread impacts on farm workers, who are largely framed as expendable and replaceable (Bolt, 2015; Kotsila & Argüelles, 2024), but on both the soil and water that they come in contact with. Through a political ecology lens, the effects of pesticide use cannot be isolated to humans, but to the soil and water on which agriculture and livelihoods are dependent. Imbued with the transformational responsiveness that the climate crisis puts on the agricultural sector, this article highlights how an agroecological model can act as a pathway for agriculture to contribute to "just" climate futures that respond to the exploitation of both Black bodies and the environment it relies upon.

To situate this argument, ethnographic research in an agriculturally zoned area on the outskirts of Cape Town named the Philippi Horticultural Area (PHA) will be drawn upon. From 2020-2023, I conducted interviews with key informants in the PHA, while also conducting extensive participant observation, mainly with an agroecological farming and activist group called the PHA Food and Farming Campaign (PHA Campaign). The analysis that follows is largely focused on the power dynamics that shape an emerging farmer's experience, ranging from economic to knowledge/dominant practices.

The PHA (Figure 1) is located 30km from the Cape Town central business district and has been farmed since the mid-1800s. The area was initially farmed by German immigrants, arriving then as indentured labourers, whose descendants still have a significant presence in the area (Rabe, 2008). A report commissioned by the Western Cape Department of Agriculture has shown how historical access to land for farming makes up the current political economy of the area, with all of the "commercial"

and "big commercial" farmers in the area being white (Western Cape Department of Agriculture, 2018). The area, spanning just over 3000ha in the late 1980s, is now under 2000ha (Western Cape Department of Agriculture, 2018:21). Arable land has increasingly been moved into the control of a handful of farmers who depend on increasing the scale of their operations to ensure financial viability Such expansion is closely intertwined with a reliance on pesticides and inorganic fertilisers which have contaminated the underground water (see Bessire, 2022) and Cape Flats Aquifer (CFA) on which most if not all of the commercial farmers are dependent for irrigation (Western Cape Department of Agriculture, 2018). The restrictive economic and policy landscape in which both commercial and small-scale farmers are embedded restricts the agency of farmers to "farm with nature", and enmeshes them in the "neoliberal food security order" (Clapp & Moseley, 2020). The practices of a small-scale agroecological farming group in the PHA, PHA Campaign, offer a range of alternative possibilities and act as a useful case study to reimagine the agricultural industry.

FIGURE 1: The City of Cape Town's ward designations with the PHA (Ward 43) outlined in red

Reparative socio-ecological praxis

In this context policymakers and governments alike want to "solve" the climate crisis and the agricultural question through a techno-scientific lens, through "salvational" technologies (Hulme, 2014). While the critique of a techno-fetishistic future of agriculture might be branded as "antiscience zealotry" (Borlaug, 2000), such dichotomous framings offer little utility. Rather, this article thinks with the forms of socio-environment relations that can be fostered at such a critical juncture. As environmental anthropologist Kristina Lyons has asked of agriculture in Columbia: "How do soil – what may or may not be conceived of as an object called "soil" – harbor the irreparable wounds and tracks of

violence and germinations of transformative proposals and alternative dreams? (Lyons, 2020:5)

The PHA Campaign, with its origins in state-guided agricultural development which embeds one in an expansionist and inputs-driven model, saw the limitations of such a system due to the 2008 global financial recession (Wingfield, 2022). Chairperson of the PHA Campaign Nazeer Sonday framed the transition to agroecological farming in an interview:

> *So, I had the idea, that if I had greenhouse production that gave six times the yield, then I would just do greenhouse. But it didn't work out that way. … So, I started farming in 2006 and then in 2008 I wasn't doing very well, I was producing a ton of tomatoes a week on the 8-month cycle a year, but I wasn't making enough money. Another reason why it collapsed was because the hydroponic system is very resource intensive, so we have to buy lots of fertiliser, pesticides and that kind of stuff to keep the system going. Remember there was a financial crash in 2008. So, [prices of] all commodities went through the roof, including fertiliser. So, my fertiliser went from R100 per bag to R300 per bag. But at the other end, that price remains the same. And all my other costs remain the same. So, I was not making money. (Sonday, 2021, personal communication)*

Sonday's experience almost two decades ago was not isolated or singular. The global recession led to the "food price crisis of 2007–08 [which] cemented the central role of the private sector in directing global agricultural supply chains based on specialized, industrial food production for global market" (Clapp & Moseley, 2020:1398). These events brought a temporary destabilisation of the political economy of agriculture, specifically for emerging farmers like Sonday, who did not have the capital to manage sharp variations in input costs. This prompted Sonday to reconceptualise how he wanted to farm; by turning his focus to agroecological farming methods, his starting point was the repairing of the soil of his 1ha plot.

Moving away from pesticides and inorganic fertilisers, the agroecological farming model is not used as a set technical model which dictates permitted practices, but rather as a more fundamental political ecological shift in the agricultural mode of production. As Sonday moved away from state-subsidised greenhouse production, his journey of being forcibly removed from the area due to the repressive apartheid legislation of the Group Areas Act of 1950 invoked the discourse of repairing both the soil and reconciling the journey back to a place from which he was removed. When read within the context of the climate crisis, agroecological agriculture can be positioned to respond to the wide array of challenges presented. As Sonday highlighted through his focus on the soil:

> *We [the PHA Campaign] understood that there is a carbon sequestration value when you put in plants and your farm in a particular way, you put in compost and use no-till, keep the roots in the soil, and build soil organic carbon. What became clearer, is that there is a nutrient cycle that comes off the farm and comes onto the farm. When a cabbage leaves the farm, it gets eaten and some of those leaves go into the landfill and cause greenhouse gas emissions, in particular methane. This area is well placed to bring those nutrients back into the system where we can compost them and put them back in the soil. (Sonday, 2021, interview with author)*

The process of repair concerning soil and the process of decomposition in the making of compost (Lyons, 2016), remains a time-consuming and patience-oriented

praxis. As Sonday argues above, building soil organic carbon to the level that increases the productivity of the land, stands in direct opposition to the dependence on using inorganic fertilisers and pesticides. This form of knowledge has been marginalised and lost over generations, which is a need the broader PHA Campaign aims to address (Sonday, interview with author). By intentionally positioning his farm as one that is deeply imbricated in the process of repairing the soil, and permitting the conditions for the breakdown of organic "waste" into compost (Figure 2), Sonday subverts the hegemonic political ecology of agriculture in the PHA, and by doing so, offers pathways of repositioning the mode of agriculture for both historically-privileged land owners and Black emerging farmers.

Figure 2: Mounds of decomposing compost at the PHA Campaign's farm
Source: Matthew Wingfield

The generation of food waste, often seen as a symptom of the wastefulness of the middle class (Aschemann-Witzel *et al.*, 2019), also has its origins in the aesthetics of commercial food production, which deems "ugly food" as discardable (de Hooge, 2022). When read through an agroecological lens, this "waste" is repositioned as an essential input into the process of making compost, to the degree where small-scale farmers struggle to secure access to sufficient organic waste for their farming operation (Afonso & Imbassahy, 2023). Again, rather than looking to an array of salvational technologies to solve isolated issues, environmentally attuned agricultural practice displays its wide-ranging adaptability in a world of "wicked problems". Therefore, waste management as a process of removing organic waste from the household and thus making it invisible, is intentionally made visible by the (value) chains that reinscribe this waste as a valuable commodity. The PHA Campaign, like other similarly aligned groups, has set its focus on establishing localised organic waste networks, which move away from solely the purchasing of compost from distributors at an often-unaffordable price, to enmeshing itself within a slow, deliberate and reparative praxis. Agroecological farming also "decenters the human" which Tsing (2018) suggests is emblematic of the multispecies ontological turn. As Barlow & Drew argue "[composting] as an elemental and multi-species practice that requires close attention to matter, moisture, heat and time … extends care and attention beyond the human" (Barlow & Drew, 2021:12). The PHA Campaign therefore positions itself in relation to a slower, more ecologically attuned

agricultural practice, grounded in an alternative way of conceiving how one interacts with "waste", while further challenging the reliance on inorganic inputs.

Hydropolitical futures

The PHA Campaign's agricultural project has not only moved away from inorganic fertilisers and pesticides to establish a rich nutrient cycle but also to protect the groundwater on which the agriculture in the PHA is dependent. The positioning of groundwater in relation to agriculture has only been increasingly politicised due to the context of the climate crisis (Wingfield, 2024). This article through the lens of political ecology looks rather at the related contamination of underground water resources. Among issues of the rezoning of large tracts of the PHA from agricultural to mixed-use development, and other non-agricultural industries peppered across the farming area, the use of inorganic fertilisers and pesticides is diagnosed as one of the key threats to the viability of the PHA as the "vegetable pantry" of the Western Cape (Western Cape Department of Agriculture, 2018).

Global narratives of food insecurity and water variability (flooding and scarcity) in relation to the extractive logics that frame industrialised, profit-oriented and ecologically destructive agriculture find grounding in the PHA in various ways. Commercial farmers in the PHA make sense of their model of farming concerning its heritage in the area, or in relation to increasing food insecurity. Accordingly, as Ballestero argues, "As underground figures, aquifers are also commonly approached through extractivist parameters" (2023:271). Such relationalities to water resources are longstanding but stand to be destabilised by the current context of the climate crisis. The contamination and overuse of water resources are positioned as secondary concerns to the immediacy of food insecurity, both in South Africa and across the world (Damonte & Boelens, 2019). However, arguments by Nixon (2011) and Hecht (2023), among others, bring attention to how the slow, imperceptible forms of contamination of water resources are made visible by their relation to the poor and working-class who are most likely to inhabit "toxic geographies" (Davies, 2019). Contamination and overuse, as argued above regarding soil, have impacts that span the temporality of the current moment.

Possible reparative futurities

Through the context of the climate crisis, agriculture, its use and abuse of environmental resources, and its role as one of the highest emitting industries globally continues to hold a precarious position within society. In the polarising discourse brought about by the climate crisis, agriculture is seen either as emblematic of the limitations of modernity and natural resource governance or as a paragon of how technical innovation can circumvent even planetary catastrophe. Moving away from such false dichotomies, this article has reframed food production and offered a perspective that can reposition agriculture at a time when it faces its more robust opposition. As Clapp & Moseley argued through the disruptions of the food system due to the Covid pandemic, "the crisis has revealed enormous vulnerabilities in the global food system" (2020:1411). While localised symptoms of the climate crisis are likely to do the same, they also provide the opportunity to rethink the relationship between agriculture and the environmental resources it depends on.

Drawing on an agroecological framework, the PHA Campaign has been able to reposition the way its model of food production relates to the well-being of the soil and water resources it depends on. Such practices are not to be taken as merely aspirational

or critiqued as impractical; such counter-hegemonic praxis allows us to directly address the remnants of both the colonial and apartheid regimes while taking seriously the connectivities between human and the more-than-human (Altieri & Nicholls, 2020). Furthermore, the work done by the PHA Campaign offers insight into how one can rework dominant agricultural practices, even in spaces that are deeply enmeshed in the industrialised agricultural model. As climatic conditions become increasingly unpredictable, the agroecological model, with its politics situated through discourses of climate justice, offers a viable alternative, across Africa and globally. NA94

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ENDNOTES

1 This limited historicisation of the violent dispossession of land in South Africa is developed in relation to the 1913 "Native Land Act", which has been used by the South African government as a cut-off date to land claims that can be articulated through the land reform process.

2 This article, while not providing the scope for a comprehensive engagement with the genealogy and textures of the concept of "political ecology" uses the term to consider the state of natural resources, pushing back against soil and water being positioned as a backdrop to agricultural analysis.

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Gender and food systems in six African countries

Aligning research, policies and research funding

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Research plays a fundamental role in achieving food systems outcomes but research funders and researchers often set agendas that are not necessarily informed by policy needs. This analysis explores synergies between research publications, funding and policy priorities using a gender and food systems lens. In this article the authors argue that gender research is not being adequately leveraged to investigate food systems challenges that are considered national priorities. They call on research funders, researchers and policy-makers to collaborate to define research agendas that address policy needs.

Introduction

The interconnectedness between food, livelihoods and the environment has increased the need to look at food as a system as opposed to focusing on discrete elements (HLPE, 2017). With hunger, environmental degradation and poverty on the rise, a consolidation of resources and efforts is needed to integrate planning and governance (FAO *et al*., 2023). Research plays a fundamental role in achieving food and nutrition security, health, environmental sustainability and improved livelihoods, which can be considered the outcomes of an effectively functioning food system. The centrality of research in food systems transformation was emphasised during the 2021 United Nations (UN) Food Systems Summit, with two days dedicated solely to science. In particular, one of the objectives of the dialogue was to strengthen the interface between science and policy (FAO, 2021). While pockets of research and policy innovations that advance gender equality exist, the interface between research and policy as it relates to gender remains constrained (Oliver & Cairney, 2019). Policy-makers generally develop policies in isolation from the evidence generated by researchers. Conversely, researchers and research funders set agendas that are not necessarily informed by policy needs.

Gender equality is a key lever in achieving positive food systems outcomes (Njuki *et al*., 2022). For example, women, who have limited access to resources and limited decision-making power are often responsible for food processing and preparation. Women's limited control over these domains can compromise household food and nutrition security. Gender equality remains pivotal to the attainment of the sustainable development agenda, with Sustainable Development Goal (SDG) 5 explicitly focusing on gender equality (UNGA, 2015; Quisumbing & Doss, 2021). Tools to integrate gender into research exist (Parvez Butt *et al*., 2019; de Beer *et al*., 2017), and a significant body of literature focuses on gender mainstreaming in science, technology and innovation in Africa (Jackson, *et al*., 2022; Garwe, 2021; Ampaire *et al*., 2020; Beaudry *et al*., 2023). However, the extent to which gender is mainstreamed in African food systems research has not been adequately explored. Furthermore, the extent to which food systems gender research is driven by policy priorities remains unclear. This study identified priority areas in gender and food systems research in six African countries and determined the alignment (or lack thereof) of the research with policy priorities.

Gender and food systems research

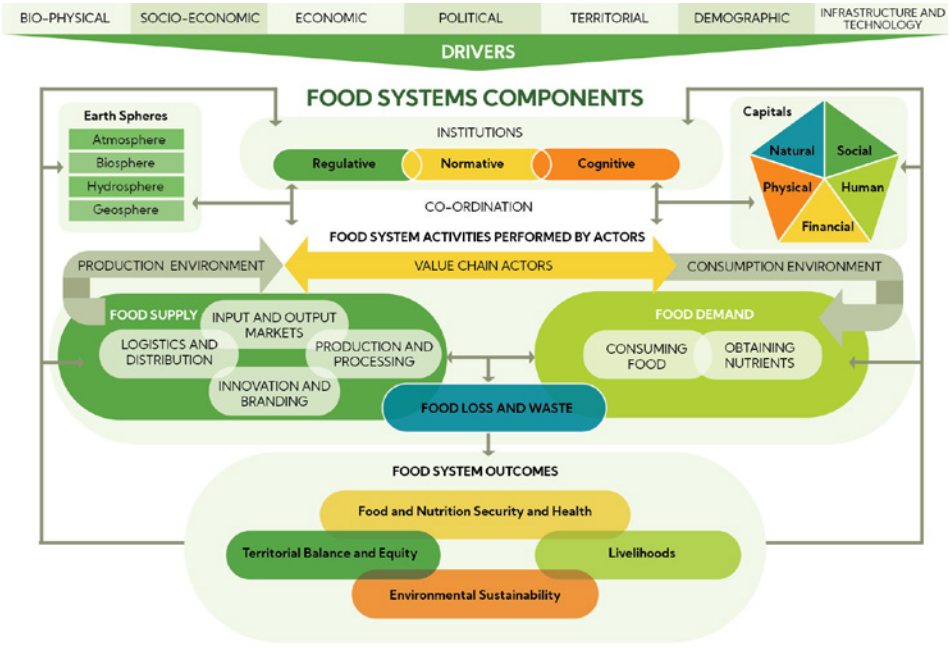
In 2017, the High Level Panel of Experts (HLPE) on Food Security and Nutrition emphasised the growing demand for a food systems approach that addresses the multifaceted and interrelated challenges linked to achieving food and nutrition security in a manner that considers the environment, livelihoods and context (HLPE, 2017). While multiple food systems exist, there are central elements common to all food systems, including the actors and activities related to producing, processing and consuming food and the outcomes that emerge from the interactions between actors and activities. In this article we use the Food Systems Research Network for Africa (FSNet-Africa) Food Systems Framework depicted in Figure 1, developed by May (2021), as our theoretical and analytical framework.

FSNet-Africa Framework for Researching Food Systems

The FSNet-Africa Framework for Researching Food Systems, hereafter referred to as the FSNet-Africa Framework, was developed as a tool for researching African food systems.

While useful for conducting food systems analysis, the framework is not uniquely African and requires refining to underscore challenges and opportunities peculiar to the African context. The FSNet-Africa Framework emphasises food systems activities from the production environment on the one end all the way through to consumption on the other end, linked through the value chain. It also includes the food systems outcomes relevant to the African context, which May (2021) proposes are food and nutrition security and health, livelihoods, environmental sustainability, and territorial balance and equity. May (2021) highlights that Africa has multiple food systems. However, there is value in understanding how Africa's shared visions, history and collaborations could help frame the cohesive concept of an African food system.

Figure 1: FSNet-Africa Framework for Researching Food Systems (May, 2021)



In the context of food systems, gender would be considered a normative institution, as gender norms, roles and responsibilities are often defined by society (Cislaghi & Heise, 2020). However, gender also cuts across all aspects of food systems and needs to be understood within and integrated into all aspects of food systems. Efforts have been made to integrate gender into food systems research (Mkandawire *et al*., 2021; Visser & Wangu, 2021). Njuki *et al*. (2022) found that much literature focuses on institutions, including social norms, and that while literature on decision-making power exists and is a fundamental cross-cutting challenge, research is isolated to specific elements of the food system rather than considering the system holistically. Other gaps identified include research on the links between women's mental health and nutrition. Linkages between gender-based violence and food systems are also under-researched (Njuki *et al*., 2022). Giner *et al*. (2022) argue that research gaps exist in relation to women's participation in entrepreneurship, including financing mechanisms and food systems in general. Limited data also exist on women's employment and leadership and the related

policies to facilitate gender equality. Evidence gaps on gender within the consumption environment also need to be addressed and linked to gendered interventions to inform food choices. However, it remains unclear why certain aspects of gender and food systems are researched compared to others.

Evidence-informed policy

There is rising interest in evidence-based or evidence-informed policies. Strydom *et al*. (2010) suggest that evidence-informed policy is essential for increasing the effectiveness of policy, confidence in policy by decision-makers and the range of options for policy-makers to select from in the policy-making process (Strydom *et al*., 2010). Research on gender is equally important for advancing the integration of gender into policies. Policies, policy objectives and policy targets should be informed by research that uses sex-disaggregated data as well as analyses that include cost-benefit analysis, gender impact assessment and gender-responsive budgeting to provide the evidence base for decision-making (Hosein *et al*., 2020). However, the integration or mainstreaming of gender in policy remains weak because of limited capacity/skills for gender mainstreaming, lack of gender equality enforcement mechanisms and misconceptions around the definition of gender (Mkandawire *et al*., 2018). Misconceptions, particularly in the context of policy, promote the notion that gender means women (Nyalunga, 2007; Okali, 2011). However, gender refers to men and women's socially determined roles and responsibilities and, importantly, the relationships between men and women (Cislaghi & Heise, 2020). Research presents an opportunity for better integrating gender into policy.

Policy-makers generally develop policies in isolation from the evidence generated by researchers.

Gender mainstreaming features in various global and national agendas – for example, SDG 5 aims to "achieve gender equality and empower all women and girls" and thus articulates the intention to address existing gender inequality. Gender mainstreaming has, therefore, been advanced through various initiatives, but gender inequality remains a challenge on the African continent. The Africa Gender Index collates data related to gender gaps in employment and earnings, measuring equality between men and women in relation to representation and empowerment, social equality and economic equality. The Index scores for 2019 show an average score of 48.6%, yielding an overall gender gap of 51.4% (AfDB, 2020). Africa thus clearly still lags behind in its progress towards achieving gender equality in society.

While the Index suggests moderate success in efforts to reduce the gender gap, significant inequalities still exist, and slow progress is being made towards the attainment of SDG 5. Traditional social and cultural norms, which vary depending on context, shape women's roles in the food system. Often, these prevailing norms, policies and legislation constrain women's participation in and benefit from food systems (Njuki

et al., 2021). The interface between research and policy offers opportunities to improve the way in which gender is integrated into food systems research and food systems policy-making. However, the extent to which policies are informed by gender research or, conversely, the extent to which policy informs gender research is vague.

There is an increasing demand by African governments for research evidence to support agenda setting as well as the design, implementation and monitoring of policies. While the capacity to supply evidence is increasing, the content is largely driven by international policies and interests (Goldman & Pabari, 2020). Research on gender and food systems also exists, with clear indications of where gender gaps in food systems research are evident. However, little is known about the extent to which food systems policy and gender research align. This article acknowledges that policy is not influenced by research alone but by multiple factors, including emerging trends, crises and political agendas. Our literature review found that while research exists on gender and food systems and integrating gender into policy, as well as on influencing policy through research, a research gap exists on the extent to which food systems gender research and food systems policy align. Using the context of gender and food systems research as a case study, this paper identifies existing research on gender and food systems, its alignment with policy and the extent to which research publications are driven by research funding.

Methodology

Following Bowen's (2009) approach, our study combined a literature search and classification process with document and thematic analysis (Ahmed, 2010; Bowen, 2009). This process also supported the triangulation of research findings to increase credibility. Drawing on themes emerging from a systematic review, we integrated the data gathered to make meaning of the results. Documents were read, re-read, coded and categorised by at least two members of the research team to reduce bias and subjectivity.

