

Scientific article

UDC 330.15

DOI: <https://doi.org/10.57809/2024.3.3.10.2>

CURRENT CHALLENGES IN STATE REGULATION: E-GOVERNMENT AND AGRICULTURAL POLICIES

Carlean Chingovo ✉

Land & Larder

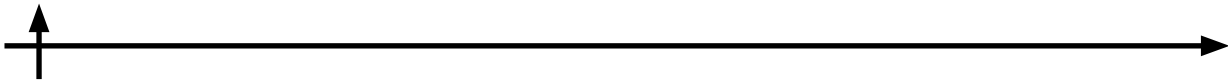
✉ carleanchingovo@gmail.com

Abstract. This article focuses on practical achievements and assessments of the results of e-government measures in the agricultural sector. E-government is based on the application of digital technologies aimed at improving public services and interaction between all stakeholders. As a tool for modernizing agriculture, it plays a crucial role in boosting the living standards of farmers. The study analyzes recent and current e-government tools that provide digital access to markets and data and dissemination of relevant information on agriculture via eMkambo, Agritex Mobile, the EcoFarmer app, etc. The authors examine the effectiveness of the AI application, blockchain, and the Internet of Things and identify the most significant bottlenecks. Based on the obtained results, it became possible to define key development tracks for the agriculture-oriented pilot projects associated with digital technologies. Such an approach proves to be highly relevant due to the fact that agriculture is a key sector ensuring food security and economic development of states.

Keywords: e-government, digital transformation, agricultural policy, digital literacy, smart agriculture, artificial intelligence, block-chain, Internet of Things

Citation: Chingovo C. Current challenges in state regulation: e-government and agricultural policies. Technoeconomics. 2024. 3. 3 (10). 15–26. DOI: <https://doi.org/10.57809/2024.3.3.10.2>

This is an open access article under the CC BY-NC 4.0 license (<https://creativecommons.org/licenses/by-nc/4.0/>)



Научная статья

УДК 330.15

DOI: <https://doi.org/10.57809/2024.3.3.10.2>

СОВРЕМЕННЫЕ ПРОБЛЕМЫ ГОСУДАРСТВЕННОГО РЕГУЛИРОВАНИЯ: ЭЛЕКТРОННОЕ ПРАВИТЕЛЬСТВО И СЕЛЬСКОХОЗЯЙСТВЕННАЯ ПОЛИТИКА

Карлин Чингово ✉

Land & Larder

✉ carleanchingovo@gmail.com

Аннотация. Данная статья посвящена практическим достижениям и исследованию результатов работы электронного правительства в сельскохозяйственном секторе. Электронное правительство основано на применении цифровых технологий для улучшения государственных услуг и взаимодействия между заинтересованными сторонами. В качестве инструмента модернизации сельского хозяйства оно играет решающую роль в повышении уровня жизни фермеров. В ходе исследования были проанализированы недавние и текущие инструменты электронного правительства, предоставляющие цифровой доступ к рынкам и данным, распространению актуальной информации о сельском хозяйстве, такие как eMkambo, Agritex Mobile, приложение EcoFarmer и др. Авторами также рассматривается эффективность применения технологии искусственного интеллекта, блокчейна и Интернета вещей с последующим выявлением наиболее проблемных аспектов, связанных с их внедрением. По результатам исследования были определены ключевые траектории развития пилотных проектов, направленных на применение цифровых технологий в сельском хозяйстве — ключевом секторе, обеспечивающем продовольственную безопасность и экономическое развитие государства.

Ключевые слова: электронное правительство, цифровая трансформация, сельскохозяйственная политика, цифровая грамотность, умное сельское хозяйство, искусственный интеллект, блокчейн, Интернет вещей

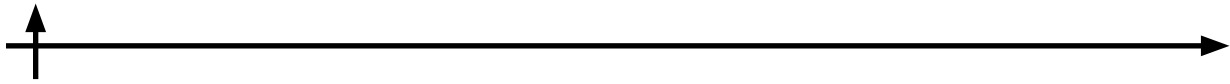
Для цитирования: Чингово К. Современные проблемы государственного регулирования: электронное правительство и сельскохозяйственная политика // Техноэкономика. 2024. Т. 3, № 2 (9). С. 15–26. DOI: <https://doi.org/10.57809/2024.3.3.10.2>

Это статья открытого доступа, распространяемая по лицензии CC BY-NC 4.0 (<https://creativecommons.org/licenses/by-nc/4.0/>)

Introduction

E-government is a term used to describe how the utilization of digital technologies by government agencies can increase the accessibility, efficiency, and transparency of public services. These consist of a variety of online platforms and digital gadgets that facilitate interactions between the government and residents, simplify government processes, and improve information transmission. E-government initiatives have become crucial in supporting farmers in the agricultural sector through timely provision of information as well as resources and markets. The use of information communication technologies (ICTs) has been employed in these initiatives to address some major problems faced by farmers, for instance market instability, climate change and resource depletion (Bwalya, 2012; Maydanova, Ilin, 2023.).

