

Strategy for the adoption and effective utilization of mobile phone technologies in smallholder agriculture in Zimbabwe

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ABSTRACT There is a growth in research on the benefits and use of mobile phone technology in the whole world. Zimbabwe as a country has seen that this is a feasible route to explore. This paper explores how other countries are using this technology to improve agriculture yields. It analyses factors that are hindering mobile phone technology use and adoption among smallholder farmers in Zimbabwe. The paper employed qualitative research design, guided by inductive approach underpinned by interpretivism philosophy. Findings from the gathered data showed that smallholder farmers are willing to make use of mobile phone technologies in their farming context. The cost of gathering data, lack of training and poor infrastructure was seen as the main hindrances to adopting mobile technology in agriculture. The paper then designs a strategy that can be used for mobile technology adoption and effective utilization by smallholder farmers in Zimbabwe. Recommendations such as farmer training, government involvement and infrastructure development in rural areas were suggested. This research adds to the existing body of literature since there was no known research in Zimbabwe which focused on developing a mobile phone strategy for smallholder farmers.

Keywords: Smallholder farmers, Mobile phone, Rural, Interpretivism, Strategy, Adoption of Technology.

1. Introduction

Agriculture is the backbone of the economic growth and poverty eradication solutions especially in the rural areas of Zimbabwe (Muchati, 2014). The majority of the country's population owns a mobile device known as cell phone that is being used for communication (Musungwini, 2016). Mobile ICT is one of the trending technologies that are providing solutions to problems encountered in any industry such as education, health and agriculture. The use of mobile devices do offer great potential in improving level of services and reducing costs in most industries. After investing huge amounts of money in mobile ICT technologies, if the mobile devices are used for communication purpose only (such as making calls and texting) they will be underutilized. This research develops a strategy for adoption and effective utilization of mobile phone technologies by small holder farmers in Zimbabwe in order to

improve the living conditions of smallholder farmers. Mobile technology and mobile phone technology is used in this research to mean mobile and cellular communication devices and services. These terms are used interchangeably to mean those technologies that can be moved from one place to another when accessing information.

2. Background and Context

Mobile phone technology is one of the many ICT technologies that have evolved in the recent years (ICT4Ag project 2014-2015). Asongu (2015) and Aker and Mbiti, (2010) highlighted that the fast penetration of ICT will bring in new opportunities for African farmers in improving their knowledge and lifestyles. Mobile phone based services have been developed in recent years, to provide marketing information and for use in agriculture (Gakuru et al 2009; Quiang et al, 2011). More so researchers have discovered that mobile phones have a positive impact on poverty reduction (Silarszky et al, 2008). However adoption of these mobile phone technologies and their utilization are low in developing countries and there is need to design adoption and utilization strategies for specific groups (Aguilar-Gallegos et al, 2015).

Mobile phone technology has become the most omnipresent technology in developing countries (Aker & Mbiti, 2010b; Musungwini, Zhou, & Ruvinga, 2014). Mobile devices such as mobile phones that are normally being used to communicate with family members can be used for agriculture business. As a result it can help transform businesses including the agriculture sector (Deloitte, 2012; Ewing et al 2014). Nyamba & Mlozi (2012) and Oladele (2015), research have shown that mobile phone technologies can improve production among rural area small holder farmers. Small holder farmers in rural areas require information on weather, markets, cultivation timing among others and mobile phone technology has been used in other countries so that this information reach farmers (Chisita & Malapela 2012).

In Sub- Saharan Africa mobile phone applications in agriculture are being used to monitor rainfall tracking, soil composition, maps, and inventory management. According to the World Bank about 67.72% of the people in Zimbabwe live in rural areas and these people depend on agriculture for survival. An increase in the number of base stations in rural areas has been noted in the past year (POTRAZ 2017). Base stations are needed for one to be able to utilize mobile phones or cell phones; therefore mobile phone technology plays a significant role in improving the livelihood of smallholder farmers in Zimbabwe.

Chisita & Malapela (2012) agrees that mobile technology adoption is providing agriculture industry with opportunities to extend their services to those who are disadvantaged and geographically dispersed especially in rural areas. According to researches done in countries such as Tanzania, Uganda, China, Ethiopia, Kenya, mobile technology plays an important role in providing information to farmers (Furuholt & Matotay, 2011; Gichamba, Lukandu, & Lukandu, 2012; Martin & Abbott, 2011; Nickitas, 2011; Qiang, Kuek, Dymond, & Esselaar, 2011; Tadesse & Bahiigwa, 2015).