The diversity of the research team involved in the study and analysis supported the exploration of varied interpretations and increased the rigour of the analysis. Researchers' disciplinary backgrounds included agricultural economics, health, political science, psychology and social science. Cultural contexts were mainly differentiated because of countries of origin, which included Jordan, Malawi, South Africa, the United States of America, Zambia and Zimbabwe. The study can be categorised as transdisciplinary as, in addition to transcending various disciplines, the research direction was also informed by consultations with the UN Interdepartmental Task Force on African Affairs (IDTFAA). Their inputs contributed to guiding the direction and refinement of the research methodology, transitioning the study from a standard literature review and analysis to an integrated document and thematic analysis. The methodology included four main elements: literature search and classification, review of the African Food Systems Guiding Framework, review of national policies, as well as research funding analysis.

Literature search and classification

Using the FSNet-Africa Framework depicted in Figure 1, a literature search was conducted using key words. The key words captured 28 elements of the food system as they relate to gender. The team systematically searched these key terms in combination with the terms "gender" and "food systems" across seven databases: EBSCO Host (so named after the company's founder, Elton Bryson Stephens), ScienceDirect, Scopus,

SpringerLink, Web of Science, Wiley Online Library and JSTOR ("Journal Storage"). These are the most commonly used and generally accepted databases for research related to agriculture and food systems. The exclusion criteria included geographic location (i.e. research being based in one of the six FSNet-Africa focus countries – Ghana, Kenya, Malawi, South Africa, Tanzania and Zambia) and year of publication (i.e. between 2015 and 2022). The FSNet-Africa project selected these countries to ensure geographic representation of east, south and western Africa. These countries were also selected because, as a Global Challenges Research Fund research excellence project, academic partners participating in the FSNet-Africa programme needed to be from African Research Universities Alliance (ARUA) affiliated institutions with a strong focus on food-related research. Non-ARUA universities were selected to strengthen research capacities at emerging and previously disadvantaged institutions. The timeframe selected is relevant because it coincides with the period in which the concept of food systems really began to gain momentum. While the HLPE only released their report in 2017, food systems articles date back to as early as 2011 (Ingram, 2011), with the Global Panel on Agriculture and Food Systems releasing a conceptual framework in 2016 (Glopan, 2016).

At least two team members collaborated on each of the 28 food systems components to review the seven databases and identify relevant articles. The initial search resulted in 5,674 articles containing one of the key words relating to components of the food system; these were exported to Endnote. Duplications were removed and thereafter article titles and abstracts were screened manually based on inclusion of the term "gender" or "women" and whether the studies were located in one of the six focus countries. After this round of screening, the total number of articles was reduced to 644. Team members working on specific components tracked the results of their searches in Excel spreadsheets that utilised the same format for organising the data (i.e. all utilising the headings Component, Authors, Year, Title, Abstract, Link, Database, Country 1, Country 2, Country 3). These spreadsheets were then collated into one spreadsheet to eliminate duplication and allow for further analysis to understand which food systems areas were most researched in the identified gender and food systems publications.

African Food Systems Guiding Framework

Based on the results of the literature search and classification, a follow-up analysis to determine the extent to which the priority areas of publications aligned with policy priorities in gender and food systems in Africa was conducted. Consultations held with the IDTFAA, considered influential leaders in activities related to food systems in Africa, led to the recommendation of three key African policy documents. These documents are regarded by them as the guiding policy framework for African food systems, hereafter referred to as the African Food Systems Guiding Framework (Kebe, 2023). The identified documents include the Comprehensive African Agriculture Development Programme (CAADP) (NEPAD, 2003), the Malabo Implementation Strategy and Roadmap to Achieve the 2025 Vision on CAADP (AUC, 2020) and the Africa Common Position on Food Systems (AUC, 2021).

These documents were reviewed to extract statements that reflect priority areas related to gender and food systems. Each team member conducted an independent review of the statements related to gender and coded each statement based on its alignment with a food systems area from the FSNet-Africa Framework. Where coding was not aligned, the team discussed each statement until consensus was reached. This

process aimed to reduce the subjectivity of the coding. The common areas across the three documents in the African Food Systems Guiding Framework were analysed to determine where similar themes emerged in terms of gender and food systems policy priorities.

Review of national policies

The team also reviewed national policies in the six focus countries to explore gender and food systems priority areas. The medium-term development plans and the national agriculture investment plans (or documents similar to these, such as strategic plans) of the six countries, focusing on the timeframe of the literature search (2015-2022), were searched for priorities related to gender in the context of the food system. The National Agriculture Investment Plans (NAIPs) were selected for review because these documents are developed in line with domesticating the Malabo Declaration and the broader African Food Systems Guiding Framework. In 2016, the International Food Policy Research Institute (IFPRI), at the request of the African Union Commission, led efforts to provide technical support to countries in developing their NAIPs (IFPRI, 2019). This support ensured that while the content and structure may differ, the NAIPs followed the Malabo guidelines consistently and were comparable. The NAIPs are key in signalling which gender and food systems areas are national priority areas for investment. We recognised that these plans would be significantly biased towards the agriculture sector; therefore, we also explored national medium-term development plans in the six countries, which highlight national priorities across multiple sectors, including health, environment, education and governance, among others – all of which influence and are central to food systems. For example, priorities related to health look specifically at nutrition, which is a core element of the food system, while priorities related to the environmental sector look at land use, farming and pollution, and climate change management, which have very specific impacts on the food system. National medium-term plans inform sector policies and indicate national priorities for each sector. Policies are typically developed using the national medium-term plans. As such, it was essential to include national medium-term development plans to understand the policy priority areas that link to food systems more broadly.

> … limited research exists in the areas of gender and finance, yet this is a critical policy priority …

These policy documents were reviewed to extract statements that reflected priority areas related to gender and food systems, using the search terms "gender", "women" and "girls" to narrow down the priority areas. The statements were coded to reflect a food systems area on the FSNet-Africa Framework. A second team member reviewed the list of statements and the coding assigned to each statement to corroborate the results.

Research funding

The results from the first three sets of analyses led to questions concerning research funding, which was proposed as being central to informing the dominant areas of gender and food systems research publications. A fourth analysis was conducted to deepen our understanding of the findings and explore the alignment of funding with research publications. A literature review explored grants related to gender in African food systems. Through this process, the Dimensions database was identified. Dimensions is a scholarly database that goes beyond research articles and their citations by including not only books, chapters and conference proceedings, but also grants, patents, clinical trials, policy documents and altimetric information (Hook *et al*., 2018). This database was used to assess research grants related to gender and food systems. While this database is not comprehensive and may overlook smaller grants from unconventional donors, it provides an indication of the type of gender and food systems research that is funded by key research funding organisations.

The inclusion criteria were grants that were awarded to the six focal countries in the period 2015 to 2022 and which made explicit reference to gender and/or women in the title or abstract. Three team members independently reviewed the grants and classified them using the 28 areas of the FSNet-Africa Framework. Where there was divergence, the team met to discuss and agree on the classifications. This minimised bias in categorisation and validated the results.

Results

The results are presented in three sections. The first section outlines the results from the literature search and classification. The second section combines the results from the African Food Systems Guiding Framework and the national policy analysis. The third section presents the results from the research funding analysis. An infographic summary of the full set of results is presented in Figure 3.

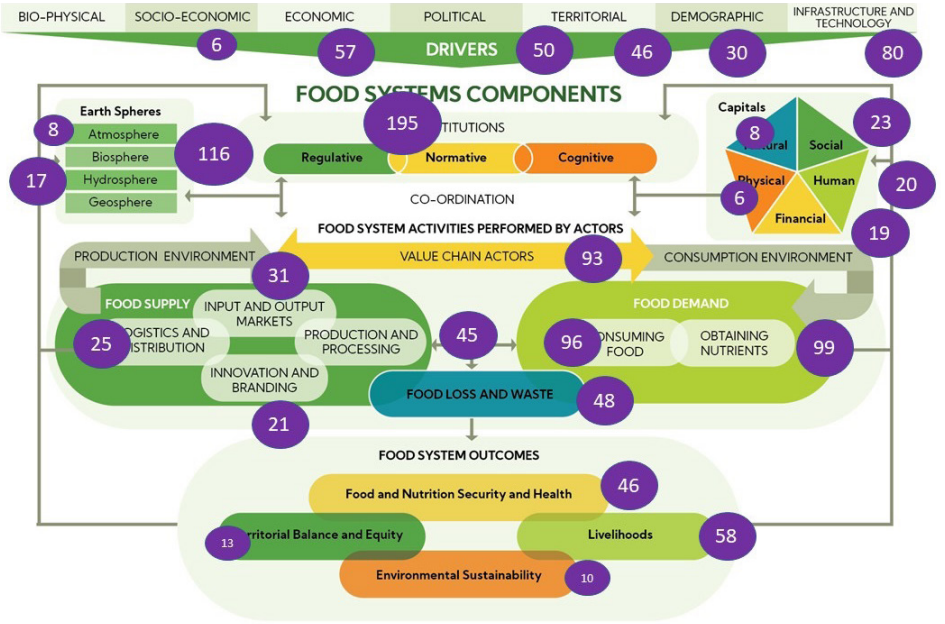
Literature search and classification

The initial results of the literature search yielded 5,674 publications. After removing duplications, 1,253 articles remained. The gender screening was then conducted and resulted in 644 articles. These were the articles that were included in the analysis.

The results of the mapping of gender research against the different areas/components of the FSNet-Africa Framework are presented in Figure 2. Research priorities related to gender and food systems identified in the six focus countries show that the majority of publications relate to institutions (195 articles found for regulative and normative institutions combined) and earth spheres (141 articles found across all four earth spheres combined), while the socioeconomic (6 publications), physical capital (6 publications) and natural capital (8 publications) categories rank fairly low in terms of published research. Economics as well as production and processing fall in the middle.

Traditional social and cultural norms ... shape women's roles in the food system.

Figure 2: Number of publications identified for each food systems area/component



African Food Systems Guiding Framework

A total of ten food systems areas were prioritised across all three documents constituting the African Food Systems Guiding Framework, with the CAADP document including the largest number of priority areas.

The most highly prioritised areas in the context of gender and food systems in these documents were production and processing, and institutions. The results indicate that there is significant alignment between research publications on institutions (195 publications) and on production and processing (45 publications) and the policy priorities included in the African Food Systems Guiding Framework. However, natural, financial and human capital, which are considered high priorities in the African Food Systems Guiding Framework, yielded only 8, 19 and 20 publications respectively, in the context of gender and food systems research. While biosphere resulted in the second largest number of research publications in the context of gender and food systems, it was not included as a priority in the African Food Systems Guiding Framework.

After comparing the food systems areas that could be identified across the policy documents, only production and processing and institutions were identified as the two common areas that were overtly linked to the concept of gender. An example of such alignment of areas is where one of the documents focuses on policy priorities related to production and includes the participation of women in agricultural activities – in particular value chains. The three African Food Systems Guiding Framework documents also prioritised the development and implementation of policies related to women's access to land, resources and training. Natural and human capital, livelihoods, input and output markets, infrastructure and technology, and financial capital were the food systems areas identified as priorities in two of the three African Food Systems Guiding

Framework documents. The areas food and nutrition security and health, politics, obtaining nutrients and economic were coded in only one document.

National development plan priorities results

This study used the national agricultural investment plans in the six countries to identify the national policy priorities in terms of gender and the food system, given that agricultural production and consumption encompass a significant portion of the food system. However, the agricultural sector does not account for the entire food system. As such, the country-specific national medium-term development plans published by the relevant planning departments within each country were also analysed to enable a holistic view of what the policy priorities are within each country. The gender priorities in terms of the different food systems areas were identified and coded.

A total of 14 food systems areas were prioritised across the national agricultural investment plans and the national medium-term development plans of the six countries. The national medium-term development plans and the national agricultural investment plans of the focal countries highlighted that African governments have only prioritised gender to a limited degree, with a significant focus on obtaining nutrients (99 publications), financial capital (19 publications) and production and processing (45 publications) in the context of gender. Natural capital (8 publications) was also prioritised to a degree. Five of the six countries prioritised obtaining nutrients, but this could be specifically related to the prioritisation of health with an emphasis on pregnant women, as opposed to women and food systems more broadly. All six countries prioritised access to financial capital for women, specifically in terms of access to loans and credit, and financial literacy training. Reference was also made to prioritising the reduction of the wage gap. There has also been a significant focus on increasing women's access to the resources necessary for production, such as extension services. Additionally, women's access to land was prioritised in five of the six countries. Gender in the context of earth spheres (141 publications), specifically in terms of biospheres, was only prioritised in three of the six countries. One aspect that was noted in many of the national policy plans but which was not analysed as part of this research as it does not directly link to the food systems is the gender gap in education, which has a significant impact on women. Not only does it limit employment opportunities for women and reduce their ability to enter the formal labour market, but it also limits their opportunities to participate in decision-making processes.

There is significant alignment between the amount of research being conducted on a particular food systems area and the national priorities linked to that area in the context of gender and food systems, except in a few instances where much research is being done on an area, but it is not mentioned as a policy priority in the majority of focal countries. These instances relate to the following food systems areas: institutions (195 publications, with four out of six countries prioritising these areas), biospheres (116 publications, with three of six countries prioritising these areas), value chains (93 publications, with four out of six countries prioritising these areas), and obtaining nutrients (99 publications, with five out of six countries prioritising these areas). However, there is also some misalignment between the research being conducted and national priorities – particularly in the areas of natural capital (only 8 publications, but with five out of six countries prioritising this area) and financial capital (only 19 publications, but with six out of six countries prioritising this area).

Research funding results

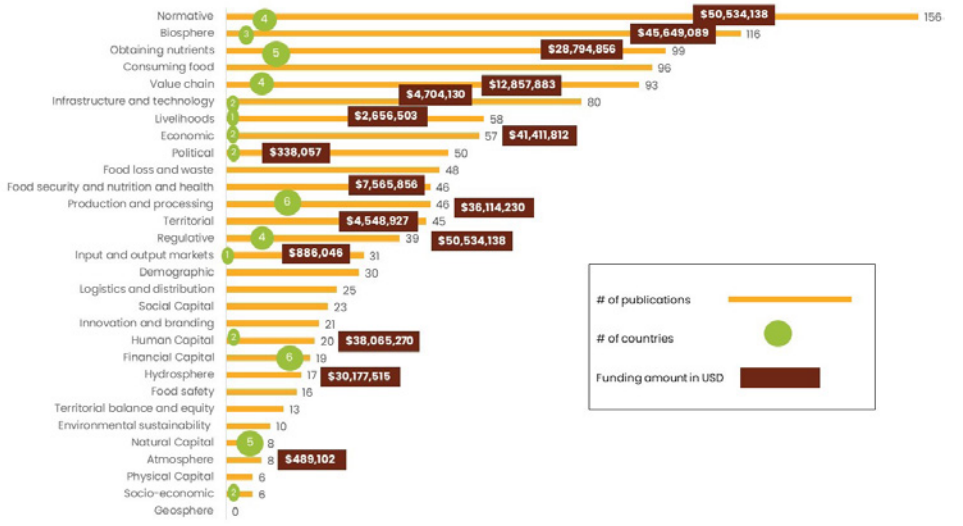
The search for grants from the Dimensions database resulted in a total of 21,115 grants. After screening for country and gender and food systems, 32 grants remained and were analysed to identify the priority funding areas. Research funding was allocated to 16 food systems areas.

The results depicted in Figure 3 show the total amount of funding allocated to a specific food systems area between 2015 and 2022. The majority of grants that focused on gender and food systems were in the areas of biosphere (11), regulative institutions (11), production and processing (9), and obtaining nutrients (7). These constituted over half of the total grants funded in the context of gender and food systems research. Although research related to gender and institutions was funded by more donors, research related to gender and earth spheres received the largest amount of funding: up to $76,515,706 for biosphere, hydrosphere and atmosphere combined, compared to $50,634,138 for institutions (see Figure 6). Economics was the third largest area in terms of actual funding amounts invested, with research in this area receiving $41,411,812. Gender and food systems research publications align significantly with research funding. This finding is evidenced by the large number of publications related to institutions (195), earth spheres (141) and production and processing (45), and the amount of funding directed towards research in each of these areas.

There is significant alignment between research funding, research publications and national policies in the areas of institutions, earth spheres and obtaining nutrients. However, based on our analysis, other highly prioritised areas in the context of gender and food systems in national policies and the African Food Systems Guiding Framework – including input and output markets, financial capital and natural capital – have received no research funding.

Figure 3 presents a summary of the collated results looking at gender and food systems research publications, policy priorities and research funding in the six countries.

Figure 3: Results summary of the alignment between research publications, policy prioritisation in the six countries and research funding



Discussion

The results reflect significant alignment between gender and food systems research funding, research publications and policy in the areas of institutions and obtaining nutrients, and moderate alignment in the area of earth spheres. These findings are consistent with Njuki *et al*. (2022), who found that much of gender and food systems literature focuses on social norms (institutions). In the context of food systems, legislation and policies – particularly around land and women's land rights – have attracted much attention in recent years. The findings are also aligned with increased global commitment towards nutrition and environmental sustainability. For example, between 2014 and 2022, there has been an increased number of initiatives to advance nutrition, including the 2014 Rome Declaration on Nutrition (FAO, 2014), the 2016 announcement of the UN Decade of Action on Nutrition (WHO, 2016) and the emphasis of the 2020 Global Panel on Agriculture and Food Systems for Nutrition (Glopan) report on diets (Glopan, 2020). Similarly, there has been significant emphasis on environmental sustainability through commitments such as the 2015 Paris Agreement where 193 member states committed to reducing carbon emissions and strengthening collaborative efforts to adapt to the impacts of climate change (United Nations Framework Convention on Climate Change, 2015).

However, the limited number of publications focused on natural capital, financial capital, human capital, and input and output markets is concerning, particularly considering the rising levels of hunger and poverty in Africa. Globally, Africa continues to have the largest share of extreme poverty rates. The Africa Gender Index reflects significant inequalities in employment, earnings and economics. This finding is consistent with Giner *et al*. (2022), corroborating our findings, which indicate that limited research exists in the areas of gender and finance, yet this is a critical policy priority as reflected in national policies and the African Food Systems Guiding Framework. Our findings suggest that although these are policy priority areas, the limited research funding channelled towards these areas might be contributing to the lack of research. Consequently, there is some dissonance between research priorities as reflected in research publications and policy priorities.

Our results suggest that the publications in the six countries are aligned with research funding in the areas of gender and earth spheres. Our results indicate that 24% of funding in the area of gender and food systems was allocated to research on earth spheres. The area of gender and earth spheres was only a national priority in three of the six countries investigated and not a priority in any of the African Food Systems Guiding Framework documents. Financial capital was a priority in all six countries as well as the African Food Systems Guiding Framework. However, no funding was identified as directed towards financial capital in the context of food systems. Limited research funding (only 13%) was targeted towards economics, which contributes to financial capital, but in the context of our analysis is not necessarily classified as financial capital (an area that received no funding).

Finance is a major driver of food systems transformation and influences the various components and agendas of the food system. The latest Ceres 2030 report estimated that an additional US$14 billion of donor funding, leveraging US$33 billion of national government expenditure, will be needed to achieve SDG 2 alone (Laborde, 2020). Generally, funding channelled towards gender is limited. This is evidenced by the official development assistance (ODA) report showing donor financing levels in 2018-2019

dedicated to gender equality were at only 2.4% of all climate-related and food systems projects (OECD, 2022). Even gender and earth spheres, where the majority of research funding is directed, does not constitute a significant proportion of total funding. The integration of gender in policy and research remains a tick-box exercise and without deliberate efforts to reserve resources for gender research, efforts to address gender equality in the context of food systems will continue to stagnate.

The mismatch between policy focus and research focus raises concerns around the successful uptake of research into policy. While research evidence may indeed be robust and valid, if it does not align with the policy agenda it is unlikely that national budgets will fund solutions based on the research evidence. Oliver *et al*. (2019) suggest that one of the main barriers to the uptake of research evidence into policy is the lack of relevance and importance of the evidence to policy. A vital facilitator to evidence-informed policy would thus be collaboration between policy-makers and researchers to ensure the research conducted is relevant to policy. This goes beyond once off consultations on research or policy priorities but continuous engagement to establish a shared vision including joint workshops and seminars with a specific focus on co-creation in the context of the science policy interface.

Gender equality is a key lever in achieving positive food systems outcomes.

The mismatch between gender research and policies could also be attributed to the weak integration of gender into policies as well as the lack of implementation of gender policies. The gender research conducted in the six focus countries does not align with the policy priorities and, therefore, can provide little evidence on how best to integrate gender into policy. Similarly, lack of research evidence integrated into the gender policies that are prioritised means that there is limited guidance on the most appropriate interventions and strategies for policy implementation.

A balance is needed to ensure that research capacity, including human and institutional, is being optimally leveraged to support both policy-led research and research-informed policy. Strengthening relationships between policy-makers and researchers remains vital to the uptake of evidence into policy. When trust and credibility have been established with policy-makers, the likelihood and ease of the uptake of research into policy increases (Uneke *et al*., 2020). However, the nurturing of these relationships relies significantly on research funding. Researchers rely on funding to support the advancement of their work. If research funding is not aligned with policy, the work of researchers is unlikely to focus on policy priorities.

Conclusion

Gender inequalities continue to constrain food systems outcomes, and there are inherent trade-offs when negotiating policy and research funding priorities. The results of this study indicate that the foci of research publications are more aligned with research funding than policy priorities, suggesting that research is primarily driven by funding.

The number of papers that were identified as genuinely including gender (644) indicates that there is a paucity of research that explicitly investigates gender in food systems research in the six focus countries. Further, the gender and food systems areas that are frequently prioritised in policy are the least researched in the six African countries. These include areas such as women's access to financial resources or participation in decision-making processes. Concerningly, it appears that the research capacity in the six African countries investigated is largely channelled towards research areas that are not defined by the countries in which the research is conducted.

While further research is needed to determine what drives research funding priorities, our results suggest that funding could be more effectively allocated to increase coherence between the priorities/focus areas of research, research funding and policy. Tailoring of research funding priority areas to align with national and continental policy priorities is vital to ensure that synergies across food systems are unlocked to contribute towards the desired food systems and gender equality outcomes. However,

the relevant stakeholders – including policy actors, researchers and research funders – must collaborate on setting the research agenda. In particular, investments in policy-led research are needed to ensure that the research capacity on the continent is leveraged to contribute specifically to Africa's defined policy priorities. Research funders need to collaborate with researchers and policy-makers to define research agendas that cut across disciplines to effectively explore and optimise trade-offs and leverage points in the food system. This is essential, not only for ensuring food systems that can function effectively, but it is also essential for promoting gender equality in all aspects of food systems.

