APSTRACT

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CURRENT ISSUES IN THE TRAINING SYSTEM OF THE MASTER OF BUSINESS DEVELOPMENT PROGRAMME IN THE LIGHT OF THE FEEDBACK OF THE PROGRAMME LEADERS

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Abstract: *Over the past decades, business schools' Masters in Entrepreneurship Development have become one of the most important venues for training future entrepreneurs worldwide. The concept of entrepreneurship and the role of the entrepreneur has been in a constant state of flux over the years, with a significant impact on the structure, methodology and objectives of training courses. Universities need to focus not only on providing traditional business skills but also on developing competences adapted to an increasingly changing economic and social environment. In this article, after reviewing the most important foreign and domestic literature on the topic, we examine the current situation of Master's programmes in business development in Hungary through qualitative research. We focus on the social and economic changes that have influenced the development of entrepreneurship education in recent years and on the trends that may shape the content and form of education in the coming period. The research will use in-depth interviews with programme leaders to find out what expectations different stakeholders - labour market actors, university leaders, students and external stakeholders - have of the Master's in Business Development. We will explore the entrepreneurial competences and effective educator roles that are seen as key today, as well as the main challenges that programme leaders of training courses are currently facing. Based on this, this paper aims to identify potential opportunities and directions for improvement in the teaching of Masters in Business Development, which can contribute to preparing students more effectively for the challenges of a dynamically changing economic environment.*

Keywords: *masters in business development, programme leader feedback, entrepreneurial competences, educator roles, qualitative research*
(JEL code: A10, A23, L26)

INTRODUCTION

Entrepreneurship education has a decades-long history all over the world, including in Hungary. The topic of our research is to explore the situation and the most important common features of business development master programmes in Hungary. However, before we turn to the training of professionals in Hungary, it is important to define what is meant by the concepts of entrepreneurship and entrepreneur.

The definition of an enterprise has undergone significant changes over the years. The modern definition, which is considered by most to be the starting point, comes from SCHUMPETER (1980), who considers entrepreneurship to be the realisation of new combinations of means of production, involving five factors: 1. the production of new goods or new qualities of certain goods, 2. the introduction of a new production process which need not be based on new scientific results, 3. the opening of a new market, 4. the conquest of a new source of supply, 5. the creation of a new organisation. According to SCHUMPETER, the function of the entrepreneur is to create these new combinations.

SOLOMON's (1991) definition of an entrepreneur is: "an innovative person who creates something change for its own sake, (adds), devoting time and effort to it, assuming ... financial, psychological and social risk ... from an activity-oriented perspective ... and accepting the rewards (and penalties) in monetary and personal return". According to CHEN, LI, and MATLAY (2006), an entrepreneur is a person who takes risks in starting and running a business, in most cases using his or her own resources. Based on SCHUMPETER's categorization, W. BAUMOL (2010) identifies the innovative entrepreneur as a

person who is adept at finding creative solutions to increase his or her wealth, power or prestige. According to research by VAN NESS & SEIFERT (2016), entrepreneurs are individuals who risk their personal capital, time and reputation to make their business venture a success.

After defining the concepts of enterprise and entrepreneur, it is essential to turn to the issue of entrepreneurial competences. A specific framework for key entrepreneurial competences for the 21st century has been developed in the European Union (EUR-LEX, 2024). EntreComp, the Entrepreneurship Competence Framework, was developed by the European Commission to define and develop entrepreneurial competences. Its aim is to provide a comprehensive basis for individuals, organisations and educational institutions to assess and strengthen entrepreneurial competences. EntreComp is divided into three main domains, each covering five key entrepreneurial competences (EU SCIENCE HUB, 2024):

1. Creating ideas and opportunities: this includes generating new ideas, identifying and exploiting opportunities, and the ability to develop a vision, create value and think ethically and sustainably.
2. Resource mobilisation: this skill combines self-organisation, mobilisation of resources such as time, money, materials and others, motivation and perseverance, and financial and economic literacy.
3. Seeking action [=taking action]: this includes taking initiative, planning and managing, managing uncertainty and risk, cooperating with others and learning from experience.

EntreComp can be applied in a wide range of fields, from education to the labour market, helping to develop individual and collective entrepreneurship skills across Europe. In this way, it supports both economic innovation and personal development, and contributes to the development of a society and economy that can adapt to a rapidly changing world, promoting innovation as well as sustainable growth. The challenges facing university students today are also a challenge for competent educators. Developing the entrepreneurial skills of their students is essential. Entrepreneurship education is key to launching and building a highly successful career, to which higher education can contribute in different ways.

Business development Master's programmes are a key part of entrepreneurship education in universities worldwide. The first such courses were founded in the post-World War II era, and were influenced both multinational corporations and prestigious business schools (DAVID and SCHAUFELBUEHL, 2015; NARASIMHAN, 2024). The spread of business education in Europe and the key role of multinational corporations in the creation of business schools such as the International Institute for Management Development (IMD) have both foreshadowed the need for Masters in Entrepreneurship Development. LAI and JUNG's (2024) study on Sino-foreign cooperative universities highlights the importance of transnational partnerships: the intertwining of master's programmes with neoliberal ideas and the strengthening of a Western orientation in the process of internationalisation, indicating the huge global development of this type of programme. In higher education, the spread of internationalisation has become one of the most important aspects of the reform agenda in recent decades and economic objectives have become increasingly prominent (DE WIT-DECA, 2020).

The first master's programmes specialising in business development or entrepreneurship studies were launched in the United States in the 1960s and 1970s (SPENDER, 2008). The idea of creating them was inspired by the general growth and diversification in business education, as the business world increasingly recognised the importance of innovation and entrepreneurship during this period. A significant milestone was the decision of Babson College in the US to establish specific entrepreneurship courses in 1967 and later to launch its business development programme in the 1970s (BABSON, 2024). Babson has since become one of the world's leading institutions in entrepreneurship education. Other universities, such as Stanford (STANFORD, 2024) and MIT (MIT, 2024), have also been early adopters of this movement, with a strong emphasis on innovation and entrepreneurship development in their business education programmes. Their programmes have generally covered entrepreneurship fundamentals, financial and business strategies, and issues related to starting and sustaining new businesses, and have since spread worldwide, being incorporated in various forms in many other universities and higher education institutions.

In Hungary, the emergence of master's degrees in business development education is relatively recent (ÁRVÁNÉ et al., 2017; POPOVICS et al., 2017). In most Hungarian universities, entrepreneurship education emerged as part of the undergraduate business, economics or management courses, and only later, in the 2000s, did they become separate master's degrees or specialised courses. The first universities in Hungary to start Masters courses in business development were mostly larger public universities. The first to establish a Master's degree in Business Development was Eszterházy Károly University (2008), followed in chronological order by the University of Debrecen (2009), the University of Szeged (2014), the Budapest University of Economics (2015) and the University of Pécs (2016) (ÁRVÁNÉ et al). The programmes are often called "Entrepreneurship Development", "Entrepreneurship and Management" or "Business Organisation" and offer a wide range of knowledge from business start-up to sustainable operation. Currently, 13 higher education institutions in the country offer accredited Masters in Business Development. These institutions include the Budapest University of Economics, Corvinus University of Budapest, Budapest Metropolitan University, University of Debrecen, Eötvös Loránd University, Kodolányi János University, Hungarian University of Agricultural and Life Sciences, University of Miskolc, University of Óbuda, University of Sopron, University of Szeged, University of Tokaj-Hegyalja and University of Pécs.

Two of the current Master's programmes in Business Development in Hungary should be highlighted. The Master's

programme in Business Development of the University of Debrecen, launched in 2009, aims to train professional specialists who, building on their internationally high quality knowledge, will in the future primarily set up their own small and medium-sized enterprises, develop their existing businesses or work in consultancy or management positions (DE, 2024). The course will provide students with a high level of knowledge in areas such as business strategy, financial analysis, business innovation and project management. According to a study by POPOVICS et al., (2016), from the University of Debrecen, learning by doing, passion, team learning, coaching and mentoring are important elements of entrepreneurship education.

The Department of Business Development and Management of Corvinus University of Budapest started to focus on business development in the early 2000s (BCE, 2024). In the academic year 2002/2003, the Department of Small Business started its specialisation in Small Business, followed by the Master's and postgraduate courses. As graduates of these courses were likely to have good job prospects and relatively high salaries, they quickly became popular with students. The key values of Corvinus University of Budapest education include high quality theoretical and practical teaching, the opportunity to participate in internships, strong international embeddedness and mobility opportunities, excellent networking opportunities and a highly prestigious degree.

MATERIALS AND METHODS

In the course of the research, we first reviewed the international and Hungarian literature related to the topic (secondary research), and drew summarizing conclusions, focusing primarily on the characteristics of Hungarian entrepreneurship education. As part of the secondary research, the literature review was carried out to collect, organise and analyse the international and domestic academic literature on the subject. As data sources, we considered academic publications with textual content, various textbooks and articles, as well as other descriptions of the educational process of the Master's degree in Business Development.

We then chose qualitative research as the primary research method, which aimed at defining the problem, better understanding it and exploring possible directions for research. Among the possible methods of qualitative research, we chose in-depth interviews as the group of possible interview formats. Of course, no general conclusions can be drawn from this, but it provides a good basis for the phase of the work that requires quantitative research.

The literature, the study of good practices and in-depth qualitative interviews (with programme leaders) will gradually contribute to the development of a methodology to study the educational process of the Master's degree in Business Development, with a particular focus on the development of entrepreneurial competences.

In our work, we used an inductive research approach, whereby a concept is formulated on the basis of empirical information (BRYMAN and BELL, 2015), i.e., in the authors' words, knowledge is inferred from empirical data.

The inductive nature of research means that "we can draw a general conclusion from our own empirical observations" (GHAURI and GRONHAUG, 2011), i.e. "moving from the specific to the general through a series of observations towards the discovery of a correlation that "brings a degree of order to the cases" (BABBIE, 2017). The structure of research is structured accordingly: observation is followed by the making of findings. The exploratory nature of the research has been the primary focus of the research. Since our aim was to explore an area that has not been extensively explored in theory, and especially in practice, we needed to understand the process in detail. To put it simply, qualitative research can be equated with exploratory research (MALHOTRA, 2002).

The qualitative interviews took the form of semi-structured interviews in May and June 2023. Our aim was to allow the interviewees to share as much information as possible about their training during the interviews. This provided them with the opportunity to explore aspects of the topic that were important to them and also gave them space to conduct experiential interviews. (In designing the interviews, we anticipated 50-60 minute interviews that would encompass the whole topic.) The primary criterion for inclusion in the sample was that the interviewee should be involved in the training process of the Master's in Entrepreneurship. As a result, the five people with the most significant experience (programme leaders) were included in the sample. The interviews were conducted using the Microsoft Teams application. Transcripts were made of the interviews, the main conclusions of which were then independently processed and summarised.

RESULTS AND DISCUSSIONS

During the interviews, all participants were expected to respond to the same main questions, reflecting the sometimes similar and sometimes different experiences and opinions of the professionals involved in the teaching of the Master's degree in Business Development. In particular, our final analysis focuses on social and economic change, stakeholder expectations, entrepreneurial competences and the roles of educators. Our synthesis aims to provide a comprehensive picture of current challenges and future opportunities.

The interviewees agreed that global and local social and economic trends have a significant impact on entrepreneurship education. Technological developments, i.e. the rise of information technologies and the digital economy, require the development of new skills and competences. The integration of the sharing economy and e-commerce is of paramount importance in entrepreneurship education. The focus on sustainable development and the circular economy requires educational content focusing on innovation and sustainability. In the context of societal change, education will

need to emphasise a mindset that supports autonomy and creativity, as students increasingly prefer a start-up-oriented, problem-solving approach. Increasing demand for products and services developed for older age groups in society will create new market opportunities. The emergence of new economic models, mainly based on the Internet, such as the sharing economy and e-banking, is bringing a new approach to education. The increasingly globalised world market requires students to acquire knowledge that works in international markets. In terms of the impact of the pandemic, the Covid-19 pandemic has highlighted the vulnerability of business models, emphasising the importance of resilience and digital adaptability.

Following an overview of the impact of current social and economic changes, we asked our interviewees what expectations different stakeholders have of the Master of Business Development. In line with our preliminary expectations, our interviewees confirmed that these expectations are very diverse. For labour market actors, interviewees consider it crucial that graduates who successfully complete the training are flexible and have the ability to solve problems creatively. Comprehensive soft skills such as communication and teamwork are important, as well as specific technical skills such as Excel, business modelling or a thorough knowledge of artificial intelligence. University leaders see the Master of Business Development courses primarily as courses focused on innovation and entrepreneurship, management courses that can produce Forbes-listed entrepreneurs

From the students' perspective, it is essential that the entrepreneurship education is practice-oriented, based on real problems, and accompanied by personalised advice and mentoring opportunities. External stakeholders also have different priorities. In their case, it is important to involve entrepreneurs and employers in the education, for example through participation in final examinations and mentoring of real business projects. Among this group of stakeholders, particular emphasis is placed on the need for sustainable, innovative solutions, closer cooperation with industry to identify real labour market needs, and stronger community engagement between business and education.

We also asked the professionals who participated in our research which entrepreneurial competences they think business development master's programmes develop the most. Respondents highlighted the importance of the following key competences:

• Strategic thinking: ability to assess the market and develop long-term plans.

• Innovation management: the ability to create and manage innovation.

• Teamwork and leadership skills: working in a team and leadership skills are of paramount importance.

• Financial literacy: basic knowledge of business planning and preparing accounting statements.

• Problem-oriented thinking: the ability to identify opportunities, which is particularly important in the entrepreneurial and start-up world.

• Autonomy and responsibility: the ability to make decisions and take responsibility for the work done is essential.

• Environmental analysis: identifying economic, social and technological changes and applying them to business opportunities.

• Digital competences: the ability to quickly learn and apply new technologies to business processes.

• Cultural sensitivity: the ability to work effectively in a multicultural environment.

• Risk management: identifying and effectively managing risks in a rapidly changing market environment.

We were also curious to know which educator roles are most dominant in business development master's programmes today, according to the survey respondents. The five professionals interviewed identified eight different main educator roles, which can be briefly summarised as follows:

1. Facilitator: in this role, educators are increasingly taking on the role of facilitating students' independent learning, for example through project-based teaching.

2. Mentor: mentors build personal relationships with students and support them in developing their careers.

3. Coach: aims to help students develop as individuals through the use of listening and guiding questions.

4. Feedback provider: educators provide continuous and constructive feedback on students' work.

5. Knowledge transferer: it focuses on the transfer of theoretical and practical knowledge, which is the basis for students' professional development.

6. Community-builder: the role of educators in strengthening the student community and building group cohesion is also of paramount importance.

7. Leader by example: the personal example set by teachers, including professional ethics and innovative thinking, shapes students' values in the long term.

8. Networker: the main focus is on building links between the profession, industries and students to foster collaboration and innovation.

The general view of our interviewees is that there are several roles in entrepreneurship education, but ultimately it is the interactive and supportive approach that is most effective. Master's students expect a level of expertise that is a notch deeper than undergraduates, so the expert role of the educators is essential. However, rather than face-to-face teaching, facilitator-type teaching is the most effective way to ensure active participation. In addition to the facilitator role, the mentor role is considered by respondents to be the second most important role in entrepreneurship education. The role of the educators is to help students experiment and learn by doing.

Overall, there was a consensus among the research participants that the role of educators is constantly changing, and that the rise of online education during the Covid-19 pandemic has led to an increased emphasis on supporting individual and group learning.

As practicing coaches, we are particularly interested in the special role that the coach approach can play in the education of Master's students in business development, and therefore a specific question was asked during the interviews. The interviewees agreed that the coach approach is important and could play an increasingly important role in the future in the teaching of entrepreneurship development. Several of our interviewees emphasised that the coach does not give instructions but guides and helps students to draw their own conclusions. In this respect, one of the programme leaders interviewed stressed that the role of the coach is not to tell the student what to do, but to guide him and only intervene if the student is about to make a serious mistake. Another colleague said that although he personally does not consider himself an expert on the coach approach, he sees the methodology as important because the coach "tries to guide the student by asking questions" without distorting his thinking. A third interviewee said that integrating the coach approach into education would be a great idea, but that, contrary to current trends, the institutional structure should support smaller groups for this methodology to be really workable.

We also asked our survey participants about their recent training and future training needs. The interviewees had all participated in some training in the last three years, but the nature of the training varied. One of the colleagues admitted to attending some kind of training every year, with the most recent ones focusing on mentoring and AI. For another, online education and a deeper understanding of e-learning systems have recently been the biggest new challenges. One colleague had attended several methodological training courses in her home institution, dealing with conflict management and student assessment techniques. And one of them had the opportunity to attend a three-day design thinking workshop at a prestigious university in the United States, in addition to a storytelling training course in Budapest.

In terms of future training needs, the trainers interviewed highlighted several potential key directions, which partly coincided with the training opportunities they had already taken up recently. There were trainers who felt that coach and mentor training could be of interest to them, as they had not yet formally participated in this, but saw potential in it. There were also some who would focus on training in new teaching methods in the coming period, introducing new techniques, and would be interested in courses on the use of technology in education (e.g. Moodle), as they see this as an important area of development for the university and for trainers. Other potential training needs include the development of face-to-face and interactive teaching, which could also be a useful area for development.

In the final part of our interviews, we sought answers to two main questions. The first was what are the biggest challenges that educators face in teaching business development today. Here again, we received a variety of responses. For many, one of the biggest challenges is the administrative and organisational constraints that hinder teaching. Students are expected to learn teamwork and collective responsibility, which is not always easy. From the instructors' perspective, one of the biggest challenges is to help students reach the "aha" moment as soon as possible, when they understand the importance of real-time testing and experimentation. It's also important to point out that the market situation for Master's students is also constantly changing, with relatively many of them continuing their studies abroad.

Finally, we also wanted to get the views of our research participants on the areas where they think entrepreneurship education could be most improved. Based on the responses received, the top ten areas for improvement are summarised below:

- Small group teaching: Teaching individually and in small groups allows you to develop personal relationships and a better understanding of students' needs.
- Using technology: integrating AI and other digital tools can significantly improve the quality of education.
- Train the Trainer programmes: training trainers is key, especially to develop mentoring and coaching skills.
- Experiential learning: by implementing practice-oriented programmes such as hackathons and incubation projects, students could significantly increase their professional experience.
- Lifelong learning: students should be offered training and workshops for continuous professional development.
- International cooperation: strengthening links with partner institutions abroad is of particular importance to ensure that students acquire internationally competitive knowledge.
- An interdisciplinary approach: integrating business develo ment with other disciplines, such as design thinking or psychology, could create significant positive synergies.
- Strengthening student feedback: continuous dialogue with students to improve teaching content and methods can increase the effectiveness of the feedback system.
- Integrating the measurement of social impact: the evaluation of the social and economic impact generated by students' projects and enterprises should also be integrated into the programmes.
- Hybrid learning models: combining online and face-to-face learning can increase flexibility and accessibility.

Entrepreneurship education, including Masters in Business Development, has a decades-long history both at home and around the world. During this period, not only the concept of entrepreneurship but also the concept of the entrepreneur has undergone significant changes. In Hungary, the rise of entrepreneurship education can be traced back to the 2000s. In our paper, after a review of the secondary research, i.e. the literature on the subject, we conducted in-depth interviews with five Hungarian experts in the primary research, and drew conclusions from our own empirical observations.

The research participants agreed that current social and economic trends have a significant impact on entrepreneurship education. Different stakeholders in education have dif-

ferent priorities. According to the respondents, key entrepreneurial competences that education should aim to develop include strategic thinking, innovation management, teamwork and leadership skills, problem-oriented thinking and digital competences. Innovative (facilitator, mentor, coach) and traditional (knowledge transferer, feedback provider) roles are mixed as dominant educator roles in the Master in Business Development. According to the interviewees, the coach approach is already important, but may become even more important in the future.

All our interviewees had recently received training, but the nature of the training varied. In addition to methodological courses, online training has come to the fore during the Covid-19 epidemic, and in recent months, AI courses. Increased demand for these training courses is expected in the near future, including through an increased role for coaches and mentors, and a greater emphasis on face-to-face and interactive forms of training.

Among the most significant challenges facing academics, respondents cited administrative and organisational constraints, a moderate level of student empowerment and significant outward migration. Small-group teaching, increased use of technology, lifelong learning and hybrid teaching models were highlighted as the most important areas for improvement in entrepreneurship education.

Overall, we can conclude that the interviewed programme leaders of the Master's in Business Development all face similar and different problems in their daily work. However, thanks to their persistent work and professional dedication, the interviews showed that they have all the necessary qualities to be able to respond to the professional and human challenges of the years ahead, which will certainly not always be easy, thus laying the foundations for the long-term future of business development master's programmes in Hungary. We consider that the results of our qualitative exploratory research related to the Master's programme in Business Development could also serve as a good basis for conducting a primary, quantitative research using descriptive methods with an inductive approach for the development of the programme.

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ACCESS TO CREDIT AND ITS INFLUENCE ON COCOA FARMERS' WILLINGNESS TO PAY FOR EU-APPROVED PESTICIDES IN ONDO AND OSUN STATES

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Abstract: *The efficient use of certified and environmentally safe pesticides is essential to sustaining cocoa production in Nigeria, particularly as international markets increasingly demand compliance with residue and quality standards. In the cocoa sector, EU-approved pesticides are recommended for effective pest and disease control; however, their adoption depends largely on farmers' capacity and willingness to pay for these inputs. A clear understanding of how credit access and other socioeconomic factors influence willingness to pay is, therefore, necessary to support farmer compliance. This study investigated the effect of credit access on cocoa farmers' willingness to pay for EU-approved pesticides in Ondo and Osun States, Nigeria. A multi-stage sampling procedure was used to select 240 cocoa farmers. Data were analysed using descriptive statistics, the double-bounded contingent valuation method, and a logit regression model. The results showed average values of 46 years for age, 23 years for farming experience, 7 persons for household size, and 8.54 hectares for farm size. The majority (85%) of farmers expressed willingness to pay for EU-approved pesticides, with 62.5% willing to pay a 25% premium above the market price. Logit regression estimates revealed that gender, age, marital status, education, access to extension services, cooperative membership, quantity of pesticide used, household size, farm size, and access to credit significantly influenced willingness to pay. Credit access in particular increased the probability of willingness to pay, indicating that liquidity constraints play a major role in the adoption of approved pesticides. The study concluded that access to credit is a critical determinant of cocoa farmers' willingness to pay for EU-approved pesticides. This suggests that policy interventions aimed at improving pesticide compliance must incorporate strategies that strengthen farmers' access to affordable credit. The study recommends that young farmers be encouraged to participate in cocoa production, cooperative associations be strengthened, and*

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INTRODUCTION

The cocoa tree (Theobroma cacao) remains one of Nigeria's most economically significant perennial crops due to its adaptability to diverse agro-ecological conditions and varying soil and climatic environments (Ogunjimi & Farinde, 2012; Kehinde et al., 2016; Kolawole et al., 2020). Currently, fourteen states—Abia, Adamawa, Akwa Ibom, Cross River, Delta, Edo, Ekiti, Kogi, Kwara, Ogun, Ondo, Osun, Oyo, and Taraba—actively engage in cocoa cultivation, collectively contributing a substantial share of national supply (Oluyole & Sanusi, 2009; Adeola et al., 2021; Kehinde et al., 2021; Oyenpemi et al., 2023). Production in these regions is dominated by smallholder farmers for whom cocoa functions not only as a primary income source but also as a foundation of livelihood security (Amujoyegbe et al., 2018; Adeniyi & Adebayo, 2022). Beyond farm-level importance, cocoa generates employment across the value chain—harvesting, fermentation, drying, processing, transportation, and marketing—positioning it as a key driver of rural development and poverty reduction (FAO, 2023; Kehinde & Ogundeji, 2023; Kolade & Komolafe, 2021). Nationally, cocoa remains a major foreign exchange earner, with output for the 2023/2024 season estimated at 320,000–350,000 tonnes (BusinessDay, 2024; ICCO, 2024). The crop also supports state and local government finances through taxes and levies. Recognising its eco-

nomic potential, the Nigerian government has increasingly prioritised cocoa as a strategic non-oil export commodity for economic diversification and rural growth (Adesiyan et al., 2023; FAO, 2023; Nwankwo et al., 2022). Cocoa production further stimulates numerous agro-industrial and service activities, including agrochemical distribution, packaging, and transport logistics (Adeniyi & Adebayo, 2022).

Despite its economic relevance, cocoa production continues to be undermined by pervasive pest and disease pressures. These biotic stressors—including mirids, cocoa pod borer, and black pod disease—can cause yield losses of up to 45 percent, with severe outbreaks resulting in losses exceeding 80 percent (Mokwunye et al., 2012; Adepoju et al., 2021; Kehinde & Tijani, 2021). Consequently, farmers increasingly rely on pesticides to manage field and storage pests (Bateman, 2010; Faloni et al., 2022). Proper pesticide application supports plant health, stabilises yields, and enhances bean quality for domestic and export markets (Damalas & Eleftherohorinos, 2011; Alabi et al., 2022). However, recent studies report rising concerns about harmful residues—particularly organophosphates and organochlorines—on cocoa beans from Nigerian producing regions, which threaten food safety and jeopardise international market access (Oluwajobi et al., 2023; Akande et al., 2023; Adeoye et al., 2021). The European Union (EU) maintains strict Maximum Residue Limits (MRLs), requiring cocoa imports to meet thresholds of 0.01 mg/kg for several pesticide compounds (ICCO, 2008; EU Commission, 2021). In response, the Nigerian government has promoted a list of EU-compliant pesticides, including Actara 25WG, Esiom 150SL, Funfurun-OH, Champ DP, Ridomil Gold 66WP, Ultimax Plus, Kocide 2000, Roundup Clear Weed, Touchdown, and Phostoxin, supported by farmer enlightenment campaigns and extension programs (FMARD, 2022). Nevertheless, many farmers continue to use banned or unapproved chemicals due to cost constraints, misinformation, and limited access to EU-approved inputs (Olayemi & Adegbola, 2020; Oluwajobi et al., 2023; Kehinde & Tijani, 2024). This persistent non-compliance underscores the need to understand the determinants of farmers' decisions regarding the purchase and proper use of approved pesticides.

A critical issue that emerges is whether farmers are willing and financially able to pay for EU-approved pesticides, which are often more expensive than widely available alternatives. Willingness to Pay (WTP)—the maximum monetary value a farmer is prepared to offer for an input—reflects perceived benefits such as higher yields, improved bean quality, or better access to premium export markets (Marine Le Gall-Ely, 2009; Oke et al., 2019; Adesiyan & Kehinde, 2024). In the cocoa sector, WTP is shaped by socioeconomic and institutional characteristics, including income, education, household size, farm size, market access, and risk perceptions (Adedeji et al., 2023; Kehinde et al., 2024). Among these, access to credit is particularly influential, as it enables farmers to overcome liquidity constraints and purchase costly but compliant inputs (Kehinde & Alabi, 2025; Kehinde et al., 2025). Extensive empirical evidence shows that access to credit increases farmers' adoption of improved technologies such as fertilizers, certified seeds, and approved pesticides (Ojo & Kehinde, 2021; Bawuah et al., 2022; Kehinde, 2025). Yet many cocoa farmers lack access to credit due to inadequate collateral, unfavourable interest rates, and limited financial awareness, hindering their ability to purchase EU-approved pesticides despite recognising their benefits (Adedeji et al., 2023; Ayanlade & Ojebisi, 2024). Despite this well-acknowledged relevance of credit, empirical studies specifically examining how credit access influences cocoa farmers' WTP for EU-approved pesticides remain scarce, representing a key knowledge gap. Addressing this gap is vital because WTP shapes long-term adoption, compliance with international standards, and the global competitiveness of Nigeria's cocoa exports.

Against this backdrop, the present study examines how access to credit affects cocoa farmers' willingness to pay for EU-approved pesticides in Ondo and Osun States—two of Nigeria's leading cocoa-producing regions. These states provide a suitable context for assessing how differing socioeconomic conditions and credit environments shape farmers' purchasing behaviour. The first objective is to describe farmers' socioeconomic characteristics, including age, education level, income, farm size, household composition, and access to credit or financial services, thereby establishing the economic context of pesticide purchasing decisions. The second objective is to profile pesticide-use patterns, distinguishing between EU-approved and non-approved chemicals while documenting frequency of use, sources of supply, application methods, and the underlying rationale guiding farmers' preferences. This assessment provides insight into prevailing pesticide practices within the cocoa belt. The third objective is to determine farmers' willingness to pay for EU-approved pesticides by estimating the maximum price they would offer given their socioeconomic conditions and perceived benefits. Finally, the study evaluates the influence of credit access on WTP, testing the hypothesis that farmers with access to formal or informal credit demonstrate higher WTP for compliant pesticides than those without credit access. Findings from this study are expected to inform targeted policy interventions—including input-financing schemes, credit programs, and subsidy mechanisms—aimed at strengthening pesticide compliance, enhancing export competitiveness, safeguarding public health, and improving the livelihoods of cocoa-growing households in Ondo and Osun States.

MATERIALS AND METHODS

Study Area

The study was conducted in Osun and Ondo States, two of the most prominent cocoa-producing areas in southwestern Nigeria. Osun State is located in the south-western geopolitical zone and lies within latitudes 7.0° and 9.0°N and longitudes 2.8° and 6.8°E. The state covers a landmass of approximately 8,602 km² and has an estimated population of 4,137,627 people (NPC, 2006; NPC, 2023 projections). Osun lies between 300 and 600 m above sea level and is characterised by a gently undulating terrain interspersed with low hills. The state experiences a tropical climate marked by distinct wet and dry seasons. Annual rainfall ranges from about 1,125 mm in the derived savannah zone to nearly 1,475 mm in the rainforest belt,

supporting the cultivation of a wide variety of crops. Mean annual temperatures fluctuate between 27.2°C in June and 39.0°C in December, reflecting the influence of the West African monsoon and dry north-easterly winds. Administratively, Osun State comprises 30 Local Government Areas (LGAs) grouped into three senatorial districts, each subdivided into two administrative zones. The state is culturally homogenous, predominantly inhabited by sub-ethnic groups of the Yoruba, such as the Ife, Ijesa, Oyo, and Igbomina, although migrants from other parts of Nigeria also reside in the urban centres. Yoruba and English serve as the principal languages of communication. Agriculture forms the backbone of Osun State's economy, engaging a significant proportion of the rural population. The favourable climatic and edaphic conditions support the cultivation of major food crops, including maize (Zea mays), yams (Dioscorea spp.), cassava (Manihot esculenta), cocoyams (Colocasia spp.), rice (Oryza sativa), and various leafy vegetables (Amaranthus spp.). The state is also notable for its production of cash crops such as cocoa (Theobroma cacao), kolanut (Cola nitida), and oil palm (Elaeis guineensis). Cocoa farming, in particular, provides income for thousands of smallholder farmers and constitutes a vital economic activity that shapes rural livelihoods.

Ondo State, popularly referred to as the "Sunshine State," is also situated in southwestern Nigeria with Akure as its administrative capital. The state lies between latitude 7° 10′ North and longitude 5° 05′ East, covering a total land area of approximately 14,793 km². Ondo State has a population of 3,441,024 people based on the 2006 National Population Census, with projections indicating significant growth over the past decade. The state is divided into 18 Local Government Areas comprising both inland and coastal communities, the latter extending towards the Atlantic shoreline through Ilaje and Ese-Odo LGAs. The people of Ondo State are predominantly Yoruba, speaking various dialects such as Akoko, Akure, Idanre, Ikale, Ilaje, Ondo, and Owo, with pockets of non-Yoruba-speaking groups, including the Ijaw in riverine areas. The state's physical environment ranges from the coastal mangrove belt in the south to lowland rainforest and derived savannah in the central and northern districts. The tropical climate supports a high diversity of agricultural activities with a long rainy season and average annual rainfall well above 1,500 mm in some areas. Ondo State has an agrarian economy with farming, fishing, lumbering, and trading as predominant occupations. It is Nigeria's leading cocoa-producing state, consistently contributing the largest share of national cocoa output. Cocoa production in Ondo benefits from favourable rainfall distribution, fertile forest soils, and a long history of cocoa cultivation dating back to the colonial period. Other important crops produced in the state include rice, yam, maize, cassava, cocoyams, taro, coffee, vegetables, and various fruits. Agricultural production is largely undertaken by smallholder farmers using traditional technologies, although recent interventions by government and development agencies aim to enhance input access, extension services, and value-chain development.

Together, Osun and Ondo States form a major component of Nigeria's cocoa belt and provide an ideal setting for examining cocoa farmers' access to inputs, pesticide use behaviour, and willingness to pay for EU-approved pesticides.

Figure 1: Map of Ondo and Osun States

Sampling Procedure

A multistage sampling procedure was employed to select respondents for the study. In the first stage, two Local Government Areas (LGAs) were purposively selected from each state based on their high concentration of cocoa-producing households. In Osun State, Ife Central and Ife East LGAs were chosen, while Idanre and Ile-Oluji/Okeigbo LGAs were selected in Ondo State. These four LGAs are recognised as major cocoa-producing zones and therefore provide an appropriate setting for assessing farmers' pesticide use behaviour and willingness to pay for EU-approved pesticides. The second stage involved the simple random selection of six cocoa-producing communities from each of the four LGAs, giving a total of 24 communities. This approach ensured that the sample captured geographical and socio-economic diversity within the selected LGAs. In the third stage, a simple random sampling technique was employed to select ten cocoa farmers from each of the selected communities. The community lists of cocoa farmers, obtained with the assistance of local extension agents and community leaders, served as the sampling frame for this stage. In total, 240 cocoa farmers (10 farmers × 24 communities) were selected and interviewed for the study. This sample size was considered adequate for generating reliable estimates and conducting multivariate statistical analysis related to pesticide use and willingness to pay.

