

HARNESSING ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE CONSUMPTION AND DIETS IN AFRICA'S FOOD SYSTEMS

Emmanuel Ndhlovu

College of Business and Economics, University of Johannesburg, Auckland Park, South Africa

Abstract

Most Artificial Intelligence (AI) applications in food systems focus on the supply side (production, efficiency). There is a research gap on how AI can effectively influence consumer behaviour to promote sustainable, healthy diets without manipulative or invasive personalised marketing. This article aims to close this gap that has practical and policy implications. This article explores how AI applications can shape and influence sustainable consumption and diets in Africa, identifies the challenges of integrating AI for sustainable consumption and diets, and examines opportunities for integrating AI applications for sustainable consumption and diets. This article is based on qualitative data collected from 26 research and policy experts working on African agriculture and food systems. The data was collected through in-depth interviews between August and November 2025. The findings show that leveraging AI for sustainable consumption and diet in Africa presents a transformative opportunity to enhance food security, improve nutritional outcomes, and reduce environmental impact across the continent. AI applications are particularly vital in addressing the double burden of malnutrition, where undernutrition and obesity coexist, by enabling personalised nutrition, improving supply chain efficiency, and promoting climate-smart agriculture. The article concludes that to maximise impact, relevant stakeholders must develop tailored, low-cost AI solutions and foster public-private partnerships, especially in regions with limited resources.

Keywords: Artificial Intelligence, consumption, food, food systems, sustainability

1. Introduction

The sustainable transformation of Africa's food systems must not be limited to production and supply chains; it must also address consumption. Food consumption must be conceptualised as integral to the broader efforts toward food system transformation. Understanding consumption and dietary patterns is a critical, often-overlooked leverage point in food system transformation research and policy. While many strategies focus on supply-side technological solutions, the demand side has received little scholarly attention. Nonetheless, understanding the demand side (what, how, and why people eat) is equally essential for creating sustainable, healthy, and equitable food systems. Neglecting the demand side threatens to undermine efforts to transform and sustain the food system. Diets are a primary driver of environmental degradation (Fanzo et al., 2022). Actions such as dietary shifts, particularly reducing red meat and dairy in high-income regions, are considered the most effective demand-side action to reduce greenhouse gas emissions (Macdonald, 2025; Moosburger et al., 2025). In addition, food system activities (from production to disposal) account for nearly 30% of global greenhouse gas (GHG) emissions, 60% of biodiversity loss, and 70% of water use (Rokicki & Fayisa, 2026). Therefore, actively monitoring the impact of each stage of the food chain wields immense potential to contribute significantly to environmental sustainability efforts. Shifting to more plant-rich diets in developed areas directly reduces the strain on natural resources. This highlights that targeting consumption can contribute significantly to sustainable food systems. Individual choices influence what is produced and sold, while personal decisions impact food waste at the household level. Shifts in diet can catalyse social movements for food justice and sustainability. Therefore, for food system transformation to be successful, it must be demand-driven, recognising consumers as active agents in the transition toward a more sustainable and healthier world. Previous studies have not adequately conceptualised and theorised the demand side of food systems.

Previous studies on food system transformation have primarily focused on transforming how food is produced, processed, packaged, and transported to reduce emissions, conserve resources, and support local economies, thereby addressing issues such as hunger, climate change, and biodiversity loss (Choruma et al., 2024; Nasaka & Ndhlovu, 2026). In Africa, sustainability efforts have also focused on transforming supply-side components, with limited attention to consumption and diets. Key strategies for food system transformation in Africa involve adopting agroforestry, strengthening small-scale farmers, utilising digital tools, and enhancing regional trade to reduce dependence on food imports and combat climate change (Arogundade & Hassan, 2025; Chidoko et al., 2026). Consumption and dietary factors are limited in African food system research and policies due to the urgent, overriding focus on immediate food security (availability and access) over long-term

sustainability, coupled with severe economic constraints, rapid, often unplanned urbanisation, and deeply rooted cultural, logistical, and infrastructure barriers. Policies and research often prioritise production to combat hunger, leaving little room for addressing consumption patterns. As a result, while the integration of Artificial Intelligence (AI) is transforming food systems, the transformation is concentrated on the supply side, while the demand side lags. Neglecting the demand side (consumer behaviour, dietary patterns, and consumption choices) in AI-driven food system transformation can severely hinder sustainability goals, leading to, at best, limited success and at worst, unintended environmental and social harm. While AI is highly effective at optimising supply chains, ignoring the 'why' and 'how' of consumption often results in supply-side innovations that do not match consumer needs or fail to reduce the overall environmental footprint. This article seeks to close this gap, which has practical and policy implications. AI is a branch of computer science that enables machines to simulate human intelligence, including learning, reasoning, problem-solving, and decision-making (Dignum, 2019). AI systems analyse large datasets to identify patterns, allowing them to act autonomously, understand language, and improve performance over time without explicit programming for every task (Dekeyser & Whitehead, 2025; Ndhlovu & Meyer, 2026).

AI comprises core functional components, learning, reasoning, problem-solving, perception, and language understanding, enabled by foundational technologies like machine learning (ML), neural networks (deep learning), and data. These systems often utilise advanced hardware, robotics, and Natural Language Processing (NLP) to mimic human cognitive functions. Its core functional and technical components include ML, Deep Learning (DL), NLP, Computer Vision (CV), robotics, Knowledge Representation and Reasoning (KRR), and data and computing power.

ML is a core subset of AI that trains algorithms to find patterns in data, allowing them to learn and make decisions or predictions without being explicitly programmed for every task, improving as they are exposed to more data, and powering modern AI from recommendation engines to natural language processing (Razzaq & Shah, 2025; Wulff et al., 2025). Essentially, it is all about teaching computers to learn from examples, as humans do, to recognise patterns and apply that knowledge to new situations.