Limitations

Using search words such as "gender," "women" and "girls" in the research, policy documents and grants database may have excluded important documents that address gender indirectly. Given the extensive number of articles retrieved (1,253), the authors opted to exclude research articles that did not explicitly focus on gender to ensure the data remained manageable. However, for policy documents and grants, where the data set was less extensive, a comprehensive read of available documentation was conducted alongside the keyword search. Further qualitative research is needed to explore specific parameters that may further explain the alignment or misalignment of the research with funding and policy priorities.

Declaration of interest statement

None of the authors included in this manuscript have any conflicts of interest. NA94

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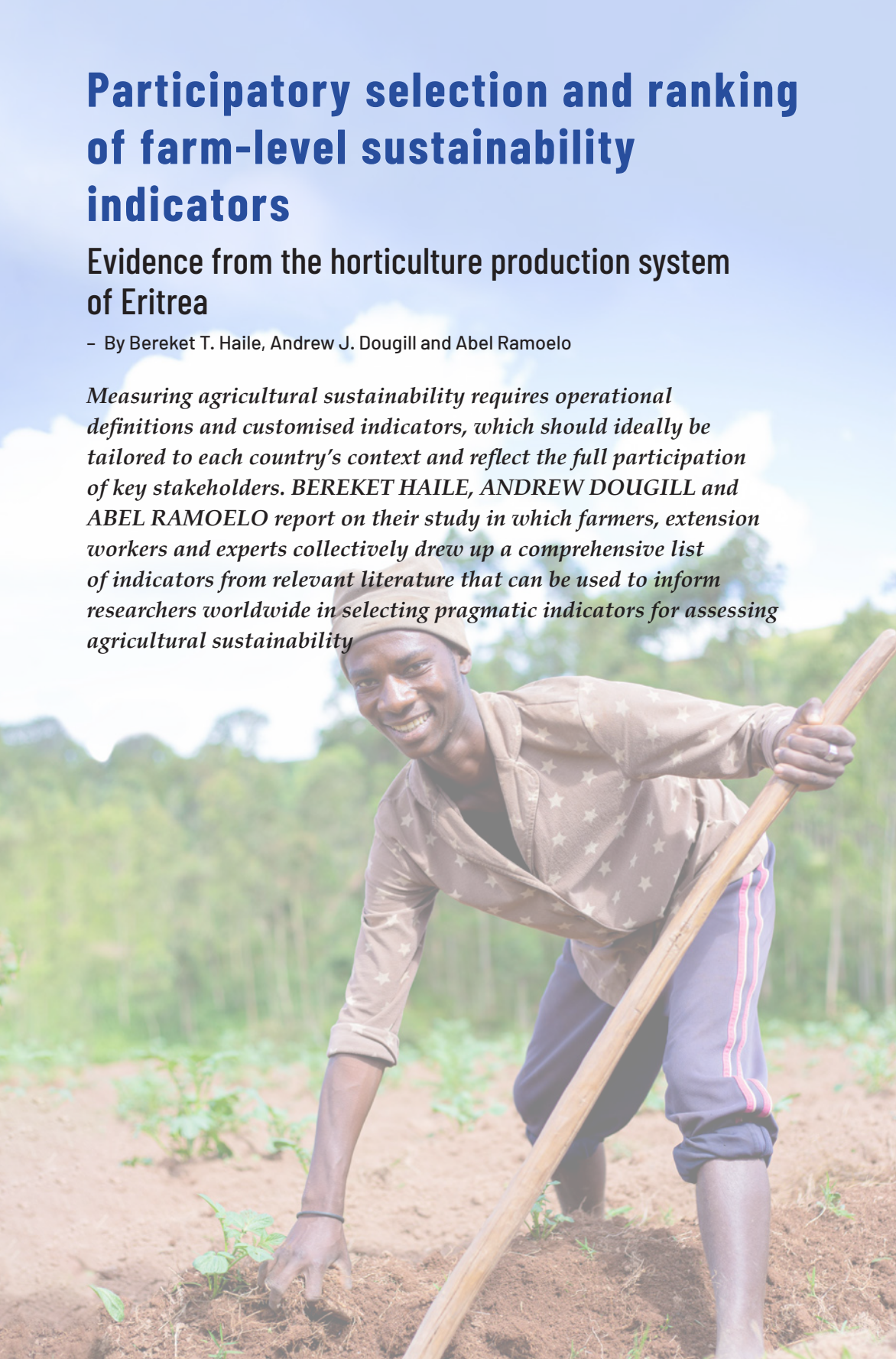
Participatory selection and ranking of farm-level sustainability indicators

Evidence from the horticulture production system of Eritrea

– By Bereket T. Haile, Andrew J. Dougill and Abel Ramoelo

Measuring agricultural sustainability requires operational definitions and customised indicators, which should ideally be tailored to each country's context and reflect the full participation of key stakeholders. BEREKET HAILE, ANDREW DOUGILL and ABEL RAMOELO report on their study in which farmers, extension workers and experts collectively drew up a comprehensive list of indicators from relevant literature that can be used to inform researchers worldwide in selecting pragmatic indicators for assessing agricultural sustainability



Introduction

Evaluating the sustainability of agricultural practices has long been a pressing research question, yet it continues to face significant methodological and conceptual challenges (Bell & Morse, 2008). Effective measurement of agricultural sustainability requires the selection of indicators that are not only scientifically robust but also contextually relevant (Reed *et al*., 2008). In response, numerous studies have demonstrated that participatory approaches can enhance the acceptance and legitimacy of sustainability initiatives, as stakeholders are more likely to support and implement indicators when they have been involved in their selection (Luján Soto *et al*., 2020; Roy *et al*., 2013; Yegbemey *et al*., 2014). Therefore, it is recommended to develop indicators that are tailored to each specific context, with full and transparent participation from both local and national stakeholders (Reid & Rout, 2020). Such approaches enable the development of locally agreed-upon indicators through a methodologically sound process, with thresholds defined by consensus among key stakeholders.

Initial sustainability studies used methods and indicators mostly crafted by experts (Syers *et al*., 1995; Taylor *et al*., 1993). However, recent advances have focused on participatory selection and evaluation of sustainability indicators of a particular agricultural practice including putting thresholds and weights to the indicators (Eze *et al*., 2022; Hermans *et al*., 2021; Luján Soto *et al*., 2020). This is mainly because the involvement of key stakeholders in the selection process fosters a sense of ownership among those who are concerned about sustainability initiatives with indicators chosen to reflect the local needs and priorities.

Several studies have attempted to summarise and synthesise the various agricultural sustainability indicators proposed and applied by researchers (Bathaei & Štreimikienė, 2023; Hayati, 2017). There are only limited studies to date in Africa which have followed participatory approaches in selecting sustainability indicators (Asare-kyei *et al*., 2015; Marandure *et al*., 2020; Reed & Dougill, 2002; Yegbemey *et al*., 2014). Such studies highlight the importance of frameworks and methods to include the perception of wider stakeholders and the socioeconomic and environmental context of the study area in constructing sustainability indicators usable in specific regions of Africa. A standard method for engaging multiple stakeholders in the participatory process of sustainability assessment has yet to be established, but certain best practices and guiding principles have been identified. Reed *et al*. (2006) recommend an adaptive shared learning process that involves local communities. Indicators developed by farmers and frontline extension workers are typically easy to understand but usually lack objectivity and are difficult to measure using replicable methods. Expert-led indicators on the other hand are scientifically rigorous but difficult to be understood and applied by farmers (Reed *et al*., 2006). Similarly, Reed and Dougill (2002) propose the use of a participatory shortlisting method, whereby a comprehensive list of indicators sourced from the scientific literature is subjected to a collaborative evaluation and refinement process together with local communities.

Once indicators are shortlisted through a participatory approach, their scientific soundness can be validated by selected experts who have knowledge of the local environment and have the required expertise in the concerned aspect of sustainability (Fraser *et al*., 2006; Roy & Chan, 2012; Van Calker *et al*., 2005). In this way, it is possible to develop sustainability indicators that reflect the diverse perspectives and priorities of a wide range of stakeholders which can lead to a locally appropriate and more effective sustainability assessment.

Horticultural crop production is growing to meet the increasing urban food demands across the world and especially Africa. It requires intensive land and resource utilisation, including significant groundwater extraction and high inputs of energy, fertilizers and pesticides, leading to sustainability challenges such as soil degradation and water contamination (Bergstrand, 2010; Wainwright *et al*., 2014). Additionally, the sector is highly susceptible to market fluctuations due to the perishable and bulky nature of produce, which poses economic risks (Etefa *et al*., 2022; Ghebreslassie *et al*., 2014). The seasonal and labour-intensive nature of horticulture also makes it reliant on a largely unskilled workforce, intersecting with various social sustainability challenges (Wainwright *et al*., 2014). Therefore, assessing the sustainability of horticultural practices requires a comprehensive approach that considers these multifaceted challenges.

Eritrea is a suitable case study nation as horticulture is fast-growing, and based on an input-intensive production system (MoA, 2006), yet an integrated sustainability assessment that incorporates economic, environmental and social dimensions has not been previously attempted. This study aims to meet two main objectives: a) to develop a set of indicators, representing the economic, environmental and social aspects of sustainability, customised for the horticulture production system of Eritrea, with the intention of providing the guidance required for a comprehensive assessment of horticultural crop farming sustainability at the farm level; and b) to assess the perceptions of different stakeholder groups in the relative importance of the indicators in measuring sustainability of horticulture farming.

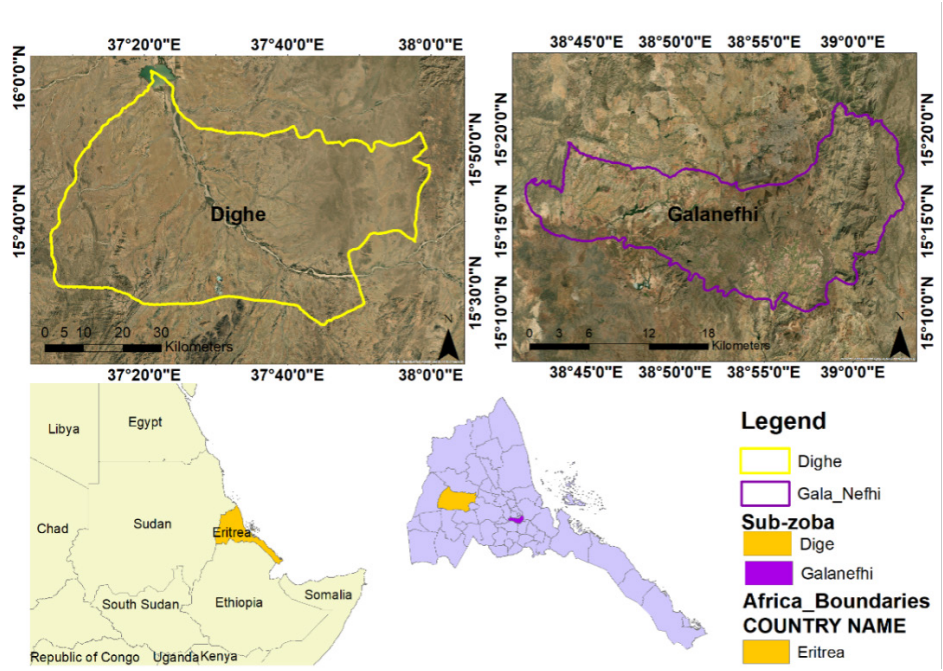
The methodological framework used in this study, centred on stakeholder-engaged indicator development, presents a scalable and adaptable model that can be applied in diverse international settings, especially in regions with similar agroecological conditions. The findings from this research can therefore serve as a critical benchmark for Eritrea and similar nations, guiding policy interventions and fostering international collaborations aimed at enhancing the sustainability of horticultural agriculture.

Materials and methods

Study area

Eritrea is located in the northeastern part of Africa with a population of approximately 3.6 million of which about 69% are living in rural areas (National Statistics Office [NSO], 2013; UNSA, 2021). The country is divided into six administrative regions called *zobas*. This study focuses on two sub-*zobas*, namely Gala Nefhi and Dighe, representing the two agroecological zones with the highest potential of producing horticultural crops, i.e., the Central Moist Highland and the Western Moist Lowland (Figure 1). Reports from the Ministry of Agriculture show that sub-*zobas* Gala Nefhi and Dighe recorded the highest average horticultural crop production in their respective *zobas* (MoA, 2022).

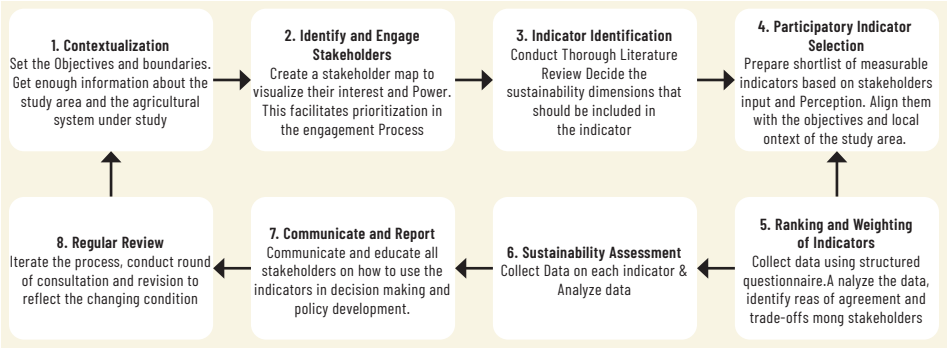
Figure 1. Eritrea, showing the location of the study area



This study employed an iterative research process that actively involved multiple stakeholders from Eritrea's horticulture production system. To facilitate the selection of sustainability indicators, a three-day participatory workshop was organised in March 2023. The workshop was attended by 35 participants, comprising five females and 30 males, who represented all key stakeholder groups in Eritrea's horticulture sector.

Figure 2 shows a logical framework which outlines the sequence of activities followed in this study. It elaborates on the iterative approach followed from the conceptualising of the concept through the participatory engagement process up to the mechanisms of collecting feedback from stakeholders and reviewing the process.

Figure 2. Logical framework of analysis



Modified by the authors based on Frater & Franks, 2013; Luján Soto et al., 2020; Reed & Dougill, 2002. (NB. Only stages 1-5 reported in this paper).

Identification of participants

The initial identification of key stakeholders was grounded in a stakeholder analysis conducted during the review of national agricultural policy documents (MoA, 2006). This document had previously identified stakeholders and clustered them into task groups to assist in policy development. Consequently, the stakeholders identified within the context of horticultural crop production served as the primary basis for inviting participants to the workshop.

The workshop brought together a broad spectrum of stakeholders, including farmers and heads of producers' associations (5), frontline agricultural extension workers (4), representatives from the Ministry of Agriculture headquarters (4), representatives from regional offices (4), planners and policy experts (4), agricultural inspectorates from the Regulatory Services Department (2), researchers and academics (3), representatives from the Ministry of Land, Water and Environment (3), international development partners (3), representatives from the Eritrean Women Association in Agribusiness (2) and a representative from the Ministry of Local Government (1). The participants were heterogeneous in terms of representation and technical expertise which is crucial in enabling a comprehensive multi-stakeholder analysis of horticulture production systems.

Preparation of Stakeholders Matrix

As a first activity the workshop participants were asked to define the stakes and roles of each stakeholder. To enhance this, the participants collaboratively developed a Mendelow's Stakeholder Matrix, a tool designed to visualise the interests and power dynamics of each stakeholder group (Mendelow, 1991). By plotting stakeholders based on their power and interest levels, the Matrix provided a clearer understanding of the varying degrees of power and interest held by different stakeholders within the horticultural subsector. The visual representation of the Stakeholder Matrix, as shown in Figure 3, was instrumental in ensuring that key stakeholders in the horticulture sector were considered in this study.

Selection of indicators

To identify appropriate indicators for the horticulture sector of Eritrea, a long list of indicators divided into economic, environmental and social group were prepared from the United Nation's Food and Agricultural Organisation (FAO) guidelines in Sustainable Assessment of Food and Agricultural Systems (SAFA) (FAO, 2012). The FAO-SAFA framework was selected for this study as it offers a comprehensive set of 116 indicators across 21 themes and 58 sub-themes. The framework's holistic approach ensures the inclusion of all dimensions of sustainability (environmental, social, economic and governance) necessary for a thorough assessment at the farm level. The FAO-SAFA framework has been field tested in various contexts which ensures its reliability and validity (FAO, 2013). Several studies, such as Soldi *et al*. (2019) in Paraguay, Gayatri *et al*. (2016) in Indonesia, Al Shamsi *et al*. (2019) in the United Arab Emirates and Italy, demonstrated the effectiveness of the tool in providing a comprehensive list of indicators to assess agricultural sustainability. Its adaptability allows it to tailor the indicators to the horticulture production system of Eritrea, while promoting stakeholder engagement and ensuring comparability with other studies.

The following criteria were applied to shortlist the indicators into a more manageable number as agreed with stakeholders (Dale & Beyeler, 2001; De Mey *et al*., 2011; Zhen & Routray, 2003).

a) Measurability and availability of data: This refers to how easy or difficult the indicator is for all stakeholders, including farmers, to calculate as well as understand and use.

b) Compatibility with the horticulture production system of the country: This shows the extent to which the indicator is compatible with the farming practice and institutional structure of the farm. This means that the indicators should be perceived by key stakeholders as being relevant to use and implement.

c) Known response to disturbances and anthropogenic stresses as well as changes over time and space: The indicators should be able to predict changes that can be averted by management actions.

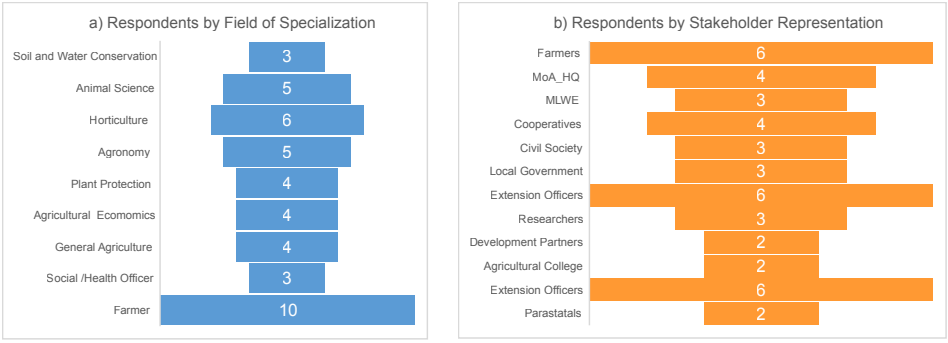
d) Integrative and inclusive: The indicators should be able to measure sustainability in a wide range of farming practices within the horticulture production system (e.g., fruit, vegetable, floriculture and mixed farms).

Using the above criteria, each group prepared a shortlist of indicators through an active discussion among the members. Workshop participants referred to relevant documents and used their knowledge and normative view to set perceived thresholds or critical loads (values) for the indicators by considering a range of specific economic, environmental and social factors.

Ranking of indicators

Based on a stakeholder map prepared during the workshop, 44 respondents were purposively selected to represent the range of stakeholders identified. The representation and specialisation of these respondents are illustrated in Figure 3. Each respondent was asked to rank the 12 shortlisted indicators on a scale from 1 (most important) to 12 (least important) based on their perception and understanding. To ensure clarity and avoid any potential misunderstanding or misinterpretation, clear definitions of each indicator were provided to all respondents prior to ranking. The rankings provided by stakeholders were then consolidated and the total weighted score of each indicator calculated, as shown in figure 6.