Analytical technique

The data collected for this study were analyzed using a combination of descriptive and inferential statistical techniques. Descriptive statistics were employed to summarize and present the socio-economic characteristics of the respondents, including measures such as frequencies, percentages, means, and standard deviations. The Contingent Valuation Method (CVM) was used to estimate respondents' willingness to pay (WTP) for the interventions or services under consideration, providing a monetary valuation of their preferences. Additionally, the logit regression model was applied to examine the factors influencing respondents' binary choices or decisions, allowing for the identification of significant determinants of their behavior.

Descriptive statistics

Descriptive statistics were employed to summarize the

socio-economic characteristics of cocoa farmers and to profile the various types of pesticides they handle, including information on frequency of use, categories of chemicals, and handling practices.

Contingent valuation method

We employed the double-bounded contingent valuation method (CVM) to estimate cocoa farmers' willingness-to-pay (WTP) for European Union (EU)–approved pesticides in this study. The WTP framework is grounded in the stated preference approach, which seeks to obtain valuations for goods or services that lack observable market prices. Under this approach, respondents are presented with a carefully designed hypothetical market scenario and directly asked to indicate the maximum amount they are willing to pay for the good in question (Kimenju et al., 2005). This technique is particularly suitable for evaluating products such as EU-approved pesticides, for which market penetration may still be limited, and price information is not yet well established among farmers. CVM has been widely applied for more than three decades to value non-market goods, including environmental amenities, public services, and agricultural innovations. Its usefulness stems from its flexibility in capturing both use values (e.g., productivity gains from pesticide use) and non-use values (e.g., compliance with export standards or environmental safety). The method is often preferred in contexts where revealed preference approaches—such as market-based or behavioral observation methods—are unfeasible because the relevant markets do not exist or are poorly developed. In agricultural economics research, CVM has proved especially valuable in understanding farmers' preferences for new technologies, input quality improvements, and sustainability-enhancing innovations. Previous studies highlight its effectiveness in eliciting WTP for improved seed varieties, enhanced fertilizer blends, disease-resistant crops, and integrated pest management options (Yadav et al., 2012). Accordingly, its application in this study provides an appropriate and rigorous means of capturing cocoa farmers' valuation of EU-approved pesticides, which are relatively new in the Nigerian cocoa sector and essential for meeting international regulatory requirements, particularly within the European Union export market.

The theoretical foundation of WTP is rooted in utility maximization. Let U(X)represent an individual's preference function, where X=(X_1,…,X_n)denotes a vector of private goods available at market prices:

p=(p_1,…,p_n) (1)

The individual maximizes utility subject to an income constraint y. The indirect utility function is expressed as:

V(p,y)=max{u(x)|p.x≤y} (2)

The dual minimum expenditure function is:

m(v,u)=min{p.x|U(x)≥u} (3)

Differentiating the expenditure function with respect to price yields the Hicksian (compensated) demand function:

x_i^u (p,q,u)=m_pi (p,q,u) (4)

Similarly, the Marshallian (ordinary) demand function is obtained as the negative ratio of the partial derivatives of the indirect utility function with respect to price and income:

$$x_i(p,q,y) = \frac{-V_{pi}(p,q,y)}{V_y(p,q,y)} \quad (5)$$

An individual will therefore express willingness to pay for a good if the purchase increases utility, subject to the income constraint.

The double-bounded dichotomous choice format proposed by Hanemann et al. (1991) was adopted because it enhances the statistical efficiency of WTP estimates by allowing each respondent to provide two price-related responses rather than one. After the initial bid is presented, the respondent is offered a higher follow-up bid if the initial response is "yes" or a lower one if the initial response is "no." This sequential structure generates more information about each individual's underlying WTP and significantly reduces the variance of the estimated parameters when compared with single-bounded formats. In addition, the double-bounded approach yields tighter confidence intervals, increases the precision of the WTP distribution, and minimizes strategic bias that often arises in open-ended formats (Arrow et al., 1993).

To ensure that respondents had a clear understanding of what they were valuing, farmers were first briefed on the key features, safety advantages, residue compliance benefits, and productivity-enhancing effects of EU-approved pesticides. These explanations were complemented with visual aids, labels, and demonstrations to provide concrete illustrations of pesticide use and the regulatory requirements associated with EU markets. This sensitization step was essential because EU-approved pesticides are relatively new in the study areas, and farmers' prior awareness varied considerably. Providing uniform information helped minimize information asymmetry and ensured that WTP responses were based on comparable levels of understanding.

Following the briefing, each respondent was randomly assigned an initial bid price representing the hypothetical cost of purchasing EU-approved pesticides. The double-bounded elicitation procedure is then followed by a structured decision sequence. If the respondent accepted the initial bid ("yes"), a higher follow-up bid was offered to determine whether they were willing to pay more than the first amount. Conversely, if the respondent rejected the initial bid ("no"), a lower follow-up bid was presented to determine the minimum price they would be willing to pay.

This procedure leads to four possible combinations of responses (Kimenju et al., 2005):

Yes–Yes (yy): Respondent accepts both the initial and higher follow-up bid.

Yes–No (yn): Respondent accepts the initial bid but declines the higher follow-up bid.

No–Yes (ny): Respondent rejects the initial bid but accepts the lower follow-up bid.

No–No (nn): Respondent rejects both the initial and lower follow-up bid.

These response patterns provide interval data that allow the researcher to infer bounds around each respondent's true WTP, thereby improving the reliability and robustness of the final WTP estimates.

The corresponding probabilities are expressed as:

$$Pr_{yy}(B, B^u) = 1 - F(B^u) \quad (6)$$

$$Pr_{yn}(B, B^u) = F(B^u) - F(B) \quad (7)$$

$$Pr_{ny}(B, B^d) = F(B) - F(B^d) \quad (8)$$

$$Pr_{nn}(B, B^d) = F(B^d) \quad (9)$$

where:
B= initial bid;
B^u= higher bid for "yes" responses;
B^d= lower bid for "no" responses;
$F(\cdot)$= cumulative distribution function of WTP.

Combining these probabilities, the log-likelihood function for the sample is:

$$InL = \sum_{i=1}^{N}\left[yy_i lnPr_{yy}(B_i, B_i^U) + yn_i lnPr_{yn}(B_i, B_i^U) + ny_i lnPr_{ny}(B_i, B_i^d) + nn_i lnPr_{nn}(B_i, B_i^d)\right] \quad (10)$$

To tailor the double-bounded CVM approach to the specific context of EU-approved pesticides, several steps were undertaken to ensure that farmers' responses reflected informed and realistic valuations. First, respondents were provided with hypothetical yet contextually accurate information regarding the key attributes of EU-approved pesticides, including their productivity-enhancing effects, health and safety implications, compliance with European export standards, and associated environmental benefits. This preliminary sensitization helped create a uniform understanding among cocoa farmers, many of whom had varying degrees of prior exposure to EU-certified inputs. The initial bid price offered to each farmer represented the prevailing market-equivalent cost of EU-approved pesticides. This served as the baseline for elicitation and reflected a price that farmers might reasonably encounter if such products were widely available in the local market. For respondents who accepted the initial bid, higher follow-up bids were sequentially presented at 25%, 50%, 75%, and 100% premiums above the initial price. This ascending bid structure helped determine the upper bound of the respondent's maximum willingness-to-pay. Conversely, respondents who rejected the initial bid were presented with progressively lower bid amounts in line with the double-bounded elicitation framework. This descending sequence made it possible to identify the lower bound of each farmer's WTP and to distinguish between outright non-payers and farmers who were willing to pay but only at reduced prices. By incorporating both upward and downward adjustments to the initial bid, this bidding strategy enabled the study to generate robust interval-based estimates of farmers' WTP for EU-approved pesticides. It also allowed the analysis to capture heterogeneity in price sensitivity, potential liquidity or credit constraints, and farmers' perceptions of the relative benefits of certified EU-compliant pesticide products

Logit regression model

A binary logit regression model was used to examine the effect of credit access on cocoa farmers' willingness to pay (WTP) for EU-approved pesticides. The choice of this model was informed by the nature of the dependent variable, which is categorical and dichotomous—taking the value 1 if the farmer accepts the offered bid for the EU-approved pesticide and 0 otherwise. When the outcome variable captures a yes/no, accept/reject, or willing/not willing decision, discrete choice models such as logit or probit are typically recommended because they are designed to estimate the probability of an event occurring as a function of explanatory variables. Although logit and probit models generally yield similar empirical outcomes, the binary logit model is widely regarded as more practical and advantageous from a mathematical and interpretive standpoint. The logit specification offers ease of estimation, more intuitive interpretation of coefficients through odds ratios, and greater flexibility when modelling behavioural responses to price changes or policy interventions (Foster et al., 1984). These characteristics make the logit model particularly suitable for studies investigating farmers' adoption decisions, perceptions of risk, and valuation of agricultural technologies such as certified pesticides. Furthermore, the application of a binary logit regression aligns with methodological choices in previous willingness-to-pay studies. Several authors have employed logit models to evaluate the socio-economic and institutional factors influencing farmers' WTP for improved agricultural inputs and natural resource management interventions. For example, earlier research has used binary logit models to assess farmers' WTP for irrigation water improvements, water conservation technologies, and agricultural innovations (Kidane et al., 2019; Abdelhafidh et al., 2022; Biswas & Venkatachalam, 2015; Tang et al., 2013). By adopting a similar modelling framework, this study ensures methodological consistency with established empirical literature while allowing for robust estimation of the determinants of cocoa farmers' WTP for EU-approved pesticides—particularly the role of credit access, which is expected to influence liquidity constraints and investment decisions.

The underlying latent WTP variable is expressed as:

$$Y_i^* = \beta^i X_i + \varepsilon_i \quad (11)$$

where:

- β is the vector of parameters to be estimated,
- X_i is the vector of explanatory variables,
- Y_i^* represents the unobservable (latent) WTP for EU-approved pesticides, and
- ε_i is the error term assumed to follow a normal distribution $N(0, \sigma)$.

$$Y_i = \begin{cases} 1 & if\ Y_i^* \geq b_i \\ 0 & if\ Y_i^* < b_i \end{cases}$$

where b_i denotes the bid amount randomly assigned to the i^{th} farmer.

Parameter estimation for the binary logit regression model was carried out using the Maximum Likelihood Estimation (MLE) procedure, following the approach outlined by Greene (2004). MLE is the standard estimation technique for discrete choice models such as the logit because it identifies the parameter values that maximize the probability of observing the sample outcomes given the model assumptions. In other words, MLE selects the set of coefficients that makes the observed pattern of farmers' willingness (or unwillingness) to pay for EU-approved pesticides most likely.

Under the logit framework, the probability that a cocoa farmer iaccepts the offered bid for an EU-approved pesticide (i.e., Y_i=1) is expressed as a logistic cumulative distribution function:

$$L(\mu, \sigma) = \sigma^{-n}(2\pi)^{-n/2} exp\left[-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(\tau_i - \mu)^2\right] \quad (12)$$

The maximum likelihood estimator is:

$$\theta = \frac{1}{n}\sum_{1=1}^{n} x_i \quad (13)$$

Where θrepresents the parameter vector that maximizes the probability of observing the sample responses. Once the parameters were estimated, it was essential to evaluate how well the binary logit model explained farmers' willingness to pay for EU-approved pesticides. To assess the overall goodness of fit, the Hosmer–Lemeshow test was employed. This test is widely used in logistic regression analysis because it compares the predicted probabilities generated by the model with the observed outcomes across subgroups of the sample, thereby assessing whether the model's predictions differ significantly from actual behaviour. In the context of this study, the Hosmer–Lemeshow test provided a formal statistical measure of how accurately the logit model captured cocoa farmers' acceptance or rejection of the offered bid for EU-approved pesticides. A p-value greater than 0.05 indicates that there is no statistically significant difference between predicted and observed values, implying that the model fits the data well (Hosmer et al., 1989). This threshold, therefore, serves as evidence that the explanatory variables—including credit access—appropriately describe variations in farmers' WTP decisions within the sample.

The empirical specification of the logit model used to assess the determinants of cocoa farmers' WTP for EU-approved pesticides is expressed as:

$$Y = \beta 0 + \beta 1X_1 + \beta 2X_2 + \beta 3X_3 + \beta 4X_4 + \beta 5X_5 + \beta 6X_6 + \beta 7X_7 + \beta 8X_8 + \beta 9X_9 + \beta 10X_{10} + \beta 11X_{11} + \beta 12X12 + ei \quad \ldots. \quad (14)$$

Y= willingness to pay ((1=yes, 0=otherwise)

The explanatory variables are: X1= Age of farmers (in years); X2= Sex of the farmer (Male=1, female=0); X3= Education (years spent in formal education); X4= marital status (1= married; 0= otherwise); X5= Farm size (hectares), X6= Farming experience (years), X7= Membership of cooperative (yes=1, no=0), X8= household size (actual number), X9= Quantity (kg), X10= Access to credit (access=1, no access=0), X11= Income (Naira), X12= Access to extension service (access =1, no access = 0).

Table 1 presents the dependent and explanatory variables incorporated into the logit regression model used to determine cocoa farmers' willingness to pay (WTP) for EU-approved pesticides. The dependent variable is a binary indicator coded 1 for farmers who accept the offered bid price and 0 otherwise, consistent with discrete choice modeling approaches used to estimate the probability of adopting improved agricultural inputs (Greene, 2012; Wooldridge, 2010).

The selection of explanatory variables is grounded in theory and supported by empirical studies on technology adoption, farm investment decisions, and pesticide-use behavior. Sociodemographic characteristics such as age, sex, marital status, educational attainment, and household size are included to capture variations in preferences, risk perception, and intrahousehold decision-making. The a priori expectation for these variables is mixed (±) because their influence may be context-specific. For instance, age may either enhance adoption through accumulated experience or reduce WTP due to risk aversion at older ages (Adesina & Baidu-Forson, 1995; Feder et al., 1985). Education is generally expected to positively influence WTP by improving understanding of the benefits of EU-approved pesticides (Nkamleu & Adesina, 2000), although its effect may vary depending on farmers' exposure to agricultural innovations. Farm-related variables—farm size, farming experience, and cocoa output—are included as indicators of productive capacity and the economic incentives driving investment in certified pesticides. Larger farm sizes and higher output levels are expected to have a positive influence

Table 1. Description of Dependent and Explanatory Variables

Dependable Variables	**Description**	
Willingness to Pay (WTP)	Dummy variable; 1 if the farmer is willing to pay/accepts the bid for EU-approved pesticides, 0 otherwise	
Independent Variables	**Description**	**Expected Sign**
Age	Age of farmer in years (continuous)	±
Sex	Dummy; 1 if male, 0 if female	±
Education	Years of formal education completed (continuous)	±
Marital status	Dummy; 1 if married, 0 otherwise	±
Farm size	Size of cocoa farmland in hectares (continuous)	+
Farming experience	Number of years spent in cocoa farming (continuous)	±
Cooperative membership	Dummy; 1 if member of a cooperative, 0 otherwise	+
Household size	Number of persons in the household (continuous)	±
Quantity of cocoa output	Cocoa output in kilograms (continuous)	+
Access to credit	Dummy; 1 if the farmer has access to credit, 0 otherwise	+
Income	Monthly/annual farm income in Naira (continuous)	+
Access to extension services	Dummy; 1 if the farmer has access to extension services, 0 otherwise	+

Notes: 1. ± indicates that the expected effect could be positive or negative depending on context. 2. + indicates a positive relationship is expected with farmers' willingness to pay.

on WTP because farmers with more commercial orientation tend to invest in productivity-enhancing technologies (Doss, 2006; Langyintuo & Mungoma, 2008). Farming experience may exhibit either a positive or negative sign: experienced farmers may better appreciate the benefits of compliant pesticides, but may also rely on traditional practices, thereby lowering WTP (Uaiene et al., 2009). Institutional and economic variables—cooperative membership, access to credit, income, and access to extension services—are expected to positively affect WTP. Cooperative membership often enhances exposure to new technologies, reduces information asymmetry, and strengthens collective bargaining, thereby promoting adoption (Abebaw & Haile, 2013). Access to credit and higher income levels relax liquidity constraints and enable farmers to invest in certified pesticides, implying a positive a priori sign (Foster & Rosenzweig, 2010). Similarly, extension contact is expected to positively influence WTP by improving farmers' knowledge of safe pesticide use and international market requirements (Anderson & Feder, 2004; Mabe et al., 2018).

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

The socio-economic characteristics of the respondents are presented in Table 2. The majority of the respondents (79.2%) are male, indicating that cocoa production in the study area is male-dominated. This aligns with cultural norms in many cocoa-producing communities where men typically control access to farmland and inheritance, and are therefore more actively involved in tree-crop cultivation. Cocoa farming is also labour-intensive, involving tasks such as land clearing, pesticide application, and pod breaking, which often require significant physical effort that discourages female participation. Similar findings are reported by Kehinde and Adeyemo (2017), Amujoyegbe et al. (2018), Adeyemo & Kehinde (2020), and Abidogun et al. (2019). The mean age of respondents is approximately 46 years, suggesting that most farmers are within their economically active years. This age distribution implies a workforce that is still capable of meeting the physical demands of cocoa production, thereby sustaining productivity. This also indicates that although farmers are gradually ageing, they remain productive participants in the cocoa value chain. This trend is consistent with the findings of Omoare et al. (2016), Kehinde and Ogundeji (2022b), and Oladoyin and Aturamu (2022). Age is important because it influences farmers' labour availability, managerial ability, and decision-making style, confirming the observations of Akintelu et al. (2019) and Adeyemo et al. (2020). A majority of the sampled farmers (61.7%) are married, indicating that cocoa producers typically have family responsibilities that may encourage greater commitment to farming. The availability of family labour in married households is also a key factor supporting cocoa production activities. This observation is supported by earlier studies, including Ayanwale et al. (2024), Sowunmi et al. (2019), and Fadipe et al. (2012), which found that marital status is closely linked to labour availability and household economic decisions. Formal education is relatively widespread among the respondents, with 73% having at least some level of formal schooling. Educated farmers are generally better positioned to understand pesticide instructions, interpret extension messages, and appreciate the benefits of using approved chemicals. This may positively influence their willingness to adopt improved production technologies. Similar conclusions were reached by Kehinde et al. (2021), Kehinde (2021), and Awoyemi and Aderinoye-Abdulwahab (2019), who reported that education enhances farmers' capacity to comprehend agricultural innovations. The average household size is approximately seven persons, consistent with the findings of Awoyemi and Aderinoye-Abdulwahab (2019). Large household sizes are common in rural Nigeria and provide an important source of family labour for farm work and domestic activities (Oluponna et al., 2023). This suggests that respondents could rely on household members to support labour-intensive cocoa farming operations.

The mean farm size is about 8 hectares, indicating that the respondents are predominantly large-scale producers compared to typical smallholder farmers in Nigeria. Larger farm sizes may enhance production capacity and provide economies of scale. In addition, respondents averaged 23 years of farming experience, demonstrating a strong accumulation of knowledge regarding cultivation practices, including pest management. This finding is consistent with Kehinde and Adeyemo (2020) and Adekunle et al. (2023), who noted that extensive farming experience improves farmers' decisions regarding pesticide use. Many respondents (61.67%) belong to cooperative societies, suggesting that farmers value collective action as a means of obtaining technical support, accessing credit, and improving market participation. Cooperative membership also facilitates knowledge sharing on good agronomic practices and enhances farmers' capacity to negotiate for better prices. These functions are well documented in the works of Ayanwale et al. (2023). Access to credit is relatively high among the respondents (76.7%). This indicates that financial support plays a significant role in enabling farmers to procure inputs, including approved pesticides. Access to credit has been shown to influence production efficiency and farmers' ability to adopt recommended technologies. The mean farming experience of 23 years further suggests that respondents are well-established in cocoa cultivation and possess substantial expertise to guide production decisions, including pesticide selection. A significant proportion of farmers (83.3%) reported access to extension services. This implies that extension agents play an active role in disseminating information on improved cocoa production techniques and safe pesticide use in the study area. This finding corroborates Alao et al. (2020) and Olupona & Kehinde (2022). About 85% of respondents are aware of approved pesticides, likely due to consistent extension contact and training programmes. Similarly, 83.33% of respondents reported using approved pesticides, indicating strong compliance with recommended chemical use. However, a minority still use non-approved pesticides due to availability challenges, particularly the continued presence of lindane in open markets, as reported by Aminu et al. (2019). Farmers who used approved pesticides highlighted their effectiveness, consistent with the conclusions of Akinneye et al. (2018) and Kehinde et al. (2018).

Table 2: Socio-economic characteristics of the respondents

Variables	Cocoa Farmers
Age (years)	46.37(±13.33)
Male (%)	79.2
Married (%)	61.7
Formal education (%)	73
Household size (#)	7.23 (±3.22)
Access to credit	76.7
Farm size (ha)	8.54(±5.72)
Years of farming experience	22.97(±11.29)
Extension visit (%)	83.3
Cooperative (%)	63.7

Source: Field Survey, 2020

Profile of Pesticides used by the farmers

Table 3 presents the profile of pesticides used by cocoa farmers in the study area. The results reveal that Redforce is the most widely adopted pesticide, with 83.3% of farmers reporting its use, while 16.7% used Radomil. This dominance of Redforce suggests that farmers perceive it as more effective, more readily available, or more affordable—factors consistently shown to influence pesticide choice in agricultural economics (Akinneye et al., 2018; Kehinde, 2022). From an economic standpoint, the preference for Redforce may reflect a rational cost–benefit calculation by farmers, who seek to maximize crop yield while minimizing input costs. Regarding pricing, a majority of farmers (59.1%) purchased pesticides within the ₦300–₦350 range, with smaller shares obtaining pesticides in the ₦355–₦400 range (19.2%) and the ₦300–₦350 band (21.7%). This concentration at lower price points underscores the role of affordability and liquidity constraints in input adoption decisions, consistent with findings in similar smallholder contexts (Abebaw & Haile, 2013; Foster & Rosenzweig, 2010). Economically, this suggests that cocoa farmers operate under tight budget constraints and are price-sensitive, which can influence both the type and quantity of pesticides they purchase. The packaging preferences further illustrate this economic behavior. Most farmers (89.2%) purchased pesticides in sachet form, favoring smaller, more affordable quantities. This aligns with the principle of liquidity management: smallholder farmers often face cash-flow limitations and risk aversion, making it economically rational to buy inputs in manageable quantities that reduce upfront costs and minimize financial exposure (Adegbola & Bamishaiye, 2014; Mabe et al., 2018). Sachets also enable precise application, reducing wastage and aligning expenditure with farm size, thereby enhancing input-use efficiency. The findings indicate that Redforce and Radomil are the predominant EU-approved pesticides among cocoa farmers, with a clear preference for Redforce. The observed patterns in price sensitivity and packaging choice highlight how economic constraints—particularly affordability, cash-flow limitations, and risk management—directly shape farmers' pesticide adoption decisions. These results reinforce prior studies emphasizing that smallholder compliance with recommended pesticide use is closely tied to economic realities rather than purely agronomic considerations (Aminu et al., 2019; Ayemo & Kehinde, 2018; Ayanwale et al., 2023).

Table 3: Profile of Pesticides used by the farmers

Type of Pesticides	Percentage	Supplier
Redforce	83.3	Marketer
Radomil	16.7	Marketer
Total	100	
Unit Prices (₦)	Percentage	Mean
300- 350	59.1	366
355- 450	19.2	366
455- 500	21.7	366
Total	100	SD ±65.57
Quantity	Percentage	
Litre	10.8	
Sachet	89.2	
Total	100	

Source: Computed from field survey, 2020

Willingness to Pay for EU-Approved Pesticides

Table 4 presents cocoa farmers' willingness to pay (WTP) for EU-approved pesticides in the study area. The results indicate that 85% of respondents are willing to pay for certified, environmentally compliant chemical inputs, reflecting a generally positive disposition toward adopting improved pesticides.

This high WTP aligns with prior studies showing that farmers are more inclined to adopt inputs perceived as effective, safer, or compliant with export standards (Akinneye et al., 2018; Kehinde, 2022).

Using the standard mean price of ₦365 per litre, the analysis shows that the majority of farmers (62.5%) are willing to pay 25% above the market price (₦365–₦466). This suggests a relatively strong valuation of EU-approved pesticides, particularly among farmers motivated by yield quality, adherence to international residue standards, and long-term farm productivity. Similar observations were reported by Anang et al. (2015) and

Akpoti et al. (2019), who found that farmers are generally willing to tolerate modest price increases for inputs that enhance productivity or market access. A smaller proportion of farmers (30%) are willing to pay a 50% premium (₦365–₦548), indicating that WTP declines as prices rise. This pattern reflects the well-documented price sensitivity of smallholder farmers, who operate under liquidity constraints and variable income streams (Abebaw & Haile, 2013; Foster & Rosenzweig, 2010).

Notably, none of the farmers is willing to pay a 100% price increase, highlighting a clear economic threshold beyond which additional costs are prohibitive. The observed decline in WTP with rising prices underscores the critical role of affordability in input adoption decisions and is consistent with the law of demand.

Economically, it demonstrates that while cocoa farmers recognize the benefits of EU-approved pesticides, adoption is constrained by cash-flow limitations and risk aversion, a pattern corroborated in similar studies of smallholder agricultural systems (Mabe et al., 2018; Ayanwale et al., 2023).

Table 4: Willingness to pay for EU-approved pesticides

Willingness to pay	Percentage (%)
Yes	85
No	15
Total	100
Price acceptance	
Increase by 25%	62.5
Increase by 50%	30
Increase by 100%	0

Source: Computed from field survey, 2020

Mean price of approved pesticide = N365/litre

Effect of credit access on cocoa farmers' Willingness to pay for EU-approved pesticides

The results of the Logit model indicate that the estimated log-likelihood value was –122.017, and the model was statistically significant, suggesting a good fit to the observed data. The McFadden Pseudo R^2 of 0.47825 implies that approximately 47.8% of the variation in cocoa farmers' willingness to pay (WTP) for EU-approved pesticides is jointly explained by the explanatory variables included in the model. This relatively high pseudo-R^2 reflects the strong explanatory power of the selected socio-economic, institutional, and farm-level factors in accounting for differences in farmers' WTP. Additionally, the Hosmer-Lemeshow goodness-of-fit test confirmed that the model closely aligns with observed outcomes, providing further evidence of its reliability for analyzing determinants of WTP. Table 4 presents the marginal effects of the explanatory variables on cocoa farmers' WTP. Marginal effects offer an intuitive interpretation of how each factor influences the probability that a farmer is willing to pay, while holding all other variables constant. The statistical significance of the log-likelihood value confirms that the variables collectively explain meaningful variations in WTP, reinforcing the robustness of the model. The following discussion interprets the contribution of each variable, highlighting how household characteristics, farm attributes, and institutional factors shape farmers' decisions to adopt EU-approved pesticides.

The marginal effect of gender was positive and statistically significant (0.544), indicating that being male increases the probability of willingness to pay for EU-approved pesticides by 54.4%. This substantial effect highlights the critical role of gender in shaping investment decisions in agricultural inputs. Male farmers often have greater access to productive resources—including land, farm tools, and capital—and generally earn higher farm incomes compared to female farmers. They also tend to exercise stronger decision-making authority within households, allowing them to allocate resources toward adopting improved practices such as certified pesticides. This finding is consistent with Adu-Gyamfi et al. (2019) and Ezekiel (2023), who documented significant gender disparities in the adoption of modern agricultural technologies, emphasizing structural inequalities that influence technology uptake. The result underscores the importance of gender-sensitive interventions aimed at enhancing women farmers' access to productive resources and decision-making power to increase their participation in certified input adoption. Similarly, age exhibited a positive and statistically significant marginal effect (0.043), indicating that each additional year of a farmer's age increases the likelihood of paying for EU-approved pesticides by 4.3%. Older farmers may benefit from accumulated practical experience and knowledge about the risks associated with substandard or banned pesticides, making them more inclined to invest in safer, certified alternatives. They may also have greater awareness of long-term productivity and health implications linked to low-quality inputs, influencing their willingness to pay for quality pesticides. This observation aligns with Leclère et al. (2023), who reported that experience accumulated over time enhances the adoption of improved agricultural inputs. The positive effect of age suggests that policies promoting pesticide adoption could leverage experienced farmers as peer educators or extension partners, thereby encouraging wider adoption among younger or less experienced farmers.

The marginal effect of marital status was positive and statistically significant (0.956), indicating that married farmers are 95.6% more likely to pay for EU-approved pesticides compared to their unmarried counterparts. This substantial effect highlights the important role of household and social structures in shaping investment decisions in agricultural inputs. Marriage often brings additional household labor, reducing the burden of farm work and allowing farmers to focus more on adopting improved practices. It also facilitates cooperative decision-making and shared financial responsibility, creating an enabling environment for investment in higher-quality inputs. This finding aligns with prior studies linking marital stability to greater adoption of modern agricultural technologies (Ezekiel, 2023), suggesting that social support within households can enhance technology uptake. Education exhibited a positive and highly significant marginal effect (1.143), indicating that each additional year of formal schooling increases the probability of paying for EU-approved pesticides by 114.3%. This remarkably strong effect underscores the critical role of education in shaping farmers' awareness, perception of risk, and decision-making regarding safe agricultural practices. Educated farmers are better able to understand pesticide regulations, recognize the potential health and environmental risks associated with substandard or banned chemicals, and appreciate the benefits of adhering to EU standards. They are also more likely to engage with extension services, interpret technical information accurately, and implement recommended practices effectively. This result corroborates Adu-Gyamfi et al. (2019), who emphasized that education enhances the adoption of improved agricultural technologies by equipping farmers with the knowledge and cognitive skills necessary to make informed decisions.

The marginal effect of extension visits was positive and statistically significant (0.044), indicating that farmers with access to extension services are 4.4% more likely to pay for EU-approved pesticides. Extension officers play a crucial role in disseminating knowledge about safe pesticide use, EU compliance standards, and modern agricultural practices. Through training, field demonstrations, and advisory services, extension personnel enhance farmers' awareness of the benefits associated with certified pesticides and provide the technical guidance necessary to facilitate adoption. This finding supports the well-established view that access to extension

services is a key driver of agricultural technology uptake, as documented by Leclère et al. (2023). It underscores the importance of strengthening extension networks, particularly in cocoa-producing regions, to build farmers' capacity to adopt high-quality, certified inputs. Similarly, access to credit exhibited a positive and statistically significant marginal effect (0.044), suggesting that farmers with access to financial resources are 4.4% more likely to pay for EU-approved pesticides. Access to credit alleviates liquidity constraints and enables farmers to invest in relatively higher-cost certified inputs that they might otherwise be unable to afford. It also facilitates the timely purchase of inputs and allows farmers to apply recommended rates, thereby enhancing both productivity and compliance with quality standards. This result aligns with Diagne et al. (2022), who highlighted the pivotal role of credit in enabling smallholder farmers to adopt productivity-enhancing technologies. The positive impact of credit access emphasizes the need for policies and programs that expand affordable financial services for farmers—particularly those cultivating high-value crops such as cocoa—to support the adoption of safe and certified agricultural inputs.

In contrast, household size exhibited a negative and statistically significant marginal effect (–0.865), indicating that each additional household member reduces the likelihood of willingness to pay for EU-approved pesticides by 86.5%. Larger households typically face higher consumption needs and competing financial obligations, which can constrain their ability to allocate resources toward relatively more expensive certified inputs. This negative effect highlights the financial pressures that large households encounter, limiting their capacity to invest in quality-enhancing agricultural technologies. This observation aligns with Ali et al. (2020), who noted that large household burdens often reduce investments in improved farm inputs. Similarly, farm size had a negative marginal effect (–0.073), suggesting that increases in farm size reduce the probability of paying for EU-approved pesticides by 7.3%. Larger farms require proportionally greater volumes of pesticide, and the associated cost of using EU-approved products can become substantial. This cost factor may discourage adoption, particularly among resource-constrained smallholder farmers, and underscores the influence of input cost intensity on investment decisions. This finding is consistent with prior evidence indicating that higher input costs can negatively affect farmers' willingness to purchase premium agricultural products (Ali et al., 2020). Finally, the quantity of pesticides used also demonstrated a negative marginal effect (–0.022), indicating that farmers who apply larger amounts of pesticides are 2.2% less likely to pay for EU-approved products. Higher pesticide usage translates into increased expenditure, and the price premium of certified pesticides may act as a deterrent to adoption. This result corroborates previous studies highlighting that rising input demands can limit farmers' willingness to adopt costlier but higher-quality alternatives (Ali et al., 2020). It suggests that interventions promoting EU-approved pesticide adoption should consider strategies to reduce the cost burden for farmers who require large pesticide volumes, such as bulk subsidies, cooperative purchasing schemes, or targeted financial support programs.