It is increasingly accepted that digital transformation in agriculture is a powerful engine aimed at boosting productivity, sustainability and economic growth. With digital technologies invited, farming practices are improved via optimization of resources, rise in crop yields and better access to markets. This revolution entails several activities such as policy setting, promotion of research and development projects, financial assistance, putting up infrastructural



facilities and many others. Governments can encourage e-Government services to bridge the Digital Divide so that even small scale farmers benefit from IT innovation. This in turn contributes to broader objectives of food security, poverty alleviation and sustainable rural development (Chavhunduka, 2020).

Materials and Methods

This research implements an extensive literature review, encompassing academic papers, government reports, and industry analyses. A descriptive analysis is employed to present a clear picture of current agricultural landscape, highlighting its reliance on information and communication technologies. The main purpose is to assess how e-government influences the agricultural sector in three major areas:

1. Government Initiatives: What government initiatives/policies have been put into place to support the process of digitization? Ultimately, what policy frameworks/programs have been built over time to promote farmers' adoption of IT tools?

2. Impact on Farmers: Assessing implications of e-government services on information dissemination and market accessibility for farmers to evaluate the effectiveness of the government's digital assets and resources on the farming methods, featuring market accessibility, and its economic effect on farmers.

3. Case Studies: Case studies for investigating best practices of e-government in agriculture. In this sort of reviews we aim to discuss all examples of best practices in order to define existing challenges and promising development paths.

Results and Discussion

E-government, or electronic government, aims to apply information and communication technology (ICT) to government activities and practices so as to improve efficiency, transparency, and citizen participation. E-government includes the following constituents:

E-Services – provision of government services via internet, such as online submission of tax returns or applying for a license;

E-Administration – utilization of digital tools to enhance internal government processes by means of better resource management and operational efficiency;

E-Democracy – using electronic platforms, like online consultations or voting systems, in order to facilitate citizen engagement and participation in decision-making processes.

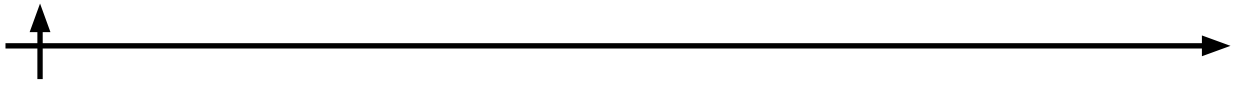
E-government initiatives are focused on bringing public services closer, reducing administrative loads, and promoting more openness as well as accountability. In relation to agriculture, this can enable farmers receive essential data on weather patterns, prevailing market prices, and best practices, hence increasing their productivity levels and boosting resilience (Chikwanha, 2019).

Government interventions aimed at supporting and regulating the agricultural sector are referred to as agricultural policies. They may involve subsidies, trade restrictions, price stabilization or support schemes and research and development programs, etc. Within the context of digitalization, there are a number of policies that stand out:

Development of Digital Infrastructure – policies aimed at connecting rural areas through internet access and ICT infrastructure for farmers;

Subsidies and Incentives – financial provisions towards adoption of new technologies including training programs meant to improve farmers' digital literacy;

Research and Development – funding for research in innovative agricultural technologies



that can be transferred digitally to farmers;

Regulatory Frameworks – setting standards and regulations for digital tools and data management in agriculture so as to ensure safety, privacy, and compatibility (Da Silveira, 2021).

These policies are important for promoting widespread adoption of e-government services as well as digital tools within agricultural sector. Effective agricultural policies can play a role in bridging the existing digital divide by providing smallholders with the necessary resources required to catch up with the ongoing technological changes in this field (Kshetri, 2014).

Digital transformation in its widest definition involves the integration of digital technology in all business and social activities that transform the nature and modes of operation and deliver services or value to people. Some of these technologies include precision farming, IoT sensors, drones, and block-chain. They help farmers to:

Optimize Resource Use. With precision agriculture technologies, farmers can use water, fertilizers and pesticides more efficiently thus reducing wastage and increasing yields.

Enhance Decision-Making. It is possible for farmers to access data analytics and AI to identify crop health issues, availability of soil nutrients, market dynamics etc.

Improve Market Access. By using digital platforms farmers can link up with buyers directly, thereby avoiding middlemen, leading to fairer prices.

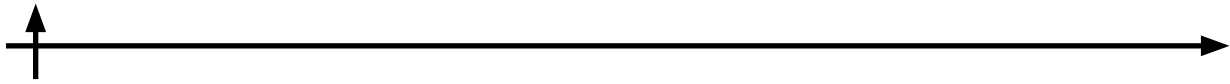
Increase Resilience. Real-time information on weather patterns and pest outbreaks enables farmers to make timely responses to emerging conditions, thus minimizing associated risks (Revenko, 2019).