DL is a powerful subset of ML in AI that uses multi-layered artificial neural networks, inspired by the human brain, to mechanically learn complex patterns and features from vast amounts of data, enabling tasks such as image recognition, natural language processing, and self-driving cars (Chen & Chen, 2026). The 'deep' in DL refers to the multiple layers, which allow the system to build hierarchical representations and perform sophisticated, human-like analysis without explicit programming for every rule.

NLP is a field that teaches computers to understand, interpret, generate, and manipulate human language (text and speech) to bridge the communication gap between humans and machines, powering applications such as virtual assistants, translation services, and sentiment analysis (Ferrari & Ginde, 2025; Herman, 2024). It combines computer science, AI, and linguistics to process language data for practical tasks, using machine learning to find meaning and enable actions.

CV in AI is a field that trains computers to interpret and understand the visual world (images and videos) like humans do, using DL and algorithms to identify objects, classify data, and make decisions, powering applications ranging from self-driving cars and facial recognition to medical diagnosis and robotics. It is about enabling machines to 'see,' process, and derive meaning from visual inputs to perform complex tasks and solve problems (Ndhlovu & Meyer, 2026; Shan et al., 2025).

Robotics in AI involves integrating intelligent algorithms, ML, and CV into physical machines, enabling them to perceive, learn, and operate autonomously or semi-autonomously in real-world environments (Chen & Chen, 2026). While traditional robotics handles repetitive tasks, AI-powered robotics enables robots to adapt to new situations, make decisions, and interact with the world with human-like precision.

KRR is an AI field focused on encoding information about the world into symbolic, machine-readable formats (representation) to enable systems to draw inferences, solve complex problems, and make decisions (reasoning) (Cambria, 2025). It serves as the 'brain' of intelligent systems, managing knowledge structures such as rules, graphs, and ontologies.

Data and computing power are the foundational pillars of AI, acting as the 'fuel' and 'engine,' respectively, that drive ML and algorithmic performance. Data provides the information needed for AI to learn, while computing power provides the hardware to process it rapidly. Data represents the vast quantities of information (text, images, video, and numbers) that AI systems use to identify patterns, learn, and make decisions. ML and DL models require massive, diverse, and clean datasets to train effectively and achieve high accuracy. This includes structured data (databases) and unstructured data (unorganised information, such as social media posts or images). Computing power refers to the physical hardware and infrastructure, such as Central Processing Units

(CPUs), Graphics Processing Units (GPUs), and Tensor Processing Units (TPUs), that run complex, iterative algorithms. It enables the training of DL models, which involve vast amounts of mathematical operations, to be completed in reasonable timeframes. Advances in AI are driven by the combination of greater data availability and stronger computing power, enabling more complex models. AI relies on high-performance data centres designed for intensive, parallel processing (Ferrari & Ginde, 2025).

This article (i) explores how AI applications can be used to shape and influence sustainable consumption and diets in Africa, (ii) identifies the challenges for integrating AI for sustainable consumption and diets in Africa, and (iii) examines opportunities for integrating AI applications for sustainable consumption and diets in Africa. Understanding how AI can transform the demand side in Africa's food systems allows stakeholders to shift from reactive, supply-driven models to proactive, consumer-centric, and sustainable systems. By analysing data on consumer behaviour, purchasing habits, and dietary preferences, AI helps optimise the entire food supply chain, from production to consumption, reducing waste, enhancing food security, and improving profitability. Focusing on the demand side with AI in Africa's food systems creates a 'smarter' food supply chain that is more efficient, responsive, and aligned with the urgent need for a more sustainable and equitable food future.

This article proceeds as follows: The following section reviews the literature related to the study. An outline of the research methodology used follows this. After this, the findings are presented and discussed, respectively. Lastly, conclusions are drawn from the findings and the discussion.

2. Literature Review: Consumption, Diets, and Sustainable Transformation

A literature review on the connections among consumption, diets, and sustainable transformation reveals a critical consensus: the current global food system is a primary driver of environmental degradation, yet it also holds the most significant potential for rapid climate mitigation. The literature establishes that food systems are responsible for roughly 25-30% of GHG emissions (Rokicki & Fayisa, 2026). Transformation is no longer viewed as optional but as a prerequisite for staying within 'Planetary Boundaries.' The literature on the intersection of consumption, diets, and sustainable transformation is limited but evolving (Polyporitis et al., 2025; Seubelt et al., 2022). Existing literature shows that sustainable consumption is no longer just about carbon footprints. It has evolved into a 'Safe and Just' framework that balances environmental limits with social equity and human rights (Moosburger et al., 2025). The primary reference point for current global policy is the EAT-Lancet 2.0, which updated its original 2019 'Planetary Health Diet' to specifically address social justice and regional cultural contexts (EAT-Lancet Commission, 2025). The 2025 EAT-Lancet Commission report provides an evidence-based roadmap for transforming global food systems to be healthy, sustainable, and just by 2050. It refines the Planetary Health Diet to tackle non-communicable diseases and, critically, expands its focus to include social justice, equity for food system workers, and the necessity of staying within all planetary boundaries (climate, land, water, biodiversity). The report shows that adopting the plant-rich Planetary Health Diet could prevent 15 million premature deaths annually. It also highlights that current food systems breach planetary boundaries and account for about 30% of greenhouse gas emissions. Transformation is needed to halve these emissions. Key actions include shifting diets towards plant-based foods, enhancing circularity in food systems, reducing food loss, and utilising sustainable agricultural intensification. The report models how 10 billion people can be fed a healthy diet within safe planetary limits by 2050. The 2025 commission acts as an urgent, science-based call for a 'Great Food Transformation,' requiring, for instance, a radical decrease in red meat and increased consumption of legumes, nuts, fruits, and vegetables.