Table 5: Effect of credit access on Cocoa farmers' willingness to pay for EU-approved pesticides

Willingness to Pay	Coefficient	P >|z|	Marginal effect
Gender	2.865*	0.075	0.544*
Age	0.342**	0.040	0.043**
Marital Status	2.123**	0.026	0.956**
Education	3.180**	0.030	1.143**
Income	5.288	1.000	0.676
Experience	0.169	0.152	0.643
Extension	4.970**	0.023	0.035**
Credit	4.258**	0.028	0.044**
Cooperative	1.535	0.351	0.766
Household size	-1.071**	0.023	0.865**
Farm size	-0.067**	0.032	0.073*
Quantity	-0.020**	0.034	0.022**
Constant	15.510***	0.000	
Log likelihood = -122. 017			
Log likelihood ratio (X2) = 123.8483***			
Hosmer-Lemeshow= 1.659***			
Mc Fadden Pseudo R2= 0.47825			
Prob>chi2 = 0.004			

Source: Field survey, 2020

CONCLUSION

This study provides empirical evidence on the influence of credit access on cocoa farmers' willingness to pay for EU-approved pesticides in Ondo and Osun States, Nigeria—an area where limited prior studies have linked financial capacity, pesticide regulation compliance, and farmers' adoption behaviour. Unlike earlier research that focused largely on pesticide use patterns or agronomic considerations, this study integrates socioeconomic, institutional, and farm-level variables to reveal the multifaceted determinants of farmers' valuation of certified pesticide inputs. Findings from the logit model show that factors such as gender, age, education, marital status, cooperative membership, access to extension services, household size, farm size, and quantity of pesticide used significantly shape farmers' willingness to pay. Among these variables, access to credit emerges as one of the most critical determinants, confirming that liquidity constraints substantially influence the capacity of cocoa farmers to purchase approved pesticides. The study further reveals that most farmers are willing to pay up to a 25% premium above the current market price of EU-approved pesticides, demonstrating strong perceived value for quality, safety, and export-compliant inputs. However, willingness declines sharply at higher price levels, underscoring the role of affordability and financial constraints. These results highlight the dual importance of economic empowerment and regulatory compliance in sustaining Nigeria's position in the international cocoa market. Overall, the findings underscore that enhancing access to credit—alongside strengthening ex-

tension services and farmer organizations—is vital for promoting wider adoption of EU-approved pesticides and ensuring compliance with global residue standards. The study, therefore, contributes to policy efforts aimed at aligning sustainable cocoa production with pesticide regulation, farmer welfare, and international market requirements.

Recommendations

Based on the empirical findings and policy relevance of the study, the following measures are recommended to enhance farmers' willingness to pay for EU-approved pesticides and strengthen the competitiveness of Nigeria's cocoa sector:

1. Although many farmers use approved pesticides, a proportion still use cheaper or mixed chemicals. Regulatory agencies such as NAFDAC and CRIN should intensify monitoring, market inspection, and enforcement to ensure compliance with EU-approved pesticide standards and safeguard Nigeria's cocoa export quality.

2. Education significantly increases farmers' likelihood of adopting approved pesticides. Therefore, training initiatives should focus on less-educated and older farmers, emphasizing safe handling, residue limits, environmental protection, and market benefits associated with EU-certified inputs.

3. Cooperative membership positively influences willingness to pay. Strengthening cooperatives as platforms for distributing input, implementing group purchase schemes, delivering training, and monitoring can enhance adoption rates and reduce input costs through collective bargaining.

4. Because credit access is a key determinant of willingness to pay, government agencies, microfinance institutions, and development partners should expand credit opportunities through low-interest cocoa input loans, cooperative-based lending programs, and government-backed agricultural credit initiatives. This will help farmers overcome liquidity constraints and purchase certified pesticides in required quantities.

5. Variables such as gender, age, and household size significantly influence WTP outcomes. Policy interventions should ensure equitable resource allocation by providing targeted support to women farmers, younger farmers, and households with high dependency ratios, ensuring broad-based adoption of approved pesticides.

6. Since willingness to pay declines sharply at higher premium levels, input subsidies, bulk-purchase discounts through cooperatives, and seasonal price-support programmes can make approved pesticides more affordable, especially for farmers with large farm sizes or high pesticide requirements.

Policy Implication

The findings of this study demonstrate that improving cocoa farmers' access to credit is essential for increasing their willingness to pay for EU-approved pesticides and ensuring compliance with international residue standards. Since socioeconomic factors such as education, cooperative membership, and extension contact significantly influence adoption, policies that integrate financial support with farmer training and institutional strengthening will have the greatest impact. Enhancing credit availability, expanding extension services, and strengthening farmer organizations can collectively increase the uptake of certified pesticides, improve cocoa bean quality, and safeguard Nigeria's competitiveness in global markets. These results highlight the need for coordinated interventions that address both financial and knowledge-based constraints faced by cocoa farmers.

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OPTIMISING PUBLIC HEALTH OPEX: A CONCEPTUAL SYSTEMATIC REVIEW OF HEALTH SECTOR AND RURAL DEVELOPMENT STAKEHOLDER MANAGEMENT IN KENYA

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Abstract: *The African Health ecosystem is yet to optimize multi-stakeholder collaborative efforts for desired outcomes in health-care interventions. Despite heavily relying on multiple sectors and developing progressive engagement frameworks, challenges in harnessing diverse stakeholder contributions to meet evolving health-care priorities persist within the sector. This situation exacerbates the challenge of health disparities, especially regarding regional and rural development. We seek to focus on Reversing the Hierarchical Overview of Public Health Stakeholders in Kenya by redesigning it to fit - a community and related stakeholders-centred Approach. We used the Conceptual Systematic Review to conceptualize the complexity of stakeholders' ecosystem coordination. We use peer-reviewed literature and reports covering the stakeholders in public health, including the rural development context. We coded the literature findings following the CSR stages. The study develops a proposed ecosystem map of stakeholders that incorporates suggested changes for improved local stakeholders' coordination and local ownership of health investment activities in Kenya. The structuring and layering of the stakeholders was informed by the tenets of the stakeholder salience model, thus advancing theoretical and implementation discourse in the area by including households, proposed Village Development Committees, Ward Development Committees, Community Development Committees, Cooperatives, Associations, Self-Help Groups, County Delivery Unit and the Specialised Directorate of Rural Development.*

Keywords: *Operational Excellence (OPEX), Rural, Governance, Ecosystem, Public Health*
(JEL code: P11, H 51, I15)

INTRODUCTION

The African Health ecosystem is yet to optimize multi-stakeholder collaborative efforts for desired outcomes in healthcare interventions. Despite heavily relying on multiple sectors and developing progressive engagement frameworks, challenges in harnessing diverse stakeholder contributions to meet evolving healthcare priorities persist within the sector. This situation exacerbates the challenge of health disparities, especially regarding regional and rural development (NGOMA et al., 2024). Habitually, the Kenya Public Health Landscape has been reliant on a traditional top-down approach to resolving challenges in the sector. Strategic health-care decisions inadequately capture local and community engagement strategies. Local communities and surrounding stakeholders should play a pivotal role in intervention design, account-

ability practices, and activities delivered (HALDANE et al., 2019). Community is the most impacted by health-care outcomes; therefore, they should be at the core of the design and decision-making process. In the context of Rural Healthcare Project Planning and Management, for purposes of equitable distribution at the sub-national level, sector players leverage structures for coordination, which is vital in resolving inequalities and inefficiencies. Often, lack of prioritisation, misalignment, and duplication of efforts/interventions limit the outcomes of health-care provision (ADJAGBA et al., 2024). Furthermore, since 2010 Kenya made notable steps within its legal, regulatory and policy framework with the objective to enhance local development and ownership at the last mile. Despite the promulgation of the new constitution which majorly targeted the institution of a new and responsive system of governance, the devolved system is still greatly faced with quantifiable implementations gaps towards delivering its mandates.

This study presents a proposed ecosystem map of stakeholders that incorporates suggested changes for improved local stakeholders' coordination and local ownership of health and rural development investment activities in Kenya. The structuring and layering of the stakeholders were informed by the tenets of the stakeholder salience model: legitimacy, urgency and power.

This study involves the design of a proposed ecosystem map of stakeholders that incorporates suggested changes for improved local stakeholders' coordination and local ownership of health and rural development investment activities in Kenya. The structuring and layering of the stakeholders were informed by the tenets of the stakeholder salience model: legitimacy, urgency and power.

LITERATURE REVIEW

The main challenges discussed in the literature are connected to the hierarchical structure of public health management in rural areas (FRANCO et al., 2021). As such, reversing this hierarchical approach of public health stakeholders in Kenya can avoid the potential bottlenecks.

As the findings on the impact and sustainability of development projects from ARISE CONSORTIUM (2024) majorly in poverty stricken/informal areas, enhancing local stakeholder participation, incorporating local cultural dynamics and implementing continuous monitoring and evaluation are essential elements of successful development projects. This is further complicated by the unique dynamic of rural Kenyan communities. Meanwhile, the engagement strategies would require agile methodologies for effective stakeholder engagement. In addition, factors such as education levels, access to information, communication platforms, and technology hinder participative planning that is centred around communities. Mainly to empower lower-level stakeholders, analysis must be undertaken to provide a landscape of sector stakeholders, their roles, types of engagement, existing coordination frameworks, and nature of decision making (ARISE CONSORTIUM, 2024).

Moreover, as shown by experiences in developing countries, a more decentralized development planning can benefit regional and rural areas (AKATCH 2001; AKATCH et al., 2021). This is further confirmed by the evaluation done on Kenya's special rural development program which presents decentralized decision making in rural areas and successfully implemented innovative and flexible procedures within the government organization (WORLD BANK GROUP, 2018).

Systems Thinking Design Framework

There are varied definitions of OPEX FOUND et al. (2018); KOVILAGE et al., (2022a, 2022b); MAQABLEH and AKHORSHAIDEH (2016); NAIK et al. (2024), though it is widely perceived as a state in which strategically designed processes, relevant technologies and tools are sought after by a team to optimize the flow of value in a context that is leadership, solution-focused and empowerment oriented (WELCH et al., 2016). Based on the proposition that all stakeholder groups have inherent benefits if applied appropriately, the concept and its laws could drive improvement, bolster performance, and facilitate best practice. The objective of our paper is to provide an insightful mapping of Kenyan stakeholders in the public health sector highlighting the opportunities and challenges for project management in rural areas. Contemporarily, there has been growing scholarly and empirical interest in systems thinking approaches given the myriad of precedent factors and complexity of health-care design. However, there are significant shifts towards practical inter-disciplinary knowledge that transcends theoretical advancements (MORGAN et al., 2024). Essentially, the systems thinking design framework evolved from a raft of perspectives, dynamic interrelationships and a conceptual lens for complexity. The theory is based on the precept that there exist levers within entities that can be combined to interact optimally, through a design approach that maximises desired outcomes, greater than the independent total of independent value (BORAL et al., 2025). Change is considered a critical enabler of operational excellence (OPEX).

Salience Model

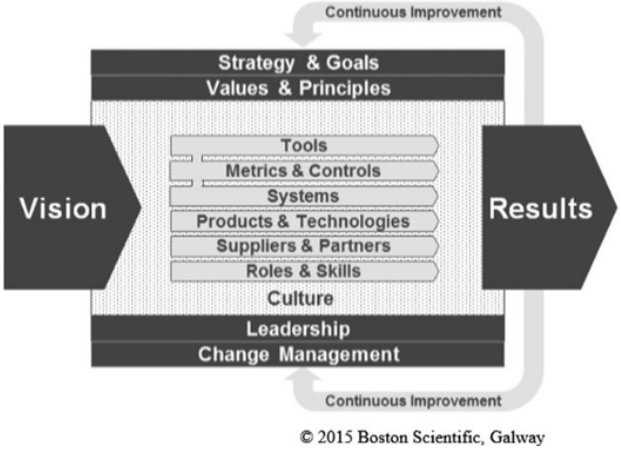
The salience model is a strategic tool that aids in identification and differentiation of stakeholders in ecosystems. It is a 3-phased/strategy tool that is useful in categorising stakeholders and management issues for systematic analysis that informs action plans, strategic tools, instruments and policy implementation (RAUM, 2018). The assessment of the salience model captures multiple benefits, synergies and interrelationships based on urgency, legitimacy and power. By mapping stakeholders and inherently varied stakes, ecosystem regulation, governance, sustainability and optimisation of outcomes can be achieved (BERTASSINI et al., 2021). These are imperative in designing effective and efficient stakeholder engagement activities, building capabilities and responding to community needs.

OPEX Framework / Model

Presently, global uncertainties require a further in-depth assessment of the gaps and critical challenges in prior research on stakeholder management for health and rural development, often hindering systemic optimisation of operations (WOOD

et al., 2021). In this context, Operational Excellence is also commonly known as OPEX. This model emphasizes consistent improvements based on the results presented, as well as the importance of leadership and change management in the results. Furthermore, the tools, metrics & controls, systems, products & technologies, suppliers & partners, roles & skills enhance the overall performance, provide evaluation and metrics, benchmarking, and improve overall the strategy implementation, values, and organizational culture (FOUND et al., 2018). The Boston Scientific Operational Excellence Model gives a whole system approach to operational excellence as illustrated in Figure 1, being a useful model for improving the stakeholders in the public health sector of Kenya.

Figure 1: Boston Scientific Strategic Operational Excellence Model



Source: FOUND ET al., 2018, page 11.

Research gap identified: Based on the literature reviewed, we found out that there is a need to redesign and / or improve the intersectoral coordination mechanism of the health stakeholder's ecosystem to make it responsive, build a culture that supports continuous improvement and remedy overlaps and implement stumbling blocks.

MATERIALS AND METHODS

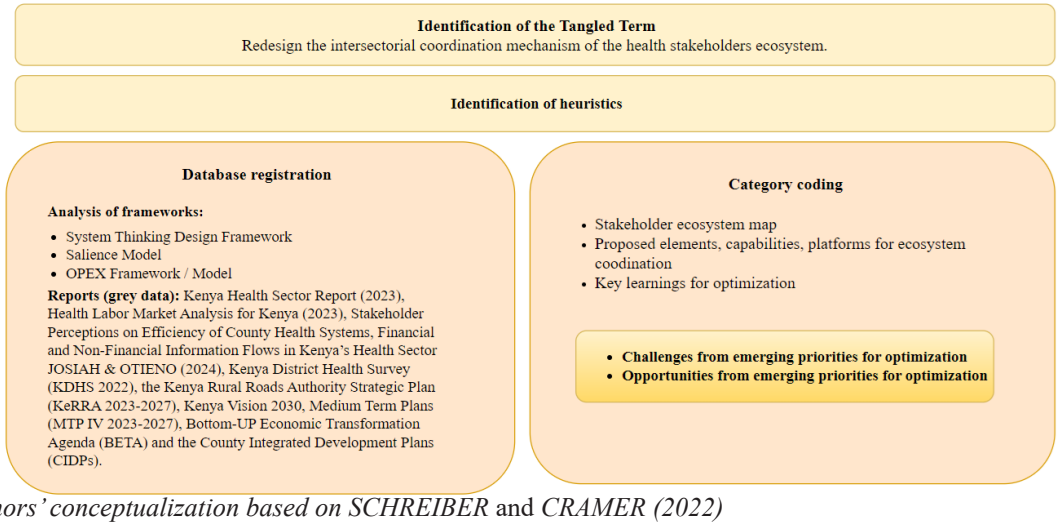
Materials

The materials used for this study is a combination of peer-reviewed articles and reports done on Kenyan stakeholders. The scholarly work analyzed was from 2010 until 2024, from different databases. Because of the complex nature of the topic, we used a narrative review to present a thorough evaluation of the stakeholders. Meanwhile, the secondary data analyzed where from Kenya Health Sector Report (2023), Health Labor Market Analysis for Kenya (2023), Stakeholder Perceptions on Efficiency of County Health Systems, Financial and Non-Financial Information Flows in Kenya's Health Sector JOSIAH and OTIENO (2024), Kenya District Health Survey (KDHS 2022), the Kenya Rural Roads Authority Strategic Plan (KeRRA 2023-2027), Kenya Vision 2030, Medium Term Plans (MTP IV 2023-2027), Bottom-UP Economic Transformation Agenda (BETA) and the County Integrated Development Plans (CIDPs).

Methodology

The method used for this study is Conceptual Systematic Review (CSR) which helps break down a complicated term by using 6-stage which starts with the identification of the complex term, identification of heuristics, the database registration and coding of categories (added inductively), and findings are presented in the results and documented narratively as visualized in Figure 2. This new method was introduced by SCHREIBER and CRAMER (2022) for simplifying interdisciplinary topics. The study reviews the innovative frameworks done on stakeholders for System Thinking Design Framework, Salience Model, OPEX Framework / Model which helped us map the proposed elements, capabilities and platforms in the discussion session (see Results section). We applied the qualitative content analysis method (using coding) to extract data and draw insights on health and rural development to integrate the current empirical studies and reports done on the topic (SNYDER, 2019).

Figure 2: Conceptual Systematic Review process of sourcing evaluation and synthesis of the findings



Source: Authors' conceptualization based on SCHREIBER and CRAMER (2022)

RESULTS AND DISCUSSION

The Kenya Health Sector Strategic Plan, which largely focuses on health systems strengthening and sustainable preventive healthcare practices at national, sub-national, and community levels, bases the success factors of its implementation on stakeholder needs mapping and assessment, beyond financing (WACHIRA et al., 2024). Arguably, organisations achieve operational excellence but grapple with sustenance. Scholarly discourse on sustainable operational excellence advances that it requires complex integration of multiple factors such as systems thinking, organisation-specific variables, technology, people, processes, coupled with socio-economic aspects (NAIK et al., 2024).

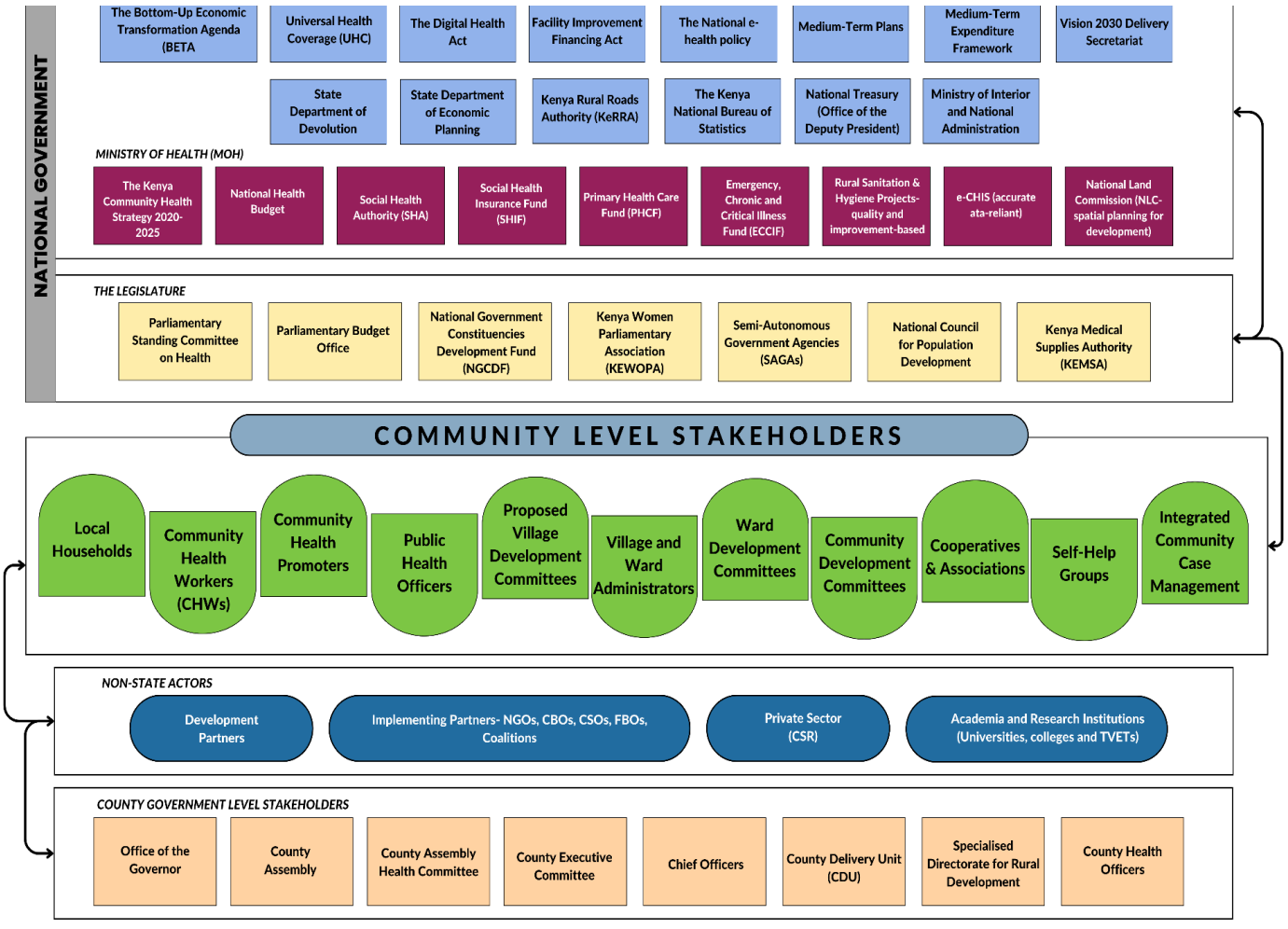
Kenya Health and Rural Development Ecosystem Players

The main ecosystem players in Kenya are the National Government with executive and legislature roles, community level stakeholders, country government level stakeholders and non-state actors.

The dynamic responsibilities and complexities displayed in the map are based on the anchoring proposition of systems thinking design frameworks. Similarly, the concept of urgency, legitimacy and power as enshrined in the salience model suggest that the scoped issues, challenges and opportunities could be combined to achieve optimal impact.

Through the map, we depict the synergistic influence, reliance and contribution of all ecosystem players in advancing the health and rural development agenda. We used Microsoft excel sheets to map stakeholders from analysed literature and further, Canva for android, version 2.310 to visualise the mapped stakeholder ecosystem map as illustrated in figure 3.

Figure 3: Redesigned Ecosystem Map



Source: Authors (2025)

Proposed Elements, Capabilities and Platforms for Ecosystem Coordination: Our analysis of inherent capabilities, elements and platforms using the Boston Scientific Strategic Operational Excellence Model scoped the ecosystem coordination illustrated in table 1.

Table 1. Categorisation, Rationale, Elements and Capabilities

Stakeholder Category	Rationale/Areas of Interest	Documents/ Elements/ Instruments, Capabilities and Platforms
National	National Government Engagement Plans Review of stakeholder engagement forums Social accountability audits Data-driven initiatives E-development platforms Adjusted County Development Priorities Rural development budget tracking Collaborative project and delivery monitoring Transparency scoreboards Performance Score tracker and Dashboard	The Bottom-Up Economic Transformation Agenda (BETA) Universal Health Coverage (UHC) Medium-Term Plans Medium-Term Expenditure Framework The Kenya Community Health Strategy 2020-2025 National Health Budget Social Health Authority (SHA) Social Health Insurance Fund (SHIF) Primary Health Care Fund (PHCF) Emergency, Chronic and Critical Illness Fund (ECCIF) Preventive Care Programs Rural Sanitation & Hygiene Projects-quality and improvement-based e-CHIS (accurate data-reliant) The Digital Health Act Facility Improvement Financing Act The National e-health policy
Community	Community Needs Identification Social accountability audits Data-driven initiatives Community Feedback surveys and trackers Community initiated project monitoring Community Cooperation Coordinating Programs	Integrated Community Case Management Analogous Inspiration
County	Adjusted County Development Priorities Health Budget Tracking Data-driven initiatives	County Government Engagement Plans Social accountability audits

Source: Authors (2025)

Findings: Key Learnings, Challenges, Opportunities and Emerging Priorities for Optimisation

Based on analysed literature, mostly grey sources, the emerging priorities, challenges and learnings have been demonstrated in table 2, 3 and 4.

Table 2. Key learnings for optimisation

Constraint	Key learnings
Budget	Inadequate financing
Leadership/suboptimal salience	Delayed operationalization. Some health and rural development guidelines and operational plans are yet to be fast-tracked- hindering efficiency and effectiveness.
Technology	Use of input data that does not reflect the full ecosystem needs, players and priorities in budgeting and policy implementation.
Leadership/suboptimal salience	Need for integration of all community stakeholders in the health and rural development ecosystem.
Infrastructure	Limited supporting infrastructure in rural and marginalised areas to support health development and OPEX.
Leadership/suboptimal salience	Misaligned research priorities and duplication of research trends/outputs, raising deficiencies in critical comprehensive development aspects- sub-optimal solution, product and service delivery within marginalised communities.

Source: Authors (2025)

Table 3. Challenges from emerging priorities for optimisation

Challenges	Outlook Rating
Retrogressive cultural practices	Predominant
Resource constraints	Predominant
Corruption and mismanagement of funds	Adverse
Predominant vertical, top-down approach to community service development in rural areas	Adverse
Small scale existing programs for rural development and public health, resulting in uncoordinated care.	Adverse
Integrated effort towards implementation of robust policy documents	Modest
Regional and local disparities in infrastructural development, quality and service delivery	Predominant

Source: Authors (2025)

Scoping Rationale

The outlook rating scores are based on an outlook analysis criteria based on trends, commentaries and documented gaps in operational issues on public health and rural development. The criteria incorporate the sensitivity of time and desired community outcomes against the actions that are required to be undertaken by stakeholders but are greatly hampered by scoped challenges (VAN DIJK et al., 2021). On a scale range of Modest to Adverse (where modest represents normal degree of challenge, while predominant represents main impediments/major issues and adverse depicts extreme cases that greatly impede the achievement of operational excellence).

Opportunities from emerging challenges and priorities for optimisation

The identified opportunities are ranked on a scale ranging from low to high, where low depicts least effort, medium depicts moderate effort and high indicates tangible political will and salience.

Prioritisation Rationale: The priority ranking scores are based on a ranking criterion anchored on the scope of the existing implementation and pursuit gaps, the time horizon and the matched community needs (VAN DIJK et al., 2021). Time sensitivity, strategic relevance, social/community acceptance and influence of the stakeholders handling the issues, are tenets of the assigned prioritisation score and recommended outlook (COMM, 2019). The anticipated magnitude of impact and strategic alignment underscore operational excellence. On a scale range of Low to High (where low depicts the least level of prioritisation over the longest allotted period, medium depicts considerably time sensitive, admissible social acceptance and favourable outcome while high represents prioritisation required over the shortest possible period of time- very urgent, extremely socially needed and highest possible positive outcome required).

Table 4. Challenges from emerging priorities for optimisation

Codes	Opportunities	Current priority ranking	Recommended Prioritisation Ranking
1	Expanding the scope of data inputs	Low	Medium
2	Policy implementation and budget advocacy towards costed implementation plans	Medium	High
3	Enhancing efficiency; quality; outcome metrics/tracking; accountability, coordination capabilities	Low	High
4	Leveraging capabilities such as: digital and geo-spatial markers, trackers, intelligence-disease mapping, human movement, volunteers' footprint.	Low	Medium
5	Timely review of expiring strategic plans and frameworks.	Medium	High
6	Updating the national, regional and local research agenda and priorities	Low	High
7	Exercising more salience in high-disparity areas.	Medium	High

Source: Authors (2025)

CONCLUSIONS

There is a need for a system in which county government-level constraints can be supported and resolved at national level. Creating a dashboard or interface for issues raised at local and sub-national levels can efficiently propel rural health program prioritisation, backed by adequate resourcing. Additionally, a proper convergence point needed to be introduced between the National Government Health Working Groups and the County Government Technical Health Working Groups to have a clear communication channel for feedback with government; grass root to national level communication is disintegrated. The study recommends that the executive arm of government should prioritise fast tracking the operationalisation of essential structures: rural development units, community feedback trackers, stakeholder engagement avenues and Primary Care Networks (PCNs), which are reliant on a hub and spoke model. Such structures would enhance engagement with both health and rural development stakeholders, coordination and facilitate continuous improvement in facility operations and service delivery. By exemplifying salience and predominant political will in this, it portrays a systematic approach to underscoring the crucial role of multi-disciplinary and intersectoral teams in achieving efficiency, effectiveness and consequently, operational excellence. Theoretically, the study advances the use of stakeholder theory and its evolving frameworks for contemporary contexts and multi-theoretic integration.

Study limitations

The study is largely limited to grey literature sources but corroborated with reliable peer-reviewed sources. Further, it does not fully quantify and take into consideration the ever evolving and varied preferences of stakeholders, instead it leans into centralisation and prioritisation of communities by proposing empathetic strategies to stakeholder management.

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ENHANCING AGRICULTURAL MARKET EFFICIENCY THROUGH THE INTEGRATION OF VALUE CHAINS INTO TANZANIA'S AGRICULTURAL COMMODITY EXCHANGE AND WAREHOUSE RECEIPT SYSTEM

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Abstract: *Improving the performance of small-scale agriculture remains a strategic priority for the Tanzanian government in its journey toward industrialization, as articulated in the Integrated Industrial Development Strategy. To support this vision, the integration of the Agricultural Commodity Exchange (ACX) with the Warehouse Receipt System (WRS) was introduced to strengthen forward market linkages for products originating from smallholder farms. However, as the agricultural sector continues to evolve, it has become increasingly evident that the existing marketing framework requires reassessment and adaptation to meet emerging needs. This study was conducted to evaluate the necessity of upgrading the current market structure, with a particular emphasis on the sunflower sub-sector a key contributor to rural livelihoods and national agribusiness. Using a cross-sectional survey design, primary data were collected from smallholder sunflower farmers across Kondoa and Itigi district councils. Gross margin analysis revealed a significant disparity in earnings: farmers engaged in sunflower oil production achieved substantially higher returns compared to those selling raw sunflower seeds. Complementary secondary data sourced from the Tanzania Cooperative Development Commission (TCDC), Tanzania Mercantile Exchange (TMX), and the Warehouse Receipt Regulatory Board (WRRB) confirmed that the current system lacks mechanisms to support the trading of processed agricultural products. This gap limits the potential of smallholder farmers to fully capitalize on value addition. In light of these findings, the study recommends a strategic enhancement of the existing framework to include a dedicated trading platform for value-added agricultural goods. Such a reform would not only improve income generation for smallholder farmers but also elevate the overall performance of Tanzania's agricultural sector, driving inclusive economic growth.*

Keywords: *Small-scale agribusiness, commodity exchange market, warehouse receipt system, gross margin, sunflower sub-sector*
(JEL code: C35, D63, I41)

INTRODUCTION

Smallholder farmers in Tanzania encounter numerous obstacles in establishing both backward and forward market linkages, which are essential for enhancing crop productivity and securing income (Beroud and Awokuse, 2025). Backward linkages such as access to improved seed varieties and agricultural inputs play a critical role in boosting production volumes while managing input costs (Zozimo et al., 2023). Conversely, Rugeiyamu et al. (2024) emphasized that effective forward market linkages are key to the successful marketing of sunflower seeds, whether sold in raw or processed form. The income stability of smallholder farmers largely hinges on the seamless integration and performance of both backward and forward market systems (Molela, 2017). Within Tanzania's sunflower industry, the forward market includes the trade of raw oilseeds, refined edible oil as the primary product, and oil-cake as a by-product (Recha and Demissie, 2023). Among these, unprocessed sunflower seeds dominate market activity, accounting for at least 80% of all transactions, as reported by Mchopa (2025) and George (2020).

Under the existing government framework, all cash crops in Tanzania were mandated to be traded through the Agricultural Commodity Exchange (ACX), the Warehouse Receipt System (WRS), or a hybrid model combining both platforms (Ngendahayo and Nayak, 2024; Narayanan et al., 2024). These systems, designed to strengthen forward market linkages, aimed to empower smallholder farmers by facilitating access to concessionary loans backed by their stored produce and connecting them with reliable buyers (Narayanan et al.,

2024). Crucially, this initiative sought to protect farmers from exploitation by unauthorized intermediaries who often use inaccurate weighing equipment and offer unfair prices (Molela, 2017). Additionally, ACX and WRS provided collective platforms for farmers to unify their voices and enhance their bargaining power regarding pricing and timing of sales (Gunawan et al., 2024). Despite these benefits, existing literature lacks clarity on whether these systems adequately support smallholder sunflower farmers who prefer to market processed products rather than raw seeds.

Previous researches, including studies by Nyamandege et al. (2024) and Shao et al. (2023), identified several areas for enhancing the performance of Tanzania's agricultural trading systems, particularly the Warehouse Receipt System (WRS). To improve operational efficiency, these studies recommended greater transparency and inclusivity such as integrating informal small and medium enterprises (SMEs) through innovations like blockchain technology. Nazzala (2023) further highlighted the importance of warehouse infrastructure and leadership quality as critical factors influencing system effectiveness.

However, these recommendations primarily focused on facilitating the trade of unprocessed sunflower seeds and did not address challenges faced by smallholder farmers engaged in marketing processed sunflower products. This study, therefore, assessed the income generated by farmers involved in both raw seed and value-added sunflower product businesses. The overarching objective was to determine whether smallholder farmers should continue trading unprocessed sunflower seeds or whether the existing systems require upgrading to support the inclusion of processed products in formal trading platforms.

LITERATURE REVIEW

Sunflower Agribusiness in Tanzania

The sunflower trade in Tanzania is regulated by the Cereals and Other Produce Board (CPB), which was established under the Grain and Mixed Crops Act of 2009. One of CPB's key responsibilities is safeguarding the commercial interests of smallholder sunflower farmers by facilitating reliable forward market connections (United Republic of Tanzania [URT, 2022]). The board functions similarly to other regulatory bodies overseeing major cash crops such as cashew nuts, tobacco, sisal, coffee, cotton, and tea (Lukurugu et al., 2022; Louhichi, Ricome and Paloma, 2022). In an effort to broaden the scope of sunflower agribusiness, the government introduced the Sunflower Sector Development Strategy 2016–2020, which aimed to incorporate sunflower oil and cake into the portfolio of traded products. Despite these efforts, the strategy fell short of expectations, as seed trading remained the predominant activity among smallholder farmers (Erasmus and Kaungal, 2024).

