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RESEARCH ARTICLE

An Analysis of Agribusiness Digitalisation Transformation of the Sub-Saharan African Countries Small-Scale Farmers' Production Distribution

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Abstract: The article aims to analyse how digitalisation transforms the marketing and distribution of produce by small-scale sub-Saharan African agribusiness. Small-scale farmers reside in remote areas where market information is limited. This tendency has led them to underperform and meant that a significant portion of their produce would be shared amongst the few traders in their remote small market. This underperformance tendency of small-scale farmers tends to affect achieving sustainable development goals. To obtain the data, the author administered a structured survey to small-scale farmers carrying out agribusiness in the sub-Saharan African countries. This survey was divided into two sections: The demographics section and eleven statements, six relating to digitalisation and five to Agribusiness transformation, to which the participants had to answer in accordance with a 5-point Likert scale. Simple random probability sampling was used to draw a valid sample of 383 from the population of small-scale farmers. PLS structural equation modelling (SEM) using SmartPLS 4 was used to analyse the data and test the hypothesis. Results revealed a significant contribution of digitalisation of agribusiness on the market transformation of small-scale farmers' products in sub-Saharan Africa, particularly in Tanzania. This market transformation resulted from the ability of digitalisation to offer a reduced role of intermediaries, provide opportunities for farmers to expand their markets, and improve the linkage between farmers and the market through customer engagement and interaction. It was further found that digitalisation transforms agribusiness by enhancing digital advertisement, communication, and promotion and allowing easy payment methods.

Keywords: Agribusiness; Digitalisation; Small-scale farmers; Digital marketing

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1. Introduction

Historically, agriculture has been recognised as essential to economic development and promoting rural development for both the developed and developing world [1,2]. Scholars and policymakers have recorded the significant contribution of agriculture in terms of aggregate growth, exports and employment in accelerating the well-being of living standards of many communities [3-5]. This has led the agricultural sector to be vital in addressing some sustainable development goals, which include hunger, poverty, inclusive and equitable quality education, gender equality, empowering all women and girls to healthy lives and promoting well-being for all at all ages. For example, Praburaj [4] found and concluded that agriculture is the primary food supply source for the world's underdeveloped, developing or even developed countries. They further advocate agriculture as one of the most effective ways the sector promotes economic growth and nation-building through its close ties to the rest of the economy. As a result, the agriculture sector is seen as the foundation of all development efforts in rich and developing nations.

Despite the potentiality of the agriculture sector, it is well acknowledged that in sub-Saharan Africa, the agriculture sector is dominated by small-scale farmers who face many constraints that hamper them from normal agriculture to commercialising their agricultural products. For example, Pandey and Pandey [6] have found that limited access to accurate and timely market information impedes farmers' marketing of farm produce in sub-Saharan Africa. They added that the limited access to market information has led to the high cost of transactions and the emergence of intermediaries. Smidt [7] has found that small-scale farmers face the challenge of accessing proper market information to channel their products to the right market, leading them to sell their farm produce at low prices through intermediaries. On the other hand, Vasumathi and Arun [8] advocated that many small-scale farmers don't have access to quick and consistent marketplaces to sell their produce. Thus, they have little need to expand into large-scale farming to increase their income. Due to this circumstance, African governments have prioritised agricultural and agribusiness transformation on their policy agenda to combat issues like food and nutrition insecurity, climate change, young unemployment, and overall economic growth. The continent's agriculture might become a powerhouse to feed a burgeoning population and build a respectable agribusiness structure that could employ millions of young people with the correct policies on innovation.

Realising the importance of agriculture and the problem faced by small-scale farmers, it is seen in the agriculture policies and empirical evidence that when agribusiness is transformed through digitalisation, it will support the growth and performance of the agribusiness sector and it will contribute to the achievement of sustainable development goals [9,10]. "Digital native" young entrepreneurs at the forefront of innovation applied to many economic sectors, according to Kaur and Sandhu [11]. They have a window of opportunity due to technology's tendency to bring nations closer together, lower trade barriers, and otherwise improve the world. Digitalisation in agriculture could be a game-changer for increasing productivity, profitability, and climate change resilience [12]. A significant agribusiness might be achieved with the aid of an inclusive, digitally enabled agricultural transformation, improving the standard of living for Africa's smallholder farmers [13]. It might increase the involvement of women and young people in agribusiness and open up job opportunities along the value chain. According to Izuogu et al. [14], the digitalisation of agribusiness has reduced the need for intermediaries, given farmers the chance to expand their markets, and strengthened the connection between extension and research centres and small-scale farmers' productivity and way of life.

Additionally, Chinakidzwa and Phiri [15] have promoted the idea that digitisation presents a chance to reduce expenses, boost visibility, enhance customer relationships, provide better market sensing, and boost customer convenience. They noted that one strategy for providing farmers with a comprehensive education platform is to digitalise the agriculture industry. According to Kaur and Sandhu [11], Farmers confront weak road networks, price volatility, and a lack of market knowledge, making digital innovation a crucial alternative to connect farmers to markets. As a result, with the rise in global population and the need for food production to achieve sustainable development, digitalisation will assist farmers in conducting agribusiness by enabling easier access to marketing.