The International Food Policy Research Institute (IFPRI) (2025) report analysed 50 years of food policy, arguing that tackling future crises requires resilient, sustainable, and inclusive food systems. Its key priorities include leveraging technology, strengthening social protection, reducing malnutrition, and empowering the private sector for sustainable value chains. The report reflects a shift from focusing solely on agricultural production to a comprehensive, systems-based approach that covers nutrition, health, and sustainability. It posits that climate change, conflict, and rising inequality demand stronger resilience in food systems to protect vulnerable populations. It also emphasises that policies must encourage value chains that produce nutritious food, addressing both under- and overnutrition. Key areas include strengthening social protection programmes, transforming public spending to support sustainability, and using evidence-based research for policy design. The report emphasises that navigating the next 50 years requires integrating multidisciplinary approaches to build, just, and equitable food systems.

The World Resources Institute (WRI) (2025) also conducted reviews on affordable and healthy diets with its global stakeholders. The findings emphasise the need to align nutrition, environmental sustainability, and affordability. The key findings highlighted that healthy diets require reducing high-impact foods like meat, sugar, and ultra-processed items, while improving food security and considering the well-being of food producers. Diets

should prioritise nutrient-dense, whole foods, balancing intake across food groups, while reducing excessive meat, salt, and fat. It also posited that diets must be lower in GHG emissions and land use, significantly reducing the consumption of animal-based products (especially beef) and moving towards plant-rich diets. The reports posited that sustainable eating needed to be practical, affordable, and accessible to all, addressing the high cost of healthy, sustainable foods. It advocated for worker welfare, reducing food loss and waste, and promoting food culture. The report identified that modern, urbanised, and fast-paced lifestyles, coupled with high marketing of unhealthy foods, posed significant challenges to adopting these diets. The findings of this report are widely supported (see Wale & Gandidzanwa, 2025).

Wale and Gandidzanwa (2025) argue that transforming agri-food systems is an intricate task requiring a nuanced, multi-stakeholder approach that views sustainability as a continuous journey rather than a fixed end-state. The authors identify challenges like systemic inefficiencies and policy fragmentation, advocating for different systems, economic, social, and environmental, to function together. Sinclair et al. (2025) reviewed international food-based dietary guidelines (FBDG) from 58 countries. They found that very few explicitly recommend reducing meat or dairy for environmental sustainability. Despite the necessity of plant-based shifts to achieve climate goals, most guidelines lacked clear, actionable, and quantified guidance on limiting animal-based food intake to manage the environmental impact of food systems. The review highlights that transitioning to sustainable diets requires a comprehensive, interdisciplinary approach that considers affordability and cultural context.

The literature also shows that consumers often struggle to change their diets for sustainability due to a combination of economic, practical, psychological, and social barriers (Polyportis et al., 2025; Wale & Gandidzanwa, 2025). While many are aware of environmental issues, a 'value-action gap' persists, in which intentions to eat sustainably are overridden by daily constraints such as price, convenience, and entrenched habits. Research shows that while roughly 65% of consumers claim they are open to changing their habits for the environment, far fewer actually follow through at the grocery store (Halicka et al., 2025). The reasons for this resistance are rarely about a lack of caring; instead, they are rooted in a complex web of economic, psychological, and structural barriers. The most cited reason for not adopting a sustainable diet is cost. Consumers often perceive sustainable foods (organic, fair-trade, or local) as 20% to 50% more expensive. In a 2022 German case study, researchers found that price was the primary driver of food choices, often outweighing both health and environmental concerns (Seubelt et al., 2022). Conventional food is artificially cheap because its environmental costs (water pollution, carbon emissions) are 'externalised', meaning they are not reflected in the shelf price. In many regions, energy-dense, highly processed foods are the most affordable calories available, making sustainable options a 'luxury' for lower-income households (Ponce-Carreón et al., 2025).

The literature shows that even when price is not the main obstacle, the human brain is wired to resist dietary changes. Psychological factors preventing consumers from adopting sustainable diets stem from ingrained habits, emotional attachments, and cognitive biases, primarily manifesting as an attitude-behaviour gap, high meat attachment, and preference for convenience and taste over environmental concerns (Boiteau & Pingali, 2026; Nichifor et al., 2025). These barriers include routine purchasing, prioritising convenience, emotional connections to meat, cognitive dissonance, aversion to novel foods, difficulty defining sustainability, lack of knowledge, low self-efficacy, cultural norms, social pressure, and the intention-behaviour gap (Ponce-Carreón et al., 2025).

The literature showed that mobilising consumers to change their diets for sustainable food systems requires a shift from relying solely on information campaigns to a combination of behavioural nudges, structural changes in food environments, and leveraging social influence (Halicka et al., 2025; Nichifor et al., 2025). Effective strategies focus on making sustainable choices easier, more affordable, and culturally acceptable, emphasising plant-based foods, local produce, and reduced food waste. AI integration is another potential strategy to shape and influence sustainable consumption and diets in Africa.

3. Materials and Methods

3.1. Research Design

This article adopted an exploratory research design underpinned by the grounded theory (GT) philosophy. This was meant to generate new insights into consumption and diets in Africa's food system, as well as the diverse factors shaping prospects for change. The exploratory research design is critical for investigating consumer behaviour and consumption trends, which remain under-researched. This served as the foundational first step to clarify the problems and define the study scope. Its high flexibility and low cost allow the author to adapt to new insights by participants.

On the other hand, the GT philosophy's rigorous, inductive, and comparative nature made it ideal for exploring consumption and diet issues that have not attracted satisfactory research and policy attention in Africa's food

systems efforts. This enabled the article to emerge systematically from empirical data (in-depth interviews), ensuring the findings are closely connected to the African real-world context. GT was particularly exceptionally effective at capturing ‘why’ particular consumption trends and diets emerged among African consumers, as well as ‘how’ AI-driven solutions could help fast-track the sustainable transformation process. The philosophy also offered opportunities for reduced bias.

3.2. Population and Sampling

The population was defined as all agricultural and food systems experts in Africa, whether African or non-African. Purposive sampling was used to identify participants. Participants were selected based on expertise, availability, and willingness to participate. Participants who could communicate in English were targeted. English was used as the standard language for participants across all African countries, despite their different languages. Conducting the interviews in a language both the interviewer and the interviewee understood well was critical for ensuring data accuracy, fostering trust, and capturing nuanced, authentic information. A total of 26 participants consented to participate in this study. All participants were high-level experts who were cognisant of the ethical issues of research processes.

