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THE IMPACT OF E-COMMERCE ON THE SUPPLY CHAIN OF SMALL-SCALE FARMING: EVIDENCE FROM LIMPOPO PROVINCE, SOUTH AFRICA

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Abstract

Small-scale horticultural farmers in Limpopo, South Africa have struggled to gain full market access and lag large-scale farmers in terms of technology and the necessary resources to engage in e-commerce. This study assesses the impact of e-commerce on the supply chain of horticultural commodities for small-scale farmers in the Limpopo. Using a quantitative research approach, the study targeted 200 small-scale farmers specializing in horticultural commodities. The study used a random sampling technique to select 100 participants. The key results are that e-commerce provided farmers with accurate information for decision-making, reduced costs in the supply chain, and increased the efficiency of fresh produce delivery to customers. However, e-commerce has not enabled small-scale farmers to charge competitive prices for their produce. Research implications: The South African government is advised to prioritize investment in rural connectivity where most of these small-scale farmers are located, connecting farmers' organizations with e-commerce platforms. The government is also encouraged to collaborate with the private sector to enhance the organizational and commercial capacities of farming organizations.

Keywords: Digital Transformation; Rural Economy; Agriculture; Technological Integration

1. INTRODUCTION

The agriculture sector plays a crucial role in employing rural communities and has contributed to lifting hundreds of millions of people out of poverty through rural development programs across Latin America and South Asia in the 20th century through productivity gains (Fan & Cho, 2021; Rob & Cattaneo, 2021). In addition, African economies rely on the agriculture sector for providing food security and enhancing living standards (Rafael, 2023). E-commerce is defined as the buying and selling of products and services over the internet (Jain et al., 2021). E-commerce is important for growing a business because a consumer's internet shopping history is a predictor of future purchases over the internet (Cachero-Martínez & Vázquez-Casielles, 2021; Le, Carrel & Shah, 2022; Ratchford, Soysal, Zentner, & Gauri, 2022). The benefits of e-commerce are evident as it has increased the profits of the horticulture (type of agriculture that produces garden crops, fruits, vegetables, and ornamental plants) industry and decreased expenses through more efficient operations and lower search costs (Drotskie, 2018).

There are many forms of e-commerce platforms, including business-to-business (B2B) and business-to-consumer (B2C) (Dai et al., 2021). The B2B model is one of the most popular forms of e-commerce, occurring when a product or service transaction takes place between two businesses (Shankar et al., 2022). Agriculture stands to benefit greatly from a B2B model; this model eliminates many handlers, allowing the farmer to connect directly with the buyer (Masinde, Phoobane, & Brown, 2021). E-commerce reduces transportation costs, information costs, and delivery delays, leading to efficiency increases (Li, Lin, Turel, Liu, & Luo, 2020; Liu & Guo, 2021; Prajapati, Chan, Daultani, & Pratap, 2022). Establishing electronic marketplaces, anticipated to be more open and competitive than traditional marketplaces, could potentially attract more customers. The result will be an increase in demand and a strengthening of the firm's strategic

position among niche product seekers or geographically constrained customers (Obi & Ayodeji, 2020). Online agro-food firms that have received certification for Islamic dietary law and food safety outperform those that have not according to Permani, Sahara, Satria, Suprehatin, & Nuryartono (2023). Finally, rural e-commerce helps Chinese farmers' marketplaces grow, which increases their income as well as linked industries and jobs (Li & He, 2024).

The challenges of e-commerce are apparent as the online activities of farmers in developing nations are still in their early stages (Nchimbi, Dida, Marwa, & Michael, 2021). The challenges include inadequate internet connectivity and high fees imposed by private internet providers (Nazir & Roomi, 2020). In China, agriculture industry consumers have difficulty trusting e-commerce suppliers (Ji, Chen, & Zhuo, 2020). However, agribusinesses overcome this problem by interacting more face-to-face with their clients. Another drawback of implementing e-commerce is that setting up the online marketplace may initially require a substantial amount of time (Shibi & Aithal, 2022); online farmers' markets, like traditional markets, necessitate a committed staff of market managers and volunteers to manage operations along with a designated location for product organization and collection (Aaker & Moorman, 2023).

When it comes to new customer expectations, the B2B model faces challenges like low value creation due to fewer buyers and sellers, lower productivity, scalability, and high costs associated with servitization (Matzner et al., 2021; Wirtz & Kowalkowski et al., 2023; Cohn, 2024). Another disadvantage of e-commerce is that customers are unable to physically inspect, handle, or smell products before making a purchase in online farmers' markets (Drotskie, 2018). Finally, producers encounter the challenge of creating comprehensive product descriptions and building trust with their clients.