Implementation of the above mentioned technologies in agriculture promises three potential benefits – higher production output, sustainable development and profitability. Many traditional problems that were faced by farmers including lack of access to markets and inefficient use of resources can be addressed through the employment of various digital tools.

In order to successfully address existing problems and push for a more progressive form of agriculture, it is necessary for governments to support new agricultural initiatives that have digital elements and modernize the sector to incorporate innovative technologies for the benefit of the farmers. In Zimbabwe, for instance, such initiatives are associated with the push to increase yields and productivity in the agricultural sector, and making agricultural production conform to global market requirements. Government has realized the role of digital technologies in solving some of the pertinent problems including, poor productivity, market access and susceptibility to climate change shocks. Consequently, several policies and programs that support the application of Digital Tools and enhancement of competitiveness have been implemented (Shonhiwa, 2021).

For example, the National ICT Policy envisages how ICT can be used to foster socio economic growth, the sector which includes agriculture. This policy also stresses the necessity of a strong digital platform, technology solutions, innovations and research. Moreover, the Agricultural Policy Framework also includes digital transformation into its ongoing policy that is seeking to enhance agricultural and food system through precision farming, mobile applications, and e-extension services. The above mentioned frameworks provide an institutionalized opportunity to employ Information Technology in Agriculture and make it a systematic process which can follow over a specific program cohesively in tandem with over all development programs.

E-Agriculture is another, perhaps one of the most famous, initiatives in agriculture. Its primary goal is to equip farmers with efficient instrumental and information support to improve their performance and extend markets. It involves development of mobile applications that provide information on weather, markets, and standards on the go. Another exemplary program includes the Smart Agriculture that aims to utilize IoT sensors for resource management resulting in increased crop productivity (Stoces, 2016). These are typically jointly realized with



international organizations, as well as with private business.

To a greater extent, all these government trends are aimed at increasing efficiency in the agricultural sector, gaining market access, and sustainable outcome. Coordination of ICT for farming, through incorporating ICT tools into the farming processes is seen by the government as a means of improving yields and cutting input costs, making the business more commercially viable. Market access improvement is another essential outcome, which implies these measures to link farmers' production directly to consumers with fewer intermediaries promoting better pricing. In addition, it also supports sustainable practices that reduce the use and degradation of natural resources for agriculture to support food production adaptation to climate change.

When comprehensively implemented, these measures can contribute to a number of benefits for farmers that are hard to underestimate, such as access to information, market access and economic boost.

1. Access to Information

Considering e-services, the access to important information by farmers is enhanced substantially: weather conditions, prices for crops, as well as production recommendations. Available government websites and smart applications enhance the timeliness of communicated information and weather changes that farmers need in order to make adequate decisions about planting or harvesting their crops. Further on, the market price information helps farmers to sell their produce in a market of their choice at the right time in order to get the fair price for their products. These e-government platforms also provide farmers with educational information and even suggest best practices to incorporate more advanced farming techniques and enhance their yields.

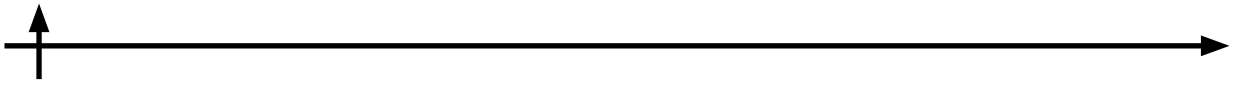
2. Market Access

Online markets make it easier for farmers to get to market because sourcing marketing inputs is done directly with the buyers without intermediaries. Some e-government initiatives present online markets where farmers can offer their produce with related prices for direct agreement with the buyers. It unambiguously benefits farmers by offering better prices and, at the same time, expands their market access beyond immediate regional context. In addition, another advantage of internet-based markets is that they bring efficiency to supply systems by offering logistical aid and monitoring the flow of goods in order to minimize losses (Mashingaidze, 2020).

3. Economic benefits

The positive economic impacts of e-government services include income ethnicity and enable the farmers to get relevant information on the weather and market trends in order to prevent loses in the event of farmers producing crops which are prone to be destroyed by bad weather conditions. Also, digital tools can make efficient use of resources by extending the effective utilization of water, fertilizers, and pesticides. Combined with general market access and direct bargaining with buyers, these tools support the economic viability and expansion of agriculture as a key industry (Sylvester, 2019).

However, several challenges are experienced by the farmers to avail the e-government services even if they have lots of advantages. For instance, digital literacy is still a major modern issue because not all farmers and especially the older generation are knowledgeable when it comes to using digital devices. Another challenge is the infrastructure aspects that limit participation, including lack of reliable Internet connection in rural areas. What is more, accessing the necessary digital devices and using data services to power smart solutions can be very expensive to the smallholder farmers. In order to overcome these challenges, it is necessary to undertake specific action which might include conducting computer training and investments in ICT in the rural regions (Wolfert, 2017).