3.3. Data Collection

The data was collected between August and November 2025 using semi-structured and open-ended interviews. The interview guide, which was emailed to participants before the interview, comprised semi-structured and open-ended questions designed to gather information on consumption and diet trends in Africa, as well as on how AI could serve as an intervention. This enabled participants to provide as much detail as possible while staying within the study’s focus. Interviews were conducted both in-person and virtually, depending on the accessibility of participants. Fourteen participants (65.4%) were interviewed virtually, while nine (34.6%) were interviewed in-person. Participants were generously spread across Sub-Saharan Africa (SSA) (see Table 1). Each interview was assigned a code that indicated the country and the participant's number in the interview sequence for that country. This was to ensure that all of the region’s sub-regions were represented. Interviews lasted for an average of one hour and were conducted at times chosen by participants. All interviews were recorded with participants' consent.

Table 1: Summary of participants

COUNTRY	CODE	TYPE OF INTERVIEW				TOTAL PARTICIPANTS
		IN	N ^o	V	N ^o	
Botswana	BOTS	√	1	√	1	2
Ethiopia	ETH	-	-	√	1	1
Ghana	GHA	-	-	√	2	2
Kenya	KEN	√	2	-	-	2
Malawi	MAL	-	-	√	2	2
Mali	MALI	-	-	√	1	1
Namibia	NAM	-	-	√	1	1
Nigeria	NIG	-	-	√	3	3
Rwanda	RWA	-	-	√	3	3
Senegal	SEN	-	-	√	2	2
South Africa	SA	√	3	-	-	3
Zambia	ZAM	√	1	√	1	2
Zimbabwe	ZIM	√	2	-	-	2
	TOTAL	9		17		26

Source: Author

Key

IN = In-person interview

V = Virtual interview

N^o = Number of participants for each interview type

3.4. Data Analysis

Thematic data analysis was used. All interviews were first transcribed, converting spoken, unstructured audio into a searchable, organised text format, allowing for efficient coding, thematic analysis, and immersion in the data. This was meant to enhance data accuracy and ensure a thorough review of content, allowing the author to identify patterns, nuances, and non-verbal cues (such as pauses or emotion) that could be easily missed when

listening alone. By engaging in interview transcription and iterative coding, the author remained open to emerging insights, which served as a buffer against imposing preconceived assumptions on the data.

After transcription, the first stage of data analysis involved organising the case details and grouping facts in a coherent order. This involved selecting and simplifying the data to align with the research objectives. This enabled the author to summarise and organise the data based on the structure of the interview guide. This categorisation was based on participants' views and the researcher's judgement of the importance of particular issues with respect to the research objectives. This was followed by classification of findings, in which specific categories were identified to group data into evocative groups. After this, the interviews were scrutinised for specific meanings within two broad categories under investigation: the state of Africa's food systems and AI integration to improve consumption and diets in Africa. Underlying patterns related to the study were then identified from the data. Guided by these two categories, nine themes were established (Table 2). Lastly, data were synthesised to inform the general conclusions. Data were then summarised in tables, charts, and direct quotations.

3.5. Limitations

This study relied heavily on virtual interviews, and the authors were unable to build rapport with all participants. The focus on high-level experts also excluded familiar people who could have provided on-the-ground insights needed for further theorisation of AI in food systems. Given the small, non-representative sample of 26 participants, the findings of this study are difficult to generalise to larger populations. It is hoped that this study will inspire future studies to conduct investigations supported by large sample sizes. In doing so, mixed-methods research approaches are recommended to generate a more comprehensive understanding of AI among African consumers.

4. Findings

4.1. Demographic Details

Participants were recruited from 12 countries across SSA (see Table 1). The majority of participants were in Southern Africa (50%). In addition, Southern Africa had the highest proportion of participants interviewed in person (26.9%). West Africa had eight participants (30.8%), all of whom were interviewed virtually. In East Africa, three participants were identified in Kenya and Ethiopia. Two of the participants were interviewed in-person while one participated virtually. For Central Africa, two participants were identified in Rwanda, both of whom participated virtually. The dominance of Southern Africa in the total number of participants and in-person participants could have been influenced by the author's geographic location.

Most participants were male (65.4%), while females accounted for 34.6%. In addition, most participants were located in policy and research institutions (50%). This was followed by participants in academia, mostly universities (34.6). Two participants were in government departments, while two participants were in the private sector. All participants were highly qualified, with several years of working experience in agriculture, food systems, or in the teaching and research space focusing on these disciplines (see Figure 1)

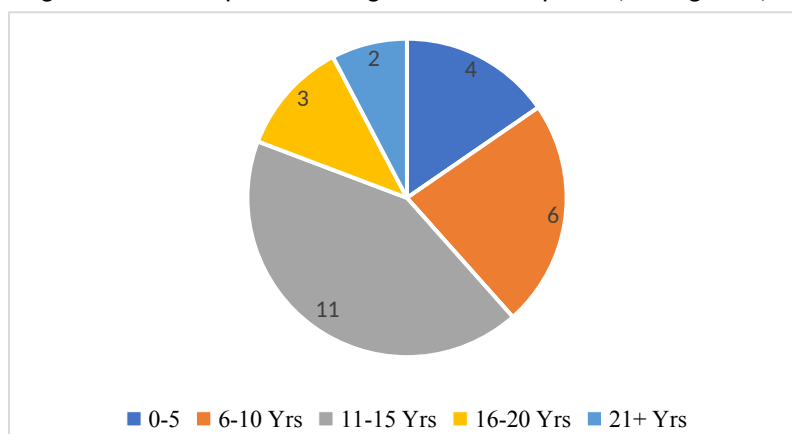


Figure 1: Experience of Participants in Years

Source: Author

Figure 1 shows that 42.3% of participants had work experience spanning 11-15 years. This was followed by 23% who are 6 to 10 years experienced. A total of 15.4% had less than 5 years of experience, 11.5% had 16-20 years, and 7.8% had over 21 years. The seniority of many participants had several benefits for the study. Research participants with many years of experience (often referred to as subject matter experts) were critical to this study as they provided in-depth, nuanced, and reliable data that less experienced individuals could not. Their expertise allowed them to identify nuances in previous consumption trends, spot emerging diet trends, and offer insights into the 'why' and 'how' current trends necessitated challenge.