Despite the acknowledgement of the contribution of digitalisation of agribusiness and the emergence of recent technology, which is affordable and accessible by small farmer's agribusiness. Most sub-Saharan African nations have fallen short of the standards necessary for an effective agricultural revolution, and the productivity of African agriculture is significantly lower than that of the rest of the world [16,7]. These sub-Saharan African nations' agricultural performance is still woefully inadequate and unquestionably far below their agribusiness potential [17]. Small-scale farmers continue to be underrepresented in agribusiness practices because of the intermediate [16]. Farmers are frequently ill-equipped to assess whether digital platforms and activities are appropriate [17,16]. As a result, it is currently uncertain if the digitalisation of the agriculture industry will be able to change small farmers' agribusiness in a way that will support sustainable development objectives. Given the region's booming population, extreme poverty, rapid urbanisation, and problems with food security, Sarker et al. [9] claimed that connecting smallholder farmers and markets in sub-Saharan Africa is essential to release the full potential of the agricultural sector in the area. This study aims to close this gap by examining how agribusiness digitalisation transforms the marketing and distribution of produce by small-scale African farmers in sub-Saharan African countries, specifically Tanzania.

2. Literature Review

2.1 Conceptualisation of Key Terms

Digitalisation

Varas [18] defined digitalisation as the change from a traditional business to a digital one. That is the use of digital technologies to change a business model and provide new options for earning money and creating value. Additionally, Bowen and Morris [19] described digitalisation as the process of transforming a business model using digital technologies to create new revenue streams and value-creating opportunities. According to Bajrang [20], digitalisation incorporates digital tools and systems into different corporate functions, such as management, communication, manufacturing, and customer service—Sarker et al. [9] defined digitalisation as making workflows and processes easier and more efficient.

The Agriculture Sector

According to one definition of agriculture, it is a way of life that encompasses raising animals, fish, crops, and forest resources for human use and providing the agro-allied goods our industries need [21]. Contrarily, the agriculture sector is defined by Varas [18] as the sub-sectors that include crop, livestock, and fishing. Agriculture was defined by Chung et al. [22] as a sector of the economy that encompasses the production of crops and animals as well as agricultural engineering and the creation of agricultural equipment, fertilisers, and other farming-related items.

Agribusiness

According to Davis and Goldberg [23], agribusiness is the aggregate of all activities involved in producing and distributing farm supplies, farming operations, and the storage, processing, and distribution of agricultural products and commodities. Another definition states that it consists of businesses with a profit motive that supply agricultural resources and process, market, transport, and distribute agricultural products and consumer goods [24]. Agribusiness is defined by Huang and Chen [25] as the science that coordinates the production, processing, and distribution of food and fibre as well as the provision of inputs for agricultural production.

Agribusiness Transformation

A general definition of agricultural transformation is the transition of the agrifood system from being farm- and subsistence-oriented to being more commercialised, productive, and off-farm-oriented [26]. According to Jayne et al. [5], agricultural transformation results in higher farm productivity, making farming commercially viable and bolstering interlinkages with other economic sectors.

2.2 Cognitive Response Theory

This theory was defined by Anthony Greenwald in 1968, assuming that marketing tools can influence the relative importance that individuals attach to various product attributes, purchase decisions being purely rational [27]. In this paper, digitalisation as a marketing tool can influence the relative individual or farmers attached to a local gastronomic experience. According to the cognitive response theory, people's evaluative reactions to information that is relevant to their attitudes are the main cause of attitude change. The theory links this study since it explains the ability of digitalisation, such as having a responsive influence on the transformation of agribusiness among small-scale farmers.

The applicability of cognitive response theory in studying the influence of digitalisation on the transformation of agribusiness marketing among small-scale farmers is observed in some studies [28,29]. For example, Khanna [28,30] states that the digitalisation of agriculture is enabling the collection of enormous volumes of geo-referenced data regarding growth conditions in the field and making it possible to automate the implementation of input applications with a variety of spatial constraints.

Despite the applicability of the cognitive response theory, this theory has vague operational variables relevant to the study of the influence of social media marketing on local gastronomic experience. To address this weakness, the empirical literature review was used to construct the operational variable in this study. Hence, this theory helped to link the influence of social media marketing on branding local gastronomic entrepreneurship.

2.3 Empirical Literature Review

Reddy [30] conducted a study on the impact of digitalisation on agribusiness in India. Findings indicated that digitalisation significantly influences small-scale farmers to access multiple buyers for their products and get higher prices. He further found that through digitalisation, the agents and intermediaries are not getting involved in the digital marketing system, increasing the farmers' profit. Moreover, he concluded that the digitisation of agribusiness tends to produce market updates that can reach producers and consumers in a fraction of a second [31].

In their study of the digitalisation of agriculture in Nigeria, Usman et al. [32] demonstrate how the digitalisation of agriculture has reduced the need for intermediaries, given farmers the chance to expand their markets, strengthened the connections between extension and research centres, and increased the productivity and standard of living of small-scale farmers.

On the other hand, Sharma et al. [33] carried out a study on digitalisation in the field of agricultural marketing. Findings demonstrate how digitalisation contributes to the use of electronic exchange trading of agricultural products and online placing of orders for agricultural product distribution. They further found digitalisation to promote the use of digital distribution channels which in turn help farmers avoid intermediary structures and to increase profits.

Rolandi et al. [34] carried out a meta-analysis of empirical evidence on the impact of digitalisation on agriculture and rural areas. They noted that digital technologies in agriculture helped to increase precision in the decisions on which crops to grow by market trends and distribution channels and on when to intervene with agricultural work. They added that digitalisation may reduce costs for farms and promote agricultural production.

Because the interconnectedness of digital instruments that characterise digitalisation has created a new sociotechnical context in which human activities are carried out [35,36], experts refer to digitalisation as the fourth industrial revolution Rural and agricultural areas are also affected by these phenomena [37]. While smart farming encompasses the entire value chain (before, during, and after on-farm production, including e-commerce platforms, blockchain-enabled food traceability systems, and precision agriculture itself), precision agriculture can be viewed as being related to on-farm activities involving specific digital solutions (e.g., yield mapping, GPS guidance systems, and variable rate application). Similar to digitization, digitalisation is a process that builds on digitization by adding interconnection, which broadens the range of domains involved in innovation and leads to socioeconomic and institutional changes [38].