Figure 3: Field of specialisation and stakeholder representation of the 44 respondents



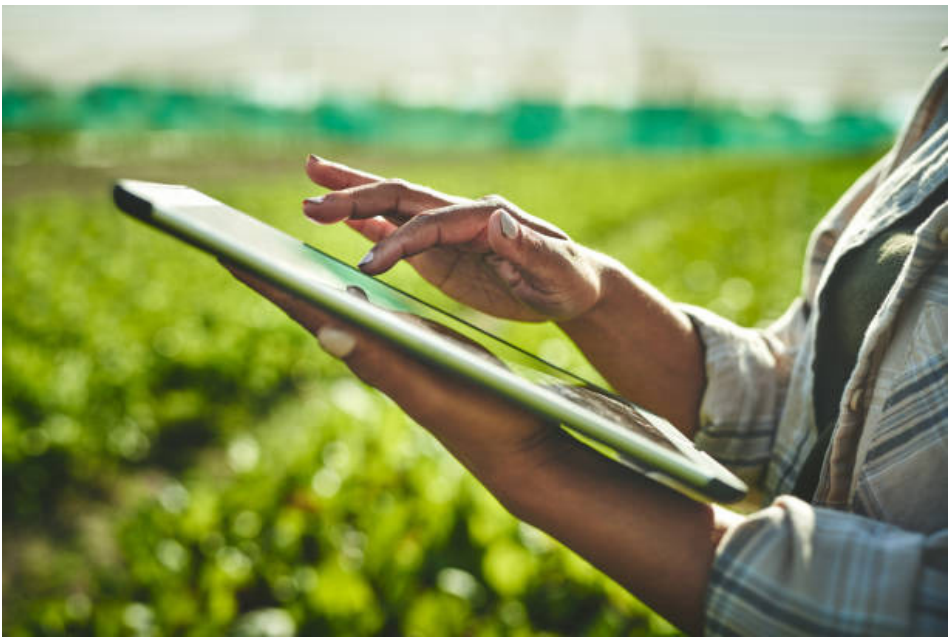
The same respondents were also asked to express their perception of the relative importance of the indicators using a Likert Scale (5 = extremely important; 1 = not important). Means and standard deviations of the ranks were used to see the variability of the choices among respondents and the diversity of their perceptions. Based on the result of the Likert Scale data, the Relative Importance Index (RII) of each indicator was

calculated using equation 1, a method commonly employed in ranking attributes based on survey responses (Kometa *et al*., 1994). The RII was computed in addition to the mean scores to facilitate comparison across different indicators and ensure a standardised interpretation of their importance, expressing each indicator's importance relative to the maximum possible value, thereby allowing a better comparative analysis across indicators.

$$RII = \frac{5n_5+4n_4+3n_3+2n_2+1n_1}{A*N} \quad \text{..... (1)}$$

Where n_5 is the number of respondents saying extremely important, n4 saying very important, n3 saying moderately important, n2 saying slightly important and n1 saying not important. A is the highest possible score i.e. 5 and N is the total number of respondents i.e. 44

The respondents were categorised into three major groups: experts (14), extension workers (20) and farmers (10). Their ranking values were averaged and compared for consistency. To analyse the differences in rankings among the three groups, the Kruskal-Wallis H test was used. This non-parametric test is ideal for this study considering the ordinal nature of the data, number of groups compared (>2) and smaller sample size per group where normality cannot be assured. Moreover, Kendall's Coefficient of Concordance (Tau) and Spearman's Rank-order Correlation (rho) were applied to see if there was agreement among the rankings given to the indicators by the main stakeholder groups. While both Kendall's Tau and Spearman's rho measure the same type of association, they can yield slightly different results due to the different ways they handle tied ranks. Kendall's Tau is generally considered more robust to tied ranks, making it a preferred choice when dealing with data that has ties. However, Spearman's rho is

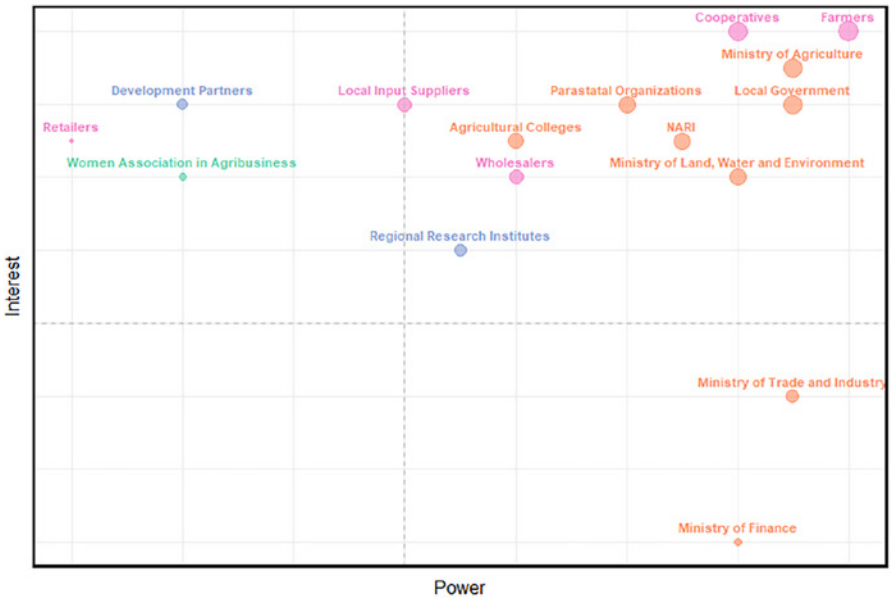


more sensitive to outliers and may be more appropriate when the data is approximately normally distributed (Xu *et al*., 2013) contrary to the opinion of equivalence between SR and KT in some literature, the behaviors of SR and KT are strikingly different in the aspects of bias effect, variance, mean square error (MSE).

Results

Participants first developed a Stakeholders Matrix to categorise key stakeholders in the horticulture production system by their power and interest levels (Figure 4). This visual tool identifies stakeholders with high influence and interest, such as farmers and the Ministry of Agriculture, emphasising their crucial role in sustainability initiatives.

Figure 4: Stakeholder power vs. interest Matrix for horticultural crop production in Eritrea



Colour of stakeholders shows which category they represent (purple: private sector; orange: government bodies; and green: civil society organisations).

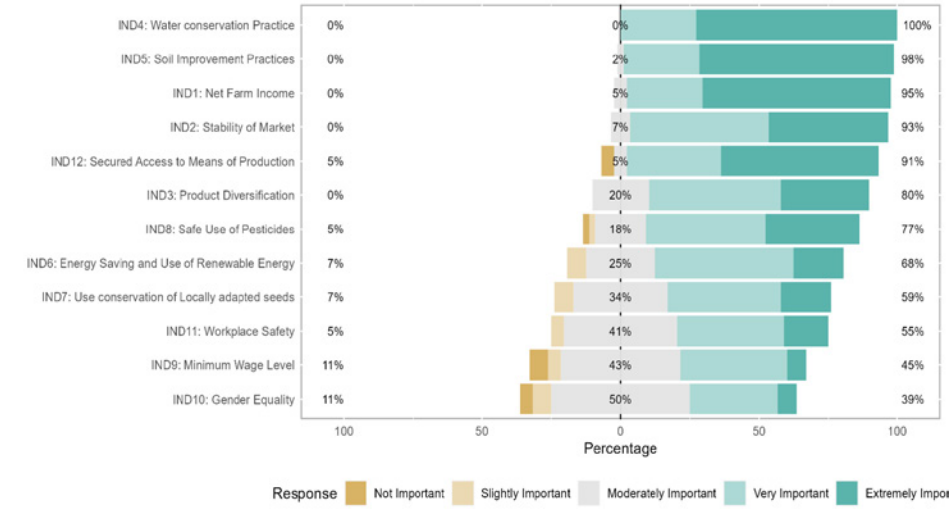
The participants in the national consultative workshop applied the above-mentioned criteria to shortlist the indicators. Indicators chosen twice or more by a group of stakeholders were considered in the final list. Indicators that appeared to be similar were either merged or excluded to avoid redundancy. For example, the indicator Use of Organic Fertilizer is a subset of, and can be merged with, Soil Improvement Practice. The use of renewable energy and energy efficiency can also be merged as one indicator as Energy Efficiency and Use of Renewable Energy.

Accordingly, 12 indicators (three economic, five environmental and four social) were selected in the final list (Table 1) and their ranking is displayed in Figure 3.

Table 1: Final list of indicators and their definitions (FAO, 2013)

Shortlisted Indicator	Definition
Net Income	This indicator measures profitability, financial viability and stability over time after accounting all expenses, including operating costs, depreciations and interest. It measures if the farm is generating sufficient revenue after covering all its costs.
Stability of Market	This is measured by calculating the income structure and determining the number of years the farm has an ongoing business relationship with its major buyer(s) as well as income share per buyer. It also measures financial loss due to unsold products.
Product Diversification	This indicator assesses the diversity of a farm's production by measuring whether it simultaneously generates income from multiple products, encompassing a variety of plants and/or animals.
Water Conservation Practices	This indicator measures the availability of irrigation water over the years and assesses the use of water conservation practices on the farm.
Soil Improvement Practices	This indicator measures the prevalence of using organic fertilizers and if using chemical (synthetic) fertilizers, the adoption of best practices to mitigate the negative impact of chemical fertilizers.
Energy Saving and Use of Renewable Energy	This indicator measures the use of renewable energy sources and application of best practices to reduce energy consumption at the farm level.
Use & Conservation of Locally Adapted Seeds and Varieties	This indicator checks whether the farms save and use locally adapted varieties/seeds that are open pollinating.
Safe Use of Pesticides	This indicator measures the risks and hazards in the use of chemical pesticides and the application of safety measures and best practices.
Minimum Wage Level	This indicator measures if all unskilled labor on the farm earns at least a living wage (or a minimum national wage rate).
Gender Equality	This indicator checks if there is any discrimination in payment, benefits, bonus, workload, scheduling, etc. between men and women working in the same position. It also checks if basic maternity rights (according) to the labour law of Eritrea are respected for all female farm workers.
Workplace Safety	This indicator assesses the implementation of best practices to ensure the well-being and protection of farm employees. It measures whether the farm provides (ensures) a safe, clean and healthy workplace for employees.
Secured Access to Means of Production	This indicator measures whether primary producers have access to the basic "means of production" as expressed in terms of land, water, extension services, training and credit.

Figure 5: Percentage of respondents on the different level of importance of the indicators collected using a Likert Scale



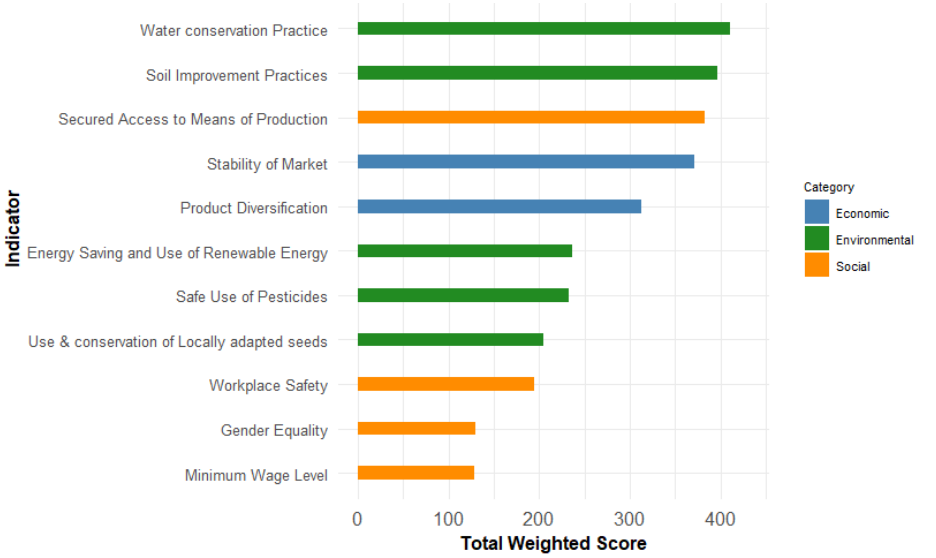
Using the Likert Scale results, mean value and standard deviation was calculated for each indicator. Moreover, the RII of each indicator was calculated as shown in Table 2.

Table 2. Results of the Likert scale showing the mean value, standard deviation and the RII value of each indicator

Indicator	Mean	SD	RII
Net Income	4.64	0.57	0.92
Stability of Market	4.36	0.61	0.87
Product Diversification	4.11	0.72	0.82
Water Conservation Practice	4.73	0.45	0.94
Soil Improvement Practices	4.68	0.51	0.93
Energy Saving and Use of Renewable Energy	3.80	0.82	0.75
Use and Conservation of Locally Adapted Seeds and Varieties	3.70	0.85	0.74
Safe Use of Pesticides	4.05	0.91	0.80
Minimum Wage Level	3.34	0.93	0.66
Gender Equality	3.30	0.87	0.65
Workplace Safety	3.66	0.80	0.73
Secured Access to Means of Production	4.39	0.94	0.87
Weighted Average 4.06			

Following the ordinal ranking of the indicators, the weighted score of each indicator was calculated (Figure 6).

Figure 6: Ranking preference or total weighted score of the indicators



The Kruskal-Wallis H test shows statistically significant differences in the ranking of three indicators i.e. Net Farm Income ($p = 0.019$), Soil Improvement Practices ($p = 0.011$) and Workplace Safety ($p = 0.034$) among the groups. No significant differences were observed for the other indicators, as detailed in Table 3.

Table 3: Mean (SD) values for sustainability indicators across different respondent categories (experts, extension workers and farmers), with Kruskal-Wallis H-statistics and corresponding p-values.

	Experts (n=14)	Extension workers (n=20)	Farmers (n=10)	H-statistic	p-value
	Mean (SD)	Mean (SD)	Mean (SD)		
Net Income	3.07 (2.23)	4.20 (3.52)	1.30 (0.48)	7.93	0.019*
Stability of Market	5.07 (2.76)	4.75 (2.36)	3.50 (0.85)	2.84	0.244
Product Diversification	6.50 (2.24)	5.85 (2.25)	5.10 (1.79)	2.66	0.264
Water Conservation Practices	3.43 (2.21)	3.60 (1.98)	4.20 (1.40)	1.70	0.428
Soil Improvement Practices	4.07 (1.90)	3.20 (2.19)	5.40 (0.97)	9.04	0.011*
Energy Saving and Use of Renewable Energy	7.57 (2.41)	8.05 (2.87)	6.80 (1.14)	3.11	0.212
Use and Conservation of Locally Adapted Seeds and Varieties	9.14 (2.07)	7.55 (2.24)	8.80 (1.48)	4.74	0.093
Safe Use of Pesticides	7.36 (3.25)	7.15 (2.72)	9.30 (1.06)	5.18	0.075
Minimum Wage Level	9.71 (2.70)	10.25 (2.36)	10.30 (1.83)	0.28	0.868
Gender Equality	9.79 (1.93)	10.00 (2.25)	10.50 (1.08)	0.67	0.716
Workplace Safety	8.07 (3.45)	7.90 (3.16)	10.70 (1.64)	6.77	0.034*
Secured Access to Means of Production	4.21 (3.51)	5.50 (3.61)	2.10 (0.99)	4.81	0.090

Sample sizes for each category are indicated in brackets. Statistically significant differences are marked with an asterisk (*) at $p < 0.05$.

Table 4. Kendall's Tau and Spearman's rho correlation results for correlation between the ranking of the three groups (experts/specialists, extension workers and farmers)

		Correlation coefficient		
		Expert/ specialist	Extension worker	Farmer
Kendall's Tau	Expert/specialist	1.000	0.687**	0.718**
	Extension worker	0.687**	1.000	0.515*
	Farmer	0.718**	0.515*	1.000
Spearman's rho	Expert/specialist	1.000	0.869**	0.869**
	Extension worker	0.869**	1.000	0.755**
	Farmer	0.869**	0.755**	1.000

The correlation of ranking by experts with extension workers and farmers was found to be significant at 0.01 level (2-tailed). This suggests that there is strong evidence to support the existence of a significant positive relationship between the rankings provided by government and academic experts and those provided by extension workers and farmers.

Discussion

The Mendelow's Stakeholder's Matrix result shows that government agencies were placed in the high power, high interest quadrant due to their regulatory authority and resource control. International development partners and regional research institutes, with significant financial resources and technical expertise, were positioned in the medium power, high interest quadrant. Stakeholders like the Farmers' Association, private input suppliers, transportation providers and retailers were placed in the high interest, low power quadrant. This categorisation facilitated strategic prioritisation and engagement of stakeholders. This aligns with other studies using the Stakeholder Matrix method, which find that government bodies and regulatory authorities are typically positioned in the high interest, high power quadrant (Ludovico *et al*., 2020; Reed *et al*., 2009).

Workshop participants excluded those indicators with high data requirements and sophisticated methods as well as indicators not applicable to small-scale horticulture production in Eritrea. For example, participants decided to exclude indicators such as Carbon Footprint, GHG Balance, Intensity of Material Use and Ecosystem Connectivity. Instead, they opted for simple practice-based indicators that could be easily measured and monitored. This aligns with other studies where stakeholders prefer indicators that are easy to measure and straightforward (Luján Soto *et al*., 2020). Accordingly, indicators like Net Farm Income, Stability of Market, Water Conservation Practices and Gender Equality were selected by all groups. This is also shown in case studies conducted in several other African countries, where indicators such as Crop Yield, Land Use and Water Consumption have been commonly used to assess agricultural sustainability nationally (Gebre & Rik, 2017; Yegbemey *et al*., 2014). This is linked to the challenges in gathering complex data and using sophisticated measurement techniques. However, focusing solely on these easily measurable indicators can overlook important aspects of

agricultural sustainability such as biodiversity, soil health and social equity, which are crucial for long-term sustainable development (Bender *et al*., 2016).

Both the Likert Scale and the Ordinal Ranking gave a similar result. Indicators such as Net Farm Income, Water Conservation Practices, Soil Improvement Practices, Secured Access to Means of Production and Stability of Market have got highest preferences among the respondents. Social sustainability indicators gained the lowest rank in both methods. This can be attributed to various factors. Economic indicators are often prioritised as they directly impact the financial well-being and profitability of farmers. This is in line with studies undertaken to assess the adoption behaviour of farmers to new technology or practices in Northern Iran where perceived income was the main driver in the adoption process (Ashoori *et al*., 2019). Other studies also support the tendency of farmers to favour economic indicators when selecting indicators (Latruffe *et al*., 2017; Van Calker *et al*., 2005) .

Scholars like Pretty (2007) strongly recommend use of social indicators and argue that agricultural systems with high levels of social and human assets are more able to innovate in the face of uncertainty. Nonetheless, social indicators are often perceived as less tangible and their measurement can be more complex and subjective compared to economic and environmental indicators (Murphy, 2017; Vivas & Hodbod, 2024).

The standard deviation values provide insights into the variability or dispersion of the responses for each indicator. In this study, indicators related to social sustainability, such as Minimum Wage Level, Gender Equality and Workplace Safety, have higher standard deviation values, suggesting that there is more diversity in the stakeholders' opinions or preferences for these indicators. Research examining farmers' views on social sustainability revealed that the perception of social sustainability is influenced by various factors, including production types (such as dairy, crop and other livestock), farmers' characteristics and awareness (Saleh & Hinrich, 2023). Indicators with

values lower than the weighted average indicate a relatively lower level of perceived importance. This means that most of the respondents have a low perception of the importance of most of the social indicators and two of the environmental indicators, namely Energy Saving and the Use of Renewable Energy and the Conservation of Locally Adapted Seeds and Varieties.

Indicators such as Net Farm Income, Water Conservation Practices and Soil Improvement Practices have high RII values of 0.92, 0.94 and 0.93 respectively. The high RII values in conjunction with the mean values indicate a strong consensus among the stakeholders regarding the significance of these indicators. However, it is important to note that while high RII values highlight the priority stakeholders assigned to specific indicators, this does not imply that other indicators, such as Gender Equality or Minimum Wage Level, should be deprioritised. The RII is also highly influenced by the background and expertise area of the respondent. Moreover, the concept of sustainability may have been interpreted differently by various stakeholders, which could have influenced how they assigned higher or lower values to specific indicators.

Comparing the mean ranking results of experts, extension workers and farmers, we observed that farmers prioritise indicators such as Net Farm Income and Access to Means of Production, specifically land and water. This observation is further supported by the results of the Kruskal-Wallis H test, which revealed statistically significant differences in the rankings of Net Farm Income ($p = 0.019$) and Soil Improvement Practices ($p = 0.011$) among the three groups. Farmers consistently ranked Net Farm Income higher, reflecting its critical importance to their livelihoods, while extension workers placed greater emphasis on environmental indicators like Soil Improvement Practices and Water Management Practices. These differences show the prioritisation of each group concerning agricultural sustainability. Farmers, whose daily activities are directly impacted by income and resource access, naturally prioritise economic and access-related indicators. Conversely, extension workers, with their focus on supporting long-term agricultural practices, may prioritise environmental sustainability indicators such as soil and water management. This underscores the importance of collaboration and cooperation among stakeholders. Such collaboration is crucial because it fosters a collective approach to implementing sustainable changes in agricultural systems, promoting knowledge sharing, innovation and resource sharing, which ultimately leads to more effective and impactful solutions for sustainable agriculture (Fraser *et al*., 2006).

... it is recommended to develop indicators with full and transparent participation from local and national stakeholders.

Both Kendall's (W) and Spearman's (rho) values for the comparisons between experts and extension workers indicate a high level of agreement. This suggests similar perceptions of

the indicators' importance by the two groups. However, the relatively lower W value of 0.515 for the comparison between farmers and extension workers suggests a lower level of agreement in their rankings of the indicators. This variance probably emanates from their immediate concerns. Usually, farmers are more concerned with their immediate economic needs by utilising the necessary resources to sustain their livelihoods like using excessive chemical fertilizers to maximize crop yield. Extension workers (mostly hired by the government) advocate for soil improvement practices such as crop rotation and organic fertilizers to protect the long-term health of the soil and prevent environmental degradation. This difference in priorities can lead to a difference in the selection of indicators to assess sustainability. Nonetheless, finding common ground and understanding between the two parties is crucial for the successful execution of sustainable farming practices.

It is expected that the level of agreement or concordance between various groups will vary based on their backgrounds, expertise and roles in the agricultural sector. However, it is important to note that correlation does not imply causation, and the interpretation of Spearman's Rank-order Correlation and Kendall's Coefficient of Concordance should be done in conjunction with other considerations, such as the theoretical relevance of the indicators and the specific goals and objectives of the sustainability assessment.

Conclusion and recommendations

This study aimed to identify and prioritise contextual sustainability indicators for horticultural production systems in Eritrea through a participatory, multi-stakeholder approach. Out of a long list of FAO-SAFA indicators, 12 indicators were deemed to be relevant by all stakeholder groups and feasible for measuring sustainability in the horticulture production system of Eritrea. However, the study revealed differences in the perceived importance of these indicators among the different actors.

These findings suggest that while there is a shared understanding of the overarching goals of sustainability, the pathways to achieving these goals may differ among stakeholders. This underscores the importance of inclusive and participatory approaches in sustainability assessments, where diverse perspectives are integrated to create more comprehensive and applicable frameworks.

The implications of this study extend beyond the context of Eritrea. The methodology used here, grounded in stakeholder engagement and contextual relevance, provides a replicable framework for assessing agricultural sustainability in other developing regions. Future research should continue to refine these indicators, ensuring they remain adaptive to changing environmental and socioeconomic conditions. Policymakers should consider these findings when developing sustainability guidelines for horticulture production in Africa, ensuring that the assessment of sustainability is both inclusive and reflective of local realities. NA94

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Food systems transformation in Zimbabwe

Effectiveness of participatory monitoring and evaluation

– By Joseph Tinarwo, Vain D.B Jarbandhan and Aaram Gwiza

The usefulness of participatory monitoring and evaluation (PM&E) in food systems transformation in Africa remains poorly explored. JOSEPH TINARWO, VAIN JARBANDHAN and AARAM GWIZA explain how PM&E is designed to measure programme effectiveness and is geared towards promoting programme ownership, empowering beneficiaries, enhancing transparency and accountability, and improving the projects and programmes. However, they caution that the effectiveness of PM&E in food system transformation requires adequate budgetary support, rolling capacity-building initiatives, multistakeholder partnerships, policy integration, and indigenous knowledge-sharing and learning practices.