4.2. Summary of Themes

Data analysis yielded nine key themes. The categories in which themes were organised were predetermined during the study's conceptualisation. In the first category, four themes were established, while five were established in the second category (Table 2).

Table 2: Summary of Themes

CATEGORY	THEMES
Challenges of Africa's food systems	Climate Change Conflict and Instability The Digital Divide Infrastructural Deficiency
Harnessing AI to Improve Consumption and Diet Behaviour	Personalised Nutrition and Disease Management Enhanced Dietary Assessment and Monitoring Sustainable Consumption and Waste Reduction Behavioural Change and Coaching Food Innovation and Safety

Source: Author

4.3. Challenges of Africa's food systems

The findings revealed that Africa's food systems are under severe strain, "*characterised by a paradox of high agricultural potential alongside ballooning undernourishment, with up to 500 million people affected to date*" (ZIM 02). It was reported that, despite many people in the region relying on agriculture, many faced moderate-to-severe food insecurity, "*worsened by climate change, conflicts, high import costs, and a general political leadership crisis*" (ZIM 01). The findings showed several key aspects of the state of the region's food systems.

4.3.1. Climate Change

The findings showed that in Africa, climate change acts as a hunger risk multiplier, disrupting every stage of the food system, from how crops are grown to what ends up on a family's plate. Participants revealed that the continent was warming roughly 0.3 °C per decade, faster than the global average (MALI 01), which is fundamentally altering dietary patterns and caloric intake (NIG 03). Participants mentioned that climate change posed a severe, multi-layered threat to food systems across Africa, impacting production, distribution, and consumption. The abiotic hazards (Physical Changes) driven by rising temperatures and shifting rainfall patterns include prolonged droughts, intense flooding and waterlogging, rising temperatures and heatwaves, erratic rainfall patterns and shifted seasons, aridification and desertification, saltwater intrusion and sea-level rise, and soil erosion and land degradation. The biotic hazards (Biological Shifts) driven by climate change mentioned included increased pest outbreaks, disease prevalence, and Aflatoxin contamination.

The impact of the identified climate change hazards includes reduced crop yields, post-harvest losses, food price volatility, and reduced nutritional quality. Some regional patterns showed that Southern Africa was heavily impacted by drought and rain-fed maize failure (ZIM 01), the Sahel faced progressive desertification (SEN 02), and East Africa experienced intense alternating drought-flood cycles (ETH 01). It was reported that climate change had drastically reduced the volume of food available for consumption across all sub-regions (MAL 02). Most participants (57.7%) reported significant declines in staple crop yields due to extreme weather, estimating that even the staple crops: maize, millet, and sorghum, which are the backbone of African diets, could see yield reductions. In West and Central Africa, warming ocean temperatures and ocean acidification are anticipated to reduce fisheries' catch potential, a critical source of protein for coastal communities (SEN 02). It was reported that persistent desertification was pushing pastoralist communities in the Sahel region to abandon traditional diets. The loss of livestock (due to a lack of pasture) was drastically reducing milk and meat consumption, which are primary protein sources. In Southern Africa, it was reported that heavy reliance on rain-fed maize was making maize production very challenging, and that during the 2023-2024 drought, countries like Zimbabwe and Zambia experienced near-total crop failures in some districts, forcing them to rely on international grain aid (ZAM 01).

The findings also revealed that climate change not only reduces food supply but also degrades its quality. Participants mentioned that "*high nutritional dilution levels can actually lower the nutrient density of crops*" (SA 02). Another participant mentioned that heat stress and water scarcity make it difficult to grow "*thirstier but*

nutrient-dense crops like fruits and vegetables” and that “this forces a shift toward more resilient but less nutritious starches (like cassava), leading to micronutrient deficiencies” (SEN 01). As a result, child stunting is anticipated to remain and “could reach 24 million by 2050, specifically due to climate impacts” (KEN 02).

4.3.2. Conflict and Instability

Food insecurity is the primary challenge reported in Africa, with West Africa among the most affected sub-regions. According to participants, the food insecurity crisis in West Africa is not the result of *“a single failure but a triple threat of a combination of complex and dirty factors” (SEN 02)*. Insurgency in the Lake Chad Basin and the Liptako-Gourma region is implicated in displacing farmers and severing trade routes, triggering food shortages (GHA 01). In Mali, Northern Nigeria, and Burkina Faso, armed violence has *“become a mechanism for eroding already weak local food systems” (SEN 01)*. In Nigeria, about 40 million people were projected to be food insecure, with high malnutrition remaining a critical issue for children (NIG 03). Nigeria holds the highest number of food-insecure people in Africa, with the crisis concentrated in the northeast due to protracted conflict. However, it has spread nationwide due to extreme food price inflation and currency depreciation (NIG 01). Similar trends were reported for other countries. For instance, in the Democratic Republic of Congo (DRC), decades of armed conflict, *“particularly in the eastern regions, have displaced over 30 million people, preventing farmers from planting crops” (GHA 02)*. In Sudan, *“the civil war since 2023, the country home to one of the world’s most severe hunger emergencies” (KEN 02)*. Likewise, South Sudan has *“over 50% of its population requiring urgent food assistance. Overlapping crises of flooding and localised violence have decimated local food systems” (KEN 01)*. In Ethiopia, a combination of the lingering effects of the Tigray conflict and severe climate fluctuations (drought followed by El Niño floods) has kept millions dependent on humanitarian aid (ETH 01).