In order to support the idea of ICT being highly beneficial for farmers, it is important to showcase several platforms successfully employed in agriculture.

Case Study 1: Project A - eMkambo

eMkambo is an e-government project in Zimbabwe trending to offer a virtual platform for farmers to obtain relevant market news and engage in the sale of farming produce. The project intends to provide farmers with opportunities to get closer to the markets and gain an understanding of market prices, as well as streamline and optimize sales (Agricultural solutions; Food and Agriculture Organization of the United Nations. Digital Agriculture: Supporting Digital Transformation in Agriculture).

The eMkambo platform was created by the Ministry of Agriculture and Information Communication Technology, together with the technology stakeholders in Zimbabwe and innovation counterparts from other countries. It encompasses the establishment of a mobile application where farmers can register and list their products; and a web-based portal which will enable them to compare the current market price with those set by major supermarkets and buyers. Educational meetings were organized to make farmers familiar with the use of platform, and rural information centers were established to address the existing issues.

As a result, farmers can now get the latest information on the market and obtain higher income, since they can now bargain for better prices and also cut out several intermediaries. What is more, it has improved market transparency and competition in the agricultural market (Ministry of Agriculture. eMkambo: Transforming Market Access for Farmers).

Case Study 2: Project B - Agritex Mobile

Another practice developed to support the overall mission is Agritex Mobile which focuses on availing extension service through the use of mobile phones. In this project, the Short Message Service, SMSs and Mobile applications are used to convey timely advice on farming, weather and pests to farmers.

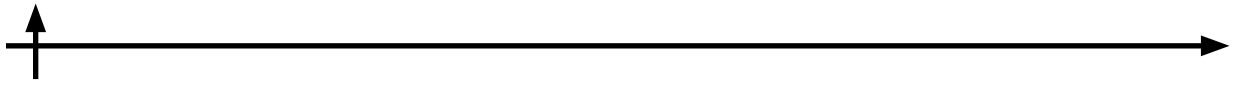
Administered by the Ministry of Lands, Agriculture, Water, Climate, and Rural Resettlement, Agritex Mobile encompassed the creation of a tool that alerts subscribers through SMS and avails Agritex information. It also took an evolutionary approach that began with the implementation of pilot projects across a few districts. Introductory training programs and workshops were carried out to familiarize farmers with the technology available.

The Agritex Mobile has enhanced extension services to enable reaching out with improved impacts in Zimbabwe. Farmers are now able to get the permit advice and alarms, hence act on time on the current conditions and other threats such as pests and diseases. The project has been viewed as helpful in enhancing the productivity of yields, as well as a reducing losses potentially brought by unfavorable climate conditions and pest attacks. Furthermore, due to the readily available professional advice, farmers have been able to improve their farming practices and enhance their yields (Ministry of ICT. Postal and Courier Services. E-Agriculture Initiative).

Case Study 3: Project C - EcoFarmer

EcoFarmer is a new online market that was created by the Econet Wireless Company in partnership with the Zimbabwean government. The alarm clock informs the farmers about the prevailing weather conditions and farming advice. This service also provides a sales platform to access and sell agricultural products.

EcoFarmer was delivered through a mobile application interface. The project entailed provision of SIM cards with services already installed by NGOs and other related organizations that provided services through promotional campaigns and partnerships with farmers and companies. The platform also has micro-insurance products, which can be used as a safety net in compensating farmers for losses caused by adverse weather conditions.



EcoFarmer has made a big difference for the agricultural industry within shorter time span by bringing detail information and services handy for the farmers. The weather patterns and advice on farming have also helped farmers arrange themselves in a better way and have higher management performance. The virtual marketplace has enabled easy access to quality inputs and the increased number of market outlets for their produce. In addition, the micro-insurance service offered by the Ministry, has provided a backup for the farmers by affording them an assurance of minimizing risks encountered in farming through an insurance (Government of Zimbabwe. National ICT Policy).

However, there is still a collection of challenges for farmers to deal with. Primarily, they include infrastructure issues, lack of digital literacy and sustainability, policy and regulation barriers.

Infrastructure Issues

Prominent and recurrent factors hindering effective implementation of e-government strategies in the agricultural sector relate to infrastructure. It is worth mentioning that many areas in Zimbabwe, especially in rural zones, still have a poor internet connection that is required to use different digital resources. It is compounded by a scarcity of electricity, meaning farmers cannot charge their devices or engage in internet-supported activities consistently. What is more, considering the capital-intensity of digital devices, and accessibility to data services by the smallholder farmers, they end up locked out from cooperation with e-government. Such infrastructure deficiencies impede digital transformation and prevent its whole-scale application in agriculture (Smart Agriculture in Zimbabwe).