Introduction

In the contemporary world, PM&E has received widespread recognition as a tool for measuring the effectiveness and credibility of development interventions (see Sage *et al*., 2021; Ruwa, 2016). In the context of food systems transformation, the concept of participation has been increasingly recognised as a vital strategy, because of its innovative methods of judging and learning from change that is more encompassing and open to the desires and ambitions of the people who are directly affected (Loveleen & Sukhdeep, 2019). In particular, the concept of PM&E deals with the meaningful involvement of primary stakeholders to facilitate significant development across societies (Rogito *et al*., 2020; Estrella & Gaventa, 1998). PM&E differs from traditional M&E because it strives to meaningfully involve key programme stakeholders in measuring and judging the progress of their programme – specifically the achievement of outcomes (Mujuru, 2018; Chambers, 1997). Bamberger *et al.* (2010) argue that PM&E focuses on the extent to which the programmes attain results.

Food systems transformation is imperative, mainly because of the multiplicity of challenges confronting food systems in achieving equitable access to healthy, nutritious food for all while paying attention to environmental sustainability and resilience to shocks (Von Braun *et al*., 2021; Webb *et al*., 2020). For stakeholders advocating for food systems transformation, the M&E process now demands innovative methods of measuring and learning from change that are more flexible, inclusive and participatory. Essentially, the argument is that conventional M&E is inappropriate for measuring development interventions to end hunger and all forms of malnutrition by 2030, as enshrined in Sustainable Development Goal (SDG) 2 (Fan & Swinnen, 2020; Fanzo, 2019). The rise and demand for PM&E in food systems transformation is a result of the need to promote transparency and downward accountability, as well as to enhance the active participation of the primary stakeholders of local beneficiaries and programme staff members (Kropp *et al*., 2020; Masset & Haddad, 2015).

There is a shortage of systematic evidence about the effectiveness of PM&E in transforming food systems. This study seeks to contribute toward addressing this gap. It is hoped that the findings from this research will help policymakers and development partners design and implement M&E systems for food systems interventions that can actively promote the participation of all stakeholders and beneficiaries at the grassroots level. The authors draw on lessons from Zimbabwe to understand the effectiveness of PM&E in food systems transformation.

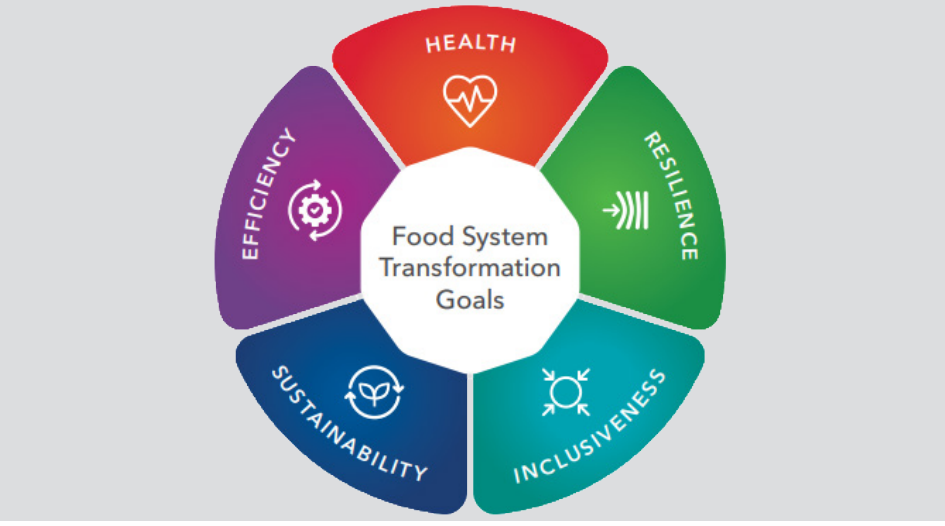
Conceptualising the role of PM&E in food systems transformation

The concept of food systems transformation and the argument for it stem from the 2017 United Nations High-Level Panel of Experts on Food Security (HLPE) Report on Nutrition and Food Systems. This report argues that some radical changes are needed in agriculture and food systems to achieve healthy, sustainable and equitable diets to meet the SDGs (HLPE, 2017; Von Braun *et al*., 2021). However, as Caron *et al.* (2018) argue, for food systems transformation to occur, food systems should:

- support every individual to follow a nutritious and healthy diet;
- demonstrate sustainable agricultural production and food value chains;
- deal with climate change and focus on building resilience; and
- promote the revitalisation of rural areas.

Figure 1 shows the five key features required in food systems transformation that are essential to address the challenges currently threatening local and global food systems (Swinnen *et al*., 2021). For nations to achieve the SDGs by 2030, their leaders must transform the food systems of these countries to ensure higher efficiency and the private sector must be given much-needed incentives to accomplish this. The barriers along the food supply chain (from production, transportation and food storage to food consumption) must be removed (HLPE, 2017). Food systems also need to produce healthy, nutritious and affordable foods while promoting their widespread consumption and paying attention to food safety (Fanzo, 2019). To achieve meaningful transformation, food systems must include smallholder farmers and traditionally excluded social groups such as women, youth and the disabled in decision-making. Notably, these systems should assist them in forming and strengthening their livelihood strategies (Fan & Swinnen, 2020). Role-players in food systems must also increase their efforts toward environmental sustainability by strengthening sub-national governance strategies. They must also use regulations, digital technologies and innovations to conserve and protect natural resources and biodiversity (Von Braun *et al*., 2021). Lastly, for food systems to achieve transformation, they must be resilient. Resilient food systems must potentially cushion or bounce back swiftly from shocks (FAO *et al*., 2020).

Figure 1: Food system transformation goals



Source: Swinnen et al., *2021*

With the drive towards promoting broad-based participation of all stakeholders in the development process, it is imperative that M&E also needs to be participatory (Guerra-López & Hicks, 2015; Bamberger *et al*., 2010). The proponents of food systems transformation advocate using participatory approaches in assessing and implementing food and nutrition security interventions (Kosec & Resnick, 2019; Lartey *et al*., 2018). Bamberger *et al*. (2010) define PM&E as a process through which all the stakeholders at different levels participate in the monitoring or evaluation of a specific policy, programme or project, share control of the activities, the process, and the outcomes of the M&E practice, and take part in finding applicable solutions. The use of PM&E in

food systems transformation entails the meaningful participation of local programme stakeholders and beneficiaries. Furthermore, these role-players should be given the opportunity to reflect on and learn from their practices (Rogito *et al.*, 2020; Pereira *et al.*, 2020). PM&E permits the programme managers and field staff to better understand different stakeholders' perspectives and community members' dynamics, which can contribute to transforming food systems (Sage *et al.*, 2021). In this way, PM&E increases the capacity and confidence of local programme staff and community members to articulate their priorities and criticisms of food systems transformation strategies, contributing to the interventions' sustainability and ownership (Masset & Haddad, 2015; Chambers, 1997).

Method

Research design

This research is premised on document search and a mixed research methodology, which used a survey and key informant interviews to determine the effectiveness of PM&E in food systems transformation. One advantage of using mixed methods is that the investigator can cover a relatively big sample size and gain insights into the population's attitudes, opinions, behaviours or characteristics (Creswell, 2014). The researchers purposefully sampled 65 respondents, as shown in Table 1. Thirty were directly involved in M&E programmes and projects related to food systems transformation within their respective organisations; 20 respondents held managerial positions as either directors or programme managers and a subset of 15 key informant interviews was purposively selected from the total sample of 65 members representing different stakeholder groups such as government, donors, civil society and community members. The researchers chose the respondents carefully based on their qualifications and experience in M&E and food systems transformation to ensure equal representation of all the stakeholder groups and genders to get rich and credible data (Bernard, 2017).

Sample

Table 1: Distribution of respondents by organisation and gender

Category of Respondents	*Frequency*	*Male*	*Female*
Government	*15*	*11*	*4*
Donors	*12*	*7*	*5*
Civil Society	*19*	*13*	*6*
Community Members	*19*	*3*	*16*
Total	*65*	*34*	*31*

Source: Responses from field survey, 2021

Data-gathering instruments

Questionnaires were used to collect quantitative data, while unstructured key informant interviews with different stakeholder groups enabled the researchers to understand the practical issues affecting different groups using PM&E approaches in food systems transformation.

Data collection procedures

Questionnaires were administered both face-to-face (mainly with community members) and virtually (through emails) as a Covid-19 pandemic preventive measure and because emails are usually fast, cost-effective and have a high response rate (Bernard, 2017). Each interview lasted approximately 35 minutes. The interviews were recorded using a voice recorder for transcription purposes.

Data analysis

Descriptive statistics were compiled using Statistical Package for the Social Sciences (SPSS) Version 22 software to determine how effective PM&E is in building project ownership, learning and empowering community members in the food systems transformation process. In addition, the researchers thematically analysed qualitative data from key informants and open-ended questions. The results from the analysis were used to develop a proposed conceptual framework for strengthening PM&E in food systems transformation in Zimbabwe.

Ethical issues

The researchers sought permission to research the individual organisations and their staff members. The researchers obtained individual consent from the participants. It was explained to the participants that they had the right to withdraw from the interview process without being penalised. The researchers assured participants that the responses would only be used for research purposes and that their confidentiality would be respected.

Results

Data from the interviews and questionnaires reveal that participants cognise that PM&E is integral in transforming food systems.

Through key informant interviews, 80% (n=12) of the respondents argue that using PM&E in food systems transformation is still a comparatively new development principle and practice in Zimbabwe.

Table 2: The purpose of PM&E in Zimbabwe's food systems transformation

Purpose of PM&E	*Strongly Agree*	*Agree*	*Undecided*	*Disagree*	*Strongly Disagree*
Building Project Ownership	*1.4%*	*54.3%*	*18.6%*	*25.7%*	*0%*
Enhancing Learning	*2.9%*	*78.6%*	*18.6%*	*0%*	*0%*
Empowering Beneficiaries	*1.6%*	*78.6%*	*2.9%*	*0%*	*0%*

Source: Responses from field survey, 2021

The study showed that 55.7% of the respondents believe that PM&E increases the project ownership of the beneficiaries at a community level. In addition, 81.5% of the interviewees argued that PM&E enhances learning for project beneficiaries and other food systems transformation stakeholders. Moreover, 80.2% of the respondents acknowledged that PM&E empowers project beneficiaries through involvement in and interaction with experienced food systems transformation and M&E practitioners throughout the project life cycle.

How PM&E differs from the conventional expert-led approaches

Key informant interviews revealed that external experts have characteristically led the M&E of food and nutrition security interventions. As a result, the assessment of programme performance was done using pre-set indicators, techniques and planning tools that exclude key stakeholders in the programme evaluation. The respondents working for the government on M&E confirmed that outside experts often conduct assessments. Beneficiaries were not allowed to participate in the decision-making on issues that affect them actively. In Zimbabwe's food systems transformation, questions such as how to implement participatory approaches and which strategies work in which settings are central to the theme of continuing discussions.

PM&E's approach to food systems transformation

A documentary search revealed that some stakeholders involved in Zimbabwe's food systems transformation using PM&E are doing so because of the pressure from donor organisations or other development agencies. Local non-governmental organisations (NGOs) mostly work as implementing agencies of large NGOs or donor organisations. For example, at the initial stages of the project or programme, the Foreign, Commonwealth and Development Office (donors) collaborates with different stakeholders to design the programme to establish the M&E framework and the indicators to be measured. In this way the process can be described as participatory when it involves the government, external M&E consultants and many NGOs. However, the primary beneficiaries at the grassroots level are usually not meaningfully represented or involved in these initial stages of the M&E process. The following quotes are illustrative:

> *While PM&E provides data for food systems transformation implementers and sponsors, it is important to note that, in most cases, the primary beneficiaries are not involved in the project design.* Key informant 1

In this way, PM&E in food systems transformation results in increased project ownership and accountability:

> *Once stakeholders agree on problems to be addressed, design interventions to manage them, and agree on performance measurement of expected results, there is increased ownership and accountability for achieving results.* Government Director

This enables PM&E to form part of Results-Based Management, which plays a vital role in achieving food systems transformation results:

> *PM&E is a critical part of Results-Based Management, as stakeholders participate in creating results to be achieved. They remain involved in measuring and monitoring these results throughout the entire lifespan of a programme*. Advisor, Zimbabwe Donor Agency

Participatory approaches can complement the traditional expert-led M&E, primarily based on more rigorous data-gathering methodologies. PM&E has created opportunities for various stakeholders at different levels to engage in dialogue. Community dialogue has strengthened the community's views and increased their engagement in programme implementation. As one director of a Community Working Group on Agriculture explained:

> *The use of PM&E in food systems transformation is practiced in the sub-national (ward, village, district and provincial) food and nutrition security committees in Zimbabwe.* Director of a Community Working Group on Agriculture

While it is widely acknowledged that PM&E plays a key role in ensuring food systems transformation in Zimbabwe, the PM&E process still faces several challenges. As the following quote illustrates, most of the challenges facing PM&E are related to capacity, sustainability and the extent of participation of all stakeholders:

> *Sometimes there are disagreements on indicators to measure or track a particular programme within the food systems transformation process, and the order of ranking priorities differs since different stakeholders have different agendas in every programme.* Chief of Social Policy

As one M&E specialist noted, the use of PM&E by many stakeholders involved in food systems transformation in Zimbabwe suffers from a lack of specialised PM&E staff:

> *Implementing PM&E requires high-calibre local expertise that is not always available in most organisations involved in food systems transformation and at the community level. Since there is a limited number of local staff with an understanding of M&E techniques, most organisations in food systems transformation rely on international assistance, thus compromising local ownership, participation, data utilisation and sustainability.* M&E Specialist

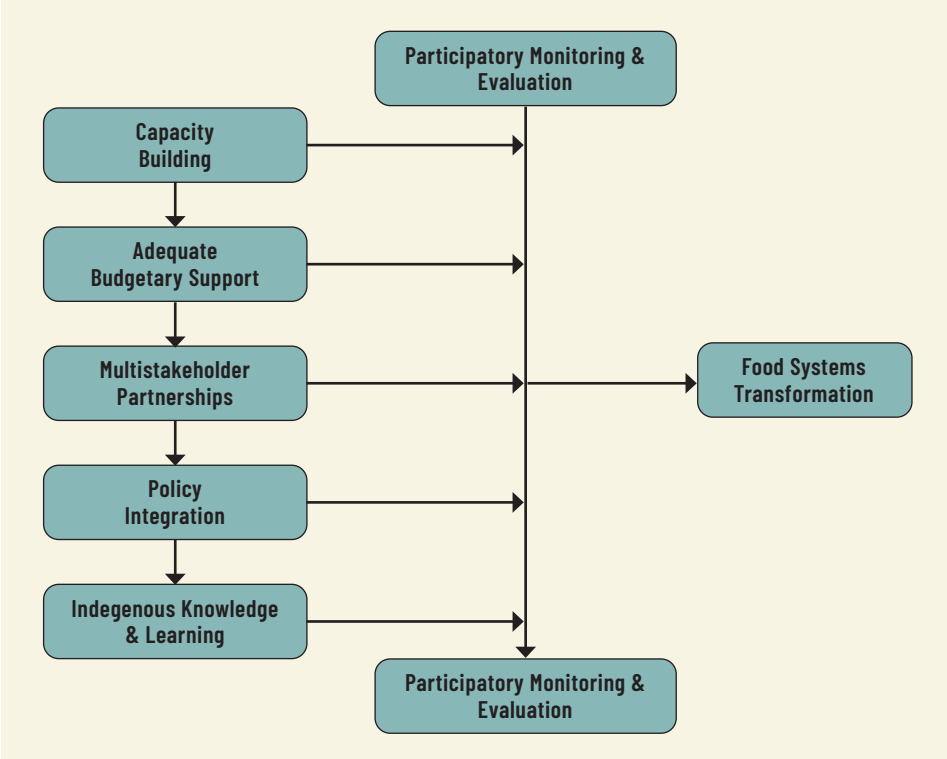
According to the Chief of Research and Evaluation of a donor organisation supporting food systems transformation in Zimbabwe, donors face several challenges in the design and operationalisation of PM&E systems. There are harmonisation challenges, including dealing with many stakeholders, grant management, data management systems and reporting challenges. The other challenges include difficulties in reconciling different stakeholder priorities and preferences, leadership and challenges relating to capacity building in implementing PM&E in food systems transformation. Lack of M&E experience also makes it difficult to establish who takes the lead and is accountable.

Donors supporting food systems transformation face challenges in designing and implementing PM&E systems in low-resource countries such as Zimbabwe. This is exacerbated by the lack of understanding about which stakeholders to include and exclude in the process. The unavailability of national standard procedures for implementing appropriate interventions also affects the data collection process. This, coupled with methodological problems, may result in challenges in estimation because of the variations in data collection procedures across implementing partners, government departments and other relevant stakeholders. Donors also face ethical challenges in implementing the PM&E approaches that emanate from collecting data on sensitive areas like malnutrition, livelihoods, resilience strategies and health.

Conceptual framework for strengthening PM&E in food systems transformation

Based on the results, the authors created a conceptual framework for strengthening PM&E in food systems transformation in Zimbabwe, as presented in Figure 2.

Figure 2: Conceptual framework for strengthening participatory monitoring and evaluation in food systems transformation in Zimbabwe



Source: Authors' own construction

Discussion

The study found that M&E is vital in Zimbabwe's food systems transformation agenda, as it strengthens programme management and enhances efficiency. In the absence of effective M&E, it is often difficult to judge whether food systems transformation is going in the right direction.

To strengthen the role of PM&E in food systems transformation, it is crucial to enhance human and institutional capacity building. While the Zimbabwean government has recently initiated the process of establishing M&E units in government ministries and the departments responsible for agriculture, environment, health and social protection, among others, there is a need to strengthen these institutions in coordinating and facilitating PM&E processes in food systems transformation. This may involve investing in training initiatives and exchange programmes to share best practices, skills and knowledge on food systems transformation. For instance, participating in international training programmes and capacity-building initiatives may facilitate skills transfer on participatory data collection and management, M&E and food

systems transformation to smallholder farmers, community leaders, extension workers, researchers and policymakers.

Further, it is important to ensure the engagement, coordination and harmonisation of diverse stakeholders involved in food systems transformation. Multisectoral coordination and multistakeholder partnerships between community members, farmer groups, research organisations and think tanks, government, donors, private sector and development partners in the M&E process of food system-related activities and initiatives encourage active participation and engagement, thereby reducing conflicts and duplication of efforts. For instance, establishing participatory mechanisms with regular consultations with diverse stakeholders in assessing food system-related projects and programmes reduces conflicts and promotes inclusivity and ownership.

... for food systems transformation, the M&E process now demands innovative methods of measuring and learning...

It is vital to ensure policy integration of PM&E into the national policy frameworks that support food systems transformation. This may entail aligning domestic, regional and international policies, strategies and programmes with participatory approaches and practices as it relates to food systems transformation. The active role of grassroots role-players in policy processes needs to be cultivated from policy planning to evaluation, establishing mechanisms for feedback from diverse stakeholders in the M&E process of food systems transformation projects and programmes. Involvement of diverse stakeholders, including grassroots role-players, in the food systems transformation processes from planning safeguards against challenges such as policy failure, policy missteps and policy inconsistencies because everyone is involved in decision-making processes.

Countries that have made good progress in transforming food systems, particularly those that are in developed nations, allocate substantial budgets to their government ministries and departments spearheading M&E and food systems transformation. Adequate budgetary support towards PM&E, as well as food systems transformation, is hinged on the government's ability to mobilise both financial and technical resources from domestic and international sources. Creating a favourable environment that allows the active role of the private sector is also crucial in mobilising resources from private institutions and organisations towards the development of innovations and startups that promote PM&E of food systems transformation initiatives.

In supporting sustainable food systems transformation, it is crucial to foster knowledge sharing through platforms such as workshops, conferences and networks to facilitate peer-to-peer learning, and dissemination of experiences and best practices.

Tapping into the effective role of indigenous knowledge sharing and learning is vital in promoting participatory PM&E in food systems transformation as communities have acquired profound insights into the knowledge of their local ecosystems, traditional agricultural practices and biodiversity over the years. For example, tapping into indigenous knowledge and learning practices in monitoring and evaluating food systems transformation projects and programmes allows stakeholders to gain insights into the practices that promote food system resilience and sustainability. The mainstreaming of indigenous knowledge sharing and learning practices into PM&E of food systems transformation initiatives promotes all-inclusive views and participation of grassroots people in decision-making processes, highlighting the importance of their traditional, social, cultural and ecological norms and practices.

Conclusion

PM&E forms an integral component of food systems transformation, and to successfully implement it, it is crucial to promote the participation of diverse stakeholders in decision-making processes. While no single formula or fixed guidelines explain how PM&E is implemented, adequate budgetary support, capacity building, policy integration, multistakeholder support and indigenous knowledge sharing and learning practices are crucial elements in establishing strong and sustainable PM&E systems in food systems transformation. The use of PM&E in food systems transformation cannot be successful if it simply extends a traditional, top-down function of a project or programme. Instead, food systems transformation actors need to design inclusive PM&E approaches and systems that are flexible, all-encompassing and inclusive of the key stakeholders, including the traditionally excluded stakeholder groups such as women, youth and marginalised people, from programme design to termination. Finally, it is imperative to mainstream and institutionalise PM&E systems throughout the entire food systems transformation process. NA94

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Big data in the food supply chain

The technological, organisational and environmental factors that play a role

By Osden Jokonya

The fourth industrial revolution has redesigned the future of food production and transformed the food supply chain. This advancement and evolution of digitalisation has enabled organisations to modify business models and processes resulting in new and increased revenue and enhanced value-offering opportunities. This has meaningfully altered and advanced the adoption of big data technologies in organisations. OSDEN JOKONYA argues that the adoption of big data in the food supply chain is important to African food systems and analyses the factors that affect its adoption.

Introduction

This study explores the technological, organisational and environmental factors that affect the adoption of big data in the food supply chain. It provides a content analysis of articles published between 2014 and 2022 using a quantitative research method based on the Technology-Organisational-Environmental (TOE) framework. The results suggest that technology factors (compatibility, perceived usefulness and relative advantage), organisational factors (technical skills, resource capacity and organisational readiness) and environmental factors (market structure and government pressure) all affect the adoption of big data in the food supply chain.