In Zimbabwe some mobile phone technologies are there for agriculture but there is slower adoption because of lack of strategies. These include mobile services and apps for agriculture. The following are some of the mobile phone technologies in Zimbabwe agriculture sector:

- EMkambo Nest – this is a mobile app for Zimbabwe’s agriculture sector which complements SMS, call centers and face to face knowledge sharing among farmers.

- Kurima Mari – this is an e-extension mobile farming App created for small holder farmers and extension workers.
- E-Hurudza Africa – a market driven platform developed by the Hurudza team to provide information to farmers regarding different markets and agriculture activities.
- Eco-Farmer – an ECONET owned mobile farming platform used to deliver farming tips and advice through SMS's
- Agro Axess – a mobile app developed by XDS (eXpert Decision Systems) that provides farmers and merchants with an input –output management solution.

At the time of carrying out this research many articles had been published on adoption and use of ICTs particularly mobile phones adoption and use by smallholder farmers in Sub-Saharan Africa. However, we established that, the diffusion models are at the epicentre of ongoing efforts to scale ICT use in agriculture. At the time of carrying out this research there was still debate on how best to achieve effective use of mobile phones in smallholder agriculture with no end in sight. Even in the developed countries the adoption and use of mobile phones is not extensive, maybe because the technology play more of a complementary role whereas in the developing countries it is the only technology available. Usually, research on the diffusion of technology is used when the researcher seeks to understand how the spread of an innovation happens among certain groups in a given environment.

At the time of carrying out this research there was no known research which specifically focused of development of a strategy for the adoption and effective utilization of mobile phones by smallholder farmers.

3. Strategy Formulation

A strategy is concerned with the future. It can be explained as a roadmap to achieve future goals. To come up with an effective strategy in the adoption of mobile phone technologies among smallholder farmers the following strategy formulation phases as explained by (Wheelen and Hunger, 2006) will be explained:

- Diagnosis
- Formulation
- Strategy implementation

The research will assist in coming up with a strategy for the adoption and effective utilization of mobile phone technology in smallholder agriculture in Zimbabwe. The mobile phone technologies are there but not known by smallholder farmers in Zimbabwe.

4. Problem Statement

(Aguilar-Gallegos et al, 2015) highlighted that adoption of mobile phone technologies and their utilization among smallholder farmers are low in developing countries and there is need to design adoption and utilization strategies for specific groups. With that in mind this can be seen as the best time to come up with strategies that can enhance adoption and use of mobile phone ICT in agriculture.

5. Research Objective

The main objective of the research is to develop a strategy for the adoption and effective utilization of mobile phone technologies by smallholder agriculture in Zimbabwe.