Digital Literacy

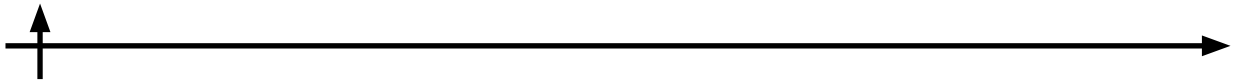
Accessibility to digital resources is one of the main difficulties to tackle, especially when it comes to farmers. Up to this day, farming is still being dominated by the elder generations who are not digitally literate enough to properly employ digital enablers in managing their ventures. This defamed literacy results in their inability to access and fully utilize e-government services (World Bank. ICT in Agriculture: Connecting Smallholder Farmers to Knowledge, Networks, and Institutions). In some cases, training programs are needed to overcome this gap. Although, such training is time-consuming and costly, therefore may not reach everyone. In addition, there are still problems of complexity in some digital platforms which hinders the farmers from utilizing the available services (OECD. Digital Opportunities for Better Agricultural Policies).

Policy and Regulatory Barriers

Policy and regulation is yet another factor that is a major concern in adoption of e-government solutions in agriculture, since they present a number of barriers that need to be overcome. In the past, it was also possible to explain constrained use of new technologies by outdated or restrictive policies (Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement. Agricultural Policy Framework). For instance, intricately restricted laws on the stewardship of data and data security may hinder the implementation of e-markets that utilize data collected on agricultural products and markets. Furthermore, there appears to be no definite norms or best practices when it comes to digital agriculture; this leads to incongruity and slows down the manifestation of novel tools as well as solutions. The issue of policies and reforms in advanced technology must undergo significant change in order for the digital transformation to be carried out effectively.

Sustainability and Scalability

Most of the e-projects are first supported by extraneous patrons or through government subsidies, but sustaining most of them ends up in demanding a recurrent funding and support system. Furthermore, there are usually problems in reproducing pilot practices at a national level and such scaling comes with much effort and costs. Factors that come into play include



procuring perfect hardware and software with constant training, and installing projects that reflect different regional conditions for sustainability and growth of e-government.

Conclusion

The future of e-government and digital transformation in agricultural forms the new trends effecting the agricultural outlook. An emerging trend is the use of enhanced technologies like artificial intelligence (AI), and machine learning (ML) to develop predictive models that would act as an advisory tool for farmers. It is usually able to pull data from different sources on the health of crops, the right time and manner of planting, as well as resource management. Another trend is block-chain technology, which contributes to increased transparency and accountability of farmers and suppliers during the distribution of products, excluding fraud and guaranteeing fair compensation for intermediaries. Moreover, the rise in demand for mobile and IoT devices promotes smart farming applications that can be used to track and control growth of crops, moisture content in the soil, and meteorological changes.

In order to enhance the effectiveness of e-government initiatives, policymakers should focus on several key areas.

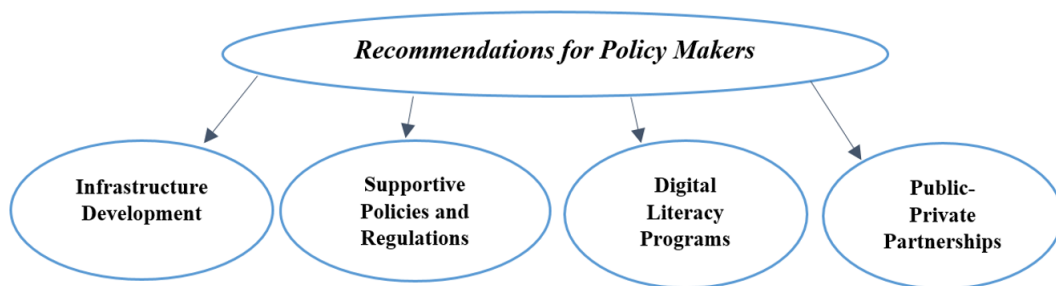


Fig. 1. Efficiency-centered recommendations for policy makers

1. Infrastructure Development – ensure that funding is directed towards strong digital networks such as the Internet; ensure cheap and reliable power source in rural areas;
2. Digital Literacy Programs – extend digital literacy initiatives to help farmers improve their understanding of digital technologies and platforms;
3. Supportive Policies and Regulations – employment of best practices and implementation of polices that will encourage the use of technologies in agriculture; protecting data;
4. Public-Private Partnerships – persuade multi-stakeholder engagement mechanisms that include the government, private and external entities to boost their competence, funding, and technologies for e-government advancement.