Smallholder farmers in Tanzania often prioritize trading sunflower seeds over engaging in value-added sunflower product businesses due to pressing cash needs (Kimaro and Nnko, 2024). Additionally, limited awareness about the benefits of value addition and financial analysis contributes to their continued focus on seed sales (Rugeiyamu et al., 2024). Many farmers perceive little distinction between trading seeds, oil, and cake, which further discourages diversification. The scarcity of processing facilities in rural areas and the high costs associated with accessing them also play a significant role in farmers' preference for unprocessed seed trading (Molela and Kira, 2025; Isinika and Jeckoniah, 2021). A recent study examined income disparities between farmers involved in seed trading versus those dealing in processed sunflower products. Its findings are crucial for guiding policymakers to enhance sunflower product markets by reforming or upgrading existing systems such as the Agricultural Commodity Exchange (ACX) and the Warehouse Receipt System (WRS).

Forward Market Linkages

Forward market linkages are vital to the growth of small-scale agribusinesses in Tanzania, as they enable farmers to access markets that would otherwise be out of reach for individuals, while also lowering transaction costs (Andre, 2023). These markets are primarily designed to accommodate farmer groups rather than individual producers, whose output often falls short of meeting buyer requirements (Isinika and Jeckoniah, 2021). Among the most prevalent farmer organizations in Tanzania are Agricultural Marketing Cooperative Societies (AMCOS), which have been central to the implementation of key systems such as the Agricultural Commodity Exchange (ACX) and the Warehouse Receipt System (WRS) within the framework of forward market linkages (Molela, 2017).

Tanzania Agricultural Commodity Exchange (ACX) Market

Established in 2014 through a public-private partnership (PPP), the Tanzania Mercantile Exchange (TMX) operates with a 49% stake held by the public sector and 51% by private entities (Magambo, 2024; Molela, 2017). TMX was founded to manage and regulate commodity exchange markets across the country, with a particular focus on agricultural commodities (Kanyangemu, Kundu and Athwal, 2019). To enhance transparency and ensure equitable pricing in agribusiness, a dedicated trading window for agricultural products was introduced, aiming to modernize market operations and improve access to reliable market information (Mgole and Yunxian, 2021).

Tripath et al. (2023) highlighted that the Warehouse Receipt System (WRS) posed challenges for smallholder farmers due to price instability and unfavorable marketing strategies. Their study found that high marketing costs significantly reduced the fairness of farm gate prices for producers. Additional barriers such as limited bargaining power, constrained market competition, and inadequate access to market information further undermined the effectiveness of the WRS (Robbins et al., 2008). In response to these issues, transitioning to a modernized agricultural commodity exchange market was deemed essential, aligning with the strategic direction outlined in the 10 pillars of the Kilimo Kwanza initiative (URT, 2022).

Agricultural commodities in Tanzania are traded through

two primary mechanisms at the commodity exchange market: the spot contract market and the derivative contract market (Kaura and Rajput, 2024). These systems incorporate collateral management strategies to safeguard the interests of trading parties, particularly buyers (Gundogdu, 2023). For farmers, the commodity exchange market plays a vital role in hedging against price fluctuations, as derivative contracts allow for price forecasting to mitigate volatility risks (Chowdhury and Bhuiya, 2023). At present, the Tanzania Mercantile Exchange (TMX) primarily facilitates trade in unprocessed sunflower seeds alongside other cash crops. A recent study evaluated the additional benefits farmers could gain from this system and recommended a structural review to better accommodate expanded trading opportunities.

Warehouse Receipt System (WRS) in Tanzania

The Warehouse Receipt System (WRS) in Tanzania is regulated by the Warehouse Receipt Regulatory Board (WRRB), established under the Warehouse Receipts Act of 2005. Its operations are guided by the Tanzania Cooperative Development Commission (TCDC) in partnership with the Tanzania Mercantile Exchange (TMX), which restricts direct purchases of cash crops from smallholder farmers (Nyamandege et al., 2024). Buyers must register their purchase intentions online through TMX, which organizes weekly electronic auctions based on inventory reports submitted by WRRB (Narayanan et al., 2024). Smallholder farmers consolidate their produce through their respective Agricultural Marketing Cooperative Societies (AMCOS), which then deliver the goods to cooperative union warehouses. These inventory records are shared with TMX, and following the auctions, TMX issues release orders to buyers for stock collection from the designated warehouses (URT, 2021).

The Warehouse Receipt System (WRS) was primarily designed to empower smallholder farmers by strengthening their collective bargaining power over produce pricing (Nangemeta, 2022). Once their goods are delivered to cooperative union warehouses, farmers receive receipts that can serve as collateral for loans from approved financial institutions (Molela, 2017). A key motivation behind the establishment of WRS was to curb illegal trade practices by unlicensed intermediaries who exploited farmers' financial vulnerabilities (Kapuya et al., 2024). However, despite its benefits, the system did not accommodate the trade of value-added sunflower products such as processed oil and cake. The existing frameworks of TMX and WRS were tailored to support transactions involving raw sunflower seeds, indicating a need for structural reforms to facilitate the inclusion of processed sunflower goods and other cash crops.

Value Chain Integration Theory

This study is grounded in the value chain integration theory, which emphasizes the importance of information flow among stakeholders in the value chain to enable accurate demand forecasting and efficient supply management (Li et al., 2022). It highlights the need for buyers to recognize that smallholder farmers are capable of supplying value-added sunflower products at predetermined rates, provided there is effective prior communication (Tiwari, 2021). Selling processed products such as sunflower oil and cake yields higher income for farmers compared to trading raw seeds alone (Zhang et al., 2021). The theory encourages farmer groups to engage in processing agricultural raw materials, thereby generating sufficient stock to meet market demand while enhancing their collective bargaining power (Li et al., 2022). Furthermore, Freije et al. (2022) argue that the theory promotes innovation in production processes, which supports the adaptation of existing systems to accommodate new product features. Recommendations to revise the operational frameworks of TMX and WRS to include trading of sunflower oil and cake do not necessitate major structural changes. Instead, they call for the integration of new features that preserve the integrity of the original systems. As Belhadi et al. (2024) note, this approach allows for a smooth transition to the updated structure without disrupting the existing setup.

MATERIALS AND METHODS

Primary data for the first specific objective were gathered from a total of 399 smallholder sunflower farmers affiliated with 11 Agricultural Marketing Cooperative Societies (AMCOS), which were deliberately selected from Kondoa and Itigi district councils. Data collection was conducted using semi-structured questionnaires. A simple random probabilistic sampling method was applied to ensure equal representation from each AMCOS, following a cross-sectional survey design. According to the 2022 National Sample Census of Agriculture, the study population consisted of 313,636 household members in Kondoa (Dodoma Region) and 126,136 in Itigi (Singida Region). The sample size was determined using Yamane's formula (1967), as shown below;

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

$$n = \frac{439{,}772}{1+439{,}772*0.05^2} = 399.63$$

The collected data were analyzed using the Gross Margin Analysis (GMA) model to evaluate and compare the income generated by smallholder farmers engaged in trading unprocessed sunflower seeds versus those dealing in processed sunflower products such as oil and cake. This comparative analysis served as the foundation for assessing the profitability of the two business models. The gross margin for each trade was calculated using the following formula:

$$GM_i = (R_i - VC_i)*Q$$

Where; GM_i stands for gross margin for quantity Q
R_i stands for revenue
VC_i stands for variable costs

Secondary data for the second specific objective were obtained through a documentary review approach, drawing from institutional sources including the Tanzania Cooperative Development Commission (TCDC), Tanzania Mercantile Exchange (TMX), Warehouse Receipt Regulatory Board

(WRRB), and various Agricultural Marketing Cooperative Societies (AMCOS). The purpose of this review was to gain insights into the operational frameworks of TMX and WRS, specifically in relation to the two sunflower business models unprocessed seeds and value-added products. The analysis was guided by the findings from the first specific objective, ensuring a contextual understanding of how these systems support or limit different forms of sunflower product trading.

RESULTS AND DISCUSSION

Gross Margin from Unprocessed Sunflower Seeds Trading

Most smallholder farmers in Tanzania participate in the trade of unprocessed sunflower seeds, either by selling directly to buyers or through the Tanzania Mercantile Exchange (TMX) under the Warehouse Receipt System (WRS), in accordance with government regulations. On average, farmers generate a revenue of TZS 900,200.00 per acre, with an estimated production yield of 643.00 kg. According to the data presented, the gross margin from this activity stands at TZS 455,094.60 per acre, translating to approximately TZS 917.49 per kilogram. It's important to note that this figure represents a basic average and does not account for administrative or fixed costs incurred throughout the farming cycle. These results closely align with the gross margin reported by George (2020) for unprocessed sunflower seed trading.

Table 1: Gross Margins from Processed and Unprocessed Sunflower Seeds Trading

	Mean Values *(95% Confidence Interval)*			
Details	**Unprocessed Seeds**	**Edible Oil**	**Seed Cake**	**Value added**
	n = 317	*n = 82*	*n = 82*	*n = 82*
REVENUE	*(100%)*	*(33.33%)*	*(66.67%)*	*(100%)*
Yields (Kg/l/acre)	643.00	112.50	225.00	337.50
Price (TZS/kg/l))	1,400.00	5,200.00	700.00	5,900.00
Total Revenue/acre	**900,200.00**	**585,000.00**	**157,500.00**	**742,500.00**
PRODUCTION COST				
Input seeds (TZS/acre)	14,456.00	4,199.58	8,400.42	12,600
Farm prepartion (TZS/acre)	38,443.71	12,258.56	24,520.79	36,779.35
First weeding (TZS/acre	39,456.95	13,882.63	27,769.44	41,652.07
Second weeding (TZS/acre	10,629.14	3,285.09	6,571.18	9,856.27
Booster (TZS/acre)	3,576.16	1,481.83	2,964.11	4,445.94
Manure/ Fertilizer (TZS/acre)	62,450.33	21,950.41	43,907.41	65,857.82
Sowing (TZS/acre)	22,549.27	8,049.99	16,102.39	24,152.38
Chemical application /acre	7,523.58	2,395.18	4,791.09	7,186.27
Bird scaring (TZS/acre)	28,537.80	9,511.65	19,026.15	28,537.80
Harvesting (TZS/acre)	58,443.71	20,054.66	40,115.34	60,170
Processing (TZS/acre)	0.00	14,998.50	30,001.50	45,000.00
Packaging (Sacks/Gallons)	9,185.71	11,000.00	2,500.00	11,000.00
Cess (TZS)	10,000.00	3,333.00	6,667.00	10,000.00
Transport	5,000.00	1,666.50	3,333.50	5,000.00
Total PC	**310,252.36**	**128,067.59**	**236,670.31**	**362,237.90**
Unit Revenue (TZS/Kg/l)	1,400.00	5,200.00	700.00	5,900.00
Unit Overheads (TZS/KG/l)	482.51	357.73	715.57	1,073.30
Unit GM (TZS/Kg/l)	**917.49**	**4,842.27**	**-15.57**	**4,826.70**
GM per acre (TZS/acre)	455,094.60	2,401,862.74	-7,721.76	2,394,140.98

Source: Authors (2025)

Gross Margin from Processed Sunflower Oil and Cake Trading

Processed sunflower oil trading is the second most common sunflower-related agribusiness in Tanzania, following the trade of unprocessed sunflower seeds. According to Mchopa (2025) and George (2020), only about 20% of harvested sunflower seeds are processed into products such as edible oil. As indicated in the referenced data, farmers involved in this value-added activity earn an average gross margin of TZS 2,401,862.74 per acre, or approximately TZS 4,842.27 per kilogram. This figure excludes any additional income from by-products like seed cake. Notably, this gross margin is 5.28

times higher than that earned from selling unprocessed sunflower seeds. However, it is important to recognize that this is a preliminary estimate that does not factor in administrative or fixed costs associated with farm operations.

Given that sunflower seed oil is typically traded alongside seed cake as a by-product, the actual gross margin from processed sunflower products amounts to TZS 2,394,140.98 per acre. However, most smallholder farmers lack the financial capacity to own processing equipment. As a result, they compensate processors either by paying a fee of TZS 128.57 per kilogram in cash or by relinquishing the seed cake as an in-kind payment. This arrangement reflects the economic constraints faced by farmers and underscores the need for accessible processing infrastructure to maximize returns from value-added sunflower products. The sunflower seed cake business is relatively uncommon among smallholder farmers in Tanzania, primarily because it tends to be unprofitable when pursued as a standalone venture. Data indicates that farmers incur a loss of TZS 7,721.76 per acre when trading seed cake as a by-product. However, this loss is typically offset by the revenue generated from the sale of sunflower seed oil, which serves as the main product. Most farmers who do not practice animal husbandry often opt to leave the seed cake with processors as an in-kind payment for oil extraction services. The economic viability of seed cake could improve significantly if farmers were able to further process it into finished products such as shoe-shine polish, brake pads, or mosquito repellent. Such value addition would not only diversify income streams but also enhance the overall profitability of sunflower agribusiness.

Upgrading the Operations of Tanzania Agricultural Commodity Exchange Market under the Warehouse Receipt System Scheme

The existing structure of Tanzania's agricultural commodity exchange market does not accommodate the trading of value-added products such as processed sunflower oil and seed cake. Findings from this study indicate that smallholder farmers earn significantly lower gross margins TZS 455,094.60 per acre from trading unprocessed sunflower seeds, compared to a much higher margin of TZS 2,394,140.98 per acre from processed sunflower products. Despite this disparity, the current framework involving the Tanzania Mercantile Exchange (TMX), Agricultural Commodity Exchange (ACX), and Warehouse Receipt System (WRS) lacks provisions for trading processed goods. To address this gap, the study recommends upgrading the system to include processing facilities at the AMCOS level, where farmers are organized. Recognizing that individual smallholder farmers often lack the financial capacity to own processing equipment, the proposed model encourages collective ownership and operation of processing machines through farmer groups. This approach would enable broader participation in value-added agribusiness and unlock higher income potential for rural producers.

Proposed Process for Trading Processed Sunflower Products

Stage 1: Processing at AMCOS

• Farmers deliver sunflower seeds to their respective Agricultural Marketing Cooperative Societies (AMCOS).

• Seeds are processed into oil and seed cake.

• Since seed cake yields minimal or negative returns when traded independently, it is recommended that farmers use it to cover processing costs either through in-kind payment or as per group agreements.

Stage 2: Transfer to Cooperative Union Warehouse

• AMCOS transfers the processed sunflower oil to the cooperative union's warehouse for secure storage.

• Farmers receive official receipts as proof of ownership for the stored oil.

Stage 3: Buyer Registration at TMX

• Interested buyers register their intent to purchase processed sunflower oil through the Tanzania Mercantile Exchange (TMX).

• Buyers choose from available contract types, including spot and derivative contracts.

Stage 4: Inventory Reporting

• The cooperative union submits detailed inventory reports to TMX, including quantities of processed oil and ownership records linked to individual farmers.

Stage 5: Electronic Auction

• TMX conducts electronic auctions for the processed oil.

• Winning bidders make payments directly to TMX's designated bank account.

Stage 6: Stock Collection

• Upon payment confirmation, buyers collect their purchased oil from the cooperative union warehouse.

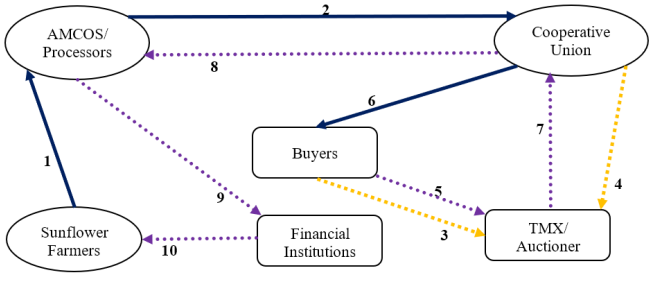
Stage 7: Payment Remittance to Cooperative Union

• TMX transfers the received payments to the cooperative union within five days of the auction.

Stage 8: Disbursement to AMCOS

• Within 24 hours of receiving funds from TMX, the cooperative union disburses payments to the respective AMCOS, which then distribute earnings to individual farmers.

Figure 1: Reviewed ACX under WRS Scheme



Source: Adopted from Molela (2017) and Molela (2025)

Stage 9: Deposit to Farmers' Bank Accounts

• AMCOS deposits the earnings into individual farmers' accounts held at consortium affiliated banks.

Stage 10: Fund Collection and Cycle Renewal

• Farmers withdraw their funds, reinvest in the next production cycle, and the process begins again.

CONCLUSION

IThe significant disparity in gross margins between processed and unprocessed sunflower product trading clearly underscores the need to reassess and strengthen forward market linkages. This study concludes that it is essential to establish an enabling environment that facilitates smallholder farmers' transition from trading raw sunflower seeds to engaging in value-added sunflower product markets. Creating a dedicated trading window for processed agricultural products particularly sunflower oil and seed cake within platforms like TMX, ACX, and WRS is crucial for enhancing the viability and competitiveness of small-scale farming. When farmers are incentivized by the higher returns associated with value addition, they are more likely to reinvest in their operations, adopt improved practices, and expand production. Such growth at the individual farmer level contributes directly to the broader performance of the agricultural sector and, by extension, stimulates national economic development. Supporting this shift through policy reforms, infrastructure investment, and cooperative-based processing models will be key to unlocking the full potential of Tanzania's sunflower value chain.

Based on the findings, it is strongly recommended that policymakers particularly those overseeing financial markets, agriculture, and cooperatives prioritize the upgrading of the Agricultural Commodity Exchange (ACX) and the Warehouse Receipt System (WRS) to accommodate the trading of processed agricultural products. Such reforms would not only enhance income generation for smallholder farmers but also help eliminate exploitative practices by unlicensed middlemen operating outside formal channels. To support this transition, the Tanzania Cooperative Development Commission (TCDC) should introduce a registration requirement mandating that any AMCOS formed around a specific crop must be equipped with a processing machine for that crop. This policy would facilitate a structural shift, encouraging farmers to move away from selling raw materials and toward engaging in value-added agribusiness. By institutionalizing processing capacity at the cooperative level, farmers can access higher-margin markets, strengthen their bargaining power, and contribute more meaningfully to the growth of Tanzania's agricultural sector.

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TRUST AND TRADE READINESS IN THE AGRIBUSINESS SECTOR THROUGH INTERCULTURAL COMMUNICATION: INSIGHTS FROM A CONSULTANCY FIRM IN INDONESIA

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Abstract: *In the era of global agribusiness, intercultural communication has become increasingly essential for fostering trust and facilitating international trade. This study explores how an Indonesian international consulting firm strategically applies intercultural communication to enhance trade readiness and build trust with global clients in the agribusiness sector. Guided by Communication Accommodation Theory (CAT), the research investigates convergence, divergence, and maintenance communication strategies across diverse cultural contexts, including East Asia, Australia, and the United States. Using a qualitative case study approach, data were collected through key informant interviews and direct observations of client-consultant interactions. The findings reveal that tailored communication, adjusted to cultural norms, client expectations, and technological platforms, plays a significant role in reducing misunderstandings and strengthening client relationships. Convergence strategies, such as mirroring tone and interaction styles, help establish rapport, while strategic divergence reinforces ethical standards and professional identity. Maintenance ensures consistency in service branding. The study concludes that intercultural competence is not merely a soft skill, but a strategic asset that improves trade outcomes, client satisfaction, and long-term partnerships in agribusiness. These insights offer practical guidance for consultants, business developers, and agribusiness firms navigating global markets. Future research may extend this analysis to comparative studies between regions or sectors to broaden understanding of intercultural dynamics in international trade.*

Keywords: *Intercultural communication; trust; agribusiness; Communication Accommodation Theory; international consulting*
(JEL code: Q13, M16, F23)

INTRODUCTION

In global agribusiness, trust is a critical enabler of trade efficiency and cooperative engagement among diverse stakeholders. As agribusiness enterprises increasingly integrate into global markets, they encounter complex challenges related to cultural diversity, regulatory compliance, and consumer confidence. Within this context, effective intercultural communication emerges as a critical enabler for building and sustaining trust across borders (Fischer, 2009; de Vries et al., 2023). The firm exemplifies how intercultural communication strategies can be systematically applied to enhance trust and trade readiness among international clients. Operating in markets where trust is a prerequisite for successful partnerships, the firm supports foreign agribusiness investors in navigating Indonesia's diverse regulatory and cultural landscapes. Through tailored communication approaches, the firm helps bridge linguistic, cultural, and institutional differences, often determining whether business negotiations succeed or fail.

In recent years, the significance of trust in international agribusiness transactions has been extensively recognized. Trust reduces transaction costs, mitigates uncertainties, and fosters long-term cooperation (Wilson, 2000). Fischer (2009) identifies effective communication as a critical factor in developing trust within agri-food chains, emphasizing the role of communication quality and frequency in enhancing collaborative partnerships. Similarly, de Vries et al. (2023) underscore trust as a central enabler of interaction and cooperation among agri-food value chain actors, noting its role in creating value and managing risks. The agricultural sector also plays a vital economic role in Indonesia, contributing approximately 12.61% to the country's GDP in 2024 (Statistics Indonesia, 2024). Fur-

thermore, Indonesia is a significant global player in agribusiness, particularly in plantation crops, with GDP from plantation crops reaching approximately 811.3 trillion Indonesian rupiah in 2023 (Statistics Indonesia, 2024). These economic indicators highlight the critical nature of effective intercultural communication for facilitating international trade and investment in the Indonesian agricultural sector.

The increasing reliance on digital communication due to globalized interactions adds another layer of complexity. While digital platforms expedite communication, they often eliminate essential non-verbal cues such as facial expressions and body language, significantly increasing the potential for misunderstandings. Hence, there is a heightened need for culturally sensitive digital communication strategies, such as using clear, unambiguous language and paraphrasing techniques to confirm mutual understanding (Chen & Starosta, 2005). Real-world examples vividly illustrate the consequences of failing to implement effective intercultural communication strategies. The cases of Walmart in Germany and KFC in China demonstrate how cultural insensitivity and inadequate communication approaches can lead to substantial business failures. Walmart's overly friendly, informal communication style, while effective in the United States, alienated German customers who preferred professional interactions. Similarly, KFC's inaccurate translation of their slogan in China caused significant confusion, highlighting the critical importance of culturally adapted communication. Beyond language and cultural nuances, timing is also crucial in international communication, particularly when dealing with different time zones. Mismanaged communication timing can signal insensitivity to client needs and negatively impact business relationships, emphasizing the importance of thoughtful scheduling and timing (Chen & Starosta, 2005). These insights align closely with the firm's practice of intercultural communication, which utilizes the theoretical framework provided by Communication Accommodation Theory (CAT). CAT suggests that effective communication involves adapting speech and behavioral styles to match those of interlocutors, thereby fostering mutual understanding and trust (Gawron & Theuvsen, 2009). The study further underscores that cultural sensitivity, linguistic adjustments, appropriate timing, and tailored communication platforms significantly contribute to building and maintaining client trust. Adopting culturally sensitive communication strategies directly impacts client perceptions and satisfaction, crucial for successful international trade engagements (Ji, Chen, & Zhuo, 2019).

Furthermore, intercultural communication contributes positively to sustainable agribusiness and rural development projects. As Breilh (2004) argues, understanding local socio-economic dynamics and cultural contexts is essential, particularly when foreign investors engage in agribusiness ventures within rural communities. Effective intercultural communication strategies thus help manage community expectations, reduce conflicts, and ensure smoother project implementation. Drawing from empirical insights at the firm, this study elaborates on specific intercultural strategies employed to meet the diverse cultural expectations of international clients from markets such as Germany, Japan, and the United States. By utilizing qualitative methods such as key informant interviews and observational data, the study aims to highlight the economic benefits and competitive advantages of intercultural competence. Ultimately, the research findings will provide practical guidance for agribusiness enterprises on integrating structured intercultural communication strategies to enhance global trade readiness and competitive positioning. This introduction sets the stage for understanding the broader implications of intercultural communication as an essential component of successful international agribusiness relationships.

Although previous studies have examined trust in agrifood value chains and intercultural communication in multinational environments, little research has investigated how Communication Accommodation Theory operates within agribusiness consulting as a trust-building mechanism. Furthermore, no current study explores the intersection between intercultural communication strategies and trade readiness in emerging-market consultancy settings. This research addresses these gaps by offering empirical evidence from the firm working with global agribusiness clients.

Research Questions:

RQ1: How does the firm in Indonesia apply intercultural communication strategies to build trust with agribusiness clients?

RQ2: How does Communication Accommodation Theory manifest in real consulting interactions across different cultural backgrounds?

RQ3: In what ways do these communication strategies support trade readiness in global agribusiness operations?

LITERATURE REVIEW

In the evolving landscape of international agribusiness, trust has become a cornerstone for enabling successful trade and cross-border collaboration. Rather than being a peripheral factor, trust now functions as a vital mechanism that underpins economic transactions and relational stability. Wilson (2000) emphasizes trust as an essential economic resource, highlighting its role in altering terms of trade, reducing transaction costs, and enhancing decision flexibility within agribusiness partnerships. This concept is further supported by Fischer (2009), who asserts that effective communication significantly mediates trust in agri-food value chains. Fischer's empirical findings underline the importance of communication quality, frequency, and transparency as central to developing trust among value chain actors. In alignment with these findings, de Vries et al. (2023) further explore the centrality of trust in agri-food value chains, identifying it as crucial for managing risks, facilitating cooperation, and creating additional value in transactions. These studies collectively underscore trust as a foundational element influencing both operational effectiveness and strategic relationships in international agricultural markets.

Building upon this foundation, recent research has illuminated the profound influence of intercultural communication on trust formation, particularly within international business contexts. Prior studies reveal that misalignments in cultural communication preferences can significantly erode trust between clients and service providers. Conversely, carefully adapted intercultural

strategies—such as the use of culturally appropriate language, message framing, and timing can enhance understanding and reinforce trust (Gregorius & Pramono, 2021). These insights are further nuanced by research emphasizing both internal and external communication dynamics within multinational firms. Surya et al. (2022) identify two key dimensions: internally, effective intercultural communication among employees mitigates information bottlenecks and fosters cohesion; externally, it supports strong, trust-based relationships with international clients. This dual focus is particularly relevant for consulting firms operating in agribusiness, where client relationships often span cultural and national boundaries.

Beyond organizational structures, intercultural communication also encompasses psychological dimensions. Mas'udah (2014) contributes to this understanding through the Anxiety/Uncertainty Management (AUM) Theory, which posits that effective intercultural interactions require conscious management of discomfort and ambiguity. When individuals approach communication with mindfulness and openness—balancing self-disclosure with cultural sensitivity—they are more likely to reduce misunderstandings and cultivate trust. Meanwhile, Fitria (2024) reframes intercultural challenges as opportunities for institutional learning. Her findings suggest that structured training in cultural awareness and conflict resolution equips employees with adaptive communication skills. These interventions not only enhance intercultural fluency but also strengthen client loyalty in diverse business settings.

A pivotal theoretical foundation for interpreting these dynamics is the Communication Accommodation Theory (CAT), originally formulated by Howard Giles. CAT explains how communicators adjust their verbal and non-verbal behaviors, either converging with or diverging from their interlocutors to align with social expectations and relational goals. In consulting scenarios, convergence strategies such as mirroring tone, speech patterns, and communication preferences can foster rapport and enhance trust (Gawron & Theuvsen, 2009). Griffin (2012) and Giles & Ogay (2007) elaborate further, noting that such adjustments are not only strategic but also relationally transformative. The relevance of CAT is further amplified in digital communication contexts, which are ubiquitous in international agribusiness consulting. As Gallois et al. emphasize, the absence of non-verbal cues in emails or video conferences makes it imperative to employ linguistically clear, empathetic, and culturally attuned communication strategies. Missteps in tone, timing, or word choice can be misinterpreted across cultures, leading to breakdowns in trust. Therefore, CAT-informed strategies are vital in bridging these gaps and maintaining client confidence across time zones and technological platforms.

Supporting this perspective, Ji, Chen, and Zhuo (2019) demonstrate that trust in food supply chains can be significantly enhanced through culturally resonant messaging and active stakeholder engagement. Their findings align with Gawron and Theuvsen's (2009) conclusions that context-specific adaptations in labeling and communication practices directly influence consumer trust in international markets. Breilh (2004) further situates intercultural competence within broader societal goals, arguing that effective communication is integral to sustainable rural development and equitable agribusiness practices. Ultimately, this body of literature underscores the intricate interplay between trust and intercultural communication as both strategic tools and ethical imperatives in international agribusiness. For consulting firms operating in multicultural environments, these insights provide a roadmap for cultivating strong, trust-based client relationships. By systematically integrating CAT, AUM, and cultural dimensions theory into their practices, firms can elevate client experiences, enhance market adaptability, and sustain long-term trade success. This literature review establishes a comprehensive foundation for examining how one of The firms (anonymized) operationalizes these theories to enhance trade readiness and global engagement in the agribusiness sector.

MATERIALS AND METHODS

This research employs a qualitative methodology with a case study approach to explore the application of intercultural communication strategies at an anonymized international business consulting firm based in Indonesia. The qualitative method was selected for its exploratory nature, allowing for an in-depth understanding of complex, contextual, and dynamic aspects of intercultural communication within a real-world organizational setting. As intercultural interactions often involve symbolic, non-verbal, and situational elements that are difficult to quantify, a qualitative approach enables richer interpretations of these phenomena (Creswell, 2013).

The case study design centers on the consulting firm as a unique and information-rich unit of analysis, offering valuable insights into the real-world implementation of Communication Accommodation Theory (CAT) in diverse cultural encounters. As posited by Giles and Ogay (2007), CAT provides a framework for understanding how communicators adjust their language and behavior to foster mutual understanding across cultural differences. This approach was particularly useful in examining how firm employees strategically navigated interactions with clients from both high-context cultures, such as Japan, where indirectness and non-verbal cues are valued (Liu, 2016)—and low-context cultures like the United States, where direct communication is preferred.

Data were collected through six semi-structured interviews lasting 45–70 minutes with the Head of Operations, the Chief Revenue Officer, three project managers, and a long-term international client, all selected through purposive sampling based on their direct involvement in cross-cultural client communication. Additional observational data from both in-person and digital interactions (Zoom, Google Meet, and WhatsApp) were incorporated to enrich contextual understanding. Interview questions explored communication adaptation, challenges in intercultural encounters, and trust-building practices. All data were analyzed using Miles and Huberman's (1994) interactive model, which comprises data reduction, coding, thematic categorization, and conclusion drawing, with triangulation across interview transcripts and observational field notes to strengthen analytical validity. For example, in interactions with Korean clients, staff adjusted their tone, posture, and use of honorifics to align with cultural norms. In contrast, meetings with American clients tended to be more assertive and focused, with minimal pauses and a preference for real-time feedback, demonstrating

divergent strategies aligned with CAT's constructs of convergence and divergence.

Theoretical grounding for this study also draws from intercultural communication scholars such as Jandt (2018), who emphasized that adaptive communication is essential in meeting varied expectations in multicultural environments. Moreover, Samovar et al. (2017) highlight the importance of flexibility in style and tone to build culturally harmonious relationships—an aspect that was visibly practiced by the consulting firm's staff. The data were analyzed using the interactive model by Miles and Huberman (1994), comprising data collection, data reduction, data display, and conclusion drawing. Throughout the research process, triangulation was employed by comparing data from multiple sources and methods to ensure credibility. The use of multiple informants, including internal staff and external clients, helped validate findings and reduce potential biases.

Limitations of the study include the restricted observation period and the diverse cultural backgrounds of the firm's international clients. While this diversity enriches the analysis, it also limits generalizability, as only a subset of cultural interactions could be examined within the given timeframe. In sum, the methodology integrates theoretical, practical, and reflective dimensions, offering a comprehensive view of how intercultural communication, anchored in CAT and supported by relevant cultural theories that enables trust-building and trade readiness in a global agribusiness consulting context.

RESULTS AND DISCUSSION

The findings of this research confirm that intercultural communication strategies are essential for establishing trust and trade readiness within the agribusiness consultancy sector. Through in-depth interviews and document analysis at The firm, four core communication strategies were identified: convergence, divergence, maintenance, and the integration of digital platforms. These strategies were consistently applied in relation to the client's cultural background, communication preferences, and professional expectations. The empirical findings affirm the theoretical foundation of Communication Accommodation Theory (CAT), particularly in the way The firm aligns and diverges communication styles to meet intercultural demands. One of the most prominent findings is the use of convergence strategies to establish rapport with clients from diverse cultural backgrounds. A project manager at The firm explained, "With our Australian clients, we avoid overly formal expressions. They appreciate directness and a tone that's friendly but efficient." This was echoed by the Head of Operations, who shared, "We train our staff to match the communication style of the client, especially in tone and structure of emails or calls. It's about building comfort and familiarity from the start." For East Asian clients, communication leaned toward more structured and indirect forms. "With Japanese clients, for example, we communicate using carefully framed emails and respect pauses in conversation," noted a senior operations executive. These convergence efforts are aligned with CAT's emphasis on similarity as a pathway to interpersonal trust.