Participants also reported emerging hunger hotspots in countries such as Chad, where over 1.5 million refugees (mainly from Sudan) are putting immense pressure on the country’s already fragile resources, with about 40% of its own population needing food assistance (RWA 02). Some participants have identified persistent inflation and high input costs (fertiliser, fuel, and spray chemicals) as factors that *“erode the purchasing power of the most vulnerable” (ETH 01)*.

4.3.3. The Digital Divide

The findings revealed that in Africa, the digital divide also *“acts as a multiplier of exclusion, where the lack of connectivity and digital literacy directly translates into hunger and environmental degradation” (ZIM 01)*. It was reported that while *“about 60% of Africans face food insecurity, those on the ‘wrong side’ of the divide are unable to access the very technologies designed to fix the system (ZIM 01)*. Participants reported the digital divide in Africa as three-layered: Infrastructure (network coverage), Affordability (cost of data/devices), and Capability (digital literacy). The divide affected both food access and consumption (ETH 01). The African agriculture sector is *“dominated by smallholder farmers, most peasants who produce for household survival. These farmers traditionally lack adequate resources to pursue their subsistence activities” (SA 02)*. Without access to precision agriculture (digital solutions), these farmers continue to rely on traditional, rain-fed methods, which are prone to failure (RWA 01). In climate-volatile sub-regions, such as West Africa, this lack of technology-driven solutions *“leads to a guesswork approach to planting, often resulting in total crop failure” (SEN 02)*. This not only undermines food access and consumption but also destabilises households’ economic base, even under favourable conditions for food production. For instance, in East Africa, connected farmers use platforms such as M-Pesa and M-Kulima to check real-time market prices (KEN 01). Disconnected *“farmers often sell to exploitative middlemen at 30–50% below market value because they lack the data to negotiate” (KEN 02)*. This compromises the potential to accumulate financial resources to diversify their diets. The findings revealed that poverty forces households to prioritise cheap, calorie-dense, nutrient-poor foods over sustainable, healthy options, leading to poor diet quality, increased malnutrition, and chronic illnesses. It hinders sustainable consumption by limiting the ability to *“purchase eco-friendly, fresh, or local products, while rising food prices worsen the crisis” (MAL 02)*.

Participants reported that gender and youth disparities also contributed significantly to compromised consumption and diets in Africa. It is reported that women produce the *“majority of food in many African countries” (NAM 01)* and yet *“have significantly lower access to digital tools than men, including access to simple gadgets like smartphones” (BOTS 01)*. This *“gender digital gap” (NAM 01)* prevents them from accessing mobile-based credit or weather alerts, entrenching household food insecurity. The African youths are also being neglected as a force for transforming Africa’s food systems. Neglecting youth has severe consequences, spanning from economic stagnation and increased food insecurity to social instability and an ageing agricultural workforce (SA 01). With over *“60% of Africa’s population under 35 and 70% of the continent’s youth living in rural areas, failing to invest in this demographic limits the potential of the agricultural sector to act as a driver of growth” (SA 01)*. Because agriculture is the backbone of most developing African economies, the failure to modernise and

involve youth directly hurts the economy and slows down poverty reduction, as agriculture-led development is up to three times more effective at this than other sectors.

The findings also revealed that sustainability in the African context involves reviving indigenous crops and reducing post-harvest loss, both of which are being revolutionised, but only for the digitally included. Digital platforms are beginning to connect urban consumers with ‘forgotten’ climate-resilient crops such as millet and sorghum (NAM 01). Those without digital access remain “*stuck in a cycle of consuming cheap, imported, processed foods, which are less sustainable and lower in nutrients*” (ZAM 01). In Kenya, farmers in “*remote regions with no 2G/3G signal remain entirely locked out of this ecosystem, continuing to use low-quality seeds and unsustainable soil management*” (KEN 02). Participants concluded that technology was no longer a luxury but a core pillar of the food system.

4.3.4. Infrastructural Deficiency

Participants also identified infrastructural deficiency in Africa acts as a massive ‘bottleneck’ that “*dictates not just how much people eat, but the nutritional quality of what ends up on their plates*” (SA 01). One participant mentioned that when roads, electricity, and water systems fail, the food system effectively shrinks, leading to higher prices and less variety (ZIM 02). The most immediate impact of poor transport infrastructure, as reported by participants, is higher food costs. It is revealed that in many African regions, it is often cheaper to import grain from another continent than to transport it from a rural farm to a local city, as high transport costs can account for up to 40% of the retail price of food in landlocked African countries (KEN 02). Participants mentioned that most African smallholder farmers often cannot reach larger markets, forcing them to sell their produce at a loss locally or watch it rot. In addition, it is revealed that urban consumers have become “*reliant on processed, shelf-stable imports because fresh, locally grown alternatives are too expensive or unavailable*” (GHA 02).

A lack of cold chain infrastructure (refrigerated transport and storage) creates a massive drain on the food supply. It is estimated that nearly 40% of the region’s fruits and vegetables perish before reaching consumers (GHA 2). Because fresh produce (perishables) is the hardest to transport without spoilage, diets often default to heavy starches (maize and cassava), leading to “*hidden hunger, where calorie intake is sufficient but essential vitamins and minerals are missing*” (GHA 02).

The lack of reliable electricity affects how food is processed and prepared at the household level. Without power, local value-added processing (such as drying, milling, or canning) cannot occur. This forces communities to export raw goods and re-import processed versions at a higher cost (MALI 01). It was reported that many households rely on biomass (charcoal or wood) for cooking. If fuel is scarce or expensive, families may skip meals or switch to foods that require less cooking time, which are often less nutritious or highly processed (NAM 01).