Farmers can adopt several strategies to better leverage e-government services:

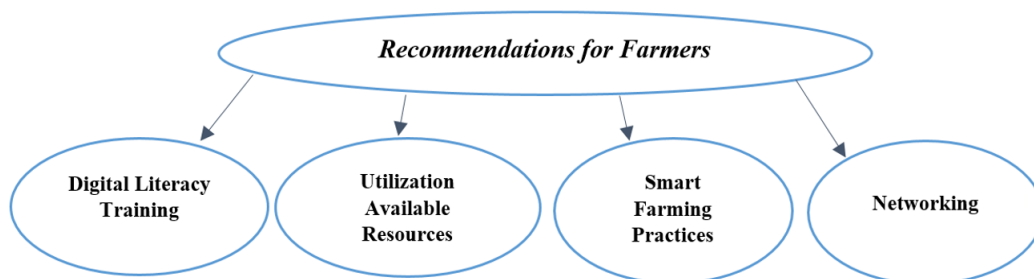
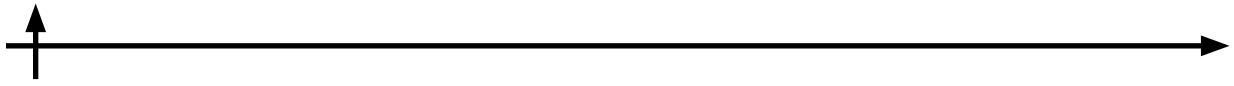


Fig. 2. Efficiency-centered recommendations for farmers



1. Engage in Digital Literacy Training – make sure that employees attend training sessions that would help them become more comfortable with smartphone applications and websites overall;

2. Utilize Available Resources – utilize the social media and other applications offered by the government and other organizations in order get the required information about the market, weather etc.; seek expert’s advice on agriculture;

3. Adopt Smart Farming Practices – integrate IoT devices and smart farming solutions to better operate, monitor and manage farms so that productivity enhanced and associated costs cut down.

4. Network with Other Farmers – access the social digital farmer platforms, forums and other relevant online groups for experience and best practice sharing.

Despite significant progress, there are still several gaps in the current research that also need to be addressed.

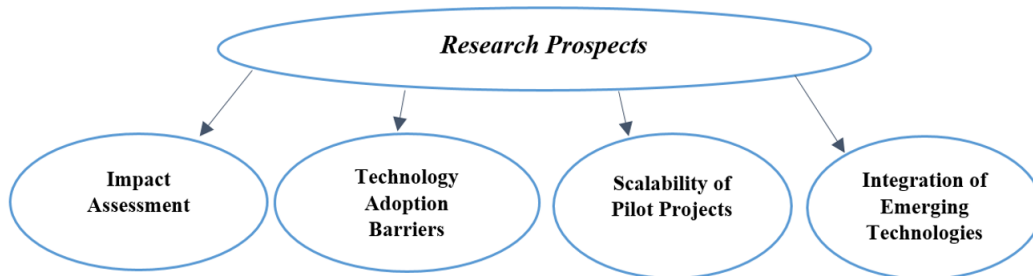


Fig. 3. Research prospects associated with e-government strategies in agriculture

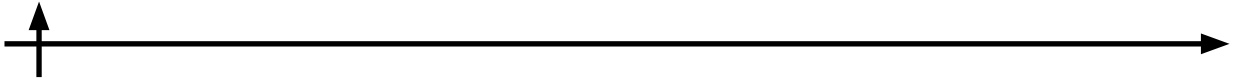
1. Impact Assessment – further research has to evaluate the long-run effects of the adopted e-government strategies on the agriculture performance and farmers’ living standards;

2. Technology Adoption Barriers – more literature review is needed to unveil the factors that hinder the farmer to embrace technologies, especially the small scale farmers;

3. Scalability of Pilot Projects – find out the external and internal stimulants and constrains of scalability and sustainability of connected pilot projects in order to transfer them on a national level;

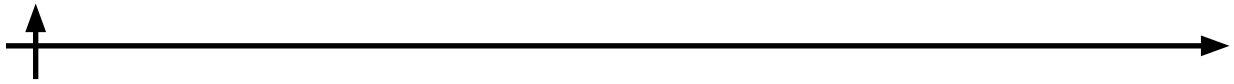
4. Integration of Emerging Technologies – examine the possibility of incorporating emerging technologies that include artificial intelligence, block chain, and IoT into the existing e-government environment to maximize benefits.

All in all, e-government is one of the revolutionary tools that, if efficiently implemented, can bring a shift in the agricultural sector towards high productivity in a short time. The availability of real time information, direct market link and timely extension services enable farmers to make better decisions, enhance production per unit of land, and ultimately raise their income. However, in order to achieve these benefits, there is a need for further investment in digital resources, effective and intensive approach in promoting digital literacy, and development of policies that support investment in ICT projects that are easy to implement. The relevant challenges that still remain require multi-stakeholder approach involving government and other policymakers, private companies, and global institutions to shed adequate light on the existing problems and support the favorable environment for digital transformation in the agriculture sector to take place. The use of e-government initiatives has the potential of improving the lives of farmers, as well as ensuring food security and economic growth in the agricultural sector.



