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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Professor Amiena Bayat is an associate professor of Economics at the Institute for Social Development (ISD), University of the Western Cape (UWC). She has undertaken research for the South African Presidency, the UN Development Programme (UNDP), the UN Industrial Development Organisation (UNIDO), National Treasury, and the European Union. She is a research fellow with FSNet Africa researching food systems in Africa.

Mark Volmink, newly appointed operations manager of Fossil Free SA, is a PhD student at UWC working on the water, energy and food (WEF) nexus in food security. He has extensive leadership and management experience in the private, government and civil society sectors, having worked in institutions such as Social Change Assistance Trust, Inyathelo: The South African Institute for Advancement and Intellimali.