Participants also revealed that infrastructure includes the availability of water, without which food systems fail. One participant mentioned that “*infrastructure is not just about roads; it is about pipes. Without clean water, the biological utilisation of food is compromised*” (GHA 02). Another participant revealed that “*even if a person consumes enough nutrients, poor water infrastructure leads to waterborne diseases like diarrhoea*” SA 01. Illnesses prevent the body from absorbing nutrients, leading to chronic malnutrition and stunting in children. The findings reveal that Africa’s consumption and diet challenges are not just a farming problem; they are an engineering one. Solving the ‘last mile’ of infrastructure could be more effective at improving diets than simply increasing crop yields.

4.4. Harnessing AI to Improve Consumption and Diet Behaviour

The findings show that harnessing AI to improve consumption and diet behaviour in Africa offers a transformative approach to addressing modern nutritional challenges, moving from one-size-fits-all guidance to precise, personalised, and sustainable solutions. The findings show that by leveraging ML, DL, CV, NLP, robotics, KRR, and big data, AI can optimise food intake, reduce waste, and promote healthier eating habits. Participants identified several key benefits of AI in improving consumption and diet behaviour.

4.4.1. Personalised Nutrition and Disease Management

The findings revealed that AI models trained on genetic, metabolic, and microbiome data can enable tailored dietary recommendations that go beyond general population-level guidelines. For instance, AI can provide “*personalised meal plans for managing Type 2 Diabetes (T2DM), cardiovascular diseases, and obesity*” (MAL 01). AI solutions can also facilitate real-time metabolic tracking. AI solutions can integrate with wearable sensors (like CGMs) to analyse blood glucose responses to specific foods in real-time, “*allowing for instant dietary adjustments*” (SA 02). It was reported that AI-driven personalised diets had shown potential to improve gut microbiome diversity and reduce symptoms of inflammatory bowel syndrome (IBS) (ZIM 02). AI-powered chatbots simulate one-on-one interaction with a human dietitian. These coaches provide 24/7, personalised advice, such as “*suggesting diet changes to lower calories while keeping the user full, and they support multiple languages*”

(BOTS 01). AI algorithms track behavioural patterns and send personalised notifications or tips at the right time to encourage healthier choices, such as eating more fibre or reducing sugar intake. AI can adjust nutritional recommendations based on patients' conditions. For instance, they can make nutritional recommendations based on a woman's menstrual cycle (e.g., suggesting magnesium-rich foods during the luteal phase to manage PMS), rather than offering a static, daily plan. They can also help parents track nutrient gaps in children's diets, providing age-appropriate meal plans that address picky eating and food allergies (KEN 02). This increases accuracy, enhances adherence to dietary plans, early detection of deficiencies, and scalable, cost-effective expert advice (NIG 01).

4.4.2. Enhanced Dietary Assessment and Monitoring

The findings show that AI tools can reduce the burden and inaccuracies associated with traditional, self-reported food logging. For instance, one participant mentioned that AI-powered applications, such as goFOOD™ 2.0, use CV to identify food items, estimate portion sizes, and calculate nutritional intake from photographs (SA 02). This has demonstrated up to 20% higher accuracy compared to traditional, subjective methods (SA 02). AI-enabled apps can also automatically track calories and nutrients, increasing compliance and providing immediate feedback (NAM 01).

4.4.3. Sustainable Consumption and Waste Reduction

Participants reported that AI tools help reduce the environmental footprint of food consumption by minimising waste throughout the supply chain and at the consumer level (SA 03). AI tools are very effective for inventory management, where they help hotels, restaurants, and households “*manage inventory by tracking freshness and optimising consumption, reducing food spoilage*” (SA 02). AI-driven apps also analyse available ingredients to recommend recipes, reducing the likelihood of food being thrown away (SA 02). In addition, they are also vital for automated waste tracking. Smart bins and AI image recognition are used to record the types and quantities of food waste, prompting more sustainable behaviour.

4.4.4. Behavioural Change and Coaching

The findings revealed that AI-powered conversational agents, chatbots, and virtual coaches offer 24/7 support for maintaining healthy eating habits. AI provides personalised, real-time feedback that has been shown to improve user adherence to healthy nutrition plans by 32% compared to conventional, static counselling (SA 02). In addition, AI can nudge consumers towards more sustainable or healthier options “*by highlighting environmental benefits or providing better alternatives*” (MAL 02). It was proposed that integrating AI with game-like features increases user engagement, making it easier to adopt long-term, healthier lifestyles (MAL 02).

4.4.5. Food Innovation and Safety

AI plays a crucial role in improving the quality and safety of food products. The findings revealed that AI revolutionises food safety by enabling real-time, proactive contamination detection, enhancing traceability, and automating quality control to prevent, rather than react to, hazards (GHA 01). ML and CV analyse vast data to identify risks (e.g., pathogens, spoilage, and fraud) in production. Key benefits include improved compliance, reduced foodborne illnesses, and enhanced supply chain transparency, though it requires addressing data biases and ensuring accessibility for all. AI models analyse environmental data, such as temperature and humidity, along with microbial, genomic, and health data to predict and prevent food safety crises, such as pathogen contamination, before they occur (SA 02). Likewise, DL revolutionises food safety by enabling rapid, non-invasive, and automated detection of contaminants, defects, and pathogens using advanced image analysis (CNNs) and predictive modelling. This improves precision in identifying foodborne pathogens, monitors hygiene compliance, and enhances supply chain traceability, reducing human error and boosting efficiency from farm to table.

CV and AI-powered sensors inspect food items for defects, contaminants, and improper labelling in real time, reducing human error and ensuring high-quality standards (RWA 03). Integration with blockchain, Radio Frequency Identification (RFID) tags, and Internet-based devices enables rapid identification of contamination sources and efficient, targeted recalls. Participants also reported that AI simplifies complex, evolving food regulations by automating documentation, monitoring compliance status, and facilitating audits (ETH 01). AI-driven CV systems also monitor compliance with personal protective equipment (PPE) requirements in manufacturing, with some systems achieving high accuracy in detecting masks and gear.

