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Exploring digitalization and sustainable practices in African agribusinesses and food supply chains: A literature review

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ABSTRACT

The Covid-19 pandemic, global trends, and technological advancements lead to the perception that digitalization is about the most sustainable means of growing Africa's agribusiness and food supply chains. Many global agribusinesses have successfully integrated digital technologies to enhance operational efficiencies and business relations with their upstream and downstream actors. However, evidence is scant on the uptake of digital technologies among small and medium agribusiness firms in sub-Saharan Africa (SSA). Against this backdrop, this review paper identifies research gaps regarding the adoption and implication of digitalization in building sustainable food systems for African economies. Our preliminary finds show some sustainable practices in the SSA food supply chains by adopting specific technologies related to production, grain storage, food waste management, and warehouse management but very low adoption of food processing technologies and digital marketing platforms. Most importantly, the application of the Internet of Things, Big data, Artificial Intelligence, Blockchain and/or Business Analytics is very rare. Most of the digitalization process tends to be mobile-based.

Keywords: Digital techologies; sustainable practices; agribusinesses; Sub-Saharan Africa

1 Introduction

The Covid-19 pandemic, global trends, and technological advancements lead to the perception that digitalization is about the most sustainable means of growing Africa's agribusiness and food supply chains. Several studies have provided evidence of the contribution of digitalization in coordinating and integrating (creating e-linkages) within the food supply chain processes (Bahn et al., 2021; Afolami et al., 2021, Atuahene-Gima et al., 2019). Most of the findings of these studies suggest digitalization is a determinant factor in the growth of agribusiness and food supply chains and for economic development. This in part also explains why a large number of studies in sub-Saharan Africa (SSA) focus on technologies reducing post-harvest losses (PHL). For example, a simple search in Web of Science and Scopus databases for 'digitalization', 'agriculture' and 'agribusiness', between 2015 and 2021 shows close to 60% of studies relating to PHL.

The application of digital technologies in the global food systems ranges from the Internet of Things (IoT), Big Data, Artificial Intelligence (AI), Business Analytics, Climate Smart Agriculture, E-commerce, and to transparency and traceability technologies (e.g., the blockchain). Digitalization is considered a key factor to enhance the sustainability and resilience of food systems. The literature supports the importance of digitalization as a catalyst for agricultural development, especially in developed economies. As Bahn et al. (pp 1-2, 2021) posits, "digital agriculture encompasses a range of technologies … touted as a potentially revolutionary solution to improve agricultural production systems' performance and sustainability". Many global agribusinesses have successfully integrated digital technologies to enhance operational efficiencies and business relations with their upstream and downstream actors. However, it is thought that in Africa, digitalization has not extensively developed due to factors such as perceived cost of technological infrastructure, political preference ordering, and lack of direct investment. Yet, evidence is scant on the uptake of these technologies among small and medium agribusiness firms in sub-Saharan Africa (SSA).

Against this backdrop, this review paper aims to contribute to the extant literature by examining the adoption and implication of digitalization in sub-Saharan African agribusinesses. It seeks to shed light on the role of digital technologies in food supply chains and the potential impact in building sustainable food systems for African economies and enhancing food security and food safety in the era of a global pandemic. More specifically, this review paper attempts to answer the research questions:

(1) What is the extent and type of digitalization and sustainable practices at the various stages of food supply chains in sub-Saharan Africa?

(2) What is the impact of digitalization on the sustainability of food supply chains in sub-Saharan Africa?

(3) What are the research gaps exploring the implication of digital technologies on the competitiveness of food supply chains in sub-Saharan Africa?

Answering these research questions would unearth the nature of digital interventions required in the various stages of the food supply chain and the potential of digitalization for enhancing the performance of agribusinesses in SSA. This would guide policy interventions relevant to enhancing the performance of various network actors and optimizing output.