REFERENCES

- Bwalya K. J., Du Plessis T.** 2012. A Snapshot Overview of the Digital Divide: E-Government and the Challenges of Bridging the Digital Divide in Africa. *International Journal of E-Business and E-Government Studies* 4(1), 1-10. doi:10.4018/978-1-4666-0324-0.ch004
- Chavhunduka R.** 2020. Digital Transformation in Zimbabwean Agriculture: Objectives and Goals. *Journal of Agricultural Innovation* 14(2), 112-129.
- Chikwanha T.** 2019. Agritex Mobile: Enhancing Agricultural Extension through Digital Innovation. *International Journal of Agricultural Extension* 12(1), 45-60.
- Da Silveira F., Lermen F.H., Amaral F.G.** 2021. An overview of agriculture 4.0 development: Systematic review of descriptions, technologies, barriers, advantages, and disadvantages. *Computers and electronics in agriculture* 189, 106405. doi:10.1016/j.compag.2021.106405
- Kshetri N.** 2014. The emerging role of Big Data in key development issues: Opportunities, challenges, and concerns. *Big Data & Society* 1 (2), 2053951714564227. doi:10.1177/2053951714564227
- Mashingaidze K.** 2020. The Implementation and Impact of eMkambo on Zimbabwean Farmers. *Journal of Agricultural Economics* 15(3), 210-225.
- Maydanova S.A., Ilin I.V.** 2023. Digital transformation strategy development in an enterprise architecture context. *Technoeconomics* 2, 1 (4), 64–75. DOI: <https://doi.org/10.57809/2023.2.1.4.6>
- Revenko L. S., Revenko N. S.** 2019. Global agricultural policy trends: bridging the digital divide. *External Challenges and Risks for Russia in the Context of the World Community's Transition to Polycentrism. Economics, Finance and Business*, 115-120. doi:10.2991/icefb-19.2019.29
- Shonhiwa M.** 2021. The Role of EcoFarmer in Enhancing Agricultural Productivity and Resilience. *African Journal of Agricultural Research* 17(4), 341-355.
- Stoces M. et al.** 2016. Internet of things (IOT) in agriculture—selected aspects. *Agris on-line Papers in Economics and Informatics* 8 (1), 83-88. doi:10.7160/aol.2016.080108
- Sylvester G.** 2019. E-agriculture in action: blockchain for agriculture (opportunities and challenges). The Food and Agriculture Organization of the United Nation.
- Wolfert S. et al.** 2017. Big data in smart farming—a review. *Agricultural systems* 153, 69-80. doi:10.1016/j.agsy.2017.01.023
- Agricultural solutions. URL: <https://www.trimble.com/en/solutions/industries/agriculture> (accessed 10.05.2024).
- Food and Agriculture Organization of the United Nations. Digital Agriculture: Supporting Digital Transformation in Agriculture. URL: <https://www.fao.org/partnerships/fao-un-system/en/> (accessed 10.08.2024)
- Government of Zimbabwe. National ICT Policy. URL: <https://www.gisp.gov.zw/reviewed-zimbabwe-national-policy-for-information-communication-technology-ict-covering-the-period-2022-to-2027/> (accessed 12.08.2024)
- Ministry of Agriculture. EMkambo: Transforming Market Access for Farmers. URL: <https://www.emkambo.co.zw/> (accessed 12.08.2024)
- Ministry of ICT. Postal and Courier Services. E-Agriculture Initiative. URL: <https://www.fao.org/e-agriculture/category/countries/zwe> (accessed 11.08.2024)
- Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement. Agricultural Policy Framework. URL: <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC211964/> (accessed 12.08.2024)
- OECD. Digital Opportunities for Better Agricultural Policies. URL: https://www.oecd.org/en/publications/the-digitalisation-of-agriculture_285cc27d-en.html (accessed 11.08.2024)
- Smart Agriculture in Zimbabwe: Leveraging IoT and Data Analytics. URL: <https://smartafrika.org/knowledge/zimbabwe-agritech-strategy-2021-2025/> (accessed 12.08.2024)
- World Bank. ICT in Agriculture: Connecting Smallholder Farmers to Knowledge, Networks, and Institutions. URL: <https://openknowledge.worldbank.org/entities/publication/1df23eb0-fc5c-5e21-b2cc-96957e921c72> (accessed 12.08.2024)



СПИСОК ИСТОЧНИКОВ

Bwalya K. J., Du Plessis T. 2012. A Snapshot Overview of the Digital Divide: E-Government and the Challenges of Bridging the Digital Divide in Africa. *International Journal of E-Business and E-Government Studies* 4(1), 1-10. doi:10.4018/978-1-4666-0324-0.ch004

Chavhunduka R. 2020. Digital Transformation in Zimbabwean Agriculture: Objectives and Goals. *Journal of Agricultural Innovation* 14(2), 112-129.