In a perfect world, the entire human race would have a satisfying meal every day, sustaining their daily nutrition intake and maintaining an excellent bill of health. This reality, however, does not exist. The World Business Council for Sustainable Development (2019) asserts that an imperative requirement for transformation is needed, as existing food systems exceed the resources available for food production. According to the World Economic Forum (WEF): "Almost two billion people do not have access to safe, nutritious, and sufficient food, while one in five children suffer from stunting and nearly one-third of the food produced each year is uneaten" (2020: 8).

The transformation of food systems is needed to deliver sustainable support for the growing population while concurrently creating opportunities within economies and supportable living for all societies (WEF, 2020). Digital technologies, especially big data, can help alleviate the challenges of food insecurity and improve food production within food systems. When looking at the food supply chain and the transformation of food systems through big data, it is important to investigate the factors affecting their adoption which potentially assists with improving the process and strategy across a food supply chain, known as 'from farm to fork'. This strategy, "addresses comprehensively the challenges of sustainable food systems and recognises the inextricable links between healthy people, healthy societies, and a healthy planet" (European Commission, 2020: 1). The study's objective therefore is to explore factors that affect the adoption of big data in the food supply chain.

Overview of food systems

The main challenge for global food systems is to ensure affordable, sufficient, nutritious and safe food for a growing population while minimising the environmental impacts and addressing climate change. The global number of hungry people increased from 564 million in 2015, when the Sustainable Development Goals (SDGs) were established, to 735 million by 2022 (Vos and Martin, 2024). A sustainable food system is crucial to the United Nation's SDGs, which call for transformative changes in agriculture and food systems by 2030 to end hunger, improve nutrition and ensure food security, requiring coordinated global efforts to make the system more productive, inclusive and environmentally sustainable (FAO, 2018). Fanzo *et al.* (2022:19) add that "sustainable food systems ensure food security and nutrition for all while preserving the economic, social, cultural, and ecological foundations needed to support food security and nutrition for future generations". While food systems have seen significant innovations over the past century, addressing sustainable food security for the growing population requires further technological advancements (Ross & Maynard, 2021). Adopting big data technologies is therefore important to address some of the challenges faced by the African food systems.

Industry 4.0

The fourth industrial revolution has redesigned the future of production and transformed the universal system of invention. This supports the reality that technological alteration is the key driver for the pertinent revolution in society and all industries within. Moreover, this notion emphasises that as the world evolves, new and existing groups of technology arise and merge to create enhanced methods of effectiveness and efficiency within businesses and society. "These rapid advances in technology are doing more than providing us with new capabilities, they are changing the way we live, work, and relate to one another" (Ross & Maynard 2021:159). Lately, the food industry has been challenged by swift and continuous variations due to the fourth industrial revolution, also known as Industry 4.0 or 4IR, which has assisted in altering the changing aspects of the trade inclusively. According to Philbeck & Davis (2018:17):

> *The idea of 4IR is often taken to be a synonym of Industry 4.0, focusing on the application of digital technologies to manufacturing. Industry 4.0 is an important component within the larger framing of 4IR with its narrower, vital focus on the relationship between digitization, organisational transformation, and productivity enhancement in manufacturing and production systems.*

As a result, these revolutions bring about endless opportunities and benefits for the transformation of food systems.

Food 4.0

Immense quantities of products with huge variety are produced within the food sector, while concurrently having to generate high expectations relating to quality and care, improved shelf lifespan and providing continuous consumer brand assurance. Organisations within the food supply chain sector are accountable for upholding and obeying high governing standards which are rigorously established as consumers constantly expect products to be safe, of high quality and readily accessible. Sandeep *et al.* (2021) state that the demand for food products is higher than ever before and resilience must be created within this sector for a variety of diverse food products to be provided. They add that it is unavoidable for organisations to tackle these circumstances and their services and offerings should be swiftly developed without any compromise on the excellence of these products. Consequently, food supply chains and the food sector must display flexibility and agility, and act speedily to respond to these ever-evolving conditions while simultaneously displaying efficiency and delivering products of high quality at the right time which are reasonably priced. These characteristics are all attainable through the implementation of technologies provided by Industry 4.0. According to Sandeep *et al*.:

> *The adoption of Industry 4.0 technologies is anticipated to revolutionise the food industry similar to automotive, aerospace, and other manufacturing. It will potentially substitute human intelligence and labour with technologies such as 3D printing, Robotics, automation, etc. The application of these technologies in the food sector is termed Food 4.0.* (2021:1138)

As a result, these revolutions bring about endless opportunities and benefits for the evolution of the food supply chain.

Overview of big data

The emergence of the big data era is not just associated with improved storage, but also with other factors such as advancements in increased computer processing power, the emergence of new technologies and the growth of the internet that made data more accessible, leading to a significant rise in data generation (Clissa *et al.*, 2023). Due to this, the model of industrialisation is being altered using smart technologies, namely, Artificial Intelligence, Robotics, Drones, the Internet, Blockchain and Big Data. These emerging technologies give rise to enhanced food production, processing, allocation and consumption. This study focuses on big data technologies as it is of utmost importance to understand the adoption of big data, its advantages and disadvantages, as well as the impact and possibilities within the food supply chain. When referring to big data, the distinguishing factor that is known to most is the data size (Manyika *et al.*, 2011). However, it can be defined as having the technological capacity to gather, collect, store, organise, process and distribute large amounts of data sets. "While at beginning, big data was defined by the 3Vs: volume, velocity, and variety. Volume refers to the exponential growth in the amount of data collected. Velocity refers to the speed of data collection. Variety refers to a large number of data sources and formats, the number of Vs has increased substantially to more than thirty" (Shekhar, *et al.*, 2017).

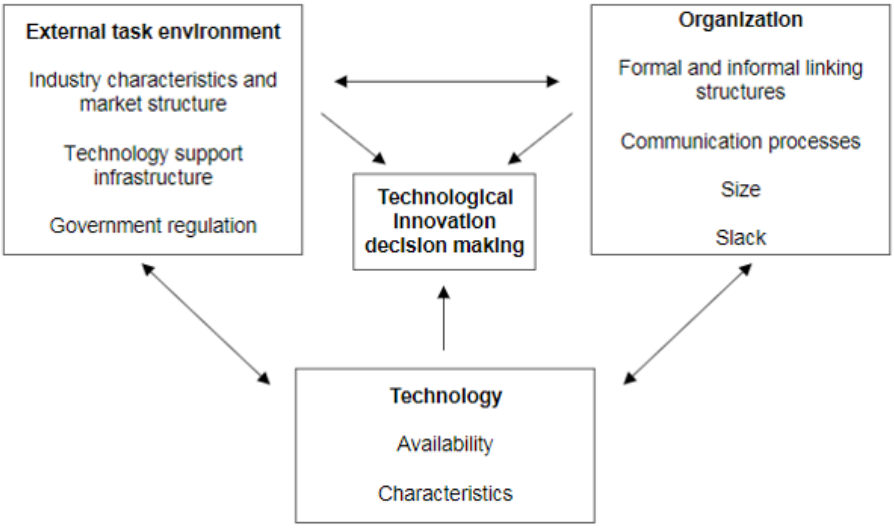
Talari *et al.* (2021) refer to big data as huge measures of speedily formed and collected, intricate online data gathered from numerous sources such as business studies, organisations, available online data records and social media platforms. "Big data is a term that describes large volumes of high velocity, complex and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information" (Clissa *et al.*, 2023). The capturing of new data will permit an improved decision-making process, promote an understanding of origination and optimise procedures within the food supply chain. Furthermore, it is seen to be a significant enabler in the use of value creation in businesses and government entities (Ylijoki & Porras, 2016:70).

The term big data was first introduced in the 1990s and interest has been amplified due to the substantial quantity of data produced during the 2000s (Clissa *et al.*, 2023). Data sets gathered consistently increase as data is continuously created from more devices and sources daily. These foundations of data sets produce enormous volumes of data and as technology evolves, more data will be gathered and collected as civilisation becomes increasingly reliant on technology. White *et al.* (2021) state that the use of big data can enhance farm cost-effectiveness, alleviate ecological risk and provide support in reaching the worldwide food security necessity. This could be a substantial disturbance within the technological space for businesses and academic environments in our current time (Agarwal & Dhar, 2014), as the immense measurements of the data collected can assist in dealing with problems that could not have been dealt with before (Oracle South Africa [OCI], n.d). "In the agriculture community, big data is often viewed as a combination of technology and analytics that can collect and compile novel data and process data in a more useful and timely way to assist decision-making (Shekhar *et al.*, 2017:7318)." However, the disadvantages of big data do exist, such as data errors, remoteness of the data, impracticable data, data mismatch, the lack of hardware and software to manage large data sets, and the non-existence of broadband infrastructure in distant areas which affect the adoption of big data in African food systems (White *et al.*, 2021).

TOE framework

Tornatzky and Fleischer (1990) established the TOE framework (Figure 1) to define the choice of technological innovation adoption by organisations grounded on the technological, organisational and environmental settings. The TOE framework is widely used in technology acceptance studies by delivering a beneficial view of e-solutions. This study uses the TOE framework to evaluate the adoption of big data technologies in digital food systems. The TOE framework identifies three categories of features that impact the methods businesses approve, implement and innovate into technological, organisational and environmental.

Figure 1: Technology, organisation and environment framework



Source: Oliveira & Martins, 2011:112.

Technological factors that influence the adoption of big data in the food supply chain

The technology context within the TOE framework is defined as the internal and external technologies that apply to an organisation, including the existing internal equipment and processes, as well as the external technologies that an organsation can access (Oliveira & Martins, 2011). Additionally, this refers to the existing technology settings within an organisation as well as the envisioned modernisation of technology that will act as an influential component in adopting the innovative technology that is on offer (Salleh & Janczewski, 2016). Hence, the core prominence is how the process of adoption can be influenced by the characteristics of the technology itself. Worldwide matters relating to food security and safety, sustainability and productivity enhancement are only some of the matters that the application of big data can potentially address. The potential benefits and capacity big data could offer the food supply chain are quite appealing, but the above challenges need to be addressed and alleviated to allow for an increased acceptance and application of big data as a technology to enhance these processes and procedures.

Organisational factors that influence the adoption of big data in the food supply chain

The organisational context is defined as the procedures related to the organisation such as the size, scope and decision-making processes (Oliveira & Martins, 2011). This setting encompasses numerous features that generally are representative of an organisation. Furthermore, these features may consist of strategy, values, principles and rules, which can either be seen as an organisational limitation or can act as an enabler when adopting innovative technology (Salleh & Janczewski, 2016). As more and more data sets grow and are formed daily and data customs become increasingly prevalent, they will become an important factor in our lives. Therefore, "the ability to access, analyse, and manage vast volumes of data is increasingly critical to successful operations of leading agribusinesses" (Ribarics, 2016:33). Manyika *et al*. (2011) advocate that big data may turn out to be a significant source of competition, supporting innovative growth in production and consumer excess if an organisation embraces the correct strategies and enablers.

Environmental factors that influence the adoption of big data in the food supply chain

The environmental context within the TOE framework is defined as the ground on which an organisation carries out its day-to-day operations, specific trade, competition as well as government interaction (Oliveira & Martins, 2011). Oliveira & Martin say it is the way "[I]n which a firm conducts its business – its industry, competitors, access to resources supplied by others, and dealing with the government" (2011:1120). Additionally, this context suggests that effects from the environment in which an organisation functions will occur when embarking on the adoption of technology (Salleh & Janczewski, 2016). Environmental factors affecting big data adoption include the government regulations to collect data from various sources, guarantee data safety and consumer unwillingness to share the data (Banica & Hagiu, 2015). This data collected can be a valuable aspect in product redesign and enhancement, reduction of costs and customer-centricity. Banica and Hagiu (2015) note that big data could act as a huge contributing factor in the documenting and understanding of consumer preferences, which will assist in creating and providing valuable information to aid new and relevant product creations.

Overview of related studies

A similar study conducted in the US used a qualitative research approach selecting and interviewing participants (Carolan, 2017). Additionally, a similar study conducted in the UK made use of a qualitative data collection method which included a detailed model to analyse and interpret the findings (Irani *et al.*, 2018). Finally, another research study conducted in the UK used a literature review based on a case study research design (Jagtap & Duong, 2019). Based on the literature review no study was conducted on factors affecting big data adoption in the food supply chain using quantitative content analysis with the TOE framework as the theoretical lens. On that note, this study will contribute to the body of work where there is a methodological gap.

Research methodology

The selected research design used to address the stated research question and its objectives for this study is a systematic literature review (SLR) with a quantitative content analysis design. Kitchenham *et al.* (2009:8) state that, "The aim of an SLR is not just to aggregate all existing evidence on a research question; it is also intended to support the development of evidence-based guidelines for practitioners." Aromataris

& Pearson (2014) propose that the SLR intends to deliver an inclusive, impartial combination of several related studies in a single paper. Mouton's (2001) findings establish that a literature review is a study of a non-empirical nature that uses secondary data with the research question being descriptive, therefore positioning itself with the study's research question. Additionally, Mouton (2001) explains that an analysis of content design comprises a textual analysis of secondary data which is empirical. The method of conducting an SLR is as follows: research question selection, bibliographic or article data selection, selection of keywords, applying practical screening measures, the application of methodological screening measures, conducting the review, and producing the findings (Fink, 2014).

Unit/s of analysis

As Babbie & Mouton (2001) indicate, the unit of analysis refers to the object of a study and examines objects to conceptualise a summarised account of all such elements. For this research study, organisations within the food supply chain are the chosen unit of analysis. The study's research objective is to explore the factors affecting the adoption of big data in the food supply chain. The study intends to conceptualise the factors affecting the adoption of big data in the food supply chain and therefore presents suitable reasoning for the chosen unit of analysis.

Research instrument

A literature search was conducted using keywords such as "Food Supply Chain", "Transformation of Food Systems", "Emerging Technologies", "Big Data", "Big Data Adoption", "Food 4.0" and "TOE Framework." This search aided in providing all articles relevant to the research topic and study. Articles published within the period 2014 to 2022 were chosen as the study was conducted in 2022 and 50 applicable articles were selected. These articles were then subjected to a manual coding process and were categorised according to the mode, frequency, correlation and analysis of variance of TOE factors as given in Table 1.

Table 1: TOE factors that influence big data adoption

Technological Factors	*Organisational Factors*	*Environmental Factors*
Complexity	*Organisational Readiness*	*Competition*
Compatibility	*Resource Capacity*	*Vendor Capabilities*
Cost	*Firm Size*	*Maintenance & Support*
Perceived Usefulness	*Technical Skills*	*IT Policy & Regulations*
Relative Advantage	*Management Support*	*Market Structure*
Security	*Strategic Objectives*	*Government Pressure*

Data sources, sampling strategies and techniques

The study adopted convenience sampling to access and select relevant peer-reviewed articles from free accessible databases for research study due to budgetary constraints. Convenience sampling also known as non-probability or opportunity sampling, involves picking a sample or samples without a primary probability-based method of selection (Price, 2013). The sampling strategy and technique involved the search for keywords relevant to the research from articles published from 2014 to 2022 including "Food Supply Chain", "Transformation of Food Systems", "Emerging Technologies", "Big Data", "Food 4.0" and "TOE Framework".

Research methods

The systematic review method ensures that the data is collected, classified and categorised into a content analysis matrix according to the TOE framework (technological, organisational and environmental factors). Primarily, the data collection technique used is qualitative as the sampling method applied is convenience sampling. A search using selected keywords aided in the sampling of peer-reviewed articles explored on selected databases such as Taylor Francis Online, AIS eLibrary and Science Direct. Aromataris & Pearson (2014) indicate that a systematic review preferably intends to provide a response rather than presenting a general summary of the literature related to a specific subject. Additionally, Aromataris & Pearson (2014) emphasise that the purpose of a systematic review is to amalgamate and sum up current information and does not pursue the creation of new information. Therefore relevant literature on the specific subject must be available and accessible.

Data analysis

The data analysis applied in the study consisted of categorising and tallying pre-defined settings which exist in the cluster of published articles. The 50 articles chosen were coded manually by the researcher constructed upon subjected clarification whereby the researcher acknowledged resemblances in the qualitative data and categorised this data into segments that share comparable content based upon factors that affect big data technology adoption. Reliability discusses the degree to which the outcome obtained by measurement and method can be repeated and replicated (Bolarinwa, 2015). Additionally, Bolarinwa (2015:198) states: "Reliability is an extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials." O'Connor & Joffe (2020) explain that inter-coder reliability is a mathematical measure of the arrangement amongst diverse coders based on how equal data is coded. In the form of data analysis, the qualitative data was transformed and coded into quantitative data. This quantitative data was then analysed using a statistical analysis tool (SPSS) to produce frequency, Analysis of Variance (ANOVA) and correlation arithmetical results.

Research results – demographics

This section of the study presents the results of factors affecting the adoption of big data in the food supply chain based on the published articles between 2014 and 2022.

Figure 2 shows the frequency of articles published between 2014 and 2022 based on factors affecting the adoption of big data in the food supply chain. The results presented indicate that 42% of the related articles were published between 2014 and 2018 while 58% of the related articles were published between 2019 and 2022. These results propose that there had been a steady increase in research produced within the stated periods,

despite a downward trough in 2018. Furthermore, 2014 and 2022 display the lowest research output at 2% each compared to 2021 which had the highest research output at 28%.

Figure 2: Articles published on big data in food supply chains by year

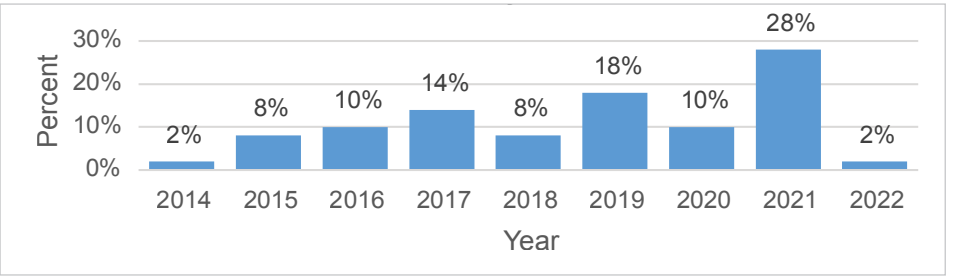


Figure 3 shows the frequency of articles published by region between 2014 and 2022 based on factors affecting the adoption of big data in the food supply chain. The results indicate that 42% of the related articles were published in Europe, 30% in Asia, 20% in America and 8% in Africa, the lowest research output region. The results show that Europe accounts for nearly half of the articles published on factors affecting the adoption of big data in the food supply chain between 2014 and 2022.

Figure 3: Articles published on big data in food supply chains by region

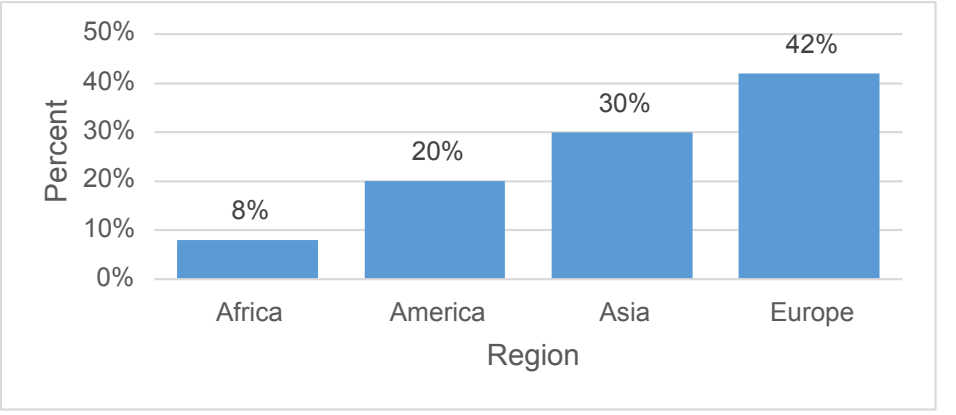
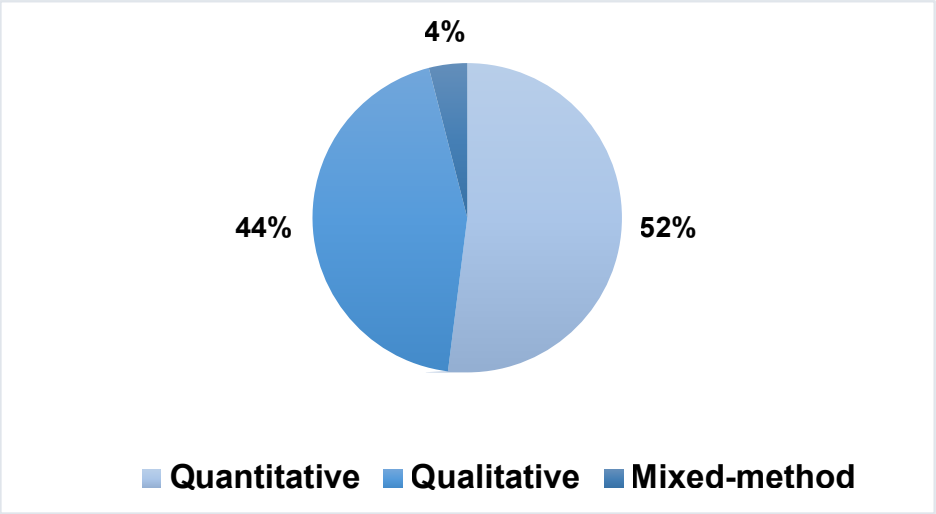


Figure 4 shows the frequency of articles published by research method between 2014 and 2022 based on factors affecting the adoption of big data in the food supply chain. The results show that most articles published conducted quantitative research at 52%, followed by qualitative research at 44%, and lastly, mixed-method research at 4%, the lowest research output by method. Additionally, the results propose that quantitative research was the most used research method when conducting studies on factors affecting the adoption of big data in the food supply chain between 2014 and 2022.