According to Rotz et al. [39], automatized agriculture not only creates new job opportunities and greatly improves the lives of farmers and workers who can use digital technology, but it also causes a sharply split labour market, which exacerbates social inequalities.

Therefore, there are lower-skilled workers in the fields, greenhouses, and warehouses who are subjected to increased scrutiny and surveillance, further rationalisation of their workplaces, and ever-escalating expectations of productivity on the one hand, and highly-skilled trained digital workers who increase productivity and efficiency on the other. Robots and automated solutions run the risk of replacing these low-skilled labourers. Additionally, according to Jakku et al., Özen and Grima and Vedrana et al. [40-42] digital tolls cannot help achieve the SDGs for Climate and the environment.

Moreover, Vasconez et al. [43] in their study on human-robot interaction in agriculture advocated that human-robot interaction can contribute to an increase in productivity and facilitate work in agricultural activities, such as fruit harvesting, handling heavy crops and fertilizer load bags, and delivering and transporting in shared environments. They show that typically, agricultural robots are autonomous or semiautonomous devices that can be controlled at various phases of the process to address challenging issues and used for repetitive operations such as land preparation, water irrigation and spraying, trimming, harvesting, monitoring and inspection, and mapping in an effort to lessen the farmer's workload and optimise process times and costs.

Ravi et al. [44] found and concluded that digital marketing tools are one of the best ways to connect with customers and attract them. They further added that digital marketing technologies and tools can be used more effectively for the improvement of the traditional marketing strategy.

Alekhina et al. [33] discussed the current state and future potential of digital technologies in agricultural marketing, particularly e-channels for the promotion of agricultural products. They note that the main digital promotion methods included an electronic system for placing state orders that took into account the benefits and drawbacks of trading on electronic platforms, submitting proposals for the purchase of agricultural products from online retailers, and maintaining one's own website.

Accelerating the formation of digital systems is a key factor in the current era's high-quality agricultural improvements. Digitalisation is one of the most important aspects of agricultural progress. The magnitude of e-commerce transactions and the entire amount of the telecommunications industry are the two biggest roadblocks to agricultural digitalisation, from the standpoint of challenges. It is necessary to capitalise on the advantages of high-value areas, strengthen the coordination system among various departments, and expedite the building of rural infrastructure in low-value areas in order to speed the development of the entire agricultural industry chain. Additionally, in order to foster various regional development models that are compatible with local circumstances, interregional communication and cooperation must be improved through digitalisation [45,46].

According to Kondratieva [47], the goal of regulating digital transformation in agriculture is to make it easier to monitor business operations' adherence to the standards of inclusivity and climate neutrality rather than to boost their economic effectiveness. The Common Agricultural Policy's (CAP) digitization plan moves the program's objectives closer to those of sustainable development. Accordingly, the goal of regulating digital transformation in agriculture is to make it easier to monitor business operations' adherence to the standards of inclusivity and climate neutrality rather than to boost their economic effectiveness. The objectives of the Common Agricultural Policy (CAP) come closer thanks to the digitalisation plan.

2.4 Conceptual Framework

Based on the theory of digitalisation facilitation and digitalisation transformation process, as noted in the literature above, we have drawn up the following conceptual framework in which we will frame our study (Figure 1).

3. Methodology

3.1 Research Paradigm

The positivism paradigm was used, asserting that actual events can be observed theoretically and empirically and explained using statistical methods [48]. The current study used many theories and previous empirical studies from different contexts to analyse digitalisation's influence on agribusiness's transformation among small farmers' marketing perspective. Through this available empirical evidence and theories, the researcher was able to construct a hypothesis on the significant relationship between digitalisation and agribusiness transformation among small farmers' marketing perspective. Further, this study was set to positivism, using statistical methods and building on evidence from available theories and empirical studies. Hence in this study positivism paradigm served the purpose.

3.2 Research Approach

A quantitative approach was used to determine small farmers' marketing perspective on the influence of digitalisation on agribusiness transformation. As Creswell [49] argued, the quantitative research approach is designed to test the hypothesis and assess its significant relationship in a quantifiable form. Hence, due to the need to test the hypothesis on the influence of digitalisation on the transformation of agribusiness, the quantitative approach was suitable in all steps of this study.

3.3 Research Design

The cross-section research design was used in the current study to establish the data collection and analysis process. As argued by Saunders and Thornhill [48], the cross-sectional design is a design that enables a researcher to collect data from many subjects at a single point in time. They further argued that the premises of cross-section lie in the fact that the reality and knowledge gaining are evidenced when one collects data at one time. Even in the current study, a cross-section research design helped the researcher collect data on the significant influence of digitalisation on the transformation of agribusiness among small-scale farmers. Hence, in this study, a cross-section research design helped the researcher establish reality and knowledge evidence by collecting data at one point to understand how digitalisation transforms agribusiness among small farmers' marketing perspective.

Independent Variables		**Dependent Variables**
Digitalisation		**Agribusiness Transformation**
D1: Digital Advertisement	⟶	AT1: Cost optimization
D3: Digital Communication		AT2: Offset middlemen
D4: Digital Promotion		AT3: Market Information
D5: Digital Payment		AT4: Customer engagement and Interaction
D6: Digital Money		AT5: Real time market update

Figure 1. Conceptual framework.

Source: Authors' compilation.