2 Research Methods

This study involves a systematic review of the academic literature on digitalization and sustainability practices in sub-Saharan Africa agribusiness and food supply chains. It sets a clear search strategy and explicit inclusion and exclusion criteria. Accordingly, we limited our search to sub–Saharan Africa and publications from the widely used databases: Scopus and Web of Science. Our search also excludes review papers, book chapters, and those published in conference proceedings. Because of the dynamic nature of the research topic, the review considers only the most recent ones (the cutoff year 2015-2021, inclusive). A systematic literature review is a four-step process that includes identification of research scope, selection of studies, literature analysis, and synthesis (Tranfield et al., 2003).

2.1 Preliminary findings

In the identification stage, a simple search using keywords "Internet of Things" or " or "Big data" or "Artificial Intelligence" or "Industry 4.0" or "Business analytics" or "Technology" or "E-commerce" or "Digitalization" or "Blockchain" or "Digital logistics" and "Food supply chain or "Agri-food supply" or "food value chain" or "agrifood value chain" related to Africa in the abstract, title, and keywords resulted in 161 and 111 published articles in peer-reviewed journals on Scopus and Web of Science, respectively. It is not surprising to find more publications on Scopus than the Web of Science as the former has a wider coverage of all fields compared to other databases. The inclusion/exclusion criteria include the following: study territory (Africa), publication type (excludes review articles, book chapters, conference proceedings and papers), and time (2015 to present). The initial screening showed 81 duplicates and thus was excluded at this stage. In the screening stage, the abstracts of 191 articles were reviewed, and 164 articles passed

this stage and were found to be relevant for further quality assessment. Finally, a quality and eligibility assessment was carried out by skimming the full-text articles, and 105 articles were found to be eligible for the final inclusion and are under a full text review. Figure 1 provides the steps followed in appraising the published articles systematically