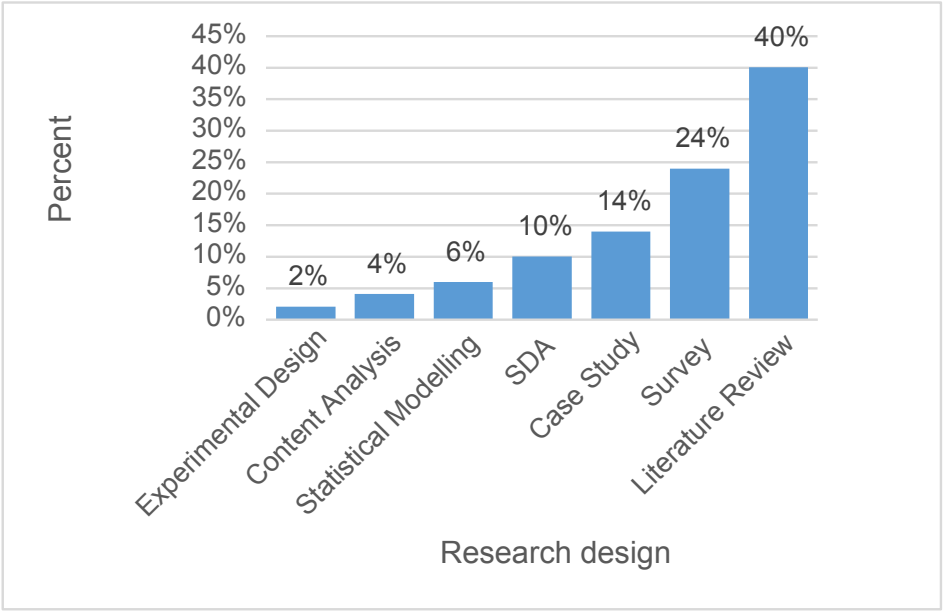
Figure 4: Articles published on big data in food supply chains by research method



Articles by research design

Figure 5 shows the frequency of articles published by research design between 2014 and 2022 based on factors affecting the adoption of big data in the food supply chain. The results propose that most articles published conducted a systematic literature review at 40%, followed by surveys at 24% and case studies at 14%. Additionally, the results propose that experimental designs were the least preferred research design at 2%, closely followed by content analysis at 4%.

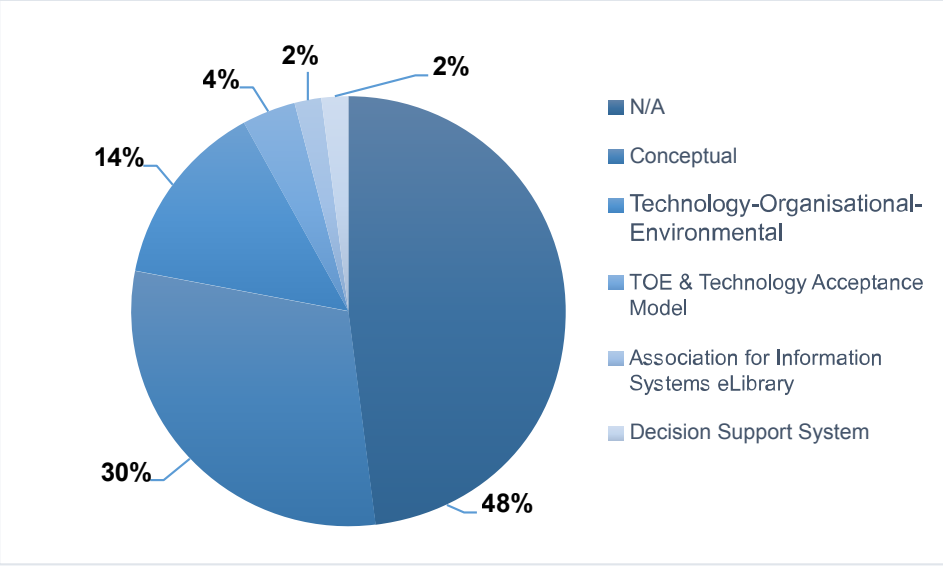
Figure 5: Articles published on big data in food supply chains by research design



Articles by the framework

Figure 6 shows the frequency of articles published by research frameworks between 2014 and 2022 based on factors affecting the adoption of big data in the food supply chain. The frameworks range from the Technology Acceptance Model (TAM), the TOE framework, the Decision Support System (DSS) framework and numerous conceptual frameworks. The results propose that most articles, at 48%, did not use a framework (N/A), whereas 30% of the articles applied conceptual frameworks. Additionally, the results propose that the TOE framework was applied within 14% of the articles, and 4% made use of a combined approach using the TOE and TAM frameworks. Lastly, the results propose that the DSS and Association for Information Systems (AIS) eLibrary frameworks were the least preferred research frameworks at 2%.

Figure 6: Articles published on big data in food supply chains by framework



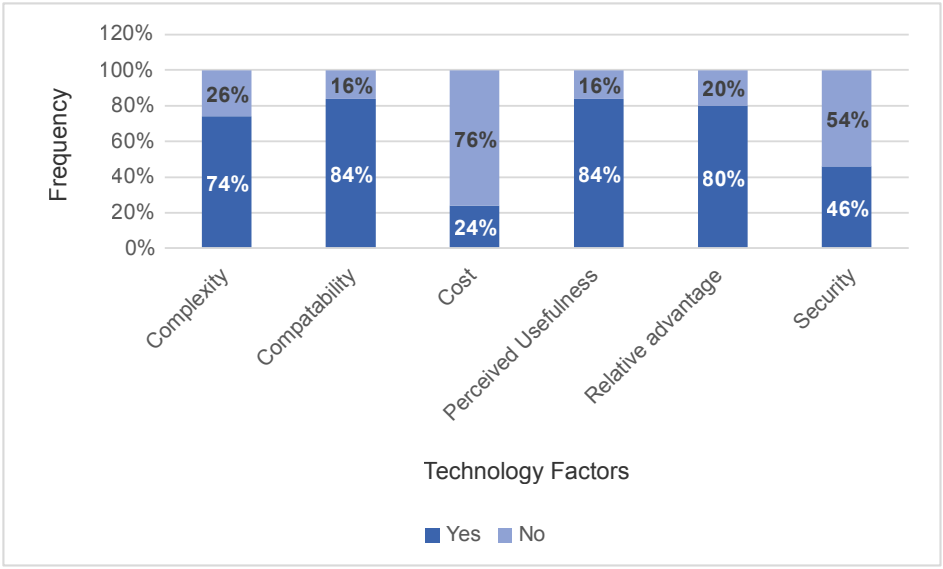
Frequency results of TOE factors

This section provides results from the study of the technological, organisational and environmental factors that affect the adoption of big data in the food supply chain.

Technological factors

The study analysed and measured six technological factors that affect the adoption of big data in the food supply chain: complexity, compatibility, cost, perceived usefulness, relative advantage and security. Figure 7 shows the frequency of technological factors that affect the adoption of big data in the food supply chain based on 50 published peer-reviewed articles. The results propose that compatibility and perceived usefulness were the most important technological factors to affect the adoption of big data in the food supply chain, at 84% each, followed by relative advantage at 80% and complexity at 74%. Only 46% of the articles covered the factor of security, with the least discussed factor being cost at 24%. The results, therefore, illustrate that organisations should consider compatibility and perceived usefulness as the most influential factors that affect the adoption of big data in the food supply chain.

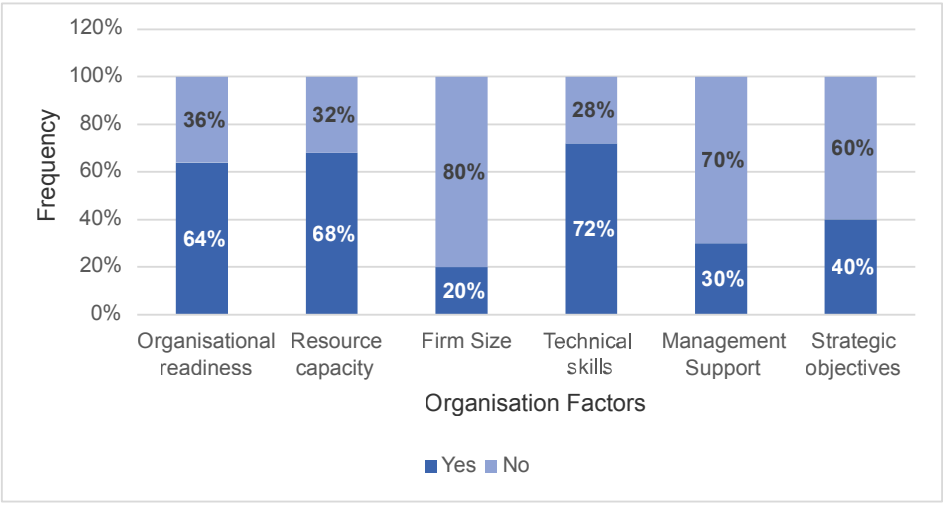
Figure 7: Frequency of technological factors



Organisational factors

This research study analysed and measured six organisational factors that affect the adoption of big data in the food supply chain: organisational readiness, resource capacity, firm size, technical skills, management support and strategic objectives. Figure 8 shows the frequency of organisational factors that affect the adoption of big data in the food supply chain based on 50 published peer-reviewed articles. The results propose that technical skills were the most important organisational factor, at 72%, followed by resource capacity at 68% and organisational readiness at 64%. Only 40% of the articles covered the factor of strategic objectives, followed by management support at 30%. Lastly, the least discussed factor was firm size at 20%. The results, therefore, illustrate that organisations should consider technical skills and resource capacity as the most influential factors that affect the adoption of big data in the food supply chain.

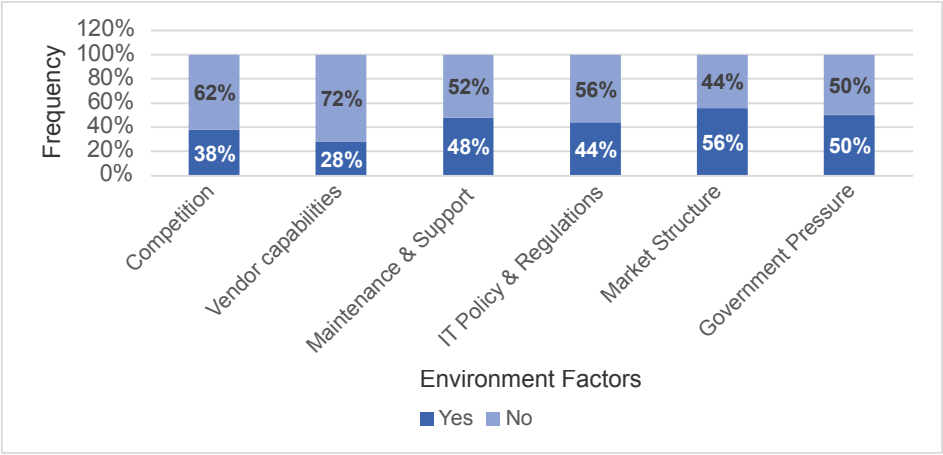
Figure 8: Frequency of organisational factors



Environmental factors

This research study analysed and measured six environmental factors that affect the adoption of big data in the food supply chain: competition, vendor capabilities, maintenance and support, IT policy and regulations, market structure and government pressure. Figure 9 shows the frequency of environmental factors. The results propose that market structure was the most important environmental factor, at 56%, followed by government pressure at 50% and maintenance and support at 48%. Only 44% of the articles discussed the topic of IT policy and regulations, followed by competition at 38%. Lastly, the least discussed factor was vendor capabilities at 28%. The results, therefore, illustrate that organisations should consider the market structure and government pressure as the most influential factors that affect the adoption of big data in the food supply chain.

Figure 9: Frequency of environmental factors



Discussion and conclusion

The research study conducted an SLR on factors that affect the adoption of big data in the food supply chain, focusing on articles published between 2014 and 2022. The study reviewed 50 articles and found that compatibility, perceived usefulness and relative advantage are the key technological factors that affect the adoption of big data in the food supply chain. The study results indicate that technical skills, resource capacity and organisational readiness are the key organisational factors that affect the adoption of big data in the food supply chain. The results also show market structure and government pressure are the key environmental factors that affect the adoption of big data in the food supply chain.

In conclusion, the study results suggest that there has been an increase in research output on the factors that affect the adoption of big data in the food supply chain which contributed to the upward research output in the regions. Furthermore, study results suggest that technology factors (compatibility, perceived usefulness and relative advantage), organisational factors (technical skills, resource capacity and organisational readiness) and environmental factors (market structure and government pressure) affect the adoption of big data in the food supply chain. The study contributes to the body of knowledge on factors affecting the adoption of big data in the food supply chain and may catalyse further studies on factors affecting the adoption of big data in the African food systems. NA94

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Affordable, accessible, healthy

Urban consumer knowledge and the use of indigenous food

By Nokuthula Vilakazi

For many residents in peri-urban areas, the price of essential healthy food items in supermarkets is unaffordable. At the same time, the more affordable informal markets tend to offer highly processed foods with low nutritional value. Indigenous foods are recognised for their potential to improve food and nutrition security, reduce malnutrition and enhance health and well-being, yet their use in urban areas is limited. In this article NOKUTHULA VILAKAZI explores the gap in urban consumers' knowledge about the availability, production, preparation and use of indigenous foods in the City of Durban, eThekwini Municipality, with a specific focus on cowpeas.

Introduction

Studies investigating food availability in urban areas have revealed that the urban food environments may not always offer affordable and nutritious food, particularly for low-income urban residents (Mudau & Mahlatsi, 2022). With an estimated 50% of the global population living in urban areas, and expected to rise to 70% (6.3 billion people) by 2050 (The World Bank Group, 2020), a complete overhaul of the global food system is needed to achieve optimal food security and reverse agro-food system damage (UNEP, FAO, & UNDP. 2023).

With more than half of the population in developing countries living in urban areas (United Nations Department of Economic and Social Affairs, Population Division, 2022), the impact of urbanisation on the food available to urban consumers is a cause for concern (Cockx *et al*., 2019). Rapid urbanisation has been accompanied by the expansion of supermarkets that drive the high acquisition of packaged, sugar-sweetened beverages and ultra-processed foods (Cockx *et al*, 2019). These supermarkets also offer healthier food options, which can cost up to 110% more in food energy compared to unhealthier options (Temple *et al*., 2011). The cost of basic healthy food items sold in supermarkets is unaffordable for low-income consumers (Vermeulen, Meyer & Schönfeldt, 2023).

High intake of ultra-processed and nutrient-deficient foods contributes significantly to the alarmingly high rates of non-communicable disease globally (Astrup & Bügel, 2019). Informal markets in urban areas typically provide affordable highly processed food to low-income urban residents (Battersby & McLachlan, 2013). Diversifying the urban food system by incorporating locally sourced, indigenous and seasonal foods can help tackle the challenge of providing affordable and healthier options (FAO, 2018).

Indigenous foods are primarily cultivated or sourced naturally in the geographic location of their origin (Mabhaudhi *et al*., 2017). The focus on indigenous foods also includes traditional foods as they have adapted to local conditions ending up confined to ecological niche areas (Kuhnlein & Receveur, 1996). Indigenous foods such as Amaranth leaves rank high in essential micronutrients such as vitamin A, vitamin B6, vitamin C, riboflavin and folate (Venskutonis & Kraujalis, 2013). As such, they are ideal for addressing food and nutrition security in their geographic locations of origin, particularly in rural areas (Mabhaudhi *et al*., 2017). The use of indigenous food in urban areas is under-reported (Slade, Baldwin & Budge, 2016).

South Africa's urban food environment is unique as it reflects the country's historic past, which saw the strategic placement of Africans on the outskirts of highly developed urban areas (Nenguda & Scholes, 2022). The urban food environment was primarily designed to cater for the elite with a desire for refined diets. While these changes have managed to meet the food demands, they have also brought undesirable changes in the food's nutritional quality.

Several indigenous foods were recognised with green leafy vegetables being the most popular. The participants identified mixed dishes such as *Isijingi* (cooked pumpkin mixed with maize meal), *isigwamba* (a mixture of green leafy vegetables and maize meal), *isithwalaphishi* (boiled beans mixed with maize meal) and *isigwaqane* (a dish made of cowpeas and maize meal). Younger participants showed limited knowledge of cowpeas and indicated that they would use cowpeas as a last option. Older participants maintained consumption to satisfy the craving for the indigenous foods that reminded them of their rural upbringing and culture and reported that availability and consumption of cowpeas has declined over the years.

Research methodology

Sample selection

The study was conducted in the city of Durban, eThekwini Municipality, South Africa. The target locations were north, west, south and central Durban (Figure 1) (eThekwini Municipality, 2022). The target was males and females older than 18 years, who are responsible for choosing and preparing food for themselves and/or other people based on their living circumstances.

Figure 1: The eThekwini Municipality functional regions

Source: eThekwini Municipality, 2022

The study employed a qualitative research approach using Focus Group Discussions (FGDs) to explore urban consumer experiences, knowledge and use of indigenous food.

The qualitative research approach was used to gain insight from urban consumers and inform the design of a survey questionnaire (Morgan, 1997). The empirical data generated by focus groups (FGs) can yield a wealth of information and vocabulary on a topic for developing a quantitative questionnaire (McNeill, Sanders & Civille, 2000).

Convenient sampling was used to select the participants. Research assistants approached individuals at the market, near supermarkets and taxi stations at strategic locations around Durban central to invite them to participate in the study. Individuals who accepted the invitation were asked screening questions to ascertain their eligibility for participating in the study. The ultimate objective for participant selection was to create an adequately diverse sample in terms of sex, age and place of residence (Table 1). Sampling was aimed at achieving socio-demographic and ideological diversity among respondents, to gain representation of multiple perspectives and experiences. Based on the eligible participant's preferred language, participants were handed information sheets in *isi*Zulu or English. Additionally, on the day of the FGD, the researcher read the information sheet and signed consent was obtained from participants before the start of each FGD. Each FG was organised according to gender and age groups.

A review of studies by Hennink & Kaiser (2022) concluded that the sample sizes for saturation when using FGs is between four to eight FGDs. Guest, Namey & McKenna (2017) suggested that two to three FGs can lead to 80% discovery of themes and 90% discovery is achieved in three to six FGs. Data saturation for this study was reached in the third FG. A total of five FGDs were conducted for the study.

Table 1: Demographic characteristics of the focus group participants

Characteristic	*N (26)*	*%*
Age		
Under 35 years	*12*	*46.1*
Over 35 Year	*14*	*53.4*
Gender		
Male	*15*	*57.7*
Female	*11*	*42.3*

The domains included knowledge, availability, accessibility, local names of indigenous dishes, knowledge of cowpeas, availability and accessibility of cowpeas, and local names of cowpea dishes. The questions were open-ended to minimise the use of leading questions and prevent participants from giving only yes or no answers.

Data collection

FGDs make it possible to collect information within a limited time frame and sample size (Morgan, 1996). A semi-structured interview guide with open-ended questions was used to maximise the pool of information gathered (Schlebusch, 2002). The structure provides flexibility with questioning according to topics raised and the level of participation

(Neumark-Sztainer *et al*., 1999). The semi-structured discussion guide was used to ensure consistency in questions asked across the groups and also flexibility with topics raised.

FG questions

FGD questions included in the discussion guide (Table 2) were developed by the research team through the process of identifying research objectives, selecting themes with specific questions, developing the guide and pilot testing. The study's overall objective was to determine urban consumers' knowledge and use of indigenous foods in the city of Durban, eThekwini Municipality. A literature review was conducted to establish a broad category of themes, from which specific questions that align with the study objectives were established. This led to the development of open-ended questions for each domain to encourage detailed responses and allow participants to freely share their experiences, opinions and perspectives. Probing questions were included to engage participants in greater depth and to ensure the flow of the conversation. The questions were organised in a logical sequence, progressing from broad topics to more specific concepts. The discussion guide was reviewed for content and readability by indigenous food experts, and modifications were made based on their suggestions. The discussion guide was pilot-tested with a small group of service staff (cleaners) and students in the Department of Consumer Science Food and Nutrition at the Durban University of Technology (DUT) that was similar to the study sample to identify any issues with the questions or flow. Feedback from the pilot test was used to revise the guide and further refine it accordingly.

A moderator led the conversation using a FGD guide with open-ended, semi-structured questions (Table 2). For quality assurance, an experienced moderator conducted the discussions in both *isi*Zulu and English, based on the initial screening of the participants during recruitment. Most of the participants responded in *isi*Zulu hence most of the group discussions were conducted in *isi*Zulu. The moderator was a well-trained professional with extensive training and experience in conducting FGDs in *isi*Zulu and English. The moderator worked from a predetermined set of discussion topics developed through an extensive literature review and consultation with indigenous food experts (researchers, farmers and government officials).

Table 2: Focus group discussion guide

1. *Describe the availability and use of indigenous and traditional foods in your area.*
2. *Are these the most commonly available indigenous and traditional foods in the area?*

(Show cowpea pictures – pass them around)

Now, let us talk about cowpeas. Please share your thoughts and experiences with cowpeas.

3. *Are cowpeas a common food in your area?*
4. *How do your past experiences with cowpeas influence the way you accept and consume cowpeas?*
5. *Are there cultural beliefs and symbolic values that you know about related to cowpeas?*
6. *Do you have any experience preparing dishes using cowpeas?*
7. *List recipes/dishes made using cowpeas that you are familiar with and know how to prepare.*

FDGs were conducted in the Department of Consumer Science's boardroom at DUT. During the discussions, an assistant took notes to ensure that all points in the guide were covered adequately as outlined in the Practical Guide to Focus-Group Research (Rosanna, 2006). Each FGD lasted a maximum of one (1) hour. The number of participants per FGD ranged between four and eight participants per session.

Data analysis

Audio recordings in *isi*Zulu were transcribed verbatim and translated into English. To ensure quality control, before translating to English the moderator and the assistant independently reviewed the transcripts against the audio recording and notes for potential discrepancies or incomplete data. The English transcripts were also cross-referenced with notes taken during the interviews.