Chikwanha T. 2019. Agritex Mobile: Enhancing Agricultural Extension through Digital Innovation. *International Journal of Agricultural Extension* 12(1), 45-60.

Da Silveira F., Lermen F.H., Amaral F.G. 2021. An overview of agriculture 4.0 development: Systematic review of descriptions, technologies, barriers, advantages, and disadvantages. *Computers and electronics in agriculture* 189, 106405. doi:10.1016/j.compag.2021.106405

Kshetri N. 2014. The emerging role of Big Data in key development issues: Opportunities, challenges, and concerns. *Big Data & Society* 1 (2), 2053951714564227. doi:10.1177/2053951714564227

Mashingaidze K. 2020. The Implementation and Impact of eMkambo on Zimbabwean Farmers. *Journal of Agricultural Economics* 15(3), 210-225.

Maydanova S.A., Ilin I.V. 2023. Digital transformation strategy development in an enterprise architecture context. *Technoeconomics* 2, 1 (4), 64–75. DOI: <https://doi.org/10.57809/2023.2.1.4.6>

Revenko L. S., Revenko N. S. 2019. Global agricultural policy trends: bridging the digital divide. *External Challenges and Risks for Russia in the Context of the World Community's Transition to Polycentrism. Economics, Finance and Business*, 115-120. doi:10.2991/icefb-19.2019.29

Shonhiwa M. 2021. The Role of EcoFarmer in Enhancing Agricultural Productivity and Resilience. *African Journal of Agricultural Research* 17(4), 341-355.

Stoces M. et al. 2016. Internet of things (IOT) in agriculture—selected aspects. *Agris on-line Papers in Economics and Informatics* 8 (1), 83-88. doi:10.7160/aol.2016.080108

Sylvester G. 2019. E-agriculture in action: blockchain for agriculture (opportunities and challenges). The Food and Agriculture Organization of the United Nation.

Wolfert S. et al. 2017. Big data in smart farming—a review. *Agricultural systems* 153, 69-80. doi:10.1016/j.agsy.2017.01.023

Агротехнические решения. URL: <https://www.trimble.com/en/solutions/industries/agriculture> (дата обращения: 10.05.2024).

Цифровое сельское хозяйство: Поддержка цифровой трансформации в сельском хозяйстве (ООН). URL: <https://www.fao.org/partnerships/fao-un-system/en/> (дата обращения: 10.08.2024)

Правительство Зимбабве. Национальная политика в области ИКТ. URL: <https://www.gisp.gov.zw/reviewed-zimbabwe-national-policy-for-information-communication-technology-ict-covering-the-period-2022-to-2027/> (дата обращения: 12.08.2024)

Министерство сельского хозяйства. eMkambo: преобразование доступа к рынку для фермеров. URL: <https://www.emkambo.co.zw/> (дата обращения: 12.08.2024)

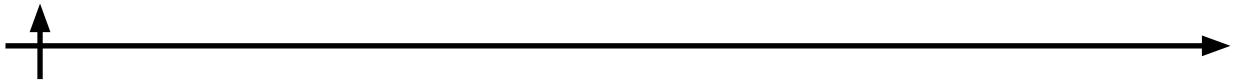
Министерство ИКТ. Почтовые и курьерские службы. Инициатива электронного сельского хозяйства. URL: <https://www.fao.org/e-agriculture/category/countries/zwe> (дата обращения: 11.08.2024)

Министерство сельского хозяйства, водных ресурсов, климата и сельского переселения. Основы сельскохозяйственной политики. URL: <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC211964/> (дата обращения: 12.08.2024)

ОЭСР. Цифровые возможности для совершенствования сельскохозяйственной политики. URL: https://www.oecd.org/en/publications/the-digitalisation-of-agriculture_285c-c27d-en.html (дата обращения: 11.08.2024)

Умное сельское хозяйство в Зимбабве: Использование IoT и аналитики данных. URL: <https://smartafrica.org/knowledge/zimbabwe-agritech-strategy-2021-2025/> (дата обращения: 12.08.2024)

Всемирный банк. ИКТ в сельском хозяйстве: Интеграция мелких фермеров в сельскохозяйственные институты. URL: <https://openknowledge.worldbank.org/entities/>



publication/1df23eb0-fc5c-5e21-b2cc-96957e921c72 (дата обращения: 12.08.2024)

INFORMATION ABOUT AUTHOR / ИНФОРМАЦИЯ ОБ АВТОРЕ

CHINGOVO Carlean – student.
E-mail: carleanchingovo@gmail.com
ЧИНГОВО Карлин – студент.
E-mail: carleanchingovo@gmail.com

Статья поступила в редакцию 15.08.2024; одобрена после рецензирования 26.08.2024; принята к публикации 29.08.2024.

The article was submitted 15.08.2024; approved after reviewing 26.08.2024; accepted for publication 29.08.2024.