Agriculture is one of the largest contributors of income in Limpopo Province (Hlatshwayo et al., 2021; Tambe et al., 2023). However, most small-scale farmers in Limpopo only sell in informal markets and do not benefit from large developed markets (Mathobela, 2021; Ndlovu & Masuku, 2021). The COVID-19 pandemic has caused farmers to embrace e-commerce (Obi & Taofeek, 2020; Guo, Jin, Zhao, & Li, 2023; Oblena & Anapi, 2023). However, Limpopo small-scale farmers are falling behind in terms of technological advancements due to the South African government's insufficient financial support (Sebola, 2019; Makgamatha, 2022). Limpopo Province is also facing a decline in essential ecosystem services such as food supply, nutrient recycling, and habitat quality. Rapid population growth, widespread land degradation, and unpredictable climate conditions worsen agricultural output and poverty.

These issues have increased small-scale farmers' financial losses, emphasizing the importance of their active participation in e-commerce platforms to promote their products in challenging business conditions. The objectives of this study are to investigate the impact of e-commerce on the supply chain of horticultural commodities in the Limpopo Province and give recommendations on strategies that small-scale farmers can use to implement e-commerce and market their products. This study is motivated by the limited literature on rural e-commerce development in South Africa (Karine, 2021). To the best of our knowledge, this study is one of the first in South Africa to study the effects of e-commerce on the supply chain of small-scale farming.

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2. RESEARCH DESIGN AND METHODOLOGY

Figure 1 illustrates the research flow that was followed in conducting the research. In this study, a quantitative approach was deemed most suitable.

Figure 1: Research Flow Chart
Source: Authors

The study adopted a positivist philosophy and targeted 200 small-scale farmers specializing in horticultural commodities. Using random sampling, 100 participants, all small-scale farmers from Limpopo, comprised the study sample. The electronic administration of 100 survey questionnaires with reminders sent via mobile SMS to ensure timely completion within a two-week period resulted in complete returns from all participants. The study employed closed-ended questions and a Likert scale to facilitate data collection and evaluation. The rationale for choosing a questionnaire was its capacity to handle a larger sample size within a constrained timeframe, while remaining cost-effective. A pilot study was conducted prior to the main study to assess feasibility in terms of time, sample size, and data collection methods.

Ten small-scale farmers participated in the pilot study, distinct from those in the main study. Two participants were individually interviewed to gather feedback on the questionnaire structure. The pilot study results indicated Cronbach's alpha ($\alpha = 0.78$) exceeded the threshold of 0.7, indicating high consistency and reliability in the results. Consequently, no modifications were made to the questionnaire based on the pilot study results.Participation was voluntary, with all participants assured of their right to withdraw at any time without consequences. Anonymity was maintained by not linking any information to individual participants and to prevent bias and subjectivity, a rigorous code of ethics was created and adhered to diligently. This study may be limited by factors beyond the researcher's control, which could impact the generalisability of the results. COVID-19 restrictions posed challenges during the sampling process, as some community

members refrained from participating due to concerns about contracting the virus. This study is based on the UTAUT theory. UTAUT has been shown to be effective in explaining behavior usage across many industries, including the willingness to adopt a mobile phone app (Semiz & Semiz, 2021). Based on eight popular user-adoption models, the UTAUT model was later updated to include three additional constructs: hedonic motivation, price value, and habit to form UTAUT2 (Shi et al., 2022). Since this study primarily concerns itself with initial adoption and not actual use, the UTAUT2 components were omitted. In Figure 1, the UTAUT theory is shown in detail.