5. Discussion

This study confirms prior findings that Africa's food systems are at a crisis point requiring urgent intervention (IFPRI, 2025; Ndhlovu, 2025a). Climate change and associated hazards, conflict and instability, structural and infrastructural gaps, economic shocks and market dynamics, food waste and loss, and nutritional challenges are the significant challenges facing Africa's food systems (Choruma et al., 2024; Mokone & Ndhlovu, 2025). This has resulted in a state whereby food consumption is now characterised by a ‘double burden’ of malnutrition: rising

hunger and undernutrition alongside increasing overweight/obesity rates. Over 57 million people face hunger, and over 1 billion cannot afford a healthy diet, driven by poverty, food system failures, and rising costs (IFPRI, 2025). Diets are shifting toward refined staples (maize, rice, wheat) and ultra-processed foods. A significant portion of the African population is undernourished (Sagomba & Ndhlovu, 2025). Diets are shifting from traditional, nutrient-dense foods to ultra-processed foods high in fats, salt, and sugar, driven by urbanisation and improved food infrastructure (Ndhlovu & Tagutanazvo, 2025). Diets rely heavily on nutrient-poor, refined staples, such as maize flour, cassava, sorghum, millet, and white rice, while consumption of fruits, vegetables, nuts, and fish is limited. While 30% of children under five suffer from stunted growth due to malnutrition, many adults face rising obesity and related non-communicable diseases (e.g., hypertension and diabetes), particularly in Southern Africa (Reardon et al., 2021). Widespread micronutrient deficiencies coexist with high-calorie, low-nutrient intake. Both the reviewed literature and this study's findings confirm that these factors require urgent, collaborative interventions to enhance local food sovereignty, improve value chains, and increase investment in resilient infrastructure.

One strand of interventions to transform consumption and diets involves integrating AI solutions. While this aspect is not well developed in the literature, this study effectively demonstrated it, providing a step-by-step analysis of how AI solutions can be used across the food chain to ensure consumers receive safe food for healthy diets. The study showed that AI can transform food consumption by enabling hyper-personalised, data-driven diets, using ML and DL to analyse biometric data for tailored meal plans that improve health outcomes and manage conditions like diabetes. AI tools can also enhance food tracking accuracy, facilitate the development of sustainable, plant-based alternatives, and optimise supply chains to reduce waste. AI is transitioning from passive tracking tools to proactive, personalised, and predictive health assistants. Its influence spans from individual, real-time nutrient tracking and personalised meal planning to large-scale, automated food quality control and consumer behaviour insights. Therefore, AI represents an untapped resource for addressing food consumption and diet challenges that include a 'triple burden of malnutrition', undernutrition, micronutrient deficiency, and rising obesity, driven by poverty, high food costs, and rapid urbanisation that increases reliance on processed foods, causing high rates of stunted growth, diabetes, and hypertension.

However, despite rapid progress, the impact of AI in Africa is constrained by several challenges, including data bias and limited generalisability. Many AI tools are trained on Western datasets, leading to inaccurate recommendations for different, non-Western, or traditional cuisines (Ndhlovu, 2025b). There are also accuracy issues with complex meals. AI still struggles to accurately identify mixed dishes or estimate hidden ingredients (e.g., oils and sauces). This makes it less effective in ensuring responsible consumption for healthy diets. In addition, ethical and privacy concerns remain. AI's reliance on sensitive, personal health data requires stringent security to prevent misuse. Sensitive consumers tend to avoid AI solutions, making them ineffective for such consumers. Generative AI tools (e.g., LLMs) can also sometimes produce inaccurate nutritional advice, highlighting the need for human oversight (e.g., registered dietitians). However, the AI-driven nutrition app market is projected to surge from around US\$4 billion in 2024 to over US\$10 billion in the next five years, indicating that its influence on diets will continue to accelerate. African consumers could also benefit from this emerging trajectory of AI in food systems.

6. Conclusion

This article explored how AI applications can be used to shape and influence sustainable consumption and diets in Africa, identified the challenges for integrating AI for sustainable consumption and diets in Africa, and examined opportunities for integrating AI applications for sustainable consumption and diets in Africa. This article was based on qualitative data collected between August and November 2025 from 26 research and policy experts working on African agriculture and food systems. The findings showed that leveraging AI for sustainable consumption and diet in Africa offers a transformative opportunity to enhance food security, improve nutritional outcomes, and reduce environmental impact across the continent. The study showed that AI solutions can transform food consumption by enabling hyper-personalised, data-driven diets, using ML and DL to analyse biometric data for tailored meal plans that improve health outcomes and manage conditions like diabetes. AI tools can also enhance food tracking accuracy, facilitate the development of sustainable, plant-based alternatives, and optimise supply chains to reduce waste. It posited that AI is evolving from passive tracking tools to proactive, personalised, and predictive health assistants. Its influence spans from individual, real-time nutrient tracking and personalised meal planning to large-scale, automated food quality control and consumer behaviour insights. Therefore, AI represents an untapped resource for addressing food consumption and diet challenges that include a 'triple burden of malnutrition', undernutrition, micronutrient deficiency, and rising obesity, driven by poverty,

high food costs, and rapid urbanisation that increases reliance on processed foods, causing high rates of stunted growth, diabetes, and hypertension.

The study, however, showed that the primary challenges of integrating AI to improve consumption and diets in Africa include limited digital and physical infrastructure, significant data scarcity regarding local food systems, and low digital literacy among smallholder farmers and consumers. It concludes that to maximise impact, relevant stakeholders must develop tailored, low-cost AI solutions and foster public-private partnerships, especially in regions with limited resources.

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Author contributions

Emmanuel Ndhlovu conceptualised, collected data, and wrote the article

Availability of data and material

The datasets generated during the current study can be obtained from the author on reasonable request.

Declarations

Ethics approval and consent to participate

The consent to participate was obtained directly from participants. All participants were above 18 years.

Consent to publish

This is not applicable.

Competing interests

Conflict of Interest

The author declares no conflicts of interest.

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