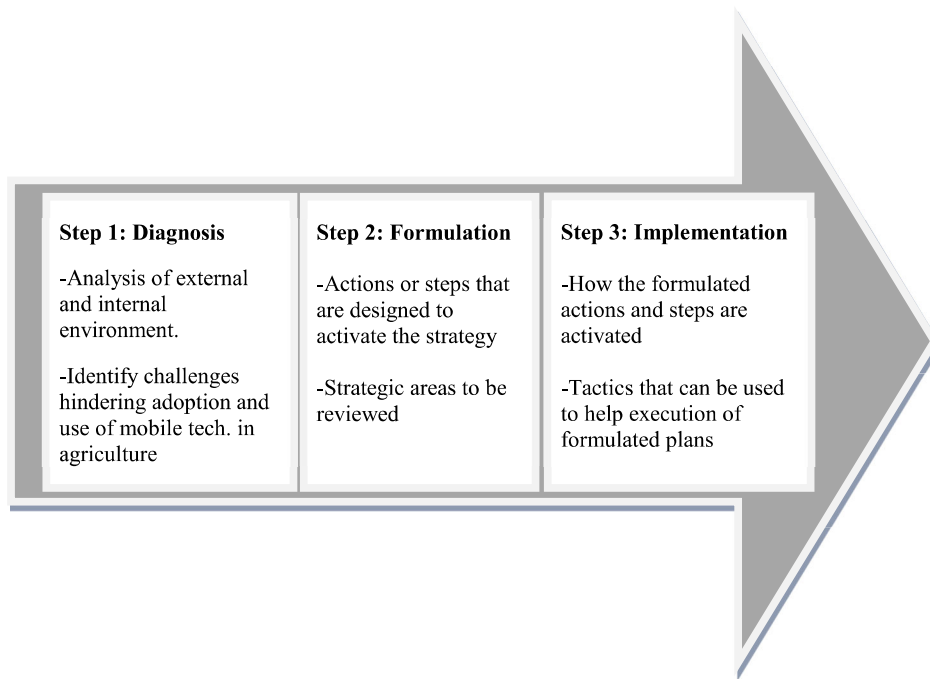


Figure 1: Strategy formulation steps

6. Research Methodology

In order to meet the research objective, the methodology employed is based on an exploratory research in the agriculture sector in Zimbabwe, involving deployment of semi-structured interviews and questionnaires. The research was done in accordance with the case study guidelines as explained by Yin (2014). Case studies do allow for the use of multiple sources of evidence. The impact of Mobile technology adoption and use in the agriculture sector in Zimbabwe is the real life phenomenon. Zimbabwe was chosen because it is a developing country which relies on agriculture and because of the new strategy of command agriculture that has been introduced. The portion of the population that the researchers used is the accessible population (Korb, 2012). Smallholder farmers in the Midlands province were used for this research because the province has a high number of populations as compared to others and the population is diverse. In this research snowball sampling was employed were participants with the required characteristics identify other participants. The results from such a study can however be generalised to other African countries which have the same context as Zimbabwe.

7. Data Collection

Data collection involved the use of semi-structured interviews with small holder farmers and agriculture extension workers. The interviews were held in Midlands's province and this included 10 extension workers and 2 supervisors. Other small scale farmers were interviewed to give their view on mobile technology use in agriculture. Most of the small scale farmers filled in the given questionnaires. A total of 40 hard copy questionnaires were distributed to different small holder farmers through their extension workers. The main aim of questionnaires was to find out which media is used by farmers to get agriculture information and the challenges

they face when using mobile technology for agriculture purposes. Of the 40 questionnaires distributed 5 were not returned giving 87.5% response rate from small holder farmers.

8. Data Analysis

Gathered data was analysed using a thematic analysis method. Braun and Clarke (2012) explained this way of analysing data as involving identifying themes and patterns within the gathered data. In cases where responses from interviewees and those who answered questionnaires pointed to a common aspect a general phrase was identified. The phrase provided a collective description to the unstructured data. Relevant aspects of the research are explained in the following section where the strategy is developed.

9. Strategy Development

To come up with an effective strategy in the adoption of mobile phone technologies among smallholder farmers the following strategy formulation phases that is Diagnosis, Formulation and implementation as explained by Wheelen and Hunger (2006) will be explained.

9.1– Diagnosis

This involves an analysis of external and internal environment. A look at the challenges hindering adoption and use of mobile technology in agriculture. Diagnosis was done through engaging farmers and other stakeholders in environmental scanning. This helped in identifying challenges that are hindering mobile technology use in agriculture, gaps and weaknesses that are there in the agriculture sector. From the environmental scanning and assessment, the results were placed into 5 groups titled diagnostics (D). These are as follows:

D1: Poor Infrastructure: Internet challenges, expensive mobile services and power shortage were seen as the main factors that affect the use of mobile technology in agriculture. Since mobile technology requires power and mobile network facilities such as base stations, most respondents highlighted the challenges in these infrastructures and the highly priced mobile services as hindrances to mobile technology use in agriculture. From this diagnostic it can be seen that there is a problem in the infrastructure and enabling services.

D2: Poor Human Skills: The second diagnostic was the issue of Human skills. The level of education, lack of technological skills of the farmers and involved stakeholders keep them away from utilizing mobile technologies for agriculture. Most stakeholders in the agriculture sector especially farmers only understand that mobile phones and technology are used for making calls and texting and they are not familiar with other functions on these mobile devices.

D3: Poor Content and Information Collaboration: The third diagnostic looks at the information and content needed by the farmers. There is a high demand for high quality agricultural information to the smallholder farmers. Provision of quality information through the mobile phone can increase production. Appropriate information which is related to farmers needs in terms of its relevance and format is needed. Information related to best crop selection, access to inputs, sound management of the farming activities and post-harvest techniques should be available to all smallholder farmers. Since they believe mostly information provided by the government and the ministry of agriculture as their main sources of information, these stakeholders should be part and parcel of information delivery. Content should be created from reliable sources. Local languages and local content should be taken into considerations. This

information should be mobilized and packed to meet different users. Smallholder rural communities' information should be widely shared.