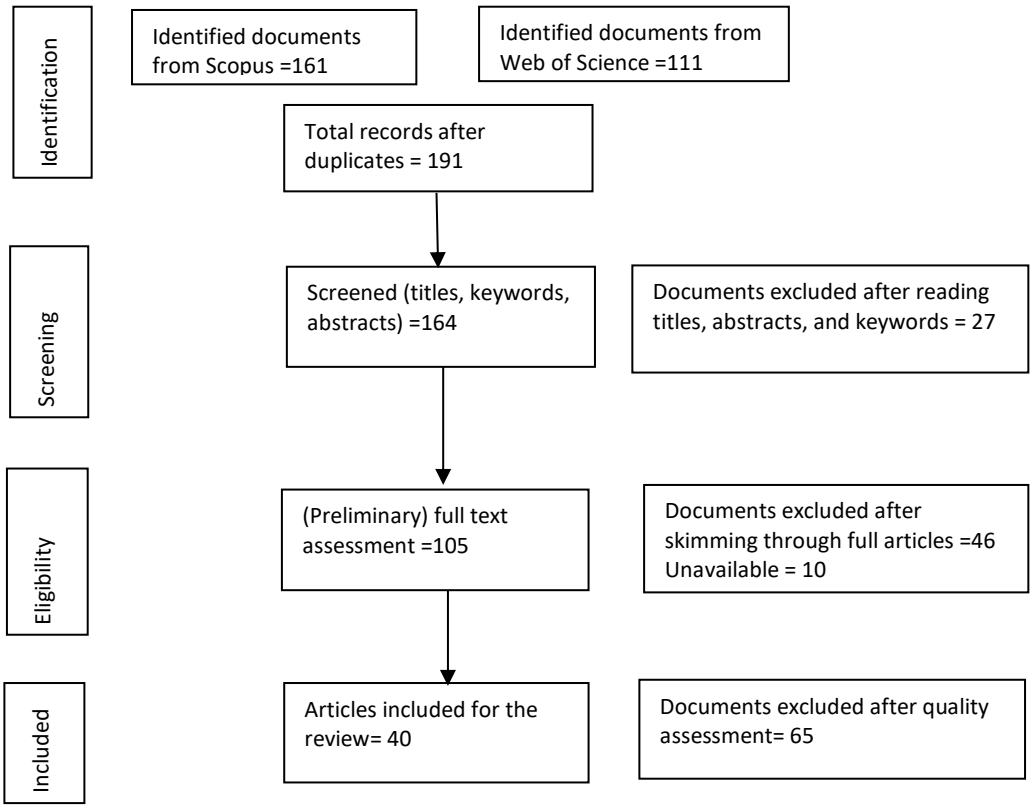

Figure 1. Steps followed in the systematic literature review

Our preliminary finds show some sustainable practices in the SSA food supply chains by adopting specific technologies related to production, grain storage, food waste management, and warehouse management. On the other hand, there is very low adoption of food processing technologies and digital marketing platforms (e-commerce). Most importantly, the application of the Internet of Things, Big data, Artificial Intelligence, Blockchain and/or Business Analytics is very rare. Most of the digitalization process tends to be mobile-based. For example, mobile-based ICT is helping small farmers in Tanzania and Ghana in the agri-value chain (Asabere et al. 2020, Fue et al. 2016). Based on these preliminary finds, the study suggests future studies to explore potential socioeconomic, technical, institutional, and other factors hindering the adoption of digital technologies in SSA. The findings from such analysis can have important implications for policy supporting the promotion of digital technologies and sustainable practices along food supply chains in SSA.

Selected References

Adeyeye, S.A.O. (2017). The role of food processing and appropriate storage technologies in ensuring food security and food availability in Africa. *Nutrition & Food Science*, **47**(1): 122-139.

Afolami, C.A., Obayelu, A.E. (2021). Mitigating the Recessional Impact of COVID-19 on Nigerian Economy through Agricultural Enterprises Promotion. *Agriculturae Conspectus Scientificus*, **86**(1): 83-91.

Agyabeng-Mensah, Y., Ahenkorah, E., Afum, E., Agyemang, A.N., Agnikpe, C., Rogers, F. (2020). Examining the influence of internal green supply chain practices, green human resource management and supply chain environmental cooperation on firm performance. *Supply Chain Management: An International Journal*, **25**(5): 585-599.

Alsetoohy, O., Ayoun, B. (2018). Intelligent agent technology: the relationships with hotel food procurement practices and performance. *Journal of Hospitality and Tourism Technology*, **9**(1): 109-124.

Amentae, T.K., Gebresenbet, G. (2021). Digitalization and Future Agro-Food Supply Chain Management: A Literature-Based Implications. *Sustainability*, **13**(21): 12181.

Asabere, N.Y., Acakpovi, A., Owusu, V.K., Attah, J.A., Opoku, E.K. (2020). Towards the Development of a Mobile Agriculture System for Poms Poultry Farm (PPF), Oyarifa-Accra, Ghana. *Journal of Digital Food, Energy & Water Systems*, **1**(1): 65-86. https://doi.org/10.36615/digitalfoodenergywatersystems.v1i1.410.

Atuahene-Gima, K., Amuzu, J. (2019). Farmcrowdy: digital business model innovation for farming in Nigeria. *Emerald Emerging Markets Case Studies*, **9**(2): 1-22.

Bahn, R.A., Yehya, A.A.K., Zurayk, R. (2021). Digitalization for Sustainable Agri-Food Systems: Potential, Status, and Risks for the MENA Region. *Sustainability*, **13**(6): 3223. https://doi.org/10.3390/su13063223.

Balana, B.B., Aghadi, C.N., Ogunniyi, A.I. (2021). Improving livelihoods through postharvest loss management: evidence from Nigeria. *Food Security*, **14**: 249–265.

Chauhan, C., Dhir, A., Akram, M.U., Salo, J. (2021). Food loss and waste in food supply chains. A systematic literature review and framework development approach. *Journal of Cleaner Production*, **295**: 126438.