Data was analysed thematically, codes were created, and inductive coding was used to gather themes inherent in the data. The data was evaluated using an inductive theme approach, as outlined by Braun & Clarke (2006). The inductive analysis allows themes to emerge from the data. Pre-defined domains from the discussion guide were used for the initial coding by two independent researchers and then jointly by the two researchers until a consensus was reached on the most appropriate codes. Transcripts were carefully examined, with representative similar quotes assigned the same codes.

Ethical clearance

Permission was provided by the Institutional Research Ethics Committee (IREC) at DUT (Ethical Clearance number IREC 024/23).

Results & discussion

Knowledge of indigenous foods

All participants were able to name indigenous foods that are used in their communities. Green leafy vegetables (*imfino*) were recognised as a popular indigenous food item by most participants in all five FGs.

> *Respondent 5: "In my area, indigenous food is easily available, especially umfino (green leafy vegetables)."*

> *Respondent 1: "In my area, we have maize, umfino (green leafy vegetables) and izinkobe (mixture of beans and maize)."*

> *Respondent 2: "We have imbuia (Amaranth) which is a type of green leafy vegetable that grows on its own, and is very nutritious."*

Indigenous food species are found in many geographic regions and are used for food and medicinal purposes (Demi, 2014). In the rainy seasons, edible indigenous and naturalised plant species are collected from the wild, fields where they grow naturally or backyard gardens where they are grown for subsistence (Nyembe, 2015). When in abundance, they are sold by street vendors to urban residents (Qwabe & Pittawaty, 2023).

Availability and accessibility of indigenous foods

The participants reported that they maintained personal connections to rural communities which made it easier to access indigenous foods that are not available in the urban area. The participants reported that most indigenous vegetables are collected from the maize fields in summer. They also mentioned that various beans, such as cowpeas, were cultivated alongside the maize crop. Edible indigenous species such as Amaranth have been reported to grow naturally in the wild, in fallow land with minimal inputs (Hart, 2010). Amaranth has also been domesticated and is grown in backyard gardens and small plots (DAFF, 2014).

The participants indicated that some local supermarkets, markets and vendors sold traditional or indigenous foods, but this was not always guaranteed. A study among Gauteng consumers found that lack of consistency in availability was one of the reasons for the low consumption of indigenous foods (Kesa *et al*., 2023).

> *Respondent 4: "Here in the city it is sold by vendors at the market."*

Seasonality was identified as a potential reason indigenous products were not always available. Poor agriculture practices and seasonality were recognised as factors affecting availability by some participants.

> *Respondent 1: "Most crops are seasonal, for example … beans and green leafy vegetables."*

> *Respondent 2: "Most vegetables are available in summer … beans, pumpkins and corn. Green leafy vegetables in my area are available throughout the year."*

Although seasonality is an important factor that affects fruit and vegetable consumption in general, people living in urban areas have an even lower intake than rural consumers (Stadlmayr *et al*., 2023). The findings from the review justify the FG findings.

Local names of indigenous dishes

Several dishes were identified as commonly prepared traditionally. Most of these are mixed with maize, which is the most commonly consumed cereal not indigenous to South Africa. Even though it is not indigenous, maize is an important cereal (Scheltema *et al*., 2015). Per capita maize consumption in South Africa is among the highest in Southern Africa, together with Lesotho, Malawi and Zambia, each exceeding averages of 100 kg/capita/year (FAO, 2021).

> *Respondent 2: "Isijingi (cooked pumpkin mixed with maize meal) and isigwamba (a mixture of green leafy vegetables and maize meal) are the most common indigenous foods in my area since it is easier to get the ingredients needed to prepare them."*
>
> *"We also have isikhuluphathi (boiled beans mixed with finely crushed mealies)"*
>
> *Respondent 8: "Phuthu (crumbly maize porridge) and (eaten with) green leafy vegetables."*
>
> *Respondent 5: "We have isigwaqane (boiled beans mixed with finely crushed mealies)"*
>
> *"We also have cornbread (fresh finely crushed mealies made into a steamed bread). When making this bread no rising agents are used, you simply crush the mealies and use their leaves to wrap the crushed mealies and bring to boil until well done."*
>
> *Respondent 1: "We have thwalaphishi (boiled beans mixed with maize meal), ubhomubhomu (white kidney beans) which is prepared differently from other beans."*

Some dishes with similar ingredients listed by the participants were given different names. For example "*isikhuluphathi*", "*isigwaqane*", and "*isithwalaphishi*" are composites of boiled beans and crushed maize or maize meal. Mkhize *et al*. (2023) also identified *"ingqumukazana"* (legumes mixed with fresh maize) as a traditional dish from KwaZulu Natal. Bambara and cowpeas *"imbumba"* were mentioned by a few participants

Easy access to modern ingredients driven by urbanisation has reduced the use of indigenous ingredients (Modi, 2009). Modern influences are seen through the modification of traditional preparation methods. Mixing traditional ingredients with modern ingredients has played a role in transforming traditional dishes across different communities (Mkhize *et al*., 2023). The use of modern ingredients was raised in all five discussions. Some of the participants recognised the modernisation of traditional dishes.

> *Respondent 3: "isiGwamba (green leafy vegetables cooked with finely crushed mealies) even though how we prepare it now is slightly different from how we used to prepare it back then."*

Plant breeding programmes specialising in researching and breeding indigenous vegetable food crops have succeeded in developing strains with different traits to the parent to address food and nutrition security (Mabuza, Mavengahama & Mokolobate, 2022). More research, however, is required to prove the speculations made by the participants regarding access to seeds and the use of fertiliser.

Knowledge of cowpeas

Despite the contribution to food security, consumption of cowpea (*Vigna unguiculata*) has declined over the years (Gerrano, Lubinga & Bairu, 2022). Knowledge transfer to the younger generation on the value of indigenous practices could help maintain their use (Dweba & Mearns, 2011). About half of the under 35-year-old participants did not know about cowpeas.

> *Respondent 3: "I don't know it…."*
>
> *Respondent 1: "It is my first time seeing it."*

Cowpeas face challenges related to soil quality and drought that limit their growth and availability (Bolarinwa *et al*., 2021). Factors implicated in the limited production of cowpeas in South Africa include climatic conditions, low productivity of genotypes, water stress, lack of improved cultivars, pests and diseases and poor storage (Bolarinwa *et al*., 2022). Some participants identified similar factors causing a decline in cowpea production in their areas.

> *Respondent 2: "We experience a lot of droughts in my area … it grows better in the summer seasons as we experience rains."*
>
> *Respondent 1: "It is not easily available as the soil conditions in my area is not favourable for its growth."*
>
> *Respondent 4: "Compared to few years ago, it is very little, we only have around 5 litres now."*

Availability and accessibility of cowpea

Cowpeas are found mainly at the Durban Fresh Produce Market (DFPM) and surrounding rural communities (Mkhize *et al*., 2023). Farmers specialising in indigenous crops such as cowpeas have a dedicated market space accessed by marketers and street traders.

> *Respondent 3: "There's the brown one … which is found mostly in the markets."*
>
> *Respondent 4: "The black-eyed are easily available … it can go for R13 ($0.69) per kilo."*
>
> *Respondent 1: "It is sold in buckets by some ladies in the market."*

Smallholder farmers are critical for the production of underutilised species. Indigenous species are produced mostly for subsistence purposes with the excess sold in informal markets (Masuku & Bhengu, 2021).

Most participants indicated that they did not use cowpeas as frequently as they had done growing up. On average, cowpeas were consumed at least once a week by the participants.

> *Respondent 2: "I love it … but I prepare it on days where I am not busy as it takes longer to cook through."*

Respondent 3: "I have it at least once a week … it is the type of traditional food that one misses regularly."

Respondent 1: "I eat it once a week, on other days I eat cabbage."

Respondent 2: "If cowpeas are not available, I replace it with red speckled beans … or we eat homegrown chicken."

Cowpeas were desired due to nostalgia for memories of their rural upbringing.

Respondent 1: "I am very fond of it … my mother cooks it really well back home."

Respondent 3: "I have very good memories of it … I only consume it only when I am home … I am afraid that if I cook it myself, I may not do so well."

Respondent 6: "Growing up, we went to events just to get it and other traditional foods … it reminds [me] of the old times."

Other reasons for consuming cowpeas were the awareness of their nutritional value, filling properties and versatility.

Respondent 4: "I consume it because it is filling … a small portion but increases … when cooked."

Respondent 2: "I consume it as a substitute … it is as nutritious as meat."

Respondent 1: "I love cowpeas, I love beans so I usually eat them … it has the same nutrition as meat."

Respondent 3: "I consume it because it is easily available and also very affordable."

Local names of cowpea dishes

Underutilised food species have a role in the traditional practices of many Africans (Lewu & Mavengahama, 2011). They remain part of the culture of African societies. Although participants identified several indigenous names, the common name for cowpea known to most participants was *"imbumba"*.

Respondent 3: "I know of Umzumbe (brown beans); uphizi (black eyed peas) … izindlubu (Bambara beans)."

Respondent 1: "I only know three varieties which are Umzumbe (red beans), imbumba (cowpeas) and Bhomubomu (kidney beans)."

Respondent 4: "Umzumbe (brown beans), ubhomubhomu (big white kidney beans), izindlubu (Bambara beans), udali (dhal), nophizi (black eyed peas). "

Participants also used colours to identify and differentiate varieties.

Respondent 3: "we name them based on their colours … we have red beans, white beans, black beans, etc."

The participants identified different preparation methods for common cowpea dishes.

> *Respondent 4: "making isigwaqane, you wash the cowpeas and boil them until well done … add maize meal and mix until well mixed."*

> *Respondent 4: "Growing up at home they used to boil potatoes and cowpeas separately. Once cooked they would mix it together and we would have it as a meal."*

> *Respondent 1: "I wash it, boil and add salt and then it is ready to be served."*

Some participant's descriptions included a modern twist to the preparation.

> *Respondent 4: "If I am preparing isigwaqane, once my beans are well cooked, I add a bit of margarine to make it smoother."*

> *Respondent 2: "I consume it … prepared as curry or isigwaqane"*

> *Respondent 5: "…when making curry, you boil [cowpeas] and on the side sauté your onion and add spices before adding your boiled cowpeas."*

> *Respondent 3:"When cooking isithwalaphishi/isigwaqane, I pick my beans, wash and boil …. Once well-cooked I add enough maize meal and stir until the maize meal is also cooked".*

Motives behind the rejection of cowpeas

Past experiences with a food can influence one's subsequent eating behaviour (Piqueras-Fiszman & Jaeger, 2016). Poor associations with foods such as cowpeas have been investigated by other researchers (Kesa *et al*., 2023). Past experiences were also given as reasons for rejecting cowpeas by some participants.

> *Respondent 6: "We consumed too much of it while growing up as we were financially not stable at home, so now I don't enjoy consuming it as it brings back those bad memories."*

> *Respondent 6: "When my great-grandmother ate it, she would get heartburn."*

> *Respondent 4: "I have heard that traditional healers are not supposed to consume cowpeas as it hinders with their gift of seeing things, so they end up lying to people."*

Legumes are known to cause flatulence and bloating which has been identified as a barrier to consuming legumes such as cowpeas (Akissoé *et al*., 2022). Legumes contain non-digestible oligosaccharides with potential side effects including gas, bloating and stomach cramps. Consumers often avoid including legumes in their diet because they do not know how to reduce the negative effects.

Discussion

The participants had an acceptable knowledge of the most common indigenous species in KwaZulu-Natal. Green leafy vegetables were reportedly known by most of the participants. Cowpeas were not as popular and appeared to be typically popular among older participants. According to the participants, lack of availability resulting from limited access to urban areas was the cause for low consumption. Furthermore,

... basic healthy food items sold in supermarkets unaffordable for low-income consumers.

seasonality makes it difficult to meet the demand for regular consumers of the indigenous species in rural and urban areas (Weinberger & Msuya, 2004).

Even though indigenous foods are seen as an affordable option compared to cash crops, the high cost of electricity in South Africa increases the processing cost. Factors such as the long cooking time limit the consumption of some indigenous foods in urban areas because of the high energy cost (electricity) involved in preparing the dishes. The long cooking time associated with preparing cowpeas has proven to be a major barrier (Chopera *et a*l, 2022). Time scarcity cited by urban consumers drives them to food that requires little or no preparation time (Jabs & Devine, 2006). In addition to the high cost of electricity, South Africa can also face serious problems with the irregular supply of electricity, which is among the leading contributors to the rising levels of food insecurity in the country (Comins, 2023).

Having a rural contact helped urban consumers maintain a supply of indigenous foods (Matenge *et al*., 2011). Some participants expressed concern about not being able to consume indigenous foods but most of the younger participants were not interested in indigenous food species. The lack of interest in foods regarded as traditional or rural among younger generation urban consumers has been reported by other researchers (Cloete & Idsardi, 2013). Reflections from a young Asian American echoed the low acceptance of traditional foods in industrialised communities (Magpayo, 2023). The smell and taste of indigenous foods have been cited as unacceptable by young people. Younger consumers choose foods regarded as acceptable by the society they identify with, which are highly processed foods. The taste of indigenous species is seen as inferior compared to processed foods (Weinberger & Msuya, 2004).

For young people, food choices are driven by the desire for convenience (Kuhns & Saksena, 2017). Lack of knowledge transfer of indigenous species from the older generation to young people compromises the sustainability of indigenous species. A study among younger consumers in the North West province of South Africa found limited knowledge of indigenous food (Matenge *et al*., 2011).

Conclusions

Several factors need to be considered to fully understand the use of indigenous food in urban areas. Seasonality, coupled with the impact of climate change, has been found to negatively affect the sustainability of indigenous food species and subsequent use by consumers. Having a rural background was found to positively influence the use of indigenous foods in urban areas. Barriers were found to be lack of time to prepare indigenous foods that need long cooking such as cowpeas, and the inferior smell and taste due to unfamiliarity. More research and strategies are required to overcome the identified perceived barriers. The strategies need to also consider additional factors such as the high cost of electricity, which is putting more pressure on the country's food security. Deliberate efforts targeted at educating urban consumers about the importance

of indigenous foods through supportive policies, strategies and programmes, such as the production and distribution of indigenous recipe books, and giving support to food service establishments that promote indigenous foods must be considered. NA94

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Dateline Africa

A focus on the food-security crisis

By Martin Nicol

1 June 2023 to 30 September 2024

This Special Issue of **New Agenda** *focuses on food systems in Africa amid the current and worsening food security crisis resulting from a multiplicity of causes, some of which stem from the historical roots of colonialism and land dispossession. More recently, food security on the continent has been severely further undermined predominantly by two factors: Firstly, climate change – which is hitting Africa most severely although it is the continent least responsible for it – has directly and indirectly caused weather catastrophes and ongoing chronic depletion of agricultural resources, severely impacting nutrition levels, especially among children. Secondly, in many countries violent instability in the form of large-scale abductions, mounting atrocious attacks by Islamic extremist forces, civil war and generalised widespread violence between armed gangs and, in places, farmers and nomadic pastoralists, have led to the disruption of farming cycles and the displacement of millions of civilians, driving many across borders and into refugee camps where they are dependent on food aid and increasingly food insecure. This issue of* **New Agenda** *has been published in partnership with Food Systems Research Network for Africa (FSNet-Africa), which is committed to finding solution to these challenges that translate into tangible outcomes and impact. Their inclusive, innovative transdisciplinary methodology embraces academic and non-academic stakeholders, including farmers at the cutting edge of implementation. IFAA is proud to be associated with this initiative and our regular Dateline Africa column in this issue is dedicated to food-related issues.*

SEPTEMBER

17 September: An estimated 1.4 million people in Namibia, nearly half of the national population, are considered to be in a state of food crisis. By October, the situation will be even worse. Unless rains come early this year, many people will face starvation.

AUGUST

23 August: The buying power of South Africa's monthly national Child Support Grant (CSG) has decreased over time, despite nominal increases to reach its present level of R530. If the CSG had increased at the rate of inflation since it was introduced after 1998 it would now be R760. As it stands, the CSG no longer covers the minimum nutritional needs of a child. South Africa is facing a crisis of child malnutrition, which in turn affects health, learning and all areas of development, according to Dr Katharine Hall at the Children's Institute in Cape Town.

01 August: The United Nation's Famine Review Committee confirmed that famine is under way in Sudan, which has been ravaged by civil war since April 2023. This is only the third time the UN has used the word "famine" since the Integrated Food Security Phase Classification (IPC) system was established two decades ago. IPC Acute Food Insecurity (AFI) Phase 5 (Famine) in Sudan was predicted "with reasonable evidence" from July / August 2024 to January 2025 in the camps of Internally Displaced Persons (IDPs) in El Fasher in Darfur. The previous two UN declarations of famine were also in Africa – in parts of Somalia in 2011 and parts of South Sudan in 2017.

General Mohamed Hamdan 'Hemedti' Dagalo [Rapid Support Forces [RSF]] (left) and General Abdel Fattah al-Burhan [Sudanese Armed Forces [SAF]] (right) are using mass starvation as a weapon of war. The war in Sudan is supported by the cynical rulers of the United Arab Emirates (UAE) and Saudi Arabia. The African Union has made futile efforts to bring the parties to the negotiation table.

JULY

29 July: Protracted violence and conflict are the biggest drivers of "devastating and unprecedented" malnutrition in north-eastern Nigeria according to a BBC report. Killings and abductions by militant Islamist groups have forced millions of people to flee from their land. This comes on top of decades-old violence between farmers and pastoralists. The situation has been exacerbated by climate change as rising temperatures result in worsening harvests and soil degradation. A total of 4.4 million children under five and nearly 600,000 pregnant women in this region are acutely malnourished, according to the United Nations World Food Programme. Médecins Sans Frontières's Medical Director, Catherine Van Overloop, said the number of

acutely malnourished children across northern Nigeria has more than doubled since mid-2023. She warned of the long-term impact on children, saying they "face developmental and cognitive issues".

24 July: One in five people in Africa faced hunger in 2023, according to the latest *State of Food Security and Nutrition in the World* report published by five United Nations specialised agencies. If current trends continue, about 582 million people will be chronically undernourished in 2030, half of them in Africa. 2030 is the target date for the world to achieve Sustainable Development Goal (SDG) 2, Zero Hunger. While Latin America shows improved statistics on nutrition (because of improved institutions) according to the report, Africa experiences more conflict as well as climate disasters influenced by climate change, which impact food insecurity on the continent.

21 July: Lesotho declared a national food insecurity disaster spanning eight months from July 2024 to March 2025. "As a result of the El Nino droughts, it is projected that

about 700,000 Basotho will need support to have food." The World Food Programme (WFP) has stated that Lesotho is still recovering from the effects of the 2020 drought, with 40% of the country's population (around 1.2 million people) affected by food insecurity.

King Letsie III, Lesotho's head of state, is the African Union Nutrition Champion. In March 2023 he hosted a continental event in Maseru on nutrition and food security to mark the AU African Year of Nutrition. The king was named Special Ambassador for Nutrition for the Food and Agriculture Organisation (FAO) at an International Symposium in 2016 held to explore country-level challenges and successes in the nutritional reshaping of food production, processing, marketing and retail systems. The king's brother, Prince Seeiso, the Principal Chief of Matsieng, told the *Lesotho Times* on 21 July 2024 that the king is passionate about issues that affect the nation, particularly food security. "His wish is to see every Mosotho go to sleep on a full belly … He believes that every individual has the right to a full stomach and that no one should have to go hungry."

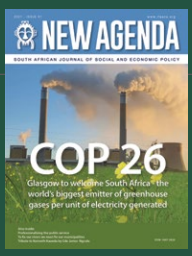
11 July: *The Economist* reported that soaring food price inflation is hitting Nigeria's poor. Overall, food price inflation was 41% in May compared to the previous year. Staple foods have trebled in price. The cause is government economic blunders and conflict, which have contributed to a weakening currency. Nigerians were already spending 59% of household incomes on food in 2023, a higher share than in any other country in the world.

3 July: African parliamentarians, in collaboration with key stakeholders, launched the Pan-African Parliament Model Law on Food and Nutrition Security. The Model Law provides parliamentarians with guidelines to design sound legal and institutional frameworks that promote and protect food and nutrition security and the right to adequate food in their respective countries. The Model Law is a collaborative effort between the Pan-African Parliament, the Food and Agriculture Organisation of the United Nations (FAO) and other partners.

JUNE

1 June: The United Nations Children's Fund (Unicef) found that 20 countries account for 65% of the total number of children living in "severe child food poverty". Ten of these countries are in Africa – and South Africa is one of them. Household income is not the only driver of child food poverty. Unicef found severe child food poverty in poor and non-poor households. Poor feeding practices occur when there is a lack of effective education on child feeding for parents and families. In addition, the overabundance of nutrient-poor ultra-processed foods in shops and markets is an ever-growing challenge: "Poor food environments are disrupting access to nutritious and diverse diets" (*Child Food Poverty Report 2024*).

1 June: The Unicef 2024 report stated: "Globally, one in four children are living in severe child food poverty in early childhood, amounting to 181 million children under five years of age … The global food and nutrition crisis and localized conflicts and climatic shocks are intensifying severe child food poverty, especially in fragile countries."



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For 25 years we have published *New Agenda: South African Journal of Social and Economic Policy* to provide you, our readers, with informed and impartial analysis that you can rely on. We publish sound and reliable information that you need to call those in power to account.

"Our huge inequalities in wealth are intolerable, including the incredible gap between top managers and employees. Our legacy of social discrimination based on colour is unacceptable, including the persisting divide between affluent suburbs and desolate townships. Our state-owned enterprises, which are supposed to be engines for development, are actually serving as employment agencies for a small overpaid middle class. The public service has been allowed to slip into a dream walk where form filling and token effort is enough to bring in a stable income for officials.

"All this points to an urgent need for civil society and progressive intellectuals to raise their voices and demand a much more serious effort by all concerned to rebuild our country on a better foundation. Let us work on that." Prof Ben Turok, 26 June 1927 – 9 December 2019 Former editor of *New Agenda*

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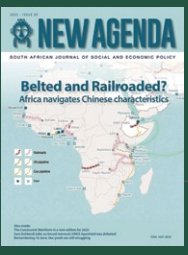

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