D4: Policies and Regulations: Implementations of policy that govern Mobile ICTs have an impact on technology diffusion and use. There is need to restore international relations with other mobile ICT providers so as to increase competition among the service providers. Foreign investment is also needed in our country to increase the use of mobile ICT among farmers. Poor or lack of strategic alignment between the ICT policies and ministry of agriculture policies is a challenge in this sector. If these two ministries work hand in hand they can achieve the goal of mobile technology use in agriculture.

D5: Financial Resources: With all the above mentioned areas finance should be included as well. As a country we suffer from under capitalization of projects and to get profits from those projects it becomes difficult. This under capitalization affects mobile phone apps and services developers to be reluctant in providing good apps and services. To this end high pricing strategy is being used so that those providing for mobile service can profit as well. Mobile data and devises are highly priced to the extent that few farmers can afford these.

9.2 – Formulation and implementation

To be able to solve and respond to the given diagnostics, gaps and challenges, action plans need to be identified for the five diagnostics. The following action plans can assist in solving the highlighted challenges.

Action Plan 1 (AP1): Poor infrastructure was identified as a challenge and factor that hinder adoption and use of mobile technology in agriculture in Zimbabwe. The suggested action plan is enhancement of the rural infrastructure. Electricity should be availed to rural citizens and it should be consistent and reliable. Mobile technologies and internet should be deployed to even the most remote areas at an affordable price.

Action Plan 2 (AP2): Poor human skills were identified as a challenge in the agriculture sector and the action plan suggested will be training of famers. Training can be done on extension workers and model farmers, and these can act as change agents. This training will involve training of different functions that are found on mobile phones. Weather information is found on mobile devices but very few can interpret their meanings. With training farmers are likely to be exposed and to be empowered thereby making proper use of mobile phones for agriculture purposes. Adult literacy programs and capacity building programs sponsored by mobile phone service providers and the government can enhance the literacy rate.

Action plan 3 (AP3): Content and information collaboration problem can be solved by rural councils. These can assist in establishing coordination among farmers, extension workers, ICT providers and agriculture institutions. If these are well coordinated relevant content will be passed through the use of mobile phones. When there is good coordination extension workers can sensitize smallholder farmers on the effectiveness of mobile phone technology in their farming activities. This helps in creating awareness

Action plan 4 (AP4): Policies should be created by the ministry of agriculture to aid mobile phone use in agriculture. Government, ministry of Agriculture and ICT should support mobile-Agriculture applications. Results from gathered data showed that most initiatives are donor based and when these are no longer there, there is no one to continue with the initiative.

Nationwide initiatives are needed that makes use of mobile phone-based systems among smallholder farmers and agriculture practitioners. Policies that guide continuation after donor-based initiatives can help curb technology use problems.

Action plan 5 (AP5): In the case of finances Subsidizing mobile devices and services can assist in higher adoption and utilization since most of them indicated that the cost of the technology is on the higher side. This can only be achieved if mobile phone service providers work hand in hand with the government and ICT ministry. Subsidizing of prices of data bundles, internet charges can also assist in utilization of mobile technology. Various actors in the value chain such as buyers of output products and sellers of inputs should also be engaged. Technology cost to farmers in rural areas should be affordable. In this case banks and mobile money service providers should consider interest free loans on mobile phone purchases to farmers and the repayments should be easy instalments.

Figure 2 summarises the challenges for adoption and use of mobile technology in agriculture, the action plans that can be used to aid adoption and how these plans can be executed.