2.4 Study Area

This study collected data in sub-Saharan Africa especially Tanzania. Tanzania was selected because it comprises various agribusiness sectors from which many small-scale farmers motivated to raise their agribusiness market performance are served. This study's target respondents are small-scale farmers working in agribusiness or selling their products to agribusiness.

There are several digitalisation services for farmers despite farmers not being very active with digital tools. Therefore, it helped to build evidence based on small-scale farmers who own agribusinesses. On the other hand, Southern Highland has many economic activities that small-scale farmers conduct. Hence, the southern highland zone is a potential area that qualifies for collecting data for the current study to understand the significant influence of digitalisation on the transformation of agribusiness among small farmers' marketing perspective.

Small-scale farmers, often known as smallholder farmers, are people or households who carry out agricultural pursuits on a modestly sized plot of land. Small-scale farming can be defined differently depending on the situation, the nation, and the particular standards applied, such as the size of the farm, the scale of the production, or the degree of revenue [50].

3.5 Population and Sampling Design

Study Population

According to Creswell [49], a population is any collection of individuals or things that are the focus of a certain survey and are related in some way. As noted above, the study population was small-scale farmers carrying out agribusiness in the southern highland zone. This particular group of people was chosen specifically because small-scale farmers strongly influence the final decision regarding the digitalisation of their agribusiness services in agriculture. Thus, the current study's data were collected from a qualified population of small-scale farmers to assess the significant influence of digitalisation on the transformation of agribusiness among small-scale farmers from a marketing perspective.

Sample Size

An alternative to Cochran's formula for determining sample size from a population is explained by Yamane [51]. He asserts that the sample size for a 95% confidence level and a p-value of 0.05 should be:

$$n = \frac{N}{1 + N(e^2)}$$

N is the population size, n is the sample size, and e is the degree of precision. When our population is calculated using this formula, population (N) = 1120 with a precision(e) of 5%. Using p = 0.5 and a 95% confidence interval, the sample size is as follows:

$$n = 1120/(1 + 1120(0.05^2))$$

$$n = 1120/2.6175$$

$$n = 400$$

Hence, to generalise our findings for the whole population at 95% confidence, we needed to collect a sample size (n) of 400 respondents for this study. However, we collected 383 valid responses, deemed adequate for producing valid and reliable research results with a +/– 9.17% error. Also, using the minimum sample size suggested by Hair Jr. [52], which would be 10 times the independent variables, would mean that we would only require a sample of 60. We then used PLS-SEM to analyse the data. Performance estimators of PLS-SEM are not affected by a small or large sample in producing long-lasting results, but rather PLS SEM tends to enhance sampling distribution to approach normality.

Sampling Technique and Procedure

Simple random sampling was used to pick our sample; the suitability of this technique is due to its ability to ensure an equal chance for each element of the population to be included in the study. In the current study, each small-scale farmer involved in agribusiness had an equal chance of being selected and included in the study process. This is because all small-scale farmers in agribusiness are homogenous, and they have the same information on the significant influence of digitalisation on the transformation of agribusiness among small-scale farmers. Hence, simple random sampling was considered suitable for choosing samples during data collection.

3.6 Data Collection Tools

A structured questionnaire and document review were used for our data collection. This structured questionnaire was taken from prior empirical studies to capture measurable data for statistical hypothesis analysis. The questionnaire comprised two sections. Section A composed of general data with three questions relating to gender, Age and experience and section B comprises eleven questions divided into two themes, one being digitalisation and the second being Agribusiness transformation. Participants were asked to respond using a Likert scale with a maximum score of 5. "1" stands for strongly disagreeing, "5" for strongly agreeing, and "3" for uncertain. According to Taherdoost [53], questionnaires are valuable for quantitative studies since they allow researchers to gather highly organised data for statistical analysis and hypothesis testing (see Appendix).

Techniques for document evaluation were also applied to bolster and support the study's data collection. According to Creswell [49], the document review method supports the opinions or claims made in academic writing and may also highlight some difficulties that have gone unnoticed by other methods.

The current study used the documentary review technique of data collecting to provide additional support for the questionnaire results and a more significant interpretation of the data gathered. Studies that are now available frequently differ in terms of study design, operational quality, and study subjects. How they approach the research question could vary, increasing the evidence's complexity.

3.7 Data Analysis

As noted above, following the data collection, the data analysis was performed using Partial Least Square Structural Equation Modeling (PLS-SEM) with SmartPLS 4. According to Hair et al. [52], the reason the researcher chose PLS-SEM is that the analysis relates to testing the theoretical framework of predictive perspective and when the structural model comprises many observed variables and latent variables from which the research is required to perform exploration of factor structure before actual testing of the hypothesis. In the current study, the hypotheses are designed using latent variables such as agribusiness transformation as the dependent variable and digitalisation as an independent variable and their respective observed variables. Having the nature of these two kinds of variables, observed and unobserved variables, in the conceptual framework of the current study, PLS-SEM was a suitable method for analysing this kind of model.

When the model consists of numerous constructs and elements, PLS-SEM delivers solutions with modest sample sizes, according to Hair et al. [54]. When distributional difficulties, such as a lack of normality, are a concern and the study calls for scores of latent variables for follow-up analysis, PLS-SEM also performs very well with high sample sizes. Technically, this is made possible by the PLS-SEM algorithm, which computes measurements and structural model links separately rather than all at once. Regardless of whether the data comes from a generalised or mixed population, Hair et al. [52,55] highlight how PLS-SEM offers a solution when techniques like CB-SEM produce unacceptable or inconsistent findings with complex and small models and sample sizes. On the other hand, exploration research that looks at undeveloped or still-developing hypotheses can benefit from PLS-SEM's higher statistical power qualities.