Yet, not all situations warranted adaptation. Divergence was employed strategically to assert The firm's professional identity. According to the Head of Operations, "When dealing with unreasonable demands, we are firm and consistent. Some clients may expect flexibility, but we maintain our ethical boundaries and local compliance standards." One client, a senior executive from a Southeast Asian tech firm, appreciated this honesty: "They don't bend the rules just to please us. That builds real trust in their professionalism." Divergence, therefore, is not resistance but a strategic assertion of core values and legal integrity. Maintenance emerged as a parallel strategy, ensuring consistency in professional branding and service quality. The firm regularly uses standardized templates for project proposals and client presentations. As described by the Chief Revenue Officer, "We use uniform language and structure in all our documents. This helps clients feel that they're engaging with a reliable and consistent partner." Such consistency reinforces identity while accommodating variation in delivery and interaction.

Digital communication platforms played a significant enabling role. Tools like Zoom, WhatsApp, and GoogleMeet were selected based on client preferences and context. "With European clients, we favor emails and structured calls. For Indonesian or Filipino clients, quick WhatsApp chats work best," remarked one business development officer. Importantly, communication was adjusted not only in format but in emotional tone. A client engagement officer noted, "With Americans, we smile more during video calls and keep the tone light. For German clients, we go straight to business and avoid small talk." The role of internal culture in shaping external communication was also emphasized. The firm's internal environment promotes intercultural awareness through regular team trainings, including role plays and culture briefings. A junior project officer reflected, "We did a simulation on Korean business etiquette. It helped me know when to speak and when to hold back during real meetings." This internal preparation translates into a client-facing communication style that is thoughtful, informed, and context-sensitive.

From the client's perspective, these strategies proved effective. One international client shared, "The firm feels like a cultural chameleon—they adjust without losing themselves." Another noted, "They're transparent when something can't be done, and that makes them more credible." In conclusion, the study found that intercultural communication at The firm is not only intentional but embedded into its operations, training, and strategy. By skillfully applying convergence, divergence, and maintenance within digital frameworks, The firm successfully builds long-term client trust and enables trade readiness. These strategies, grounded in CAT and enriched by real-world cultural intelligence, make The firm a model of effective global consultancy in the agribusiness sector.

The findings of this study substantiate the theoretical proposition that trust in international agribusiness is deeply influenced by the quality of communication and the degree of cultural adaptability exhibited during intercultural interactions. Drawing upon Fischer's (2009) framework, our research reaffirms that effective communication serves as a powerful mediator in building trust between agribusiness actors across borders. Fischer emphasized that trust levels among actors in agri-food chains can be significantly increased through timely, relevant,

and accurate communication—elements that were clearly reflected in how the firm customized its communication strategies to match the expectations of clients from various cultural backgrounds. This conclusion also echoes the findings of de Vries et al. (2023), who conceptualized trust as a dynamic and context-specific construct within agri-food value chains. They emphasize that trust not only initiates collaboration but also sustains it by reducing the perceived risks associated with opportunistic behavior among value chain actors. In our case study, The firm demonstrated this dynamic understanding by intentionally applying convergence and divergence strategies based on the cultural profiles of their clients. These practices enabled them to build credibility, maintain consistent service quality, and assert ethical boundaries when necessary—factors that are integral to fostering relational and rational trust as outlined by de Vries et al. (2023).

Additionally, our findings lend support to Chen and Starosta's (2005) argument that digital communication, although efficient, can compromise mutual understanding if not complemented by culturally sensitive adaptations. The elimination of non-verbal cues in emails or video calls increases the risk of misinterpretation. This was evident in the firm's practices where emotional tone, pacing, and platform selection were meticulously adjusted to suit client preferences. For instance, short and informal WhatsApp interactions were deemed appropriate for Southeast Asian clients, while structured video conferences were preferred for European stakeholders—illustrating the firm's agile response to the communicative context (Chen & Starosta, 2005). Further reinforcing the argument for culturally attuned communication is the application of Communication Accommodation Theory (CAT). As theorized by Giles and elaborated by Gawron and Theuvsen (2009), CAT posits that individuals adjust their communicative behaviors to either converge with or diverge from their interlocutors based on relational goals. This theory is highly applicable in the context of international consulting, where mirroring client expectations and speech patterns can significantly improve rapport and trust. The case study firm applied this theory not only in client interactions but also in internal team trainings, where simulations and cultural briefings equipped staff with the agility to navigate nuanced intercultural scenarios (Gawron & Theuvsen, 2009).

The empirical evidence also aligns with Breilh's (2004) call for socio-cultural awareness in rural economic engagement. In Indonesia, agribusiness often intersects with traditional practices and heterogeneous local values. Consulting firms must not only address logistical and legal matters but also understand the cultural implications of projects, particularly in rural or community-based settings. As shown in this study, the firm's success in facilitating international investment was not merely technical—it was relational and socio-culturally informed. The ability to manage stakeholder expectations, minimize cultural friction, and align with community norms exemplifies the operationalization of intercultural competence as a strategic asset rather than a soft skill (Breilh, 2004). Moreover, the results affirm that the effectiveness of trust-building in digital contexts can be augmented through strategies aligned with CAT and AUM (Anxiety/Uncertainty Management) theories. According to Mas'udah (2014), managing uncertainty in intercultural interactions involves both emotional regulation and mindful communication. This study observed that staff members, especially during negotiations or sensitive disclosures, employed paraphrasing and active listening techniques to reassure clients and reduce ambiguity. Such tactics resonate with Ji, Chen, and Zhuo's (2019) findings, which indicate that culturally resonant messaging, stakeholder engagement, and adaptive communication are positively correlated with consumer trust and satisfaction in food supply chains.

In synthesizing the literature and empirical findings, it becomes clear that the consulting firm's communication strategies are neither ad hoc nor superficial. They are informed by established communication theories, empirical best practices, and a deep understanding of value chain dynamics. Trust is not built merely by being responsive or polite—it is cultivated through a disciplined, research-based, and client-centered approach that recognizes the fluid interplay between communication style, cultural identity, and professional integrity. In conclusion, this study not only confirms that trust in international agribusiness is predicated on the twin pillars of effective communication and cultural adaptability, but also illustrates how these principles can be pragmatically implemented in organizational settings. The firm emerges as a compelling model for how trust-building can be institutionalized through intercultural communication training, strategic convergence/divergence techniques, and platform-specific communication planning. In doing so, the firm not only strengthens its client relationships but also contributes to the broader objective of enhancing global trade readiness in Indonesia's agribusiness sector. The findings of this study align with recent evidence from other emerging-market contexts. For instance, Sasne Grosz et al. (2024) demonstrated in Laos how institutional and cultural factors critically shape cross-cultural business negotiations, highlighting the need for cultural knowledge and negotiation strategies when Western and Southeast Asian actors engage in business relations. Moreover, research on Intercultural Communication Competence (ICC) among Indonesian start-ups shows that ICC helps firms manage value differences, reduce ethnocentrism, and facilitate smoother collaboration with domestic and foreign partners (Nurbaity et al., 2023). On a broader level, systematic reviews of intercultural negotiations confirm that trust building across cultures depends heavily on communicative adaptability and cultural accommodation (Sikorski & Albrecht, 2025). These converge with our findings, indicating that the strategic communication and trust-building mechanisms identified in this study could be transferable to other culturally heterogeneous emerging markets in Asia. Beyond confirming the relevance of CAT in intercultural consulting, this study extends the theory by demonstrating how digital communication environments introduce new forms of convergence and divergence, such as adjustments in screen presence, asynchronous response timing, and platform-specific tone modulation. These digital cues, absent in earlier formulations of CAT, highlight the need to expand the theory to accommodate multimodal and technologically mediated communication patterns that shape trust-building in contemporary global consulting.

CONCLUSION

This study concludes that intercultural communication stands as a foundational pillar in cultivating trust and trade readiness within international agribusiness consulting. The case of the firm demonstrates that trust is neither incidental nor spontaneous; it is a strategically cultivated outcome that hinges on cultural sensitivity, communication adaptability, and institutional learning. Drawing upon Communication Accommodation Theory (CAT), the firm operationalizes communication strategies that not only align with client expectations but also preserve organizational integrity, enabling the firm to operate successfully in a diverse and globalized environment. As demonstrated through empirical observations and client feedback, the firm's consistent use of convergence, divergence, and maintenance strategies across digital and interpersonal communication platforms enables effective relationship-building and reinforces their reputation as a culturally agile actor in the international agribusiness landscape.

The findings emphasize that communication in international consulting must transcend transactional efficiency and embody relational depth. Trust becomes both an input and an outcome: it is required to initiate cooperation, and it is reinforced through every culturally aligned interaction. Effective intercultural communication, therefore, does not merely supplement technical expertise, it is the vehicle through which credibility, reliability, and long-term cooperation are established (Fischer, 2009; de Vries et al., 2023). The firm's ability to deploy culturally resonant messaging (Ji, Chen, & Zhuo, 2019), adjust linguistic tone and channel use (Chen & Starosta, 2005), and embed relational cues within digital interactions (Gallois et al., 2005) further supports the assertion that communication is inseparable from strategic business practice in global agribusiness. Beyond the professional-client dynamic, the study also illustrates the importance of internal capacity-building. Through structured training, role plays, and intercultural briefings, the firm has institutionalized cultural intelligence (Ang et al., 2007), thus ensuring that its staff not only reactively manage cross-cultural differences but proactively anticipate and navigate them. This organizational infrastructure, aligned with Breilh's (2004) socio-cultural approach to sustainable development, enables the firm to engage sensitively with rural and traditional stakeholders, thereby avoiding cultural missteps and enhancing community trust.

The implications of this study extend to policymakers, agribusiness investors, and consulting professionals. For policymakers, the findings advocate for the integration of intercultural communication competencies in regulatory and trade facilitation frameworks. Government institutions involved in trade promotion can collaborate with consulting firms to disseminate best practices, particularly in emerging economies where trust deficits may hinder foreign investment. For agribusiness stakeholders, the study presents a model of best practice in client engagement, one that combines cultural adaptability with professional rigor. This research also offers key academic contributions. First, it advances Communication Accommodation Theory by contextualizing it in the high-stakes world of global agribusiness consulting. Second, it bridges CAT with complementary frameworks such as AUM (Mas'udah, 2014) and cultural dimensions theory (Hofstede & Minkov, 2010), demonstrating that intercultural communication strategies can be synthesized into practical consulting protocols. Lastly, it introduces a relational view of communication that positions trust not as a byproduct, but as a central metric of consulting success.

Practical Recommendations and Future Research Directions

From a practical standpoint, future studies should consider cross-firm comparisons across multiple consulting firms with different cultural scopes and service portfolios. This would offer deeper insights into how firm-level variations shape intercultural communication strategies. Similarly, longitudinal research could explore how firms adapt their communication approaches over time in response to geopolitical changes, digital transformation, or shifting client expectations. Furthermore, there is a growing need to examine the role of non-verbal and visual communication in digital intercultural contexts. As video conferencing and online collaboration tools become central to global consulting, future research could delve into how gesture, visual layout, background aesthetics, and on-screen presence influence trust formation. A multimodal analysis could provide a richer understanding of communication effectiveness beyond verbal content alone.

Academically, future research should explore the critical discourse surrounding intercultural power dynamics. Questions around cultural dominance, tokenism, and assimilation may reveal underlying biases in current communication practices. Investigating these aspects will allow scholars to advocate for more equitable communication standards that celebrate diversity without enforcing conformity. The inclusion of postcolonial communication theories may offer valuable critiques and pave the way for a more ethical, inclusive approach to global consulting. In conclusion, this research reaffirms that effective intercultural communication is not a mere accessory to global business, it is its lifeblood. The firm case illustrates how communication, when grounded in theory, enriched by practice, and oriented toward mutual respect, can serve as a bridge to trust, a catalyst for collaboration, and a driver of economic development in international agribusiness.

STATEMENT ON THE USE OF GEN AI

Generative AI tools, such as Grammarly and ChatGPT, were employed exclusively for language refinement. All conceptual insights, theoretical interpretations, and arguments presented in this work are entirely the author's original and independent contributions.

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AGRIPRENEURSHIP AND WOMEN EMPOWERMENT IN CONFLICT-AFFECTED RURAL NIGERIA: DEVELOPMENT AND VALIDATION OF THE RURAL WOMEN AGRIPRENEURSHIP EMPOWERMENT INDEX (RWAEI)

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Abstract: *The Rural Women Agripreneurship Empowerment Index (RWAEI), a multifaceted instrument for assessing the empowerment results of agripreneurial engagement among rural women in Northeastern Nigerian regions affected by conflict, is introduced in this study. The study examines how access to mechanization, farm production, hired labor, and market engagement contribute to long-term economic inclusion, decision-making authority, and community leadership in addition to job creation. It is framed within Sen's Capability Approach and Gendered Institutions Theory. The study uses confirmatory factor analysis (CFA), mediation analysis, and structural equation modeling (SEM) to validate the empowerment pathways and build the RWAEI model using data from 1,146 rural women in Gombe, Bauchi, and Adamawa. The findings show that the relationship between agripreneurship and empowerment is significantly mediated by labor employment and machine access.The index provides a context-specific metric for evaluating the agency and resilience of rural women, with a Cronbach's alpha of 0.812. The results back up the combination of focused capacity-building initiatives and gender-sensitive agricultural policies to increase the effect of agribusiness. By shifting from output-based models to capability-focused empowerment assessment, the study advances the conversation around agripreneurship and has wide ranging implications for poverty alleviation, post-conflict recovery, and the implementation of the Sustainable Development Goals (SDGs).*

Keywords: *Agripreneurship, Women Empowerment, Capability Approach, RWAEI, Conflict Affected Regions, Poverty Alleviation*
(JEL code: B54)

INTRODUCTION

Job creation has remained a key driver of economic stability, particularly in developing countries with high unemployment and poverty rates. In recent years, global policy initiatives such as the Infrastructure Investment and Jobs Act (2021) have mobilized significant resources to create jobs through infrastructure development (Zhan and Santos-Paulino, 2021). Despite economic growth, Africa continues to face a persistent employment challenge; over 63% of the population is still in subsistence work, despite the creation of 37 million wage-paying jobs in the last decade (Cieslik et al., 2022). This challenge is particularly acute in Nigeria. According to the Nigeria Labour Force Survey (2024), the working-age population's participation rate fell from 79.5% in Q3 2023 to 77.3% in Q1 2024, with the employment-to-population ratio falling by 2.4 percentage points.

Hence in the context of Nigeria's post-insurgency recovery, particularly in rural northeastern regions, job creation is not only an economic imperative, but also a tool for stability and empowerment (Ali and Ali, 2024). Poverty, entrenched gender inequality, and institutional fragility are all prevalent in these areas. Although agriculture continues to dominate rural livelihoods, traditional efforts to integrate women into the agricultural economy frequently fail to address the deep-rooted structural and capability-based constraints that prevent them from truly achieving economic empowerment (Kapiamba, 2024). Emerging research suggests that agripreneurship, or the entrepreneurial approach to agriculture, has transformation potential. It can promote inclusive growth, create jobs, and boost women's autonomy and community leadership (Singh et al., 2022; Sathiyabama et al., 2023). Initiatives like the National Centre for Agricultural Mechanization (NCAM) show that access to agricultural technology boosts produc-

tivity and income (Mahmood et al., 2025). Furthermore, agripreneurship is viewed as a platform for both livelihood generation and gendered transformation, providing women with new capabilities, resources, and decision-making power (Adeyanju, et al., 2023). However, a significant limitation of many rural development programs is the lack of rigorous, multidimensional tools for measuring women's empowerment in addition to income gains (Quisumbing et al., 2023). Most programs focus solely on linear economic indicators, ignoring the broader spectrum of empowerment, such as resource access, decision-making agency, social mobility, and market participation (Ferdous, 2024). Despite the recognition of agripreneurship as a rural and gender-inclusion strategy, the existing literature has largely leveraged unconnected, income-outcome, and quality indicators of empowerment. These approaches fail to aptly capture and encompass the complex underpinnings of women's empowerment, particularly in a rural and conflicted context where a lack of institutional stability, social norms, and adequate capabilities are complex and intricately interconnected. More urgently, existing strategies of women's empowerment are rarely grounded on any comprehensive theoretical underpinnings and supported by robust quantitative approaches, leaving policymakers and practitioners of development with no reliable, contextual, and specific instrument by which a significant empowerment outcome of agripreneurship can be measured, vis-à-vis income generation as a simplistic outcome. This study tackles this essential gap by establishing and empirically validating the Rural Women Agripreneurship Empowerment Index (RWAEI) a novel, multidimensional measuring methodology anchored in Sen's Capability Approach and Gendered Institutions Theory. Unlike previous empowerment metrics, the RWAEI rigorously integrates economic, human, social, and market capital dimensions and specifically incorporates the intermediary roles of mechanization access and labor employment. The study applying Confirmatory Factor Analysis (CFA), Structural Equation Modeling (SEM), and mediation variable to analyse large-scale field data from conflict-affected rural communities in Northeastern Nigeria, the study provides one of the first rigorously validated, context-specific tools for measuring agripreneurship driven empowerment among rural women.

LITERATURE REVIEW

Sen's Capability Approach (1999) and Gendered Institutions Theory (Mackay et al., 2009) serve as the foundation for this study and offer a potent lens through which to examine empowerment in addition to labor participation and income gains. When taken as a whole, these theories allow for a more thorough comprehension of how agripreneurship changes rural women's lives by increasing their capacity, agency, and access to decision-making processes.

Amartya Sen's Capability Approach

According to Sen's framework, development is the growth of people's capacities and their actual freedoms to live the lives they choose. Agripreneurship can give rural women actual options, such as having access to land, owning tools, running cooperatives, or taking part in market decisions. The capability approach shifts the focus of the study to the underlying freedoms rather than measurable outcomes (like income or employment). Gendered Institutions Theory investigates how formal and informal institutional norms perpetuate gender inequality by limiting women's access to economic resources, leadership positions, and decision-making power. In many Nigerian rural communities, gender roles are institutionalized, limiting land ownership, financial inclusion, and access to agricultural technology. Agripreneurship thus serves not only as a source of income, but also as a mechanism for breaking down institutional barriers and promoting gender equality.

Justification for Theory Integration

The Capability Approach conceptualizes the ultimate goals of empowerment (freedoms, capabilities, and functioning), whereas Gendered Institutions Theory explains the structural constraints that women face. This study captures the dynamic relationship between access (to resources and opportunity), agency (autonomy and leadership), and achievement (measurable empowerment outcomes), the three core components of the Rural Women Agripreneurship Empowerment Index (RWAEI).

Women empowerment

Women's empowerment is a multifaceted process that includes access to resources, control over income, leadership, and the ability to make life-changing decisions. Traditional metrics, on the other hand, have focused primarily on income, ignoring intangible but critical dimensions such as autonomy, community status, and decision-making power (Kabeer, 2021; Wei et al., 2021). Recent studies (Chelliah and Bagavan, 2023; Bihari and Priya, 2024) show that women agripreneurs have improved their access to land, skills, and markets, but the empowerment processes are still poorly measured and theorized.

Agripreneurship

Agripreneurship, which combines agriculture and entrepreneurship, has emerged as a promising platform for women's economic inclusion, particularly in rural areas. It promotes innovation, self-employment, and leadership in the agricultural value chain (Karaca and Ince, 2023). However, one significant gap in the literature is the lack of localized empowerment indices that capture how agripreneurship affects women's agency and capabilities over time.

Machine operation

Access to machinery and mechanized tools reduces labor intensity and time poverty for women, allowing them to take a more active role in higher-value agribusiness activities. Studies such as (Danda, 2022 and Daudu et al. 2020) discovered that women-led mechanization increased productivity and participation in rice farming cooperatives in South Asia and Nigeria. However, such studies frequently focused on productivity metrics and lacked a framework for assessing long-term empowerment.

Hired farm labour

Women who grow agribusinesses large enough to hire workers not only increase local employment, but also advance to positions of leadership and decision-making. Adeyanju et al. (2024) discovered that youth agripreneurs in the ENABLE-TAAT program hired an average of four more workers per enterprise. However, the gender disaggregated impact of such job creation, particularly on empowerment outcomes, is understudied.

Market Access and Economic Mobility

Market integration is critical for sustaining rural agribusinesses. According to research, marketing capabilities, particularly digital, cooperative, and value-added sales, boost women's income and economic standing (Ouko et al., 2022; Mishra, 2024). However, there has been little research into whether increased market access leads to social empowerment, such as influence in community decisions or land negotiations.

Empirical Review on the effect of job creation and rural women empowerment

Chelliah, and Bagavan (2023) in their study, empowering women agripreneurs through precision agriculture technology adoption. The objectives of the study were to analyses existing literature on PAT adoption theories, uncover barriers faced by women agripreneurs, and provide recommendations for overcoming these challenges. A systematic review method was employed to gather insights from diverse sources, focusing on social, policy, and educational implications. Findings reveal that barriers to PAT adoption among women agripreneurs include digital literacy, access to training programs, and limited institutional support. Social norms, inadequate resources, and policy shortcomings exacerbate the disparity. The study also highlights innovative approaches, such as peer mentorship programs connecting technically skilled young women with less technologically literate older women farmers, as an effective strategy to bridge the digital literacy divide. The study concludes that addressing the technological gap requires multi-pronged interventions involving tailored training programs, supportive policies, and enhanced access to resources for women agripreneurs. It recommends policymakers prioritize mentorship initiatives, create accessible PAT training programs, and foster inclusive digital agriculture strategies. The recent research address these gaps, women agripreneurs aree empowered to adopt precision agriculture technology, ultimately benefiting rural farming communities and contributing to sustainable agricultural practices.

Adeyanju et al., (2024) studied, harnessing the job creation capacity of young rural agripreneurs: A quasi-experimental study of the ENABLE program in Africa's growing investments in youth agribusiness empowerment programs underscore the potential of youth-led agribusinesses in creating employment and revitalizing rural economies. However, the extent to which these programs unlock job creation capacity remains under explored. This study examines the evolving role of youth and small agribusinesses in employment generation in rural areas and evaluates the impact of the African Development Bank's (AfDB) Technologies for African Agricultural Transformation (TAAT) Empowering Novel Agribusiness-Led Employment (ENABLE) program implemented in Kenya, Nigeria, and Uganda. A survey of 1,435 respondents, including 737 program participants and 698 non-participants, was conducted across the three countries. Using an Endogenous Switching Regression (ESR) model, the study analyzed determinants of program participation, factors influencing job creation, and the program's impact on employment outcomes. The findings reveal that youth-owned agribusinesses significantly contribute to job creation, hiring an average of four employees per business. The ESR results confirm the positive impact of ENABLE-TAAT on participants' job creation capacity, with non-participants showing potential for increased job creation if they had participated. Key factors influencing job creation include socioeconomic characteristics such as age and marital status, as well as business attributes like agribusiness experience, business level, income, and access to land. The study concludes that targeted agribusiness empowerment initiatives have substantial potential to enhance youth employment and reduce rural unemployment. It recommends increased investments in youth agribusiness programs to strengthen their job creation impact. Policymakers should focus on addressing barriers to program participation and supporting young agripreneurs with resources and capacity-building initiatives to expand their businesses and create sustainable employment opportunities. These efforts will contribute to reducing unemployment rates and fostering rural economic growth in the study countries and across Africa. Bihari and Priya, (2024) Economic Development of Women Agripreneurs Through Interventions of Government Livelihood. This study evaluates the impacts of these interventions on the socio-economic conditions of rural beneficiaries, forming part of a Ph.D. thesis. The study surveyed 260 beneficiaries selected from 13 blocks across three districts in Jharkhand. Descriptive and inferential statistics, including paired t-tests and Principal Component Analysis (PCA), were employed to analyze the data. The findings indicate that all respondents were beneficiaries of the National Rural Livelihood Mission (NRLM), followed by JOHAR (92.7%) and JHIMDI (14.2%). Substantial improvements were observed in asset ownership, including poly houses, vermi pits, poultry sheds, and micro-drip systems. Statistically significant increases were also noted in income, expenditure, and savings related to these assets, except for expenditure on poultry sheds. Additionally, the income from agriculture, livestock, fisheries, and agribusiness activities significantly improved post-program participation. PCA identified three principal components with an Eigen value greater than 1.0, collectively explaining 71.03% of the variance in the data. Principal Component 1 (PC1), accounting for 29.6% of the variance, was strongly associated with entrepreneurial traits such as innovation, risk-bearing ability, self-confidence, and planning orientation. The study concludes that targeted interventions have significantly enhanced the economic empowerment of rural women by improving their incomes, asset ownership, and entrepreneurial capacities. It recommends scaling up successful interventions

like NRLM and JOHAR while focusing on capacity-building efforts to foster entrepreneurial behaviors among beneficiaries. Policymakers should also consider integrating additional training and support mechanisms to sustain the socioeconomic benefits and foster long-term rural development.

Gaps and contributions to literature

Despite growing interest in agripreneurship as a tool for rural development, there is little agreement on how to quantify empowerment outcomes in a structured, scalable manner. Most studies are qualitative or use disconnected indicators without an integrated framework. This study fills that gap. Developing and validating the RWAEI.; Using a multi-theoretical approach to explain empowerment pathways.; Using quantitative modeling (SEM and CFA) to determine how specific agripreneurship inputs affect empowerment dimensions

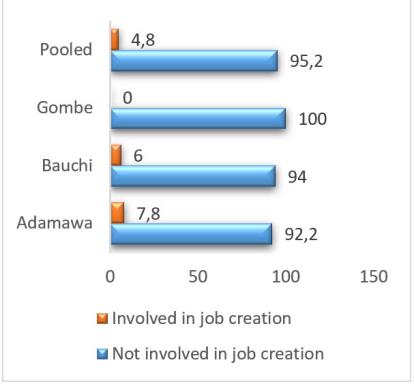
MATERIALS AND METHODS

This study employs a quantitative research technique, using a cross-sectional survey design to collect data from rural women farmers in Nigeria's Northeastern States of Gombe, Bauchi, and Adamawa, which represent the larger rural agrarian communities in Northeast Nigeria. The target population consisted of rural women who were actively engaged in agribusiness activities such as farm production, marketing, and the use of hired labor and machinery. A multistage cluster sampling method was used to select respondents from local government areas known for rural agricultural activity. Using Krejcie and Morgan's (1970) sample size determination table, 1,146 respondents were chosen from the three states. A structured questionnaire with a 5-point Likert scale was created to assess agripreneurial inputs (machine operation, hired labor, farm production, and marketing) and empowerment outcomes. Data were collected via the KoBo Collect mobile platform. Descriptive statistics were used to summarize demographics and participation rates. Confirmatory Factor Analysis (CFA) is used to validate the RWAEI structure Structural Equation Modeling (SEM) is used to test hypothesized relationships and Mediation analysis to determine the indirect effects of agribusiness inputs on empowerment via RWAEI dimensions.

RESULTS AND DISCUSSION

The findings show that agripreneurship is used to create employment at a high and consistent rate throughout the three research states. All respondents in Gombe indicated involvement in agripreneurship activities, while similarly high percentages were recorded in Bauchi (94%) and Adamawa (92.2%). These statistics show that agripreneurship has become a frequent and reliable livelihood option for rural women in Northeastern Nigeria. Rather than revealing geographical variations, the pattern indicates a shared post-conflict coping and recovery approach, through which women use farm-based activities to generate employment for themselves and for others within their communities. This study is aligned with the work of Adeyanju et (2024) suggesting that young agripreneurs in Kenya are motivated to participate in agripreneurship empowerment programs and their involvement has a causal effect on their abilities. lastly involvement in job creation activities via agripreneurship, study shows that all the rural women farmers that constituted the respondents in Gombe were involved in job creation activities, 94% of respondents in Bauchi and 92.2% of respondents in Adamawa were involved in job creation activities through agripreneurship, revealed that women create job for themselves and others in their community in Northeastern Nigeria.

Figure 1: Response Rate by Involvement in Job



Source: Field Survey, 2024

Table 1. Summary of Hypotheses Testing Results

	Hypothesis Statement	Coefficient (β)		Decision	Interpretation
H_1	Machine operation has significant positive effect on empowerment of rural women agripreneurs.	Positive (significant)	<	Supported	Machine operation enhances economic empowerment and autonomy of women.
H_2	Hired farm labour has significant positive effect on empowerment of rural women agripreneurs.	Positive (significant)	<	Supported	Use of hired labor supports income generation and job creation.
H_3	Farm production has significant positive effect on empowerment of rural women agripreneurs.	Positive (significant)	<	Supported	Increased productivity contributes to household and community economic growth.
H_4	Marketing has significant positive effect on empowerment of rural women agripreneurs.	Positive (significant)	<	Supported	Market engagement leads to income stability and expansion of value chains.

Note: The exact coefficients were not specified in the document except for an overall coefficient (β = 0.058) indicating job creation's significant positive effect on empowerment at $p < 0.05$. All hypotheses were supported based on statistical analysis using Structural Equation Modelling (SEM).

According to the survey, the poll found that many rural women in the Northeastern States work as farmers or live in rural regions are subjected to vicious cycles of unemployment and poverty owing to ongoing insurgent actions on farmlands., which has made the search for sustainable alternatives necessary, which is Agripreneurship. All the hypotheses earlier developed were supported based on statistical analysis.

Table 1. shows that there is no effect of job creation on rural women empowerment in North Eastern Nigeria, as per hypothesis. The Table shows that the calculated coefficient (β = 0.058) was significant at a p-value < 0.05, indicating a positive connection. Creating jobs for rural women has a big beneficial impact on their empowerment. Therefore, the null hypothesis was rejected and the alternative hypothesis was supported. The high level of participation in agripreneurial activities, create job across the three states surveyed Gombe (100%), Bauchi (94%), and Adamawa (92.2%) demonstrates a clear trend of rural women actively engaging in value-added agricultural activities. These findings align with Adeyanju et al. (2024), who highlighted the capacity of agribusiness programs to foster entrepreneurial engagement and job creation, especially among the youth and women in rural areas.

The study also resonates with the literature reviewed, including Alex (2013), who emphasized the transformational impact of women-led mechanization, and Chelliah & Bagavan (2023), who identified digital and institutional barriers to women's effective participation in modern agriculture. The reliability analysis further supports the internal consistency of the research instrument, with a Cronbach's Alpha of 0.812 considered acceptable in social science research. This multidimensional empowerment spanning income generation, skill acquisition, and decision-making reflects agripreneurship potential to break cycles of poverty and marginalization. The integration of women into these agricultural value chains thus supports the broader objectives of the Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 5 (Gender Equality), and SDG 8 (Decent Work and Economic Growth).

CONCLUSION

Shis study concludes that agripreneurship is a dynamic platform for empowering rural women in Northeastern Nigeria, especially in the post-conflict context. The introduction and validation of the Rural Women Agripreneurship Empowerment Index (RWAEI) offer a novel and robust framework for assessing multidimensional empowerment outcomes that goes beyond traditional income-based metrics. The findings confirm that access to mechanization, hired labor, farm productivity, and market participation all improve women's economic inclusion, agency, and leadership capacity. The high rates of agripreneurship in Gombe, Bauchi, and Adamawa highlight rural women's important role in local job creation and community resilience. Using a multi-theoretical lens, this study fills a critical methodological gap in empowerment assessment and provides a scalable model for policymakers, NGOs, and development actors looking to support gender-sensitive agricultural transformation in fragile regions. The study emphasizes the importance of incorporating empowerment metrics into agribusiness programs to effectively monitor impact and promote equitable economic recovery in accordance with the SDGs.

Recommendations with Policy Implications

1. Implement the RWAEI Framework: Policymakers, donor agencies, and program implementer should use the RWAEI as a standardized tool to assess the impact of agribusiness interventions on women's empowerment. This index can be used as a monitoring and evaluation benchmark for agricultural, gender, and poverty reduction programs.

2. Enhance Women's Access to Agricultural Mechanization: The study recommends targeted subsidies or credit schemes to help women own and operate agricultural machinery, which has been shown to significantly boost empowerment through increased productivity and autonomy.

3. Encourage women-led employment and agribusiness expansion: Development programs should assist female agripreneurs in growing their businesses to the point where they can hire workers, thereby increasing employment and women's leadership capacity in rural communities.

4. Facilitate market access via digital and cooperative platforms: Investments in digital literacy, mobile market platforms, and cooperative formation are critical for increasing women's access to value chains, pricing power, and bargaining power in agricultural markets.

Limitations of the Study

While this study offers a substantial contribution through the development and validation of the RWAEI, some limitations should be addressed. First, the cross-sectional design limits the capacity to make causal inferences or capture changes in empowerment outcomes over time. Second, although the sample size of 1,146 respondents is robust, the findings are based on three states in Northeastern Nigeria and may not be entirely generalizable to other locations with distinct socio-cultural or institutional contexts. Future studies could adopt longitudinal designs and apply the RWAEI across varied geographical locations to further assess its resilience and external validity.

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GENDER-BASED FINANCIAL ACCESS IN LIBERIA'S FISHING INDUSTRY

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Abstract: *One essential component of the competitive operation of the fishing industry is the availability of finance. Access to finance is an important issue, but women's access to finance is more critical than men's. The study's objective is to emphasize gendered experiences with financial need, access to and selection of financial services, and service providers among Liberian actors in the fish industry. The study collected and analyzed data using a cross-sectional design. The research used primary data collection methods. Workers in Liberia's artisanal fishing value chain, both men and women, were the main population of interest. Respondents were chosen for the study using a two-stage sampling technique. Purposive sample of counties and random sampling of respondents were the two components of the two-stage sampling strategy. For the study, 278 men and women fish actors were selected as respondents using the random sampling technique. This study employed quantitative methodologies for data collection. From the findings, access to financial products is generally limited for fish actors. Nonetheless, some financial services and products are exclusive to either gender. Commercial banks are more accessible to men than to women. Because of their low income and educational attainment, women have limited access to commercial banks.*

Keywords: *women's access to finance; financial needs; choice of financial institution; women's empowerment; credit worthiness*
(JEL code: B54; G21; G23; G53; Q22)

INTRODUCTION

For micro, small, and medium-sized businesses (MSMEs) to operate competitively, especially in developing nations, financing availability is a crucial component (Beck and Demirguc-Kunt, 2006). There are, nevertheless, barriers for access to finance. Access to financial products is impacted by factors such as poor income and education (Karthikeyan, 2018). In Liberia, agribusinesses continue to face difficulties in obtaining financing, which has been identified as the primary barrier to the establishment and expansion of youth-led agro-MSMEs (Kyerewaa et al., 2022).