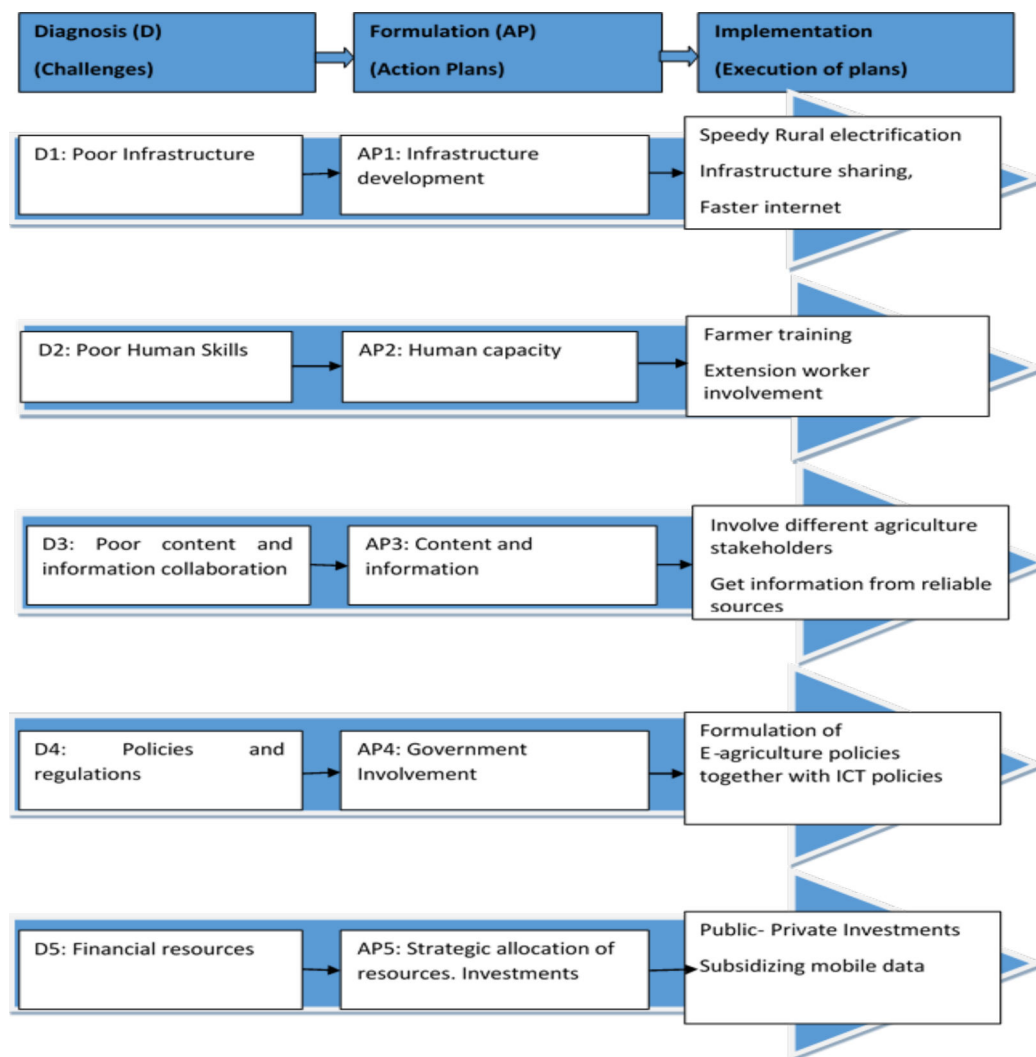


Figure 2: Summary of the five courses of diagnosis, planning, and implementation.

10. Conclusion

This research looked at the benefits and factors that affect the adoption and use of mobile technologies in agriculture. A strategy was proposed to encourage the adoption and utilization of mobile technology among smallholder farmers in Zimbabwe. Further research to test how the strategy will operate in a real environment can be done.