According to these authors, PLS should be viewed as a more open-ended version of SEM that supports composite and common factor models. This method examines the structural link between measured variables and latent constructs by combining component and multiple regression analyses. On the other hand, PLS-SEM enhances sampling distribution to approach normality; it allows models to use fewer indicators (1 or 2), but it can also handle a model with more indicators up to 50+ [55]. Scholars argue that PLS-SEM is suitable for theory development and prediction [53].

On the other hand, Fauzi [56] argued that SEM allows considering divergent and convergent validity in all variables to show model fit and allows specification searches to find better fitting models to the sample variance matrix. PLS-SEM allows the use of several indicator variables per construct simultaneously, which leads to more valid conclusions at the construct level [54]. Hence based on this, PLS, SEM is considered essential.

Additionally, PLS-SEM enables simultaneous assessments of all interactions between constructs and a set of relationships between one or more independent variables and one or more dependent variables [56]. To identify the significant relationship in this study, the three hypotheses from the conceptual framework will be simultaneously evaluated. In contrast to conventional regression analysis, this is possible because PLS-SEM considers many equations at once. This implies that a variable may act as both a predictor (regressor) and a criterion in different equations. PLS-SEM is frequently utilised because it allows for the simultaneous measurement of multiple variables and their interactions. Because it enables the simultaneous examination of relationships between variables, it has a broader range of applications than other multivariate techniques. Although PLS-SEM is appropriate for this investigation, it is frequently regarded as being complex and challenging to comprehend.

A systematic literature review tries to locate, evaluate, and synthesise all empirical data that satisfies pre-established eligibility requirements to address a research topic. According to Byrne [57], a systematic review is a statistical evaluation of the information presented by several research or sources that try to pose or respond to the same question. On the other hand, a systematic review is defined as one that is conducted to summarise the available data on a set of topics with a thorough research strategy. The current study will use the systematic review method to assess secondary data obtained through document review.

3.8 Validity and Reliability

Validity

According to Rusticus [58], validity assesses whether the research instrument truly measures what it was intended to measure and content validity ensures that all contents are captured in the course with greater emphasis on more in-depth context. According to Yusoff [59], face validity concerns whether a measure seems relevant. We ensured content validity, construct validity and predictive validity by first carrying out a pilot study to gain expert opinion to evaluate if the indicator or operational variables were relevant and appropriate to the construct designed and asked respondents to review the instrument to determine whether they measured the concept intended measure.

Convergent validity is the extent to which the construct converges to explain the variance of the items. The average extracted variance (AVE) for all items in each construct was used as a metric for evaluation. An acceptable AVE is 0.50 or higher, indicating that the construct explains at least 50 percent of the variance of the items [53]. Then we assessed discriminant validity, namely the extent to which the construction is empirically different from other constructs in the structural model. In such a setting, an HTMT value above 0.90 would indicate that discriminant validity does not exist [52].

Reliability

Haji-Othman and Yusuff [60] advocate that Reliability is the degree to which research results are consistent over time and accurately represent the total population under study. The current study ensured Reliability by conducting a pilot study before a main survey to soften the language of the instrument and remove the ambiguity of the data collection tools. Removing ambiguity helped clarify the questionnaire, improving the level of repeatability. Further, although the language of reporting this Research is English, to ensure repeatability, we used the Swahili version to ensure a clear understanding of the questionnaire by respondents who are native Swahili speakers. We tested the internal consistency of the collected data using Cronbach's alpha statistic. However, Cronbach's alpha assumes that all items are equally reliable and have equal outer loadings on the construct [61,62]. Because of the limitation of Cronbach's alpha, this study also used composite Reliability to measure internal consistency. Composite Reliability considers the different outer loadings of the items in the construct. According to Hair et al. [61], it is acceptable if Cronbach's alpha and composite reliability values score between 0.70 and 0.90. Cronbach's alpha value and composite reliability values of less than 0.70 show a lack of internal consistency reliability.

4. Findings

4.1 Respondents Profile

In this study, it was necessary to profile respondents' gender, Age and agribusiness experience because they moderate the effect of digitalisation in any social science activities [62]. Including these variables in the information system studies could help provide a real picture of the community concerning the utilisation of digital tools. Hence, these variables are very important to be included in any social research as each variable moderates different respondents' behaviour concerning the digitalisation of agribusiness, and they are used to provide a picture of the respondents involved in the study (Table 1).

Table 1. Respondents profile.

Variable	Measurement	Frequency	Percent
Gender	Male	214	55.9
	Female	169	44.1
Age	18-27 Years	135	35.5
	28-37 Years	79	20.6
	38-47 Years	60	15.7
	48-57 Years	58	15.1
	58-67 Years	31	8.1
	Above 67 Years	20	5.2
Experience in Agribusiness	Less than 5 Years	131	34.2
	Five to 10 Years	199	52
	Above 10 Years	53	13.8
Total		383	100

Source: Field data.

4.2 Validity and Reliability

The quality of any research is established by ensuring validity and reliability issues are cared for in the research process. This study used SmartPLS 4 SEM; therefore, the findings for validity were provided during the reflective measurement and structural model formulation, as presented below.

Evaluation of Reflective Measurement Model

To ensure the validity of the findings, a reflective measurement model was run and assessed to check the output's construct validity and criterion validity. The model was evaluated using the following metrics: indicators loadings, internal consistency, convergent validity, and discriminant validity to check if they align with the recommended value established by previous scholars. The reflective measurement model was run for the first time to determine the validity of the construct, namely digitalisation and agribusiness transformation, as stipulated in Figure 2 below. The model did not perform at a first run, due to the fact that the following indicator variables D2—"Digital Invoicing" and D6—"Mobile Money"; AT1—"Optimise Operation Cost" and AT5—"Real-Time Market Updates" had a low loading of less than 0.7. It is argued that if the indicator scores a loading of less than 0.7 it affects the model performance due to the fact that it will affect the value of AVE, HTMT and composite reliability. We therefore removed these indicator variables due to the fact that they had low loading of less than 0.7 which affected negatively the value of the AVE, HTMT and composite reliability. Figure 2 presents the indicator variables and their loading which relate to the recommended loadings by Hair et al. [63].