Even while access to finance is important, female's access to finance is more crucial as compared to men's (Leitch et al., 2018). According to Leitch et al. (2018), there is a contradicting opinion that female entrepreneurs need more access to venture capital (or business angel financings) despite the assumption that they just need a small amount of cash. Is micro, medium, or macro finance necessary for females? According to Leitch et al. (2018), females are primarily granted access to microcredit since it is assumed that they require microloans. Should this be the case, though? According to De Andrés et al. (2021), females are more credit worthy than men, which could result in females having access to credit even though men are more likely to receive it. One of the agro-MSMEs that need access to financial products is the fishing sector (Pomeroy et al., 2020).

The small-scale fishing industry in Liberia is seasonal. Six times as much can be traded between the rainy and dry seasons (Jueseah et al., 2020). In Liberia, females play an important role in the fishing industry. Does the fact that their incomes differ have an impact on their financial needs and the kind of financial services they want? The majority of fishermen sell directly to their spouses, Korean wholesalers, artisanal fish dealers, small cold store owners, or individual customers during the dry season. According to Jueseah et al. (2020), wives purchase about 60% of the entire catch during the dry season and 88% during the rainy season. This implies that wives should have a steady source of finance so they can buy from their husbands and maintain their standard of living. Additionally, during the rainy season, wives tend to the majority of their family's domestic needs (Jueseah et al., 2020). Then there is the issue of female's financial demands in the fishing sector. Additionally, wives offer unofficial financing to purchase fishing gear like nets and canoes or, on occasion, to pre-finance fishing excursions. The study's objective is to shed insight on the gendered experiences of Liberian fish actors with regard to financial need, service providers, and access to and selection of financial services. For the limitation of the study, while the study design is suitable for capturing a snapshot of gendered financial access, it does not allow for causal inference or examination of changes over time, which may limit the generalizability of the findings.

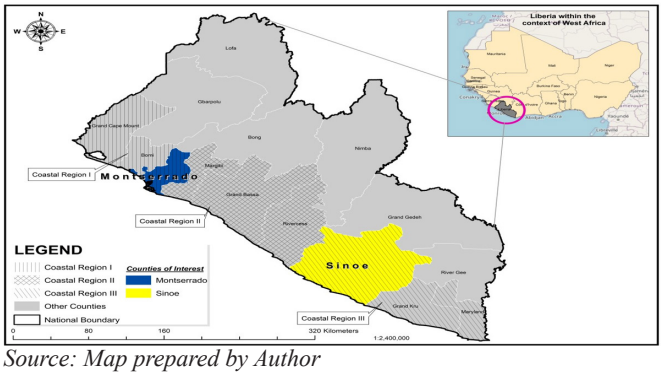
MATERIALS AND METHODS

The study collected and analyzed data using a cross-sectional design; the study used primary data collection method. Females and men employed in Liberia's artisanal fishing value chain were the main population of focus. Liberia is a coastal country, with 9 of its 15 counties located along its 579-kilometer coastline, which includes some of the most prolific fishing areas in the world (Jueseah et al., 2020). The fishing sector is critical to the livelihoods of coastal communities as well as the national economy. The industry is regarded as one of Liberia's primary revenue streams, contributing around 3% of the nation's GDP and 10% of the output of the agricultural sector (Abissa and Dumfour, 2021). An estimated 15,000 fishermen, 25,000 fish processors, and traders—mostly small-scale artisanal fish actors—are employed by the fishing industry, which also provides at least 60% of the country's protein needs (Abissa and Dumfour, 2021).

Study area

The study area is Montserrado and Sinoe counties. These fall within two (2) of Liberia's three (3) coastal regions – Region I (Grand Cape Mount, Bomi and Montserrado counties), Region II (Margibi, Grand Bassa and Rivercess counties) and Region III (Sinoe, Grand Kru and Maryland counties) (Figure 1).

Figure 1. Map of the Study Area



Source: Map prepared by Author

Sampling approach

A two-stage sampling technique was employed in the study to choose respondents. Purposive sampling of counties and random sampling of respondents were both components of the two-stage sampling technique. A total of 278 male and female fish actors were chosen as research participants from the chosen fishing communities using the random selection approach. In all, 132 fish actors were chosen from Kru Town West Point and 54 from Fanti Town West Point in Montserrado County, while 32 and 60 were chosen from Sinoe County's Greenville Down Town Beach and Greenville Fish Town Beach, respectively.

Data collection

This study used primary data employing quantitative methodologies for data collecting. Questionnaire was mostly made up of single choice questions. Using the KoboCollect platform, a structured questionnaire was used to collect primary data. The data collection was carried out by enumerators who were trained. The opinions and experiences of the fish actors were crucial to the study, since both men and females fish actors are classified as demand-side players in Liberia's agricultural finance sector.

Data analysis and reporting

Cross-tabulation analysis was conducted to examine the relationships between key categorical variables relevant to the financial behavior of fish actors, including their type of activity, access to financial services, preferred financial providers, financial needs, and barriers to accessing finance. After cleaning and coding the data in Excel and Stata, cross-tabulations were generated using Excel Pivot Tables for descriptive summaries and Stata's tabulate command for more advanced statistical outputs. Each cross-tabulation produced frequencies, percentages, and a contingency table structure that allowed for comparison across different categories of fish actors and financial characteristics. To determine whether the patterns observed in the tables reflected true associations rather than random variation, Chi-square tests of independence were applied to all cross-tabulations. For each comparison, a Chi-square statistic and corresponding p-value were generated automatically in Stata. The Chi-square test evaluated the null hypothesis that the two variables under consideration were independent of one another. When the test results produced a p-value less than the threshold of 0.001, the null hypothesis was rejected, indicating a statistically significant relationship between the variables. Using a stringent significance level of $p < 0.001$ strengthened the reliability of the findings by minimizing the likelihood of Type I errors (false positives). This ensured that the associations observed—such as differences in financial access across fish actor categories or variations in preferred financial services—were not due to chance. Tables, charts, and graphs were then used to visually present these findings in the results section. The fact that all cross-tabulations were significant at $p < 0.001$ demonstrated strong and consistent relationships among the variables examined, supporting the robustness of the study's conclusions.

RESULTS AND DISCUSSION

The gender roles observed among fisherfolk align strongly with insights from Gender and Development (GAD) theory, which argues that economic activities in natural-resource sectors are structured along socially constructed gender divisions. The study found that females primarily occupy fish processing roles (86.66% of females), while males dominate fishing activities (95.36% of males). This division is not merely occupational—it reflects broader socioeconomic norms that shape resource access, labour responsibilities, and financial decision-making.

The needs of fisherfolk are different between males and females which is consistent with the Sustainable Livelihoods Framework, which emphasizes that livelihood strategies differ according to asset access. The most pressing business financial

need of females in the fishery industry (71 out of 127 females) is usually short-term in the form of working capital while that of males (104 out of 151 males) is usually long-term in the form of buying assets and expanding their businesses as shown in Table 1. The needs of men are related to buying assets and expanding business/operation. Females on the other hand are concerned with short-term business needs like paying labours and buying raw materials. Short-term loans required by females may mean that females are hard-pressed with finances. This finding is consistent with that of EJF (2025) findings that females' major barrier in the fishery industry is finance.

Table 1: Cross-tabulation between the most pressing business financial needs of fisherfolk in relation to gender

Gender	Long term	Short term	Total
Female	56 (44.09%)	71(55.91%)	127 (45.68%)
Male	104 (68.87%)	47(31.13%)	151 (54.32%)
Total	160	118	278

Source: Field Survey

Access to financial products and services remains generally low among fisherfolk in Liberia, consistent with Pomeroy et al. (2020), who note structural exclusion of fishing communities from formal finance. About 12% of males have requested for credit before while 16% of females have requested for credit before. There is less access to credit for fisherfolk even though they desire various types of credit. Females (31 out of 127 females) mostly desire microloans while males (50 out of 151 males) mostly desire macro loans as shown in Table 2. Even though slightly more females than men have ever requested credit, gender differences in the type of credit desired illustrate further how financial needs reflect position within the value chain: females predominantly request microloans, while males request macro loans. Financial Inclusion Theory helps explain this pattern—short-term needs, smaller incomes, and limited collateral push females toward microfinance, whereas men's capital-intensive fishing activities require larger financing packages.

Table 2: Cross-tabulation between loan size that will be desired in meeting your financial needs and gender

Gender	Macro loans	Medium Loans	Microloans	Total
Female	21(16.54%)	75(59.06%)	31(24.40%)	127(45.68%)
Male	50(33.11%)	79(52.32%)	22(14.57%)	151(54.32%)
Total	71(25.54%)	154(55.40%)	53(19.06%)	278(100%)

Source: Field Survey

Savings behaviour also reflects theoretical expectations regarding gendered access to assets. Almost all fisherfolk save (257 out of 278 fisherfolk save), contradicting assumptions that low-income fishing communities rarely save. Out of the 151 men interviewed, 137 men save their income while 120 out of 127 females save their income. Yet the location of savings differs significantly: females predominantly save at home or through VSLAs and susu groups, whereas men more frequently save in commercial banks. Social Relations Theory explains this by showing how institutional structures—such as banks requiring documentation, literacy, and collateral—advantage men and disadvantage females who face structural barriers such as lower education and income. Fisherfolk saves at home, banks, VSLA/ susu groups and other avenues. More than half of fisherfolk (50.97%) save at home as shown in Table 3. Proportionally, more females (53.33%) save at home than males (48.91%) do. The proportion of fisherfolk who save in formal financial institutions like the commercial bank is about one-fifth (22%). Men (13.87%) save more in the bank than females (2.50%) do. On the other hand, more females (30.00%) save at VSLA/ Susu groups than men (19.7%) do.

Table 3: Cross tabulation of where money is saved by gender

Gender	At home	Commercial Bank	VSLA/ Susu group	Others	Total
Female	64 (53.33%)	3 (2.50%)	36 (30.00%)	17 (14.17%)	120 (46.69%)
Male	67 (48.91%)	19 (13.87%)	27 (19.71%)	24 (17.52%)	137 (53.31%)
Total	131 (50.97%)	22 (8.56%)	63 (24.51%)	41 (15.95%)	257 (100%)

Source: Field Survey

Access to formal financial institutions, including bank accounts, is similarly gendered. A large proportion of fisherfolk lack bank accounts (91.44), significantly higher than Liberia's national unbanked rate (71.40%) (the Global Economy.com,2025) . However, men (71.43%) are far more likely to have bank accounts than females (25%) as shown in Table 4. Development finance theory suggests that female's exclusion from formal finance is often rooted in limited human capital—such as literacy and numeracy skills—and restricted access to social and economic resources. The findings reflect this, with female having far lower education levels, making it difficult for them to meet documentation requirements for bank accounts or loans. This aligns with Pomeroy et al. (2020) and Letouze et al. (2021), who both emphasize education as a central barrier to financial inclusion.

Table 4: Cross-tabulation between fisherfolk who have saved in a commercial bank entity before and gender

Gender	No	Yes	Total
Female	6(75.00%)	2(25.00%)	8(36.36%)
Male	4(28.57%)	10(71.43%)	14(63.64%)
Total	10(45.45%)	12(54.55%)	22(100%)

Source: Field Survey

On the contrary, more females (87.50%) than males (42.86%) receive credit from commercial banks as shown in Table 5. The high accessibility of loans by females as compared to males may be due to provisions made by the gov-

ernment and donors in improving financial access to females. For instance, the Ministry of Finance and Development Planning has trained female-owned start-up businesses on access to financial products and services (ITC, 2021). Also, females are more credit worthy compared to males (De Andrés et al., 2021). This may lead to more females been likely to receive credit from commercial banks as compared to males. On the other hand, the reason why less males have received credit from the commercial bank may be because they are able to access interest free loans from informal sources like their wives and traders. Jueseah et al. (2020) mentioned that fishermen prefer to borrow interest free loans from their wives and other traders than to borrow from commercial banks.

Table 5: Cross-tabulation between fisherfolk who have received credit (loans) from commercial banks and gender

Gender	No	Yes	Total
Female	1 (12.50%)	7 (87.50%)	8(36.36%)
Male	8 (57.14%)	6 (42.86%)	14(63.64%)
Total	9(40.91%)	13(59.09%)	22(100%)

Source: Field Survey

Pomeroy et al. (2020) mentioned that low education affect access to financial products. In 2020, World Bank calculated gender equality in Liberia in terms of gross enrollment in primary and secondary levels to be 0.33%. Low education of females makes it difficult for them to have access to credit as they will need to present a business plan, insurance documents, income statement and profit strategy. More females (55%) than men (26.32%) emphasised that education was a major barrier to people not having access to financial products like credit as shown in Table 6.

Table 6: Cross-tabulation of access to financial products and services and gender

Gender	No	Yes	Total
Female	119 (93.70)	8(0.063)	127(45.68%)
Male	130(86.09)	21(13.91)	151(54.32%)
Total	249 (89.57)	29 (10.43)	278(100%)

Source: Field Survey

In addition to the low level of education among fisherfolk, low income is a major reason for low access to formal financial institutions' products. During the lean season, most males earn between L$3001 to L$16000 while females earn less than L$3000. This might explain why more men are likely to save than females.

Table 7: Cross-tabulation of low income as a constraint to savings and gender

Gender	No	Yes	Total
Female	14(12.39%)	113(87.61%)	127(45.68%)
Male	39(25.83%)	112(74.17%)	151(54.32%)
Total	53 (19.06%)	225(80.94%)	278(100%)

Source: Field Survey

CONCLUSION

The study reveals clear gender-differentiated financial needs and access patterns among fisherfolk. Males typically face long-term business demands that require larger and more flexible financing, making them more likely to seek macro loans. In contrast, females confront more immediate and short-term business needs, which align with a preference for microloans. Overall, fisherfolk—regardless of gender—experience limited access to formal financial products and services. Yet important gender-specific differences persist within this general constraint. Males demonstrate greater access to commercial banks, reflected in higher rates of account ownership and savings. This suggests that males may be better positioned to navigate formal financial systems, possibly because of higher literacy levels, mobility, or control over financial resources. Females, however, continue to face barriers such as lower education levels and limited or unstable income, which reduce their inclusion in the formal banking sector. Despite these challenges, females report higher access to commercial bank credit. This apparent paradox may result from two dynamics: (1) males often rely on informal credit networks—including spouses, traders, and community lenders—which reduces their need to pursue bank loans; and (2) many development initiatives specifically promote female's financial inclusion, improving their access to credit even when broader structural barriers remain. Taken together, the findings highlight that gender is a critical factor shaping financial behavior and access. Policies and financial services that fail to account for these differences risk reinforcing existing inequalities. Addressing the distinct needs of both male and female fisherfolk is essential for improving financial inclusion and supporting sustainable livelihoods within the fisheries sector.

Recommendation

Financial institutions should tailor their products and outreach strategies to the distinct financial behaviors and needs of male and female fisherfolk. Commercial banks are well-suited to target male clients, who generally possess greater capacity to save and demand larger loan products aligned with long-term business goals. Conversely, females would benefit more from services provided by VSLAs and susu groups, which offer smaller, flexible, and community-based microloans that match their short-term financial needs and lower income levels.

Additionally, interventions should not only match financial products to gendered needs but also work to reduce the structural barriers—such as education gaps and income instability—that limit female's access to formal banking. Complementary financial literacy programs, targeted loan products, and gender-responsive outreach strategies would further strengthen financial inclusion and promote a more equitable and resilient fisheries sector. Efforts to reduce structural barriers for females—such as low literacy, limited income, and restricted access to formal banking—should include financial education, simplified banking procedures, and mobile banking options. Coordinated action among government institutions,

financial organizations, NGOs, and community groups is essential to create inclusive financial access points, incentivize lending to females, and strengthen support for men's use of formal credit. These measures collectively promote equitable financial access and strengthen the resilience of the fisheries sector.

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STATEMENTS

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Disclosure statement

The authors report there are no competing interests to declare.

Consent statement

Authors confirm that all study respondents consented to publish the research paper titled "Gender-based financial access in Liberia's fishing industry in Gender, Technology and Development".

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CONTRIBUTION OF COMMUNITY BASED ORGANIZATIONS IN ENHANCING RURAL COMMUNITY DEVELOPMENT: INSIGHTS FROM OSUN STATE, NIGERIA

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Abstract: *This study examined the contribution of community-based organizations (CBOs) to rural community development in Osun State, Nigeria. Specifically, it described the characteristics of CBOs, identified their goals, types, and development projects, determined their contributions to rural development, and identified challenges limiting their performance. A multi-stage sampling procedure was employed to select 48 registered CBOs across the state. Data were collected through structured interview schedules and analyzed using descriptive statistics, while Pearson Product Moment Correlation (PPMC) was applied to test the study's hypothesis. Results indicated that the mean years of formation of CBOs was 21.3 ± 9.5 years, majority had written constitution with a mean membership strength of 40±12 members. Primary goal of CBOs was economic empowerment of members (85.4%), The most prevalent CBOs included landlord associations and social groups. Most CBOs initiated erection of security gate at community entrance (75%) and provision of vigilante (70.8%). Provision of security for community and government property (mean = 2.83) and implementing of developmental projects (mean = 2.70) were s the most prominent contribution of CBOs. The major constraints affecting CBO performance were lack of funds (mean = 1.85) and lack of government support (mean = 1.51). Statistically significant relationships were observed between contribution and leadership tenure ($r = -0.589$, $p \leq 0.01$), operational constitution ($r = 0.183$, $p \leq 0.01$), and membership strength ($r = 0.635$, $p \leq 0.05$). The study concluded that despite the fact that CBOs contributed meaningfully to rural development, their potential remains constrained by limited institutional and community support. It is recommended that government should recognize and institutionalize the role of CBOs in rural development.*

Keywords: *Community-based organizations, organizational characteristics, role performance, rural areas, rural development*
(JEL code: R58)

INTRODUCTION

Community-based organizations (CBOs) are voluntary, non-profit, and non-governmental entities formed by local populations with the aim of promoting socio-economic well-being within specific geographic or cultural settings (Oparaojiaku et al., 2021). These organizations are typically rooted in neighborhood structures and built on principles of equality and collective self-help. Dinbaba (2014) emphasized that CBOs have emerged as strategic instruments for grassroots development, especially in the context of poor governmental performance and institutional inefficiencies that have limited development in rural areas.

Rural communities in Nigeria continue to experience systemic underdevelopment, with many residents facing challenges such as poor infrastructure, lack of basic social amenities, and limited access to essential services. The inability of the government to adequately address these issues has elevated the importance of CBOs as key actors in local development. Abegunde (2017) noted that Community-Based Organizations (CBOs) are local initiatives that demonstrate resilience in the face of central government failures. Through mobilization of human, financial, and material resources, CBOs execute self-help projects tailored to community needs (Isokon et al., 2021). These include age-grade groups, village councils, women's organizations, youth associations, and co-operatives, which serve as platforms for implementing various development interventions (Yakubu, 2015). According to Ono and Adrien (2024), community development is best achieved through grassroots-driven initiatives that mobilize internal resources to improve the standard of living and discourage rural-urban migration. Eluagu (2015) supported this view, noting that sustainable rural transformation depends on participatory models of development that emphasize financial inclusion, capacity building, and community ownership of projects. CBOs serve as vital links between rural communities

and external stakeholders, including government agencies, NGOs, and donors, enabling resource mobilization, project implementation, and policy advocacy (Wachieni et al., 2023; Udeuhele and Offor, 2023)

Extant studies strengthen these insights, highlighting CBOs' emerging role in post-pandemic recovery and climate resilience. For instance, IFAD's Strategic Framework (2016–2025) emphasizes CBOs' contributions in empowering rural women and youth through farmers' organizations, addressing land access barriers where 95% of agricultural land lacks formal titles (IFAD, 2024). In other similar studies in southwestern, CBOs have increasingly focused on infrastructure like boreholes and roads, complementing national efforts amid economic regression (Nwuzor and Udoikah, 2024). Besides, there is significant improvement in access to basic services like healthcare for marginalized domestic workers where is absence of government presence in Balochistan as reported by Baig et al. (2024).

Empirical evidence supports the contributions of CBOs to development outcomes in Nigeria. Bamiwuye and Adisa (2015) found that CBOs in Osun State have sponsored training programs, financed local infrastructure projects, liaised with government institutions, and fostered social cohesion. Similar findings were reported by Odunola and Odunsi (2017), that the involvement of CBOs in initiatives such as economic empowerment, security provisioning, and infrastructure maintenance. Yidau et al. (2021) also highlighted the pivotal role played by community-based women organizations (CBWOs) in educational and healthcare development, while Oparaojiaku and Ekumankama (2020) emphasized their support for agricultural inputs and sanitation services in rural Imo State. In addition, Yang and Xu (2024) emphasized the significance of CBOs in contributing to the sustainability and well-being of migrants within resettlement communities in China. Despite these contributions, CBOs face numerous challenges including inadequate funding, limited technical capacity, unfavorable policy environments, and weak institutional linkages (Owolabi, 2018). Recent literatures reveal that exacerbated issues like low member literacy especially among 85% of rural CBOs and economic shocks, hindering their performance in states like Osun (Isokon et al., 2021; Wachieni et al., 2023: Nwuzor and Udoikah, 2024). Similarly, Udeuhele and Offor, (2023) reported that leadership disputes, elite capture, corruption, and poor accountability mechanisms weaken the contributions of CBOs. Apart from these, Wachieni et al. (2023) observed that weak institutional linkages with local government and larger NGOs, leading to duplication of CBO efforts limits their performance. These constraints hinder their potential to deliver impactful and sustainable development outcomes. However, the extent of their contributions to rural community development have been exhaustively investigated in the study area. Hence, this study was designed to assess the extent at which CBOs are contributing to rural community development, and to identify constraints limiting their effectiveness.

Objectives of the study

The main objective of this study is to assess the contributions of CBOs in promoting community development in Osun State, Nigeria. Specifically, the study seeks to

i. describe the structural and organisational characteristics of CBO in the study area;

ii. identify the goals, types and community development projects undertaken by CBOs;

iii. determine the contributions of CBOs in promoting community development; and

iv. identify the key challenges that hinder the performance of CBOs in community development efforts.

Hypothesis testing

There is no significant relationship between selected variables and their contributions to rural community development in Osun State.

LITERATURE REVIEW

This study is grounded in the functionalist theory, which provides a lens for understanding the roles played by community-based organizations (CBOs) in societal development. Functionalist theory, advanced by scholars such as Auguste Comte, Herbert Spencer, Emile Durkheim, Talcott Parsons, and Robert Merton, posits that society is a complex system made up of interrelated parts, each functioning to maintain stability and social order (Haralambos and Holborn, 2013). According to the theory, institutions and organizations within a society contribute to its overall functioning, cohesion, and survival. Each component or subsystem is expected to perform specific roles that promote equilibrium and integration. Disruption in the performance of any unit can affect the smooth functioning of the whole system. In the context of this study, CBOs represent one of such functional units within the rural development system. Their roles ranging from mobilization of resources to provision of infrastructure and security, are essential for maintaining social order and meeting the collective needs of rural communities. The effective functioning of CBOs depends on several socio-demographic characteristics such as income levels, education, age, gender, religious affiliation, and occupation of members. These factors interact to shape how CBOs execute development projects and engage in decision-making. The functionalist theory thus supports the premise that the vitality of CBOs is fundamental to community development. It also emphasizes the importance of integration among members to achieve common goals and highlights how failure in coordination or performance can hinder societal progress. Therefore, understanding the structure and dynamics of CBOs offers insight into how grassroots organizations contribute to sustainable rural development.

Modern applications of functional theory in community development further supports this framework. For example, recent studies view CBOs as an autonomous structure that play a crucial role in restoring balance to rural Nigeria's system. By tackling dysfunctional deficits and economic instability (SWTP, 2024). In volatile situations, such as northeast Nigeria, CBOs function to maintain social equilibrium through provision of security and mobilization of resources, thereby corroborating with Parsons' emphasis on adaptive subsystems (Lenshie et al., 2024).

MATERIALS AND METHODS

Sampling Technique

The study was conducted in Osun State, located in the Southwestern geopolitical zone of Nigeria and its field survey was carried out between April and October 2023. The state is administratively divided into six zones: Ife, Iwo, Osogbo, Ede, Ilesa, and Ikirun. Osun State is predominantly agrarian, with numerous community-based organizations (CBOs) operating across its local government areas (LGAs) to address developmental challenges and promote rural transformation. The target population for this study comprised all registered CBOs in the LGAs of Osun State. A multi-stage sampling procedure was employed to select the sample. At the first stage, four administrative zones, namely Ede, Osogbo, Ife, and Iwo zones were randomly selected from the six existing zones. The second stage involved random selection of one LGA from each chosen zone, namely: Ede South (Ede zone), Irepodun (Osogbo zone), Irewole (Iwo zone), and Ife East (Ife zone). At the third stage, a list of registered CBOs involved in self-help projects in the last two years was obtained from the Departments of Social, Education, and Community Development in the selected LGAs. From this list, the Yamane's (1967) formula was employed to arrive at the sample size of 48 CBOs.

This translated into 10 CBOs from Ede South, 9 CBOs from Irepodun, 15 CBOs from Ife East and 14 CBOs from Irewole LGAs. At the final stage, one executive member (either the chairman or the secretary) was purposively selected from each of the 48 CBOs to serve as a representative respondent for each of the CBO selected. Since the study is a group study, it is assumed that one of the executive members are in better position provide all required information on their group activities than ordinary member of the group. Data were collected using a structured interview schedule. The instrument included both closed-and open-ended questions designed to elicit information on the characteristics of the CBOs, their goals, contributions, and the constraints they face in community development efforts.

The Yamane's (1967) formula was employed to arrive at the sample size of 48.

Yamane's Formula = $n=N/(1+N(e^2)$

Where: n = Sample size;

N = Population size of registered CBOs;

e = Level of precision.

Using N as 63 CBOs registered involved in self-help projects obtained from the Departments of Social, Education, and Community Development; and

e as 7% margin of error at a 95% confidence,

$$n = \frac{63}{1 + 63(0.07)^2} = 48$$

Thus, a minimum sample size of 48 CBOs was used for this present study, which equal to 48 respondents

Measurement of Variables

The Contribution of CBOs to rural community development was operationalized through respondents' self-report of role performance across a list of predetermined development activities. A four-point rating scale was used 0 for Never performed, 1 for rarely performed, 2 for occasionally performed and 3 for always performed. Each respondent's total score was computed, and the mean contribution score was calculated. A mean score of 21.9 was obtained and used as the threshold: CBOs scoring below 21.9 were categorized as having low contribution, while those scoring 21.9 or above were considered as having high contribution to community development. Constraints faced by the CBOs were measured using a three-point Likert-type scale ranging from (0) Not a problem, (1) Minor problem and (2) Major problem. Respondents were asked to rate the extent to which each listed challenge affected their CBOs' contributions. Descriptive statistics including frequencies, percentages, and means were used to organize and summarize the data. Pearson Product Moment Correlation (PPMC) was employed to test the relationship between selected variables and CBO contributions to community development. All analyses were performed using IBM SPSS software version 25, and significance was determined at the 0.05. The limitation of this study is that it has limited geographical spread and only focus on the view of leaders without incorporating the view of ordinary community members.

RESULTS AND DISCUSSION

Structural and Organizational Characteristics of CBOs

Results in Table 1 show that majority (74.6%) of the CBOs were formed between11 and 30 years ago with a mean year of establishment of 21.3 ± 9.5 years. This indicates a significant duration of existence, suggesting institutional maturity and potential stability. This finding corroborates Bamiwuye and Adisa (2015) and Abegunde (2017), who observed that most CBOs in Osun State were established over a decade ago. Long-standing organizations are more likely to have developed internal cohesion and mechanisms for conflict resolution, enhancing their ability to execute community development initiatives. Majority (85.4%) of the CBOs reported having a written constitution guiding their operations. This reflects a formalized structure that enhances governance, accountability, and role clarity which would enhance their performance. Additionally, majority (62.5%) of the CBOs selected their leaders through elections, indicating a preference for democratic leadership processes. Only 25% and 12.5% selected their leaders by selection and appointment, respectively. This democratic structure is consistent with findings by Famakinwa et al. (2024), who observed that most cooperative societies in Osun State adopted electoral processes for leadership emergence. The majority (70.8%) of CBOs typically adopted leadership tenure of 3 to 4 years with a mean year of tenure of office of 3.4 years. Although this suggests regular leadership rotation, short tenures may hinder project continuity if new leaders introduce different development priorities. Many (50%) of the CBOs had their meetings on a monthly basis while (31.3 %) of the groups had their meeting on a quarterly basis. Frequent meetings foster member engagement, timely decision-making, and social cohesion. Regarding decision-making, 75% of CBOs reached decisions through consensus, reflecting

Table 1. Characteristics of CBOs

Variables	Frequency (n=48)	Percentage	Mean± Std. Dev
Years of Establishment of CBOs			
≤10	7	14.6	
11-20	15	31.2	21.3 ± 9.5
21-30	17	43.4	
31+	9	18.8	
Type Constitution			
Written	41	85.4	
Unwritten	7	14.6	
Leadership Tenure			
≤2	8	16.7	
3-4	34	70.8	3.4 ± 1.1
4-5	6	12.5	
Leadership Emergences			
Appointment	6	12.5	
Selection	12	25.0	
Election	30	62.5	
Frequency of Meetings			
Monthly	24	50	
Quarterly	15	31.3	
Biannually	9	18.7	
****Decisions Making Process**			
Consensus	36	75	
Executive meetings	8	16.7	
Voting at the general meeting	4	8.3	
Membership Strength			
≤20	3	6.3	
21-40	20	41.7	40 ± 12
41-60	25	52.1	
****Major sources of income**			
Voluntary donation	32	66.7	
Membership levy	42	87.5	
Fund raising	22	45.8	
Members due	36	75	
NGOs	18	37.5	
Government supports	9	18.8	

** *multiple responses*

Source: field survey, 2023

participatory governance. Only few (16.7%) relied on executive meetings, and very few (8.3%) employed voting at general meetings. Consensus-based decision-making fosters inclusivity, which is crucial for community ownership of development initiatives (Uzoagu, 2022). CBOs provide avenues where the voice of the indigent in the community as well as other marginalized groups is made known. Also, the result shows that more than half (52.1 %) of CBOs had membership strength of 40 to 60 members, with a mean membership strength of 40 ± 12 people. This means that majority of the CBOs had large members which could determine their financial strength and popularity of the associations within and outside the communities. A moderate membership base may enhance efficiency, accountability, and collective action, while large memberships increase financial capacity through dues and levies. This is because most CBOs rely on their membership contributions from levies and dues to carry out any development efforts which enhance their contribution to rural development. Therefore, the larger the membership strength of CBOs, the higher the financial capability through membership financial contributions. Majority of CBOs sourced their income from membership special levy (87.5%) as the main source of revenue, closely followed by

membership due (75%), voluntary donation (66.7%), fund raising (45.8%) and non-governmental support (37.5%). The findings reveal that variations in CBOs sources of income where membership dues and levies contributed highest percentage. This supports the finding of Abegunde (2017) who reported CBOs generated funds internally to finance essential projects to residents. This implies that member's commitment is necessary for the smooth running of day-to-day activities of CBOs and this can limit activities of CBOs if the membership fail to contribute generously to the purse of CBOs as at when due. These findings demonstrate the importance of internal financing for CBO sustainability and suggest a need for enhanced external support. This aligns with 2024–2025 funding cycles for rural CBOs as documented by Friends of Nigeria (2025)

Goals of CBOs

The result in Table 2 shows that CBOs were established with the primary goals of pursuing social and economic empowerment of members (85.4%), poverty eradication (79.2%), and development of entire community (72.9%) among others. These findings suggest that while CBOs are formed with a range of goals, individual welfare and community development are key priorities. These results are consistent with Iyiani and Sunday (2016), who reported similar goals among CBOs in Enugu State; and also align with current emphases on economic empowerment in IFAD-supported initiatives (IFAD, 2024).