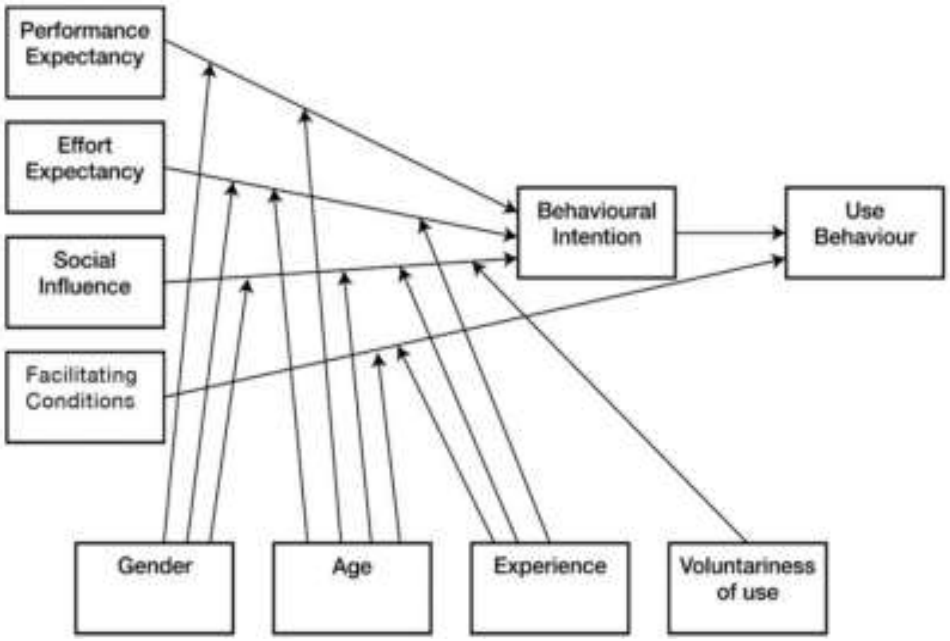

Figure 2: UTAUT Theory
Source: Venkatesh et al. (2003).

Performance Expectancy

Performance expectancy refers to the degree to which the use of a technology will be advantageous for its users (Nikolopoulou, Gialamas, & Lavidas, 2021). This study examines the farmer's perception that utilizing a mobile phone app to get horticulture information can improve their agricultural practices. One of the most attractive advantages of the agriculture app is its ability to provide farmers with accurate local information at any location and time without wasting valuable time.

Facilitating Conditions

Facilitating conditions refer to the extent to which farmers perceive the availability of technical infrastructure to support their use of technology when necessary (Giua, Materia, & Camanzi, 2022). Proficiency in using a mobile app requires abilities such as operating a phone, installing the app, and accessing its content. Farmers residing among educated individuals or having access to advantageous elements such as financial resources are more inclined to employ them.

Effort Expectancy

Farmers' effort expectancy pertains to the level of ease with which they can utilize a technology. Certain farmers may possess a higher level of proficiency in ICT-based technologies compared to others, which would result in fewer challenges while using a mobile phone to get

agricultural or crop information through an application. It is projected that farmers who have convenient access to and can analyze crucial information using a mobile phone application will be more inclined to utilize it.

Social Influence

Social influence refers to the process by which individuals or groups affect the thoughts, feelings, and behaviors of others. Social impact refers to the extent to which farmers perceive that influential individuals endorse the use of a specific technology such as a mobile phone app. The fundamental concept is that individuals seek advice from their social networks, specifically their acquaintances and relatives, on novel technologies and are influenced by the perceived social influence of influential individuals. It could be particularly advantageous in delineating initial adoption.

3. RESULTS AND DISCUSSION

Table 1 Age of participants

Age group (years)	Frequency	Percentage
<30	37	8.6
31-40	42	12.4
41-50	13	15.3
51-60	7	7
61 years& >	1	1
Total	100	100

Source: Author's calculations

This age distribution indicates that the participants are in their middle years, which indicates that participants are economically active.

Years in farming business

Table 2 below illustrates the number of years the participants have been in farming. The table shows that sampled farmers have varying levels of experience, ranging from less than one year to more than 15 years. The significance of showing farming experience is that the longer one has been in agriculture, the more likely they are to understand how the supply chain works.

Table 2 Age of participants

Age group (years)	Frequency	Percentage
<1	21	21
1-5	33	33
6-10	27	27
11-15	9	9

15 years& >	10	10
Total	100	100

Source: Author's calculations

Research Objective: To investigate the role of e-commerce in the supply chain of horticulture commodities by small-scale farmers in Limpopo Province.

To complete this objective the responses received from the questionnaire's statements were analyzed. All the statements (1 to 6) are derived from the questionnaire that was sent to the participants of the study.

Table 3 Statements for questionnaires

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. E-commerce plays a role in enabling communication with various stakeholders such as customers, suppliers, and banks	40%	35%	10%	10%	10%
2. E-commerce plays a role in bypassing of several intermediaries resulting in earning higher income.	39%	38%	11%	6%	6%
3. E-commerce plays a role in providing them with accurate information for decision making	34%	30%	15%	15%	6%
4. E-commerce plays a role in reducing costs in the supply chain of horticultural commodities operations	26%	50%	13%	9%	2%
5. E-commerce plays a role in enabling the delivery of fresher horticulture produce to customers	38%	26%	22%	9%	5%
6. Implementing E-Commerce has enabled them to charge competitive prices for their produce	14%	9%	3%	40%	34%

Source: Author's calculations

Statement 1: E-commerce plays a role in enabling communication with various stakeholders such as customers, suppliers, and banks.