Using SmartPLS we produced Figure 2, and produced the output is listed in Tables 3 and 4 to check for model validity. Table 2 shows the measurement model construct.

Indicator Loading

A valid reflective measurement model must produce a loading of 0.7 and above for all indicator variables [52]. In Figure 2 and Table 3, all indicator variables have scored a loading of > 0.7, aligned with the recommended value suggested by prior scholars.

Reliability and Convergent Validity

The reliability is assessed using Cronbach's alpha and composite reliability, where scholars have recommended that a reliable model should produce both Cronbach's and composite reliability, i.e. a p-value > 0.7 [64]. In Table 4, all constructs have scored a p-value > 0.7 for both Cronbach's and composite reliability which is aligned with the recommendation made by prior scholars for the model to be reliable. On the other hand, convergence validity was assessed using average variance extracted (AVE), which is recommended to be 0.5 and above for a model to meet convergence validity [65-68]. In Table 4, the results for AVE indicate that all constructs have scored the value of AVE > 0.5, which is recommended and accepted by prior scholars for the model to achieve convergence validity.

Discriminant Validity

The discriminant validity must be established to confirm that the measurement of a construct (variable) is distinct from other Constructs. Two ways to check discriminant validity exist 1) The Fornell-Larcker Criterion and 2) the heterotrait-monotrait ratio of correlations (HTMT). The classical approach proposed by Fornell and Larcker [69] suggested that the square root of AVE in each latent variable can establish discriminant validity if its value is larger than other correlation values among the latent variables. To do this Table 5 created in which the square root of the AVE is calculated using SmartPLS 4 software and writ-

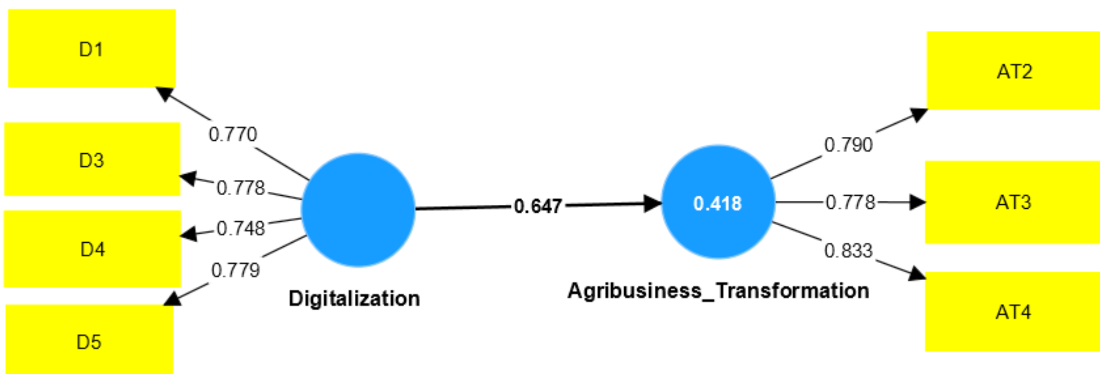

Figure 2. Reflective measurement model.

Table 2. Measurement model constructs.

S/N	Constructs	Indicator variables
1	Digitalisation	D1: Digital advertisement, D3: Digital communication, D4: Digital promotion and D5: Digital payment
2	Agribusiness Transformation	AT2: Offset middlemen, AT3: Market information, AT4: Customer engagement and interaction

Table 3. Outer loading.

Indicator variables/ constructs	Agribusiness transformation	Digitalisation
AT2	0.790	
AT3	0.778	
AT4	0.833	
D1		0.770
D3		0.778
D4		0.748
D5		0.779

Table 4. Reliability and convergent validity.

	Cronbach's alpha	Composite reliability (rhoA)	Composite reliability (rhoC)	The average variance extracted (AVE)
Agribusiness transformation	0.720	0.725	0.842	0.641
Digitalisation	0.773	0.782	0.852	0.591

ten in bold on the Table's diagonal. The results in Table 5 suggest that the square root of AVE in each latent variable value is larger than other correlation values among the latent variables. Hence for the Fornell-Larcker Criterion, this study has achieved the recommended value for discriminant validity [69-71].

Table 5. Fornell-Larcker criterion.

	Agribusiness transformation	Digitalisation
Agribusiness transformation	**0.801**	
Digitalisation	0.647	**0.769**

For discriminant validity to be achieved, scholars have suggested that the measurement model should produce an HTMT value of less than 0.8 [52]. Since the maximum value produced in this study is 0.839 below the 0.85 thresholds (i.e., the most conservative HTMT value), discriminant validity is established in the model (Table 6).

Table 6. Heterotrait-monotrait ratio HTMT list.

	Heterotrait-monotrait ratio (HTMT)
Digitalisation > Agribusiness transformation	0.839

Evaluation of Structural Model

The evaluation of the structural model is based on four criteria namely collinearity assessment, path coefficient assessment, model explanatory power and predictive power. In this assessment, we used; the variance inflexion factor (VIF), the p-value, the R square and the F square (F-Size).