References

- Aker, J. C., & Mbiti, I. M. (2010a). Mobile Phones and Economic Development in Africa. *The Journal of Economic Perspectives*, 24(3), 207–232. <https://doi.org/10.1257/jep.24.3.207>
- Aker, J. C., & Mbiti, I. M. (2010b). Mobile Phones and Economic Development in Africa. *The Journal of Economic Perspectives*, 24(3), 207–232. <https://doi.org/10.1257/jep.24.3.207>
- Baumüller, H. (2012). Facilitating agricultural technology adoption among the poor: The role of service delivery through mobile phones. ZEF Working Paper Series, (98), 35. <https://doi.org/10.1111/j.1467-629X.1980.tb00220.x>
- Baumüller, H. (2015). Agricultural Innovation and Service Delivery through Mobile Phones Analyses in Kenya Agricultural Innovation and Service, 156.
- Baumüller, H. (2017). The Little We Know: An Exploratory Literature Review on the Utility of Mobile Phone-Enabled Services for Smallholder Farmers. *Journal of International Development*, 154(August 2017), 134–154. <https://doi.org/10.1002/jid.3314>
- Burns, N. & Grove, S. K. (2001). *The Practice of Nursing Research: Conduct, Critique and Utilisation*. 4th Edition: WB Saunders.
- Chandler, A.D. (1962). Strategy and structure: Chapters in the history of American enterprise. Massachusetts Institute of Technology Cambridge, 349–407.
- Denzin, N., & Lincoln, Y. (2005). *The Sage handbook of qualitative research*. Sage Publications.
- FAO and International Telecommunication Union. (2016). *E-Agriculture Strategy Guide Piloted in Asia-Pacific countries*.
- FAO. (2016). *OECD-FAO Agricultural Outlook 2016-2025*. OECD Publishing (Vol. 18). https://doi.org/10.1787/agr_outlook-2016-en
- Furuholt, B., & Matotay, E. (2011). The developmental contribution from mobile phones across the agricultural value chain in rural Africa. *Electronic Journal of Information Systems in Developing Countries*, 48(7), 1–16. <https://doi.org/>
- Gichamba, A., Lukandu, I. A., & Lukandu, I. A. (2012). A Model for designing M-Agriculture Applications for Dairy Farming. *The African Journal of Information Systems The African Journal of Information Systems*, 4(4), 1936–282.
- Gwaka, L. T. (2017). Digital technologies and sustainable livestock systems in rural communities. *Electronic Journal of Information Systems in Developing Countries*, 81(1), 1–24. <https://doi.org/10.1002/j.1681-4835.2017.tb00598.x>
- Hussain, S. A. (2016). ICT4Agriculture lessons learned from developing countries. A systematic review protocol. In *ACM International Conference Proceeding Series (Vol. 03–06–June)*. <https://doi.org/10.1145/2909609.2909636>
- Martin, B. L., & Abbott, E. (2011). Mobile Phones and Rural Livelihoods: Diffusion, Uses, and Perceived Impacts Among Farmers in Rural Uganda. *Information Technologies & International Development*, 7(4), .17-34. <https://doi.org/10.1016/j.ijhcs.2008.08.007>
- Mintzberg, H. (1998). Five Ps for Strategy. In *The Strategy Process* (pp. 937–948).
- Mintzberg, H., & Quinn, J. B. (1996). *The strategy process: concepts, contexts, cases*. Prentice Hall. <https://doi.org/10.1083/jcb.201009052>
- Mohamed Adam, H. (2009). Research Population. Nov 15.
- Musungwini, S. (2016). A model for harnessing the power of the Mobile Phone Technology to improve Smallholder Agriculture in Zimbabwe. In *Proceedings of the 5th International Conference on M4D Mobile Communication Technology for Development: M4D 2016, General Tracks* (pp. 237–252). Maputo.
- Musungwini, S., Zhou, T. G., & Ruvunga, C. & Z. M. (2014). Harnessing Mobile Technology (MT) to Enhance the Sustainable Livelihood of Rural Women in Zimbabwe : Case of Mobile Money Transfer

- (MMT). *International Journal of Computer Science and Business Informatics*, 14(2), 46–57.
- Nickitas, D. M. (2011). Asking Questions The Definitive Guide to Questionnaire Design For Market Research, Political Polls, and Social and Health Questionnaires. *Journal of Continuing Education in Nursing*, 1–5. <https://doi.org/10.3928/00220124-20111201-01>
- Palmer, N. (2011). Strengthening Agriculture Marketing with ICT. *ICT in Agriculture:Connecting Smallholders to Knowledge,Networks,and Institutions*.
- Palmer, N. (2012). Using ICT to enable Agricultural Innovation Systems for Smallholders ICT innovations. *E-Agriculture*, 1–11. Retrieved from <http://www.fao.org/docrep/018/ar130e/ar130e.pdf>
- Porter, M. E. (1996). What Is Strategy? *Harvard Business Review*, 74(6), 61–78. <https://doi.org/10.1098/rspb.2008.0355>
- Qiang, C. Z., Kuek, S. C., Dymond, A., & Esselaar, S. (2011). Mobile Applications for Agriculture and Rural Development. *World*, (December).
- Saunders, M., Lewis, P., & Thornhill, A. (2008). *Research Methods for Business Students*. *Research methods for business students*. <https://doi.org/10.1007/s13398-014-0173-7.2>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. *Business* (Vol. 5th). <https://doi.org/10.1017/CBO9781107415324.004>
- Tadesse, G., & Bahiigwa, G. (2015). Mobile Phones and Farmers' Marketing Decisions in Ethiopia. *World Development*, 68, 296–307. <https://doi.org/10.1016/j.worlddev.2014.12.010>
- Tsokota, T., von Solms, R., & van Greunen, D. (2017). An ict strategy for the sustainable development of the tourism sector in a developing country: A case study of Zimbabwe. *Electronic Journal of Information Systems in Developing Countries*, 78(1).
- Wheelen, T. L., & Hunger, J. D. (2006). *Strategic management and business policy - Acheiving Sus. Policy*.
- Wheelen, T. L., & Hunger, J. D. (2012). *Strategic Management and Business Policy*. McGraw-Hill Education Irwin. <https://doi.org/10.1017/CBO9781107415324.004>