Chikozho, C., Makombe, G., Milondzo, K. (2019). Difficult roads leading to beautiful destinations? Articulating land Reform's contribution to rural livelihoods in the Limpopo Province, South Africa. *Physics and Chemistry of the Earth, Parts A/B/C*, **111**: 13-19.

Chimphango, A.F., Görgens, J.F. (2015). Postharvest technology for advancing sustainable bioenergy production for food processing. *British Food Journal*, **117**(12): 2850-2862

Conteh, A.M.H., Yan, X., Moiwo, J.P. (2015). The determinants of grain storage technology adoption in Sierra Leone. *Cahiers Agricultures*, **24**(1): 47-55.

Enahoro, D., Galiè, A., Abukari, Y., Chiwanga, G.H., Kelly, T.R., Kahamba, J., Ouma, E. (2021). Strategies to Upgrade Animal Health Delivery in Village Poultry Systems: Perspectives of Stakeholders From Northern Ghana and Central Zones in Tanzania. *Frontiers in Veterinary Science*, **8**: 611357

Fue, K., Geoffrey, A., Mlozi, M.R.S., Tumbo, S., Haug, R., Sanga, C. (2016). Analyzing usage of crowdsourcing platform Ushaurikilimo'by pastoral and agro-pastoral communities in Tanzania. International Journal of Instructional Technology & Distance Learning, **13:** 3-22

Garbaba, C.A., Denboba, L.G., Mendesil, E., Ocho, F.L., Hensel, O. (2018). Actors' post-harvest maize handling practices and allied mycoflora epidemiology in southwestern Ethiopia: Potential for mycotoxin-producing fungi management. Journal of Applied Botany and Food Quality, **91**: 237-248.

Gogo, E.O., Opiyo, A.M., Ulrichs, C., Huyskens-Keil, S. (2017). Nutritional and economic postharvest loss analysis of African indigenous leafy vegetables along the supply chain in Kenya. *Postharvest Biology and Technology*, **130**: 39-47.

Gondwe, T., Tegbaru, A., Oladeji, A.E., Khonje, M., Manda, J., Gaya, H. (2017). Correlates and consequences of women's participation in the cowpea value chain in eastern Zambia. *Agrekon*, **56**(3): 263-273.

Hmidach, S., El Kihel, Y., Amegouz, D., El Kihel, B., Regad, Y. (2020). Optimizing warehouse logistics flows by integrating new technologies: Case study of an agri-food industry. In 2020 IEEE 2nd International Conference on Electronics, Control, Optimization and Computer Science (ICECOCS), IEEE, pp. 1-5.

Ikram, M., Ferasso, M., Sroufe, R., Zhang, Q. (2021). Assessing green technology indicators for cleaner production and sustainable investments in a developing country context. *Journal of Cleaner Production*, **322**: 129090.

Kabbiri, R., Dora, M., Kumar, V., Elepu, G., Gellynck, X. (2018). Mobile phone adoption in agri-food sector: Are farmers in Sub-Saharan Africa connected? *Technological Forecasting and Social Change*, **131**: 253-261.

Kaminski, A.M., Cole, S.M., Al Haddad, R.E., Kefi, A.S., Chilala, A.D., Chisule, G., Ward, A.R. (2020). Fish losses for whom? A gendered assessment of post-harvest losses in the barotse floodplain fishery, Zambia. *Sustainability*, **12**(23): 10091.

Kanyi, P., Aigbavboa, C., Mulongo, N.Y. (2018). Determining issues affecting food waste: Case study of the South African meat processing industry. Proceedings of the 2018 International Symposium on Industrial Engineering and Operations Management (IEOM), Paris, France, pp 3256-3267.

Kataike, J., Kulaba, J., Mugenyi, A.R., De Steur, H., Gellynck, X. (2019). Would you purchase milk from a milk ATM? Consumers' attitude as a key determinant of preference and purchase intention in Uganda. *Agrekon*, **58**(2): 200-215.