Table 2. Goals of CBOs

**Goals of CBOs	Frequency(n=48)	Percentage
Empowerment of members	41	85.4
Poverty eradication	38	79.2
Development of entire community	35	72.9
Provision of Social Services and fostering unity	25	60
Liberation of community members	24	50

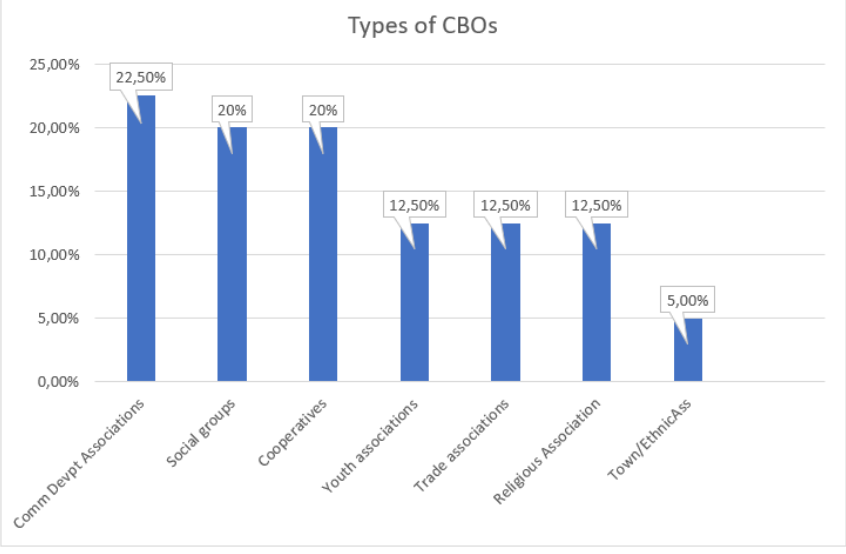
*** multiple responses,*

Source: field survey, 2023

Type of CBOs

Figure 1 shows that CBOs most common types of CBOs present in the study areas were landlord associations (22.5%), social groups (22.5%), cooperatives societies (20%) and youth associations (12.5%) among others. This finding implies that landlord associations or community development associations, cooperatives, social clubs and trade associations were prominent CBOs in the study and These associations often act as development agents within their communities. This finding is similar to the study of Odunola and Odunsi (2017) that landlord and town unions were most common CBOs in Oyo State.

Figure 1. Distribution of respondent on Types of Community Based Organisations



***multiple responses*

Source: field survey, 2023

Project/programmes undertaken by CBOs

The result in Table 3 indicated that major projects initiated and completed by CBOs in the study areas were erection of security gate at community entrance (75%), provision of vigilante and local security (70.8%), digging of boreholes (66.7%), erection of electric poles and repairs of transformers (62.5%). Others include clearing of debris and maintenance of roads (62.5%), construction of culverts (58.3%), and renovations of classrooms (50%). This implies that CBOs in the study area engaged in several developmental projects out of which provision of security facilities and services as well as infrastructural facilities such as like erection of security gates, provision of vigilante and local security services, erection of electric poles and repairs of transformers for electricity, road and maintenance of roads. These projects reflect the prioritization of physical infrastructure and community security, especially in areas typically neglected by government in rural settings. These findings support that of Odunola and Odunsi (2017), that CBOs often engage in infrastructural, economic, and security-related projects to address local development deficits. This aligns with Mercy Corps (2023) who reported that CBOs participated in constructing many agricultural training centers with demonstration plots and enhancing rural infrastructure resilience.

Table 3. Project/programmes undertaken by CBOs

**Projects	Frequency (n=48)	Percentage
Erection of security gates at community entrance	36	75.0
Provision of vigilante	34	70.8
Digging of boreholes	32	66.7
Erection of electric poles and repairs of transformers	30	62.5
Maintenance of roads	30	62.5
Construction of culverts	28	58.3
Organising vocational training	25	52.1
Renovations of classrooms	24	50
Provision of market stalls	17	35.4
Building of community halls	12	31.3
Seeds and agricultural inputs distribution	9	22.9
Provision of vocational training	7	17.5
Building of maternity and clinics	6	15

Source: field survey, 2023

Contributions of CBOs in promoting rural community development

Table 4 ranks the contributions of CBOs based on mean scores. The most prominent contribution was the provision of security for community and government property (mean = 2.83). This is because that many CBOs provide security facilities and services for their communities and government properties against vandalism through erection of security gates at the community entrance and provision of local vigilantes and security to protect lives and properties against criminal elements in their communities since government alone cannot do it. Planning and implementing of developmental projects (mean = 2.70) ranked second among CBO contributions, The is attributed to the fact many of the CBOs in the study area engaged in various self-help projects such rural electrification, construction of culverts, road maintenance among others in their communities to complement government efforts. Promotion mutual understanding among members (mean = 2.65) ranked next among the major contribution of CBOs. This is done through socialization and interaction of CBO members during regular meetings to promote team spirit, peace and unity in the community. Mobilization of members (mean=2.54) ranked. This is achieved through motivating and encouraging members of CBOs to participate and take collection action in community development activities. Another contribution is the involvement of CBOs in economic empowerment programmes (mean=2.42). CBOs often focus on organizing vocational trainings to build the capacity and boost the income generating activities of their community members and provision of financial assistance to alleviate poverty. Others contributions of CBOs are raising fund and resources for project execution by encouraging their members to give their time, skill, labour and money for the success of the projects (mean=2.32), and liaison with government for assistance (mean = 2.10) among others. This finding is in tandem with the previous works of Bamiwuye and Adisa (2015), Odunola and Odunsi (2017), Yidau et al., (2021) and Oparaojiaku and Ekumankama (2020), Wachieni et al. (2023) and Udeuhele and Offor, (2023) emphasizing the wide-ranging contributions of CBOs to rural development which include economic initiatives such as income generation and micro-credit; social programmes like education, gender equity and youth empowerment; infrastructural development (water, roads, electricity), health services like preventive care and maternal health; and environmental conservation efforts (conservation, sanitation. Recent data from World Bank (2025) further buttress the contributions of CBOs in facilitating infrastructure investments that empower rural economic activities and security through community-led linkages.

Challenges Faced by CBOs in Rural Development

Table 4. Contributions of CBOs to community development

Contributions of CBOs	Mean
Provision of security for the community or government projects.	2.83
Planning and implementing of developmental projects	2.70
Promotion of mutual understanding among members	2.65
Mobilization of members	2.54
Involvement Economic empowerment programme (skill acquisition, financial assistance to start small businesses and training).	2.42
Raising fund and labour for project execution.	2.32
Liaison with government and NGOs for assistance	2.10
Provision of infrastructure.	2.37
Protection of communities' image	1.67
Providing technical support and training for rural people	0.53

Source: field survey, 2023

As shown in Table 5, the major challenges facing CBO performance in community development were inadequate fund (mean=1.85), inadequate government supports (mean =1.70), and inadequate community supports (mean =1.11). Others included misappropriation of funds by leaders (mean= 0.86), lack of cooperation among members (mean = 0.76) and regular conflicts among members (mean = 0.65). This implies that inadequate funds and inadequate government support were the major constraints limiting CBOs contribution to rural community development in the study area. These findings underscore the pressing need for enhanced governmental and institutional support to maximize the developmental potential of CBOs. They also point to the importance of internal accountability and cohesion. Similar challenges were reported by Owolabi (2018), who noted that funding deficits and poor coordination limit CBO effectiveness in Ondo State. In the same vein, Udeuhele and Offor, (2023) reported that leadership disputes, elite capture, corruption, and poor accountability mechanisms undermine CBOs efforts in rural community development.

Table 5. Challenges Faced by CBOs in Rural Development

Challenges	Mean	Rank
Inadequate fiancé/fund	1.85	1st
Lack of government supports.	1.70	2nd
Inadequate community supports.	1.11	3rd
Misappropriation of funds by leaders	0.86	4th
Lack of cooperation between members.	0.76	5th
Regular conflict among members.	0.65	6th
Lack of accountability.	0.51	7th
Poor attendance in meetings	0.16	8th
Lack of transparency	0.15	9th
Class segregation among members.	0.08	10th
Poor attendance at meeting.	0.06	11th
Inadequate planning, implementation and supervision of programmes and projects.	0.05	12th
Existence of faction among members.	0.03	13th

Source: field survey, 2023

Hypotheses testing

Table 6 reveals that leadership tenure (r=-0.589), operational constitution (r=0.183), membership strength (r=0.636), and revenue generation capacity (r=0.734) were significantly correlated with the contribution of CBOs in enhancing sustainable development. The inverse relationship between leadership tenure and contribution to community development, suggests that longer tenures may not necessarily translate into increased effectiveness, this may be due to leadership fatigue, resistance to innovation, or a lack of rotational leadership. Also. direct correlation between operational constitution and CBO contributions, implies that CBOs with written constitutions will demonstrate greater organizational discipline and accountability, which may enhance developmental outcomes. Besides, positive correlation between membership strength and CBO contribution, indicates that CBOs with larger memberships are better positioned to mobilize resources, manpower, and collective action for development than CBOs with fewer members. This is in line with the findings of Abegunde (2017) that number of memberships has correlation with socio-physical activities and projects carried out by the CBOs in his studies. Finally, positive relationship between revenue

generation capacity of CBOs and their contribution to community development, implying that the higher financial viability is a critical factor of CBO performance in rural development activities. These results support the functionalist perspective that structural and functional attributes of institutions affect their roles and performance in maintaining societal order and facilitating development, as applied in recent rural resilience models (SWTP, 2024). Since there is statistical relationship between leadership tenure, use of operational constitution, membership strength, revenue generation capacity and contribution of CBOs in enhancing sustainable development, the null hypothesis is rejected and alternative hypothesis is accepted

Table 6. Relationship between selected variables and Contributions of CBOs to rural community development

Variables	Correlation coefficient	P-value
Leadership tenure	-0.589**	0.000
Operational Constitution	0.183**	0.014
Membership strength	0.635**	0.000
Revenue generation capacity	0.734**	0.003
Number of Meeting held	0.233	0.067
Decision making	-0.039	0.605

Source: field survey, 2023

CONCLUSION

This study assessed the contributions of CBOs to rural development in Osun State, Nigeria. The findings reveal that the majority of CBOs have existed for over a decade, are governed by written constitutions, and operate through democratic leadership selection. CBOs actively engage in development activities such as providing community security, infrastructure development, and economic empowerment initiatives. The most prevalent CBOs are landlord associations, social groups, and cooperative societies, all of which prioritize both individual empowerment and communal well-being. Despite their significant contributions, CBOs face notable challenges such as insufficient funding, lack of government support, and internal management issues. Statistically, organizational attributes such as leadership tenure, membership size, and financial capacity are significantly associated with their contributions to community development. These findings reaffirm the critical role of CBOs as grassroots actors in development and the need to support their efforts through improved institutional and policy frameworks.

Based on the study's findings, the study recommends, governments at local, state, and national levels should recognize and institutionalize the role of CBOs in rural development. This includes providing financial support, technical assistance, and policy incentives that enable effective implementation of self-help initiative. Regular leadership rotation and transparent electoral processes should be emulated by the CBOs to avoid stagnation and ensure accountability. Besides, leadership training and capacity building for both leaders and members should also be organized by the government at all levels and relevant stakeholders to improve managerial competencies. Furthermore, income generation drives of CBOs should be improved by exploring partnerships with NGOs, private donors, and microfinance institutions. Also, CBOs need to increase their membership base through inclusivity, especially for women and youth, as these can enhance their financial and operational capacity. Finally, all CBOs should be encouraged to operate with formal constitutions that define roles, decision-making processes, and governance structures to ensure accountability and organizational coherence. The future research can focus on comparative analysis of registered and unregistered CBOs' contributions to rural community development.

Author Contributions

FM conceptualized the research, designed the research instrument and methodology, participated in data analysis, writing, and reviewing of the manuscript; BDL participated in data analysis, writing, and reviewing of the manuscript; SOS participated in writing, reviewing and editing of manuscripts. FAR participated in writing, reviewing and editing of manuscripts; AIA participated in reviewing and editing of manuscripts. ODP participated in the collection of data. All authors contributed to the outcome of the paper.

Conflicts of interests

The authors declare that there are no conflicts of interest.

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THE ROLE OF TRADITIONAL FARM RISK MANAGEMENT STRATEGIES ON REDUCING CREDIT RISK IN TANZANIA AGRICULTURAL LENDING

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Abstract: *Agricultural financing enhances food security, job creation, a transition from subsistence to commercial farming, and strengthens the overall economy. However, due to unfavorable weather and market conditions there is limited financing directed towards agriculture especially in developing countries. Despite smallholder farmers' high adoption rate of tradition risk management strategies to minimizing these risks, little has been done to examine its moderating role on the relationship between agricultural risks and credit risk. This study examines the role of farm business risk management strategies on minimizing the influences of production and market risk on smallholder farmers loan repayment capacity. The quantitative study used pooled cross-sectional data from a Tanzanian commercial bank from 2019 to 2021, covering 1,277 farmers from different administrative regions. Using binary interaction effect logistic regression analysis model, the study's results indicate that irrigation, mechanization, and off-farm diversification significantly minimizes the effects of production and market risk amongst smallholder farmers in Tanzania, an indication that traditional risk management strategies are effective tools amongst smallholder farmers. On the contrary, on-farm diversification strengthens the influence of production and markets risk on loan repayment amongst the smallholder farmers in Tanzania, the results that can be influenced by a number of factors, including poor diversification knowledge among smallholder farmers. In light of these findings, the study recommends that policymakers and other development partners to develop agricultural infrastructure and provide more extension agents that can educate smallholder farmers on the best practices on traditional risk management strategies.*

Keywords: *credit risk, traditional risk management, smallholder farmers*
(JEL code: Q14)

INTRODUCTION

Around 1.2 billion people globally live in poverty, with roughly 75% residing in rural areas and dependent on farming for their livelihoods. In recognition of this challenge, boosting agricultural investment in developing countries is a central pillar of the new Sustainable Development Goals (SDGs) (Soria et al., 2019). By 2050, the industry will require at least US$80 billion annually (Chepwambok et al., 2021; World Bank, 2019). This snapshot reflects that agriculture's future is tied to significant investment. However, a major hurdle exists: unfavorable weather and market conditions, identified by rural households in low-income countries as critical threats to productivity, income and overall resilience. In response to these challenges, there is limited financing directed towards agriculture.

Agricultural sector is dominated by the smallholder farmers with the estimation that they hold 75% of agricultural land and contribute at least 80% of the world's food production (Adamopoulos & Restuccia, 2014). In the context of Tanzania, the situation is not different where by Tanzania sample census of agriculture 2019/20 indicates that most of the Tanzanians engaged in Agriculture are smallholder farmers who grow a wide variety of annual and perennial crops, cash crops and a wide variety of fruits and vegetables. According to the report, smallholder farmers have a strong dominance in all the categories of crops (URT, 2021).

Smallholder farmers in developing countries are vulnerable to production risks and market risks (Ali et al., 2020), however, the majority lack access to institutional risk management tools such as crop insurance, and thereby rely on traditional measures (Birthal et al., 2021). Despite efforts to encourage adoption of agricultural insurance to mitigate production risks, studies still indicate there is poor adoption. Factors such as liquidity constraints, discount rates, basis risk,

and trust issues contribute to the low demand for insurance among smallholder farmers (Ali et al., 2020).

A study by Knapp et al. (2021), enlightens on the role of traditional risk management strategies on mitigating the effects of productions and market risks and they find both substitutive and complementary relationship of the use of these strategies especially in Europe. Scholars have documented a wide use of traditional risk management by smallholder farmers ranging from on-farm diversification, irrigation, off-farm diversification, and mechanization, indicating their significance on improving farm yield (Birthal et al., 2021; Chigunhah et al., 2020; de Roest et al., 2018; Jena & Tanti, 2023). Limited by the shortcomings of individual traditional strategies separately, which often cover a narrow range of risks, risk-averse smallholder farmers typically adopt a portfolio of strategies to address the diverse threats they face (Akhtar et al., 2021).

Given the multiple adoption of traditional risk management strategies by smallholder farmers, it is to the knowledge of the researcher that little is known on the influence of the traditional risk management strategies on buffering farm business production and marketing risks influence on the repayment capacity of a smallholder farmer. Therefore, the aim of this study is to examine the influence of the traditional risk management strategies (irrigation, on-farm diversification, off-farm diversification and mechanization) on production risks and market risks association with farmer's repayment capacity.

MATERIALS AND METHODS

The study is based on a database from a Tanzanian commercial bank of smallholder farmers who obtained loans in years 2019, 2020, and 2021. The study utilized pooled cross-sectional data and a farmer as a unit of analysis. The commercial bank categorised farmers into two major groups: farmers who have repaid their loans and the farmers who have defaulted their loans. The commercial bank uses the BCBS definition on default event which states that for risk-weighting purposes under the standardized approach, the default exposure is defined as one that is past due for more than 90 days (BCBS, 2017). Other essential data for the study are temperature and rainfall (sourced from the Tanzania Meteorological Agency - TMA), information on diseases/pests and policy (obtained from the Ministry of Agriculture), and price volatility (sourced from the Ministry of Industry and Trade). Given the volatility of the macroeconomic variables during the study period and the collinearity among the macroeconomic variables, the study used regional GDP growth rate (obtained from the Bank of Tanzania - BoT) as the macroeconomic indicator.

Analysis model

Given that the dependent variable in this study can only assume values of either 0 or 1, it adheres to the Bernoulli distribution.

$$f(y_i|x_i) = P_i^{y_i}(1-P_i)^{1-y_i} \quad \ldots\ldots 1$$

Where y={0,1}, the P= probability function

Both Non-linear Least Squares (NLS) and Maximum Likelihood (ML) models are proficient in estimating binary models. The prevalent approach involves Maximum Likelihood, wherein the parameters are determined to maximise the log-likelihood function.

$$Log\ L(x_i;\theta) = \sum_{i=1}^{N}\left((Y_i\ LogP_i + (1-Y_i)Log(1-P_i)\right) \quad \ldots\ldots 2$$

Given the specific nature of the study, where loan data exhibit a distribution with a considerably fatter tail compared to the normal distribution, the application of the probit model is hindered due to its reliance on normally distributed data. The independent variables include farm business risks, macroeconomic factors, and the risk management strategies adopted by the farmer. Additionally, various socio-economic control variables related to the farmer, as documented by different scholars, were incorporated into the model, as they are known to influence and control the relationship of the stated variables above.

The logit model was applied in this study, utilising a dummy dependent variable representing the loan repayment capacity.

$$Prob(x) = \frac{e^{x'\beta}}{1+e^{x'\beta}} = \Lambda(x'\beta) \quad \ldots\ldots 3$$

$\Lambda(.)$ indicates the logistic cumulative distribution

The estimation model is formulated based on the maximum likelihood function for estimating binary models, as presented below.

$$Log\ L(x_i;\theta) = \sum_{i=1}^{N}\left((Y_i\ log\ P_i + (1-Y_i)Log\ (1-P_i)\ )\right) \quad \ldots\ldots 4$$

But $P_i = F(x_i'\beta)$ 5

$$P_i = F(\beta_0 + \beta_a A_t + \beta_b B_{it} + \beta_c C_{it} + \varepsilon_i) \quad \ldots\ldots 6$$

$$Log\ L(x_i;\theta) = \sum_{i=1}^{N}\left((Y_i\ LogF(x_i'\beta) + (1-Y_i)Log(1-F(x_i'\beta))\right) \quad \ldots\ldots 7$$

Where $P_i = Probability\ of\ loan\ repayment;$

Y_i : *Loan repayment capacity*

Moreover, F(.) is the cumulative density function.

Where:

$\beta_a, \beta_b\ and\ \beta_c$ are coefficients of independent variables,

A_t are farm idiosyncratic variables

B_{it} are production and market variables

C_{it} It is a macroeconomic variable (GDP)

The study utilises interaction effect logistic regression to examine the moderating influence of various conventional farm risk management strategies adopted by farmers in addressing both production and market risks on their repayment capacity. In logistic regression with predictors X_1 and X_2, an interaction model is defined by interpreting the effect of variable X_1 contingent on the value of variable X_2 and vice versa. The fundamental interaction effect model involves a predictor variable obtained by multiplying the two regular predictors. The estimation model is derived from the maximum likelihood function for estimating binary models, as depicted in equations 4, 5,

and 7. Equation seven is subsequently adjusted to encompass the interaction effect.

$$P_i = F(\beta_0 + \beta_a A_t + \beta_b B_{it} + \beta_c C_{it} + \beta_d X_1 X_2 + \varepsilon_i) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{8}$$

Where:

X_1X_2 is the interaction term.

Therefore, the study utilised interaction effect logistic regression to explore whether a substantial difference exists in the effect of market variables on the repayment capacity between farmers involved in post-harvest processing and those who are not. Furthermore, the study applied an interaction effect logistic regression model to evaluate the influence of traditional farm business risk management strategies on the repayment capacity of farmers facing production and market risks.

Table 1. Measurement of variables

	Independent variable	
1	Loan Repayment Status	Binary variable denoting whether the farmer successfully repaid a term loan. (1 = Loan repaid, 0 = Default)
	Control variables (Idiosyncratic factors of the farmer)	
2	Gender	The Binary variable indicates female and male ownership, with male ownership as the reference group.
3	Age	Number of years
4	Farm Size	The number of acres owned by a farmer
5	Farmer's experience	The number of years in cultivating a specific crop.
6	Family size	Number of individuals living in the farm household.
	Farm business risks	
7	PVOL (Price Volatility)	The annual coefficient of variation is obtained from the monthly average price of a specific crop in the region where a farmer cultivated the crop. Adopted from the studies by Kobzar et al., 2004; Huchet-bourdon, 2011). $CV = \frac{\sigma}{\bar{X}}$ CV = Coefficient of variation σ = Standard deviation
8	RAINVOL (Rain variability)	The annual standard deviation of the monthly average rainfall in millimetres for the district where a farmer cultivated the crop. Adopted from the studies by (Mwaura and Okoboi, 2014; Harkness et al., 2023). $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(P_i - \bar{P})^2}$ σ = Standard deviation N = Number of months P_i = Average rainfall in the ith month. $\bar{P}$ = Mean rainfall in a given year

9	TEMPVOL (Temperature variability)	The annual standard deviation of the monthly average temperature in degrees Celsius for the district where a farmer cultivated the crop. Adopted from the study by (Mwaura and Okoboi, 2014; Harkness et al., 2023) $\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(P_i - \bar{P})^2}$ σ = Standard deviation N = Number of months P_i = Average temperature in the ith month. $\bar{P}$ = Mean temperature in a given year
10	Diseases	Binary variable indicating the occurrence of acute diseases or pests affecting the crop for which the farmer secured a loan in a particular district during a specific year. The occurrence of diseases/pests is set as a reference.
11	Policy	Binary variable indicating the imposition of an export ban on the crop for which the farmer secured a loan during a specific year. The presence of an export ban is a reference.
	Macroeconomic variable	
12	ln_GDPR	Natural logarithm of Gross Domestic Product Growth Rate in the region where a farmer cultivated the crop.
	Risk management strategies	
13	Post-harvest processing	Binary variable indicating whether the farmer engages in post-harvest crop value addition. Post-harvest processing serves as a reference.
14	Irrigation	Binary variable indicating whether the farmer is practising irrigation. Irrigation sets as a reference.
15	Mechanisation	Binary variable indicating whether the farmer does not use a hand hoe as a major tool in agricultural activities. Mechanical tools other than the hand hoe sets are used as a reference group.
16	On-farm diversification	Binary variable indicating whether the farm engages in mixed farming or not. Farmers engaging in mixed farming serve as a reference group.
17	Off-farm income	The Binary variable indicates whether the farm engages in other income-generating. Farmers engaging in other income-generating activities are set as a reference group.

Source:Authors Review of Literature

RESULT AND DISCUSSION

Descriptive statistics

Mechanisation and repayment status

This study employed the degree of mechanisation of agricultural tools in the production process to measure a smallholder farmer's mechanisation level. Table 3.1 (below) reveals that smallholder farmers who employed hand hoes successfully repaid 70.14 per cent of agricultural loans. In comparison, 97.06 per cent of agricultural loans were repaid by smallholder farmers utilising mechanised agricultural production tools. This suggests a positive association between the level of mechanisation and loan repayment. Mechanisation, in addition to increasing efficiency, can serve as a risk management tool owing to various benefits, including timely farm preparation and planting, improved handling of produce during harvesting, enhanced quality, and consequently better market prices.

Table 2. Challenges Faced by CBOs in Rural Development

Loan Repayment Status	Mechanisation		
	Hand Hoe	Mechanised	**Total**
Default	229	15	**244**
	29.86%	2.94%	**19.11%**
Loan Repaid	538	495	**1033**
	70.14%	**97.06%**	**80.89%**
Total	767	510	**1277**

Source:Commercial Bank Data (2022)

Irrigation and repayment status

The descriptive findings highlight that 82.20 per cent of smallholder farmers engaged in irrigation farming successfully repaid their loans, compared to 79.77 per cent of those who did not practice irrigation farming, as illustrated in Table 3.2. Although the two groups differ relatively slightly, irrigating smallholder farmers still exhibit a higher repayment rate than their counterparts. This marginal distinction indicates the positive association between irrigation and loan repayment. Irrigation is crucial in optimising yields, particularly in mitigating the impact of unfavourable weather conditions, including erratic rainfall and temperature variations that can affect precipitation levels in an area. This descriptive insight aligns with the perspectives of other scholars, including (Terry and Ogg, 2017; Birthal et al., 2021; Koide et al., 2021; Vo et al., 2021), emphasising the significance of irrigation in agricultural practices.

Table 3. Irrigation and Repayment Status

Loan Repayment Status	Use of an irrigation system or not		
	No irrigation	Irrigation	**Total**
Default	139	105	**244**
	20.23%	17.80%	**19.11%**
Loan Repaid	548	485	**1033**
	79.77%	**82.20%**	**80.89%**
Total	687	590	**1277**

Source:Commercial Bank Data (2022)

On-farm diversification and repayment status

In Table 3.3, 79.22 per cent of smallholder farmers practising mixed farming successfully repaid their loans, contrasting with the 86.33 per cent repayment rate among smallholder farmers who did not engage in mixed farming. The results indicate that, despite the benefits of mixed farming, which include the potential to stabilise income by addressing various production and marketing risks, smallholder farmers practising mono-cropping have a better repayment rate than smallholder farmers who practice mixed farming. The results display the superiority of economies of scale over the economies of scope philosophies.

Table 4. On-farm Diversification and Repayment Status

Repayment Status	On-farm diversification		
	No On-Farm diversification	On Farm diversification	**Total**
Default	41	203	**244**
	13.67%	20.78%	**19.11%**
Loan Repaid	259	774	**1033**
	86.33%	**79.22%**	
Total	300	977	**1277**

Source:Commercial Bank Data (2022)

Off-farm diversification and repayment status

The descriptive findings of this study reveal that 93.57 per cent of smallholder farmers who secured loans from banks and had additional sources of income beyond agriculture successfully repaid their loans. In contrast, only 68.85 per cent of smallholder farmers relying solely on agricultural projects could repay their loans, as displayed in Table 3.4. As anticipated, having multiple income sources implies diversifying investments beyond agricultural production. This approach enables smallholder farmers to establish income streams that correlate negatively with the agricultural sector. Consequently, the failure of the agricultural sector may not impact the alternative income sources in the same manner, contributing to the over-

all stability of a smallholder farmer's income. This ability to diversify income sources is reflected in a smallholder farmer's capacity to meet debt obligations even when the agricultural sector underperforms. Aligning with the principle emphasised by Markowitz (1952) that rational investors seek to minimise risk, smallholder farmers are expected to develop additional investment options that collectively reduce overall risk. Not all production periods and farm activities occupy the smallholder farmer's time, so farmers can enhance productivity by engaging in other non-farm economic activities.

Table 5. Off-farm Diversification and Repayment Status

Repayment Status	Off-farm diversification		
	No Off-farm diversification	Off-farm diversification	Total
Default	204	40	244
	31.15%	6.43%	19.11%
Loan Repaid	451	582	1033
	68.85%	93.57%	80.89%
Total	655	622	1277

Source:Commercial Bank Data (2022)

Influence of Traditional Risk Management Strategies on Reducing Loan Repayment Risk

Risk management is an important aspect of any business, given the inherent nature of the impossibility of forecasting future income with certainty. Different strategies can be adopted to mitigate, transfer, accept or minimise the risk related to a business. Given the setting and nature of the agricultural business projects, especially those owned by smallholder farmers, the adoption of risk management strategies is primarily traditional as opposed to modern strategies such as insurance. Thus, the following sections examine the association between traditional risk management strategies that smallholder farmers adopt and the risks they face in their business projects.

Influence of irrigation on reducing production risks

The interactive logistic regression model results, showcased in Table 3.5, indicate that irrigation weakens the association between price volatility and repayment status. However, the relationship is not significant. This result implies that irrigation minimises the influence of price volatility risk on reducing the likelihood of smallholder farmers' loan repayment capacity. The result supports that irrigation improves the crop yield of a smallholder farmer in both quantity and quality. The improvements can create a competitive advantage for a smallholder farmer. The advantages come with the ability of smallholder farmers to offer superior produce in the market and supply the produce when the supply is low because of their ability to produce throughout the year. Given all these factors, a smallholder gets the advantage of fetching a better price in the market and an improved position on loan repayment.

Further, the results indicate that irrigation significantly weakens the association between rainfall variability risk and repayment status ($p<0.05$). These results indicate that irrigation weakens the ability of rainfall variability to lower the likelihood of the loan repayment capacity of the smallholder farmer. This condition means irrigation supplements the production process when the weather is not conducive to water supply from rainfall. It allows the farmer to have more production cycles in the year. Further, it enables the farmer to evade the pig cycle, a phenomenon whereby a farmer falls victim to producing in large quantities when every farmer is producing, which leads to a loss of the power to control the supply. According to Birthal et al. (2021) Irrigation can enhance crop yields and offer protection against severe climatic shocks, including droughts, thus shielding farm income variability across production periods. Further, according to Koide et al. (2021), irrigation can improve weed control and increase yield, doubling the profitability. Similarly, irrigation weakens the association between temperature variability risk and repayment status. However, the relationship is not significant. The results indicate that irrigation can lower temperature variability risk and reduce the likelihood of a smallholder farmer's repayment status. Irrigation can also regulate the soil temperature and improve the soil condition for the belowground biodiversity of numerous taxa at the field scale, thus improving ecological functioning.

Influence of mechanisation on reducing farm business risks

The results of the interaction logistic model, as presented in Table 3.5 above, indicate that mechanisation weakens the association between temperature variability risk and loan repayment status ($p<0.1$). These results suggest that mechanisation minimises the influence of temperature variability risk on reducing the likelihood of smallholder farmers' loan repayment capacity. Given its ability to plough deep and turn the soil upside down, mechanisation improves soil aeration, a crucial aspect of soil ecology. Improved soil ecology recovers soil fertility, which improves farmers' productivity and sustainability. Generally, mechanisation can enhance crop yield quality through proper handling pre- and post-harvesting. These findings are supported by other scholars, such as Van den Berg et al. (2007), Sanaullah et al. (2021) Mingzi et al. (2022), and Jena and Tanti (2023).

The results suggest that mechanisation strengthens the association between price volatility and loan repayment capacity. However, the relationships were not significant. This means that mechanisation enhances the ability of price volatility risk to reduce the likelihood of loan repayment, thereby weakening their loan repayment capacity. Given the nature of smallholder farm size, attaining economies of scale, given that the small average farm size is poor, leads to inefficient use of mechanical tools. As the average farm size of a Tanzanian smallholder farm is 2.1 ha (Rapsomanikis, 2015; URT, 2021b), It is apparent that it is difficult to reap the benefits of mechanisation by attaining the economies of scale, given the level of tools invested. On the other side, Chavas et al. (2015) describe how technological changes, including mechanisation, can alter the sensitivity of aggregate farm crop supply to external shocks, influencing the variability of food prices. As Alston et al. (2012) emphasised, innovation and technological changes in agriculture profoundly affect the structure of agricultural production, markets, and trade. Technological changes can alter the size and significance of food price volatility by affecting the sensitivity of aggregate farm supply to external shocks and changing the price elasticity

of supply or demand. In essence, technological changes have the potential to influence food price variability and, consequently, the repayment capacity of farmers.

Similarly, the results indicate that mechanisation strengthens the association between pests/diseases and repayment status. Nonetheless, the relationship was not significant. The results indicate that mechanisation strengthens the likelihood of pests/ diseases reducing smallholder farmers' loan repayment status. Given that most smallholder farmers practice economies of scale, Takeshima et al. (2020) state that mechanisation can raise or lower the economies of scope (EOS) depending on the differences or similarities in agroecological conditions in the selected crop.

Table 6. Influence of traditional risk management on the association of farm business risk and repayment status

	Irrigation	Off-farm diversification	On-farm diversification	Mechanisation
Price Volatility	-3.015	0.164	-1.52	3.48
	(4.412)	(2.808)	(5.315)	(3.563)
Rainfall Variability	-0.029**	-0.007	0.047**	-0.014
	(0.012)	(0.013)	(0.022)	(0.019)
Temperature Variability	-1.074	-0.454	1.922	-2.082*
	(1.247)	(1.006)	(1.618)	(1.217)
Export ban (Policy)		-0.635	1.646	
		(1.012)	(1.514)	
Diseases/Pests		0.085	12.158	0.996
		(1.022)	(957.486)	(1.307)

Source: Commercial Bank Data Analysis Stata Results (2022)

Influence of off-farm income on reducing farm business risks

The interaction logistic regression model results, as presented in Table 3.5, suggest that off-farm income weakens the association of farm risk related to rainfall variability, temperature variability and policy related to the export ban on repayment status. The results infer that off-farm income weakens the likelihood of rainfall variability; temperature variability and policy related to export bans to reduce smallholder farmers' loan repayment capacity. As discussed earlier, farmers diversifying into non-farm-related economic activities offer several benefits. Firstly, the smallholder farmer creates the ability to efficiently use his/her time after agricultural working time, as well as the time when there is minimum agricultural work, given that the majority of smallholder farmers use rainfed farming system. Secondly, when properly executed, off-farm diversification offers a cushion on income when the agricultural projects face challenges related to rainfall variability risk, temperature variability risk and risk related to the export ban. Income raised from economic activities with a negative or zero relationship with the crop risks can be used to cover the smallholder farmers' losses and loan instalments. However, the success of the off-farm depends much on the selection of the portfolio and the nature of the association of the farm and off-farm business.