Collinearity Assessment

Multicollinearity is used to check if each set of exogenous latent variables in the model in Figure 2 is checked for potential collinearity problems to see if any variables should be eliminated, merged into one, or have a higher-order latent variable developed. For a model construct to suffer from a collinearity problem, it should produce a variance inflexion factor above 5 [72,73]. Table 7 of this study indicates that no constructs suffered from the collinearity problem since their VIFs were lower than five, as shown in Table 7.

Table 7. Collinearity statistics (VIF).

Indicator Variables of the Constructs	VIF
AT2	1.432
AT3	1.349
AT4	1.481
D1	1.621
D3	1.483
D4	1.675
D5	1.400

Path Analysis and Hypothesis Testing

The study was designed to test digitalisation's significant influence on agribusiness transformation among small-scale farmers. This is a very important stage in assessing the hypothetical relationship between the predictor variable (Digitalisation) on the outcome variable (agribusiness transformation). The structural model was run to assess the study's hypothesis, and the results from the structural model are presented in Figure 3. In Figure 3 path coefficient of both the hypothetical relationship of the independent variable to the dependent variable indicates a significant relationship using the p-value of less than 0.05. Furthermore, Figure 3 shows the significant influence of each indicator variable since all indicator variables have scored a p-value of less than 0.05. Hair et al. [52] recommended a p-value of 0.5 or less for a model hypothesis to be significant. Hence in the current study, all indicator variables were contributing to explaining the significant influence of independent variables to the dependent variables.

Further analysis of the path coefficient is presented in Table 8 using t-statistics and p-value.

Table 8 illustrates the path coefficient of the predictors' variable (Digitalisation) towards the outcome variable (Agribusiness Transformation). This is predicted well using the p-value at less than or equal to 0.05. Hence in this study, the significant influence of digitalisation on agribusiness transformation is significantly important.

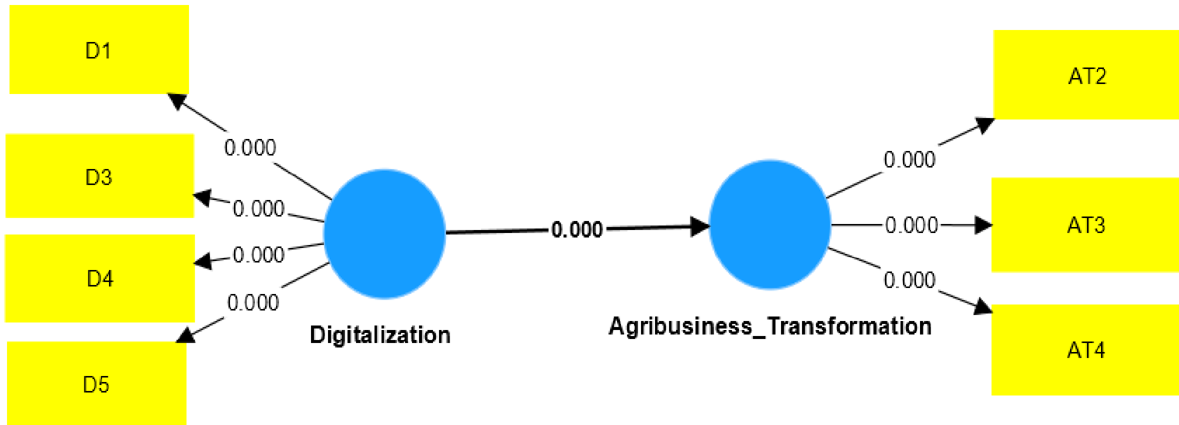

Figure 3. Structural model.

Note: D1: Digital advertisement, D3: Digital communication, D4: Digital promotion and D5: Digital payment contribute to the transformation of agribusiness through AT2: Offset middlemen, AT3: Market Information, AT4: Customer engagement and interaction.

Table 8. Path analysis.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Digitalisation > Agribusiness transformation	0.647	0.649	0.038	17.176	0.000

Model Explanatory Power and Predictive Power

This part involves examining the coefficient of determination (R^2). The R^2 Represents the variance explained in each independent variable and is a measure of the model's explanatory power also referred to as in-sample predictive power. R^2 ranges from 0 to 1, with the higher value indicating a greater explanatory power.

Table 9 indicates the R^2 of the model of 0.417. Falk and Miller [72] recommended that R^2 values should be equal to or greater than 0.10 in order for the variance explained by a particular endogenous construct to be deemed adequate. This means that the variance explained by the independent variable namely digitalisation (R^2 = 0.417) the model predictive power is satisfactory.

Table 9. Model explanatory and predictive power.

	R-square	R-square adjusted
Agribusiness transformation	0.418	0.417

5. Discussion of the Findings

This study hypothesised the relationship between digitalisation and agribusiness transformation of the marketing operation of small-scale farmers. The finding of this study has revealed a significant influence of the digitalisation of agribusiness on the transformation of marketing operations among Small-scale Farmer holders. The agribusiness sector has enhanced the transfer of information and ideas related to market information. This collaborates with the argument made by Balkrishna and Deshmukh [70] on market information in Nigeria. The study supports the cognitive response theory, as described by Ehlers et al. [27] that argues the importance of digital marketing tools in influencing individuals' relative importance to various product attributes with purely rational purchase decisions**.** This implies that when farmers adopt digital technologies, it will transform their agribusiness through access to useful market information and will bridge the current knowledge gaps. The current study supports the findings from prior studies by Reddy, Inegbedion et al., and Rameshkumar [30,71,73] that digitalisation of the agriculture sector significantly influences agribusiness transformation among small-scale farmers. This implies that findings from one context on the digitalisation of agribusiness can be transferred to other contexts to evidence the importance of digitalisation in agribusiness.