Khan, I.T., Bule, M., Rahman Ullah, M.N., Asif, S., Niaz, K. (2019). The antioxidant components of milk and their role in processing, ripening, and storage: Functional food. *Veterinary world*, **12**(1): 12-33.

Khan, S.A.R., Zkik, K., Belhadi, A., Kamble, S.S. (2021). Evaluating barriers and solutions for social sustainability adoption in multi-tier supply chains. *International Journal of Production Research*, **59**(11): 3378–3397.

Kitukutha, N.M., Vasa, L., Oláh, J. (2021). The Impact of COVID-19 on the economy and sustainable e-commerce. *In Forum Scientiae Oeconomia*, **9**(2): 47-72.

Liu, Y., Ma, X., Shu, L., Hancke, G.P., Abu-Mahfouz, A.M. (2020). From Industry 4.0 to Agriculture 4.0: Current status, enabling technologies, and research challenges. IEEE *Transactions on Industrial Informatics*, **17**(6): 4322-4334.

Liverpool-Tasie, L.S.O., Wineman, A., Young, S., Tambo, J., Vargas, C., Reardon, T., Celestin, A. (2020). A scoping review of market links between value chain actors and small-scale producers in developing regions. *Nature Sustainability*, **3**(10): 799-808.

Mathu, K.M. (2019). The information technology role in supplier-customer information-sharing in the supply chain management of South African small and medium-sized enterprises. *South African Journal of Economic and Management Sciences*, **22**(1): 1-8.

Mededjel, M., Belalem, G., Neki, A. (2017). Towards a traceability system based on cloud and fog computing. *Multiagent and Grid Systems*, **13**(1): 47-68.

Morris, K.J., Kamarulzaman, N.H., Morris, K.I. (2019). Small-scale postharvest practices among plantain farmers and traders: A potential for reducing losses in rivers state, Nigeria. *Scientific African*, **4**: e00086.

Moyo, M., Van Rooyen, A., Moyo, M., Chivenge, P., Bjornlund, H. (2017). Irrigation development in Zimbabwe: Understanding productivity barriers and opportunities at Mkoba and Silalatshani irrigation schemes. *International Journal of Water Resources Development*, **33**(5): 740-754.

Mwangi, G.M., Despoudi, S., Espindola, O.R., Spanaki, K., Papadopoulos, T. (2021). A planetary boundaries perspective on the sustainability: resilience relationship in the Kenyan tea supply chain. *Annals of Operations Research 2021*, pp 1-35.

Nitturkar, H. (2021). A practical tool to enhance the chances of success of digital agriculture interventions for sustainable development in Africa and India. *Journal of Crop Improvement*, **35**(6): 890-914.

Obayelu, A.E., Okuneye, P.A., Shittu, A.M., Afolami, C.A., Dipeolu, A.O. (2016). Determinants and the perceived effects of adoption of sustainable improved food crop technologies by smallholder farmers along the value chain in Nigeria. *Journal of Agriculture and Environment for International Development*, **110**(1): 155-172.

Oruma, S.O., Misra, S., Fernandez-Sanz, L. (2021). Agriculture 4.0: An Implementation Framework for Food Security Attainment in Nigeria's Post-Covid-19 Era. IEEE Access, **9**: 83592-83627.

Persis, D.J., Venkatesh, V.G., Sreedharan, V.R., Shi, Y., Sankaranarayanan, B. (2021). Modelling and analysing the impact of Circular Economy; Internet of Things and ethical business practices in the VUCA world: Evidence from the food processing industry. *Journal of Cleaner Production*, **301**: 126871.

Sidibé, A., Olabisi, L.S., Doumbia, H., Touré, K., Niamba, C.A. (2021). Barriers and enablers of the use of digital technologies for sustainable agricultural development and food security: Learning from cases in Mali. *Elementa: Science of the Anthropocene*, **9**(1): 1-15.

Tranfield, D., Denyer, D., Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, **14**(3): 207-222.