In Table 3 above for Statement 1, 10% of the respondents were neutral, while 75% (40% + 35%) of the respondents agreed or strongly agreed that e-commerce makes it easy for horticulture farmers to communicate with various stakeholders such as customers, suppliers, and banks. Meyer et al. (2022) report that e-commerce played a crucial role in online cattle sales during the COVID lockdowns, as the beef value chain became resilient after overcoming previous challenges. Our results align with their findings.

Statement 2: E-commerce plays a role in bypassing several intermediaries, resulting in earning a higher income.

Table 3 for Statement 2 shows that 11% of horticulture farmers are neutral, and 77% (39% + 38%) agree that e-commerce enables farmers to bypass several intermediaries, leading to higher revenue. E-commerce in horticulture increases farmers' access to new markets and adds transparency to the supply chain. It helps farmers reduce waste and increases their potential to deliver fresher horticulture produce to customers (Tempest, 2020:35).

Statement 3: E-commerce plays a role in providing them with accurate information for decision-making.

In Table 3 for Statement 3, 15% were neutral, 15% disagreed, and 6% strongly disagree with the statement. It also shows that 64% (34% + 30%) agree and strongly agree that e-commerce provides them with accurate information for decision-making. Keller (2016) supports this, stating that access to price and stock information helps farmers mitigate the risk of underselling and over- or under-supplying their crops in each market. Our results here also agree with Xie & Xiao (2020), who report that e-commerce improves accuracy in decision-making, leading to greater agricultural revenue.

Statement 4: E-commerce plays a role in reducing costs in the supply chain of horticultural commodities operations.

According to Table 4, Statement 4, 76% of the participants agree that e-commerce reduces costs in the supply chain of horticultural commodities operations. E-commerce has increased profitability in the horticulture markets by boosting sales and decreasing costs through improved operational efficiency and lower search costs in South Africa, Ghana, and India (Drotskie, 2018; Nyarko et al., 2022; Yogesh & Ravindran, 2023).

Statement 5: E-commerce plays a role in enabling customers to receive fresher horticulture produce.

In Table 3 for Statement 5, 64% (38% + 26%) of the respondents agree that e-commerce increases the potential to deliver fresher horticulture produce to customers. Increases in efficiency could result from lower inventory levels, transportation costs, information costs, and order and delivery times (Gaanckomo, 2015; Vilas-Boas, Rodrigues, & Alberti, 2023).

Statement 6: Implementing e-commerce has enabled them to charge competitive prices for their produce.

In Table 3 for Statement 6, 14% of the participants strongly agree, 9% agree, 3% neither agree nor disagree, 40% disagree, and 34% strongly disagree. This demonstrates that 74% of the participants disagree that e-commerce has enabled them to charge competitive prices for their produce. The role of e-commerce is growing in sub-Saharan Africa and its importance in lubricating supply chains is highlighted by this study. While past scholarship has investigated the importance of e-commerce, this study has focused on a relatively neglected area of the economy with regards to the effects of e-commerce. When the study's results are juxtaposed against those of international work on the subject, this study adds to findings that show the growing need for e-commerce in agriculture. The study's results offer useful insights into the function that e-commerce plays in the horticultural business. The results indicate that a substantial majority of horticulture farmers concur that e-commerce exerts a beneficial influence on their operations, namely in the areas of communication, income, and decision-making. Nevertheless, there are still challenges that require attention, such as the issue of pricing.

4. CONCLUSION

In a post-crisis economic environment where future pandemics or climate disasters are expected to become more common, e-commerce assumes greater importance. While the rise of e-

commerce has transformed how markets serve their clients, many smaller businesses in the developing world have yet to realize the benefits of online transactions. South African small-scale farmers risk failure if they do not embrace e-commerce. This study highlights the advantages of online transactions for horticulture supply chains, while also underscoring several challenges that require intervention from South African government agencies. Governments, e-commerce companies, and development banks can collaborate to prioritize investment in rural connectivity, particularly in areas where most small-scale farmers reside. They can play a pivotal role by constructing roads that link farmers to e-commerce centers near railways or highways, facilitating the distribution of horticultural products to commercial customers and consumers. Additionally, governments can partner with the private sector to enhance farmers' organizational and commercial capacities. Policies can be enacted to attract and develop tech-savvy and marketing-savvy youth to assist farmer organizations in advancing and improving the potential in the agricultural value chain that could lead to a competitive advantage. This approach aims to transform producers' organizations into modern, innovative, market-driven entities.

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