While the current study corroborates with some prior study's findings on the significant influence of digitalisation on agribusiness's transformation, they differ in terms of explanation of why digitalisation transforms agribusiness. Notably, Reddy [30] has explained that digitalisation has a significant influence on the transformation of agribusiness due to its ability to increase the selling price and reduce market cost through the enhancement of digital customer engagement and high conversion rates to buy agricultural products. On the other hand, Rameshkumar [73] found that digitalisation tends to transform the agribusiness sector by its power to create digital distribution channels that address the problem of intermediary structures in the Russian farmer's marketing sector. He added that digitalisation is helpful to farmers to reach out to multiple buyers, obtain higher prices for their products, and ensure profit maximisation. The current study found that the possible explanation of why digitalisation transforms agribusiness is that the digital structure tends to bypass the intermediary structure, which is an advantage for small-scale farmers' profit. It is further explained that digitalisation tends to transform small-scale farmers' communication structure and advertisement to be more effective and real-time efficient. The difference observed in explaining the significant influence of digitalisation is the many attributes and the contextual differences. This implies and promises that using digital tools in agribusiness improves the ability of small-scale farmers to benefit from sales outlets for their farm produce [74].

From a different perspective, some prior studies did not support the current study findings on digitalisation's influence on agribusiness transformation. Notably, Atovich et al. [75] found the insignificant influence of digitalisation on agribusiness transformation. They argued that the insignificant influence was observed due to the complication of integrating information resources into small-scale farmers' operations and the lack of compatible software and Internet technologies to fit small-scale farmers' business environments. Similarly, Chille [76] noted that the insignificant influence of digitalisation on agribusiness was due to the application of technology to small-scale farmers, which was incompatible with their capital. This concurs with those who argue that small-scale farmers are simple to establish and need simple and affordable technology to align with their capital [77]. This implies that when establishing digitalisation for small-scale farmers, one should select the technology compatible with small-scale farmers' operations. On the other hand, Abdulqader et al., Sharma et al., and Sood et al. [78-80] found that digitalisation's insignificant contribution to agribusiness transformation is influenced by the level of illiteracy among small-scale farmers, which resulted in their inability to perceive the benefit of using digital services in their marketing operation. This is contrary to the findings of our current study in which the digitalisation of agriculture was based on the use of simple technology such as mobile phone and application which was affordable and simple to apply and operate by small-scale farmers.

6. Conclusions

This study concludes that the digitalisation of the agriculture sector significantly impacts agribusiness transformation. It further concludes that the effect of digitalisation in this study is accounted by the ability of digital services to address the intermediaries' problems, enhance communication and the efficiency of advertisement of small-scale farmers' operations which create customer information, engagement and interaction. The study also concludes that the impact of digitalisation on small-scale farmers is observed when farmers use affordable and simple digital technology, which is clear and understandable by small-scale farmers.

Small-scale farmers can adopt digital technology when it is compatible with their nature, and once adopted and understood, it can transform their business market operation. Although African farmers are observed to be slow in adopting digital technology, the study's findings imply that they can quickly adopt digital technology that is compatible with their nature. Small-scale farmers cannot afford high-end technology. Moreover, although literature tends to highlight that small-scale farmers do not have the technical know-how of digital technology, from the discussion of the findings, we note that small-scale farmers adopt digital technology when it is simple, such as mobile phone technology which is also easy to use.

The study assumes the same level of education for all respondents. Although this might not be the case, it could be a case for further research. Also, this study collected data in sub-Saharan Africa, specifically Tanzania. This Tanzania zone was selected because it comprises various agribusiness sectors from which many small-scale farmers motivated to raise their agribusiness market performance are served. Although this does not necessarily reflect the position of the whole small-scale agribusiness sector, which may differ due to cultural, political and communication differences, we have tried our best to link to studies carried out in countries outside sub-Saharan Africa. Also, one can use this study as a benchmark for other research on small-scale agribusinesses in other regions.

Author Contributions

All authors contributed equally to this article.

Data Availability

The data presented in this study are available on request from the corresponding author.

Conflict of Interest

All authors disclosed no conflict of interest.

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Appendix

Survey

Section A: Demographics

Please choose the appropriate answer by putting a tick in the space provided.

1) What is your gender? ☐ Male ☐ Female	2) Which of the following categories describes your Age? ☐ 18-27 years ☐ 28-37 years ☐ 38-47 years ☐ 48-57 years ☐ 58-67 ☐ Above 67 years
3)What is your experience in Agribusiness ☐ Less than 5 years ☐ Five to 10 Years ☐ Above ten Years	

Section B: Digitalisation of agribusiness

For the following statements, please indicate your level of agreement or disagreement on the following statements based on the following scale;

5 = Strongly agree, 4 = Agree, 3 = Not sure, 2 = Disagree and 1 = Strongly disagree

Digitalisation					
D1:In our business, digitalisation enables online advertisement	1	2	3	4	5
D2:We offer digital invoicing through the digitalisation of our agribusiness market system	1	2	3	4	5
D3: Digitalisation has enhanced our business communication system	1	2	3	4	5
D4: It is easy to promote our business through digital tools	1	2	3	4	5
D5:Payment has been made possible through digitalisation	1	2	3	4	5
D6: Mobile money services are always available and easily accessed in our business.	1	2	3	4	5
Agribusiness Transformation					
AT1: Digitalisation has enabled our business to optimise operation cost	1	2	3	4	5
AT2: The adoption of digital services has addressed the problem of working with the middlemen	1	2	3	4	5
AT3: Much information is available in the digital services	1	2	3	4	5
AT4: Customer engagement and interaction have been easy due to the digitalisation	1	2	3	4	5
AT5:We are getting real-time market updates through digital services	1	2	3	4	5