Contrary to the study expectations, off-farm income strengthens the association between price volatility and the smallholder farmers' repayment status and diseases/pests and the farmers' repayment status. However, the associations were not significant. It is imperative for farmers to carefully select off-farm income activities to ensure a negative or uncorrelated relationship with farm income. Opting for activities positively correlated with farm business can exacerbate the risks linked to price volatility, diseases, and pests.

In line with these findings, other scholars propose a nuanced relationship between off-farm income and the risks faced by farmers during production and marketing. Beck et al. (2019) observe that farm households respond to low coffee prices by increasing adult wage labour within the household. Similarly, Jin et al. (2021) suggest that smallholder rubber farmers shift family labour from farms to off-farm employment in the face of declining rubber prices. Additionally, Key et al. (2017) assert that farm income exhibits greater volatility than off-farm income. Consequently, farmers strategically diversifying their business portfolio with zero or negatively correlated business lines may effectively offset the impacts of farm business risks. In contrast with the findings, A. Ullah et al. (2018) highlight that farmers' involvement in off-farm income negatively impacts their technical efficiency, reducing overall income.

Influence of on-farm diversification on reducing farm business risks

The findings from the interaction logistic regression model, presented in Table 3.5, reveal that on-farm diversification weakens the association between price volatility and repayment status. However, the association is not significant. According to the concept of diversification elucidated by Markowitz (1952), a rational farmer, akin to a prudent investor, is anticipated to select crops that maximise returns while minimising price volatility risk to an optimal level. In a set of crops with equivalent price volatility levels, a rational farmer is expected to opt for a mix of crops that yield higher returns under the same level of price volatility risk. This strategic selection involves the selection of varieties with shorter life cycles, a mix of crops that complement each other's performance in the market, and a mixture of domestic and export market-dependent.

The study further found that on-farm diversification strengthens the association between temperature variability risk and repayment status. However, the relationship was not significant. This contradicts the study's expectation that on-farm diversification will weaken the relationship. The results can be due to smallholder farmers' limited ability to create crop portfolios that follow the principles of portfolio selection suggested by the Markowitz theory of portfolio selection. Smallholder farmers should select crops with zero or negative correlations regarding their sensitivity to temperature variability risk. If the crops selected have a positive association with temperature variability, the risk impacts will be magnified. Contrary to this study, Khan et al. (2022)Farmers who have observed significant climate changes, such as decreased precipitation and increased average temperatures, have adopted various risk management strategies, including crop diversification, despite the paucity of literature to gauge their impact.

Further, the results in Table 3.5 indicate that on-farm diversification strengthens the association between crop export bans and repayment status. However, the relationship was not significant. This suggests that farmers cultivating multiple crops are less likely to repay their loans than farmers who do not practice mixed or intercropping when facing crop export bans. This can result from a lack of proper knowledge of diversification techniques for most smallholder farmers. The success of crop diversification requires well-articulated knowledge; otherwise, the benefits may not be fully realised, as evidenced by a study conducted by Quiroz and Valdés (1995). The study found that unskilled farmers producing a few state-protected crops were adversely affected during trade policy reforms due to a lack of diversification into other crops.

Adopting innovative agricultural practices (SAP) and emphasising ecological and environmentally friendly approaches underscores the significance of on-farm diversification. On the contrary, in this study, on-farm diversification strengthens the association between diseases/pests' risks and repayment status. However, the relationship was not significant. On-farm diversification has the potential to reduce crop disease frequency and severity by minimising pathogen inoculum and creating less favourable microclimates for pathogen development. However, the principles of portfolio selection that do not complement the manifestation of diseases/pests from one crop to another crop in the portfolio are crucial. Given the poor availability of extension services among smallholder farmers in rural Africa and their poor education level, it is unlikely that smallholder farmers will create a portfolio that observes the Markowitz principles of portfolio selection, which creates an area for future evaluation.

Contrary to expectations, on-farm diversification significantly strengthens the association between rainfall variability and loan repayment ($p<0.05$). This may be attributed to many farmers practising on-farm diversification, as mentioned earlier, having limited knowledge and poor access to agricultural extension services. Forming a crop portfolio mostly depends on generational inherited habits and treads on the influence of climate change and other significant and continuously changing factors. The rainfall pattern has drastically changed, requiring innovative strategies to formulate a crop portfolio to minimise the risks associated with rainfall volatility compared to the ancient ways of creating a crop portfolio. As in corporate business, creating a business portfolio requires a knowledgeable team; the agricultural extension agents should be involved in creating a smallholder farmer's portfolio that will improve and accommodate the ever-changing environment.

CONCLUSION

This study utilized econometric analysis to assess the role of traditional risk management strategies on reduction of loan repayment risk at the farm level. The analysis involved the use of secondary data from a commercial bank. Results indicates that farmers' practicing irrigation, mechanization, and off-farm diversification are more likely to pay their loans while facing production and market risks. However, farmers practicing irrigation are more likely to minimize risk related to rainfall variability, temperature variability, and price volatility. On the other hand, farmers practicing mechanization are more likely are more likely to minimize risks related to temperature variability and rainfall variability, although the later relationship was not significant. Further, smallholder farmers who practice off-farm diversification minimizes the risk related to rainfall variability, temperature variability and export ban, however the influence was not significant. Lastly the study indicated that on-farm diversification does not have a significant influence on minimizing the influence of production and market risks amongst the smallholder.

In light of these findings, the study recommends that policymakers to improve and develop, irrigation systems, improve the availability and affordability of farm machinery and technology as well as the availability of extension agents.

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EXPLORING THE MEDIATION EFFECT OF PERCEIVED USEFULNESS ON CROP DIVERSIFICATION DRIVERS AMONG SMALLHOLDER COCOA FARMERS IN TANZANIA

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Abstract: *Despite recent transformations in the marketing structure that led to sharp increases in cocoa prices, the living standards of smallholder cocoa farmers in Tanzania remain low. This study examines the drivers that influence smallholder cocoa farmers in Kilombero, Tanzania, to engage in multiple-crop farming as a strategy for poverty alleviation.Using a cross-sectional survey design, primary data were collected from 501 cocoa farmers who were selected based on convenient sampling technique from 162 Agricultural Marketing and Cooperative Societies (AMCOS) in Kilombero District. Data were analyzed based on covariance-based structural equation modeling (SEM) which was run using Analysis of variance Structure (AMOS) software.Results revealed that cocoa market price, payment waiting time, farm size, and cocoa farm income significantly influenced farmers' investment decisions, mediated by their perceptions of success. In contrast, off-farm income showed no statistically significant effect on investment decisions when perception was considered.The study focused exclusively on investment decisions among smallholder cocoa farmers in Tanzania, limiting the generalizability of findings to other contexts.Policy makers should strengthen marketing factors such as cocoa pricing and payment timelines to enhance farmers' financial capacity. Farmers, on the other hand, are encouraged to expand farm sizes and adopt improved agronomic practices as promoted by extension officers to boost productivity.This study contributes to the literature by highlighting cocoa-specific factors that shape smallholders' decisions to diversify into other crops, addressing a gap left by previous studies that emphasized non-cocoa factors.*

Keywords: *Smallholder Farmers; Cocoa; Crops Diversification; Perceived Usefulness; Kilombero*
(JEL code: Q12, Q14)

INTRODUCTION

Agriculture remains the backbone of Tanzania's economy, employing the majority of the rural population and contributing significantly to food security and livelihoods (Kitole et al., 2023). Within this sector, smallholder farmers play a critical role, yet they often face challenges such as fluctuating commodity prices, climate variability, and limited access to markets and inputs (Choruma et al., 2024). Cocoa, though not as dominant as coffee or cashew in Tanzania, has emerged as a promising cash crop in certain regions (Molela, 2017). However, reliance on cocoa alone exposes smallholder farmers to economic risks, including price volatility in global markets and vulnerability to pests and diseases (Ebenezer, 2023). Crop diversification has increasingly been recognized as a sustainable strategy to enhance resilience, improve household income, and ensure food security (Mihrete and Mihretu, 2025). By integrating cocoa with other crops such as maize, cassava, bananas, or horticultural produce, farmers can spread risks, stabilize earnings and strengthen ecological sustainability (Amuda and Alabdulrahman, 2024). Diversification also aligns with Tanzania's broader agricultural development goals, which emphasize climate-smart practices, value addition and poverty reduction (Jones, 2023).

Crop diversification is rarely a single decision, it emerges from a web of human, institutional, and biophysical factors (Blesh et al., 2023). Higher education levels tend to increase adoption of diversification because farmers better interpret market signals, manage risk, and integrate new practices (Bodago, 2024). Education is often associated with greater use of information, planning, and record-keeping that support diversified systems. More years of experience can cut both ways. In some contexts, experience strengthens adaptive strategies and local knowledge of mixed cropping; in others, it entrenches specialization in familiar cash crops (Holmelin, 2021). The study stated further that, empirical results often

show a positive association with diversification when experience is coupled with access to information and markets.

Regular contact with extension officers and participation in trainings increase awareness of agronomic options, intercropping benefits and market opportunities, thereby raising the likelihood and intensity of diversification (Ongachi & Belinder, 2025). Not just access, but relevance, consistency, and participatory approaches matter. Tailored advice on crop rotations, input management, and post-harvest handling supports viable diversification pathways (Mihrete & Mihretu, 2025). Availability of basic equipment (tillers, sprayers, irrigation kits) reduces labor bottlenecks and enables cultivation of multiple crops with timely operations (Gautam et al., 2023). Studies note that better equipment access correlates with more diversified cropping portfolios, especially when paired with input supply chains. Seeds, fertilizers and pest management tools for different crops are prerequisites; diverse input availability and reliability push farmers beyond monoculture. Heterogeneous plots (variation in fertility, slope, microclimate) encourage crop matching and diversification to exploit niches and spread risk (Mihrete and Mihretu, 2025). Poor soils can either discourage diversification (limited viable options) or motivate shifts into resilient crops depending on advisory support and markets (Mihrete and Mihretu, 2025). Larger holdings allow experimentation and spatial diversification; fragmented plots can also foster diversification if micro-conditions differ, though they raise transaction and labor costs. Stable water access enables year-round and multi-season cropping, horticulture, and higher-value diversification (Traoré et al., 2025). The study stated further that, unreliable water typically narrows options to drought-tolerant staples and reduces diversification intensity. More labor (family or hired) increases the feasibility of managing diverse crops with staggered calendars (Onyekuru, 2024).

Labor constraints often push specialization unless mitigated by equipment or cooperative arrangements. Liquidity and access to credit reduce the risk of trying new crops, cover input costs and bridge cash-flow gaps until harvest (Boansi, 2024). Prior studies consistently find that financial access is a strong positive driver of diversification. Proximity to markets, road quality, and buyer networks translate diversification into revenue (Blesh et al., 2023). Where market linkages and price information are strong, farmers diversify toward profitable crops; weak markets bias toward subsistence staples. Membership in farmer groups increases information flow, collective bargaining, and input access, all of which support diversification decisions (Blesh et al., 2023). In the absence of formal insurance, diversification itself acts as a household risk management strategy (Mihrete & Mihretu, 2025). Where safety nets or off-farm income exist, farmers may diversify more confidently into higher-value but riskier crops. Likewise, gendered control over land, labor, and incomes can shape which crops are chosen (Kocabicak, 2021). Evidence suggests women's participation, especially in horticulture and legumes, increases diversification where they have decision authority and market access (Dessalegn, 2022). Input subsidies, climate-smart agriculture campaigns, and value-chain initiatives can tip choices toward diversified systems when they support multiple crops rather than single-commodity models (Muoki, 2025). Access to ICT (phones, radio, platforms) improves price discovery and agronomic knowledge, nudging diversification where opportunities are visible and timely (Singh et al., 2023).

While studies on crop diversification often emphasize general market access and price signals, few have examined how cocoa-specific price volatility influences decisions to diversify into food or alternative cash crops. Farmers' perception of cocoa's usefulness as a reliable income source may decline when prices are unstable, potentially motivating diversification. Yet, empirical evidence on this perception-driven decision-making remains scarce. Cocoa farmers often face delays between harvest and payment due to marketing structures, cooperative processes or buyer arrangements. Long waiting times reduce liquidity, constrain investment in other crops, and may push farmers toward diversification for quicker cash flows (Demir et al., 2025). Existing literature on diversification rarely integrates payment timing as a determinant, leaving a gap in understanding how cash-flow constraints shape cropping choices. Off-farm income (e.g., trading, wage labor) can buffer households against cocoa income risks (Waarts et al., 2021). Research has shown that off-farm income generally supports diversification, but specific interactions between cocoa-related off-farm activities and crop diversification in Tanzania are underexplored. Although farm size is widely studied in agriculture, the cocoa-specific context in Tanzania where cocoa is still a relatively minor crop compared to coffee or cashew has not been sufficiently examined.

Farmers' perception of usefulness may differ as larger farm owners may see cocoa as sufficient, while smallholders may perceive diversification as more useful (Attiogbé, et al., 2024). Household reliance on cocoa income directly affects diversification decisions. High cocoa income may reduce the perceived need for diversification, while low or unstable income may encourage it. Prior studies often treat farm income in aggregate, without isolating cocoa-specific income streams and their influence on diversification strategies. Understanding farmers' perception of cocoa's usefulness as a livelihood anchor is critical, yet under-researched in Tanzania. This research seeks to explore the challenges faced by smallholder cocoa farmers in Tanzania to engage in other crops apart from cocoa farming while taking into account the mediation effect of farmer's perceptions. It examines the socio-economic drivers behind diversification and the potential impacts on livelihoods focusing on personal income. Ultimately, the study aims to provide insights that can inform policy interventions, extension services and market linkages to support smallholders in building more resilient and profitable farming systems.

LITERATURE REVIEW

Overview of Cocoa Production and Agribusiness Status in Tanzania

Small-scale cocoa agribusiness in Tanzania is a growing but underdeveloped sector, with significant potential for expansion and value addition (Molela, 2016). The study stated further that, the agricultural sub-sector is dominated by smallholder farmers

cultivating 1–3 acre plots, mainly in Mbeya and Morogoro regions, and has begun attracting attention for its fine-flavor cocoa quality. About 25,000–30,000 households (nearly 100,000 people) are engaged in cocoa farming, producing 14,000–16,000 tonnes annually. Tanzania ranks 18th globally in cocoa output (Wetengere, 2021). Most cocoa farms are small-scale, intercropped with bananas and often organically managed. Farmers rely on low-input systems, using natural pest control methods like neem and aloe vera (Ghosh & Das, 2025). Common cocoa species include Forastero, Criollo, and Trinitario, often mixed within farms. Average yields are around 540 kg/acre/year, but with improved practices, yields could reach 650 kg/acre/year (Molela, 2016).

Cocoa agribusiness in Tanzania is a relatively small but rapidly growing sector, driven by smallholder farmers and increasingly recognized for its fine-flavor cocoa potential (Lwesya, 2018). It plays an important role in rural livelihoods, export diversification and agribusiness development, though challenges in productivity, market access and financing remain (Molela, 2017). The trading is organized through a formalized system that relies on auctions and warehouse receipt mechanisms, designed to stabilize prices and ensure transparency for smallholder farmers (Molela, 2025; Carodenuto et al., 2025). Dry cocoa beans are sold through auctions under predetermined terms and conditions, similar to systems historically used in Ghana and Côte d'Ivoire (Tanzania Mercantile Exchange Market [TMX], 2024). Farmers deliver their cocoa to certified warehouses, where quality is assessed and recorded. Payments are then made after auctions. The system is regulated by Tanzanian authorities to protect farmers from exploitation and to promote fair trade practices.

Potentiality for Crops Diversification by Smallholder Cocoa Farmers in Kilombero, Tanzania

Kilombero is not just a cocoa growing area, it is a multicrop hub where rice, maize, sugarcane, bananas, cassava, legumes and horticultural crops dominate (Gebrekidan, 2020; Sulle, 2017). Cocoa fits into this mosaic, often intercropped with bananas, but rice and sugarcane remain the district's economic backbone (Isager et al., 2021). According to the study, Kilombero Valley is often called the "rice bowl of Tanzania." Both irrigated and rain-fed rice are grown, with large-scale schemes and thousands of smallholder farmers. Rice is the main cash crop and staple food in the area (Isager et al., 2021). On the other hand, maize is widely grown for household consumption and local markets (Gebrekidan et al., 2020). Often intercropped with legumes to improve soil fertility. Likewise, Kilombero hosts one of Tanzania's largest sugar estates and processing factories making it one of the districts with abundant production of sugarcane hence contributes significantly to the district's economy (Sulle, 2017). Another crop grown in Kilombero is bananas which are commonly intercropped with cocoa and maize (Isager et al., 2021). The major banana variety grown in the district is plantains which serve as both food and income sources. Furthermore, cassava and sweet potatoes are grown in small scale and serve as important food security crops in the district (Lala et al., 2023). According to study, the crops are more resilient to drought. Other crops grown in small scale include the legumes such as beans, cowpeas, pigeon peas and groundnuts which are consumed locally and sold in nearby markets (Fwaya et al., 2025; Musi and Doctor, 2021). Horticultural crops such as vegetables and fruits as well as tomatoes, onions, leafy greens, mangoes, and citrus are grown in smaller plots (Lala et al., 2023).

Theoretical Literature Review

This study integrated the internal funds theory of investment and Prospect theory to explore the drivers for crops diversification by smallholder cocoa farmers in Kilombero, Tanzania. Jan Tinbergen is credited as the proponent of the internal theory of investment, first advanced in 1938 (Klein, 1951). The theory emphasizes preferences in investment financing by distinguishing between internally generated funds and external debt (Jansen et al., 2023). It posits that firms or individuals generally prefer to rely on internal funds rather than external borrowing, primarily due to the costs of credit and the risks associated with indebtedness (Ahmad et al., 2023). The strength of the theory lies in its focus on the efficient use of retained earnings to expand businesses and acquire new sources of finance, while minimizing exposure to debt-related risks (Bui et al., 2023). Applied to smallholder cocoa farmers in Tanzania, this perspective suggests that income generated from cocoa farming serves as the primary source of financing for crop diversification. Farmers are more inclined to reinvest their earnings into new crops rather than seek external loans, given the high interest rates and repayment uncertainties in rural credit markets. However, the theory does not adequately capture situations where farmers have limited or no retained earnings and are compelled to rely solely on external financing. In such cases, investment decisions including diversification into other crops are shaped not only by financial constraints but also by farmers' perceptions of risk, debt sustainability, and long-term livelihood security. This gap highlights the need to integrate farmers' subjective interpretations into the analysis of investment behavior, thereby extending Tinbergen's framework to the realities of smallholder agriculture. This weakness of the theory is addressed in the prospect theory below.

Prospect theory, introduced in 1979 by Daniel Kahneman and Amos Tversky, provides a framework for understanding decision-making under conditions of risk and uncertainty (Trichilli et al., 2021). The theory distinguishes between two behavioral scenarios: risk aversion in situations of potential gains and risk-taking in circumstances of potential losses (Wang et al., 2024). In doing so, prospect theory addresses a limitation of the internal funds theory, which does not adequately explain investment decisions when internally generated funds are insufficient. Unlike the internal funds approach, prospect theory recognizes that investors whether firms or individuals—evaluate risks and returns before committing resources, regardless of whether those resources are internally retained earnings or externally sourced capital (Wang et al., 2025).

Applied to smallholder cocoa farmers in Tanzania, both theories offer complementary insights. Internal funds theory highlights the reliance of farmers on income generated from cocoa sales as the primary source of financing for crop diversification. Prospect theory, however, extends this understanding

by explaining how farmers make diversification decisions when internal funds are inadequate, requiring them to weigh the risks and potential returns of external financing options. Together, these perspectives suggest that cocoa farmers' engagement in crop diversification is shaped not only by the availability of internal funds but also by their risk perceptions and willingness to commit resources under uncertain conditions.

Empirical Literature Review

In Tanzania, the trading of dry cocoa beans is conducted through auctions under predetermined terms and conditions, a system reminiscent of the price-setting mechanisms historically employed in Côte d'Ivoire and Ghana (United Repbilc of Tanzania [URT], 2024; Staritz et al., 2022). The establishment of price ranges serves a dual purpose: not only to provide farmers with premium returns but also to stabilize prices, which is critical for securing a living income for cocoa producers (Boysen et al., 2023). Nevertheless, despite government interventions aimed at regulating prices, market dynamics driven by demand and supply continue to exert significant influence. These forces often undermine stabilization efforts, thereby disrupting farmers' ability to achieve sustainable incomes (Musselli et al., 2025). Moreover, Ahmad (2025) highlights that unexpected price fluctuations have detrimental effects on farmers' financial capacity, particularly in limiting their ability to reinvest earnings into other agribusiness ventures. Such volatility constrains diversification and long-term resilience. However, existing analyses of the relationship between cocoa price instability and multidimensional poverty indicators remain incomplete. Specifically, they fail to incorporate farmers' perceptions, which are essential for understanding the lived realities of price shocks and for accurately gauging the strength of the relationship between market fluctuations and poverty outcomes.

The formalization of the cocoa trading system in Tanzania was designed to empower smallholder farmers by improving their access to reliable and structured markets (Molela, 2017). Despite these intentions, delays in payment following auctions have been reported to negatively affect the living income of smallholder cocoa farmers, many of whom rely on daily earnings for subsistence (Tuffour et al., 2023). Under the warehouse receipt system, Tanzanian authorities have reduced the average waiting time for payments to approximately three days (URT, 2024). This marks a significant improvement compared to earlier practices, where farmers often waited more than a month to receive proceeds from their sales.

Nevertheless, prolonged delays in payment even when shortened continue to pose challenges. Studies by Kimbi et al. (2024) and Belair (2021) highlight that such delays undermine farmers' capacity to reinvest in their farms and other agribusiness ventures, thereby constraining long-term productivity and financial resilience. Importantly, existing analyses of this relationship have overlooked the mediating role of farmers' perceptions. Understanding how farmers interpret and respond to payment delays is crucial, as perceptions shape both their economic behavior and the extent to which delayed payments translate into broader livelihood impacts.

Mutsami et al. (2025) define off-farm income as earnings generated by farmers through activities outside agriculture, either via self-employment or wage employment. Anang et al. (2023) earlier observed that such off-farm work is often pursued with the intention of generating additional income that can be reinvested into farming activities, thereby supporting agricultural productivity. Conversely, Mapunda (2024) cautions that farmers' involvement in off-farm activities reduces the time and labor available for farming, which in turn diminishes on-farm productivity.

Mtaturu (2024) further notes that both the positive and negative effects of off-farm work are weighed when farmers make decisions about investing in other agribusiness ventures. However, this analysis does not explicitly consider whether farmers' perceptions mediate the decision-making process. Since perceptions influence how farmers interpret risks and opportunities, overlooking this dimension leaves an important gap in understanding the extent to which off-farm activities shape agribusiness investment choices. Accordingly, the following hypothesis was formulated to examine whether farmers' perceptions are central to decision-making when confronted with the mixed effects of off-farm activities. Statistics indicate that more than 80% of cocoa farmers in Tanzania are smallholders, cultivating farms ranging between 0.1 and 2.5 acres (Temba and Njau, 2025). While farm size largely determines production volume, the productivity of these farms is more strongly influenced by the adoption of improved agricultural practices (Justine et al., 2025). Ayalew et al. (2024) emphasize that the effect of farm size becomes particularly significant when both production and productivity are jointly considered. Similarly, Adesiyan and Kehinde (2024) identify farm size as a critical factor influencing crop diversification among smallholder farmers. Other studies have treated farm size as a controlled variable when examining investment decisions, operating under the assumption that larger farms inherently possess greater capacity to invest in diversification and other agribusiness ventures (Tennhardt et al., 2024). Collectively, these findings suggest that cocoa farm size exerts a direct influence on investment in crop diversification. However, previous research has not adequately explored the indirect pathways through which farm size affects diversification decisions. Specifically, the mediating role of farmers' perceptions has been overlooked. Introducing farmers' perceptions as an intervening variable helps to bridge this gap, offering a more nuanced understanding of how farm size shapes diversification outcomes beyond its direct effects.

Income from cocoa farming constitutes the primary source of earnings for 73.1% of farmers in cocoa-producing areas of Tanzania (Temba and Njau, 2025). On average, a farmer cultivates 1.27 acres, generating an annual income of USD 1,643.70, which translates to approximately USD 1,294.25 [1 USD ≈ TZS 2,410] per acre. Molela (2017) estimated the total production cost of operating one acre of cocoa from land preparation to harvesting at USD 228.97 [1 USD ≈ TZS 2,410]. This cost structure leaves farmers with a gross margin of USD 1,065.29 [1 USD ≈ TZS 2,410] per acre per annum. However, when household expenditures are factored in, the gross profit is effectively eroded, resulting in a net loss of USD 101.49 [1 USD ≈ TZS 2,410] per acre per annum (Harris et al., 2024).

Under such circumstances, farmers are left with little or no surplus to invest in crop diversification schemes. Despite this financial strain, Dogeje et al. (2024) found that cocoa income nonetheless plays a significant role in enabling investments in crop diversification. This apparent contradiction underscores the need for further inquiry. Specifically, previous studies have not examined whether farmers' perceptions mediate the relationship between cocoa income and diversification decisions. Introducing perception as an intervening variable provides a more nuanced understanding of how income constraints and subjective interpretations jointly shape investment behavior. To narrow down this gap, the following alternative hypotheses were statistically tested:

H1: Perceived usefulness positively mediates the relationship between cocoa price and crop diversification among smallholder farmers in Tanzania.

H2: Perceived usefulness positively mediates the relationship between cocoa payment waiting time and crop diversification among smallholder farmers in Tanzania.

H3: Perceived usefulness positively mediates the relationship between off-farm income and crop diversification among smallholder farmers in Tanzania.

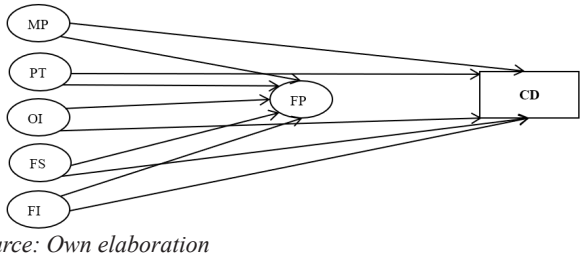
H4: Perceived usefulness positively mediates the relationship between cocoa farm size and crop diversification among smallholder farmers in Tanzania.

H5: Perceived usefulness positively mediates the relationship between cocoa farm income and crop diversification among smallholder farmers in Tanzania.

Conceptual Framework

The following conceptual framework summarizes the five hypotheses above while taking into account the theoretical framework.

Figure 1. Conceptual Framework



Source: Own elaboration

Where;

CD stands for Crop Diversification
MP stands for Market Price Fluctuations
PT stands for Payment Waiting Time
OI stands for Cocoa Off-farm Income
FS stands for Cocoa Farm Size
FI stands for Cocoa Farm Income
FP stands for Farmer's Perceptions

MATERIALS AND METHODS

Research Approach and Design

This study adopted a quantitative research approach to test the causal relationships among three groups of variables. A cross-sectional survey design was employed to examine the effects of cocoa-related factors on the marginal propensity to invest in crop diversification schemes, while explicitly considering the mediating role of farmers' perceptions. The approach enables the use of statistical techniques to validate hypotheses and generalize findings across the target population of smallholder cocoa farmers. At the same time, the design was suitable for collecting data at a single point in time, which aligns with the study's aim of capturing farmers' current experiences and perceptions regarding cocoa income, farm size, off-farm earnings, and payment systems.

Population and Sample Size

The study population consisted of 162 Agricultural Marketing Co-operative Societies (AMCOS) operating in Kilombero District, encompassing a total of 20,198 smallholder cocoa farmers. From this population, 810 questionnaires were administered, with five farmers selected based on convenient sampling technique from each AMCOS to ensure representativeness. Data analysis was conducted using 501 duly completed questionnaires, yielding a response rate of 61.85%. The questionnaires were filled in person by farmers and where necessary the enumerators who distributed them assisted in clarifying the questions.

Measurement of Variables

Different scales of measurements were adopted from previous studies as presented in table 1 below.

Table 1. Measurement of Variables

Name of Variable	Variable measurement	Studies
Market Price	Amount of money (expressed in USD) paid by a buyer in exchange of 1Kg of cocoa quantity	Musselli et al. (2025); Ahmad (2025)
Payment Waiting Time	A number of days where a cocoa farmer waits to get paid after an auction	Tuffour et al. (2023)
Cocoa Off-farm Income	Income generated by a cocoa farmer from other activities other than cocoa agribusiness	Mutsami et al. (2025); Mapunda (2024)
Cocoa Farm Size	The size of cocoa farm owned/ rented by cocoa farmer expressed in acres	Temba & Njau, 2025
Cocoa Farm Income	Income generated from cocoa agribusiness per se expressed in Tanzanian Shillings	Temba & Njau, 2025
Farmer's	An attitude of a farmer towards the expected benefits out of investment in crop diversification measured based on 5-point likert scale (1=Strongly disagree, 5=Srongly agree)	Molela (2024); Vernooy (2022)
Crop	Engaging in multiple crops farming	Hufnagel et al. (2020)

Source: Own elaboration.

Data Collection

Primary data were collected from cocoa farmers through self-administered questionnaires. A total of 501 duly completed questionnaires were returned and used for analysis.

Data Analysis

To examine the hypothesized relationships among the study variables, Covariance-Based Structural Equation Modeling (CB-SEM) was employed. The analysis was done using Analysis of Variance Structures (AMOS) software. The employment of CB-SEM model was important because of the availability of latent variable "perceived uselessness" as the intervening variable. The equation below summarizes the relationships between the variables.

$$CD = \beta_0 + \beta_1 MP_i + \beta_2 PT_i + \beta_3 OI_i + \beta_4 FS_i + \beta_5 FI_i + \text{Ь}FP_i + \varepsilon_i$$

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2 presents a summary of the demographic characteristics of cocoa farmers, highlighting gender distribution, family status, education level, and farming experience. The findings reveal notable patterns that shed light on the socio-economic structure of cocoa farming communities. The data indicate a significant gender imbalance, with male respondents outnumbering females where males were 76% while females were 24%. This suggests that cocoa farming remains a male dominated activity, possibly due to cultural norms, land ownership patterns, or labor demands that favor men's participation. However, the presence of women, though smaller, underscores their important but often under-recognized role in agricultural production. A large majority (81%) of respondents were married, while only 19% were single. This distribution implies that cocoa farming is largely a family enterprise, with household labor and decision-making playing a central role in sustaining farm operations. The predominance of married farmers also points to the intergenerational nature of cocoa farming, where family members contribute to both labor and knowledge transfer.

Table 2. Descriptive Characteristics of Respondents

	Gender		Marital Status		Education Level	
Description	Male	Female	Married	Un-married	Basic Level	Illiterate
Frequency	381	130	406	95	461	40
Percentage (%)	74	26	81	19	92	8

Source: Own elaboration

Table 3. Descriptive Characteristics of Respondents

Constructs	Items	FL	Cronbach Alpha	Alpha	CR	AVE
	MP.1	0.632	.822	.914	0.805	0.672
Market Price	MP.2	0.603	.990			
	MP.3	0.667	.904			
	PT.1	0.699	.976	.902	0.718	0.567
	PT.2	0.716	.938			
	PT.3	0.688	.989			
Payment Time	PT.4	0.786	.901			
	PT.5	0.700	.967			
	PT.6	0.765	.991			
	OI.1	0.724	.810	.921	0.721	0.508
Off-farm Income	OI.2	0.699	.898			
	OI.3	0.711	.971			
	FS.1	0.607	.911	.894	0.698	0.667
	FS.2	0.669	.996			
Farm Size	FS.3	0.688	.905			
	FS.4	0.701	.942			
	FS.5	0.604	.921			
	FI.1	0.654	.892	.907	0.704	0.609
	FI.2	0.711	.988			
	FI.3	0.734	.724			
Farm Income	FI.4	0.705	.917			
	FI.5	0.718	.999			
	FI.6	0.726	.917			
	FI.7	0.802	.999			
	FP.1	0.521	.991	.987	0.699	0.575
	FP.2	0.899	.906			
Farmer's Perception	FP.3	0.735	.982			
	FP.4	0.728	.912			
	FP.5	0.908	.941			

Source: Own elaboration, model test results

Education was measured against the basic standard seven benchmark. An impressive 92% of respondents had attained this level, while only 8% were illiterate. This relatively high literacy rate is significant, as it enhances farmers' ability to adopt new technologies, access extension services, and engage with market information. The small proportion of illiterate farmers highlights the need for targeted interventions to ensure inclusivity in training and capacity-building programs.

Validity of Research Tools and Data Reliability

The factor loading test conducted through Confirmatory Factor Analysis (CFA) established a strong association between the observed variables and their respective latent constructs, with all items loading above the recommended threshold of 0.5. This outcome provides clear evidence of construct validity, as summarized in Table 3. Furthermore, the internal consistency of the measurement items was confirmed to be acceptable, as indicated by the Composite Reliability (CR) and Average Variance Extracted (AVE) values for each construct. Together, these results demonstrate that the measurement model is both reliable and valid, thereby supporting its suitability for subsequent analysis.

With respect to discriminant validity, the test results demonstrated that the values of each construct, when compared against itself, were consistently higher than the values obtained when the same construct was correlated with other constructs. This outcome, as summarized in Table 4, provides clear evidence that the constructs are distinct from one another, thereby confirming the adequacy of discriminant validity within the measurement model.

Table 4. Discriminant Validity Test

Construct	MP	PT	OI	FS	FI	FP
MP	**0.704*****					
PT	0.611	**0.712****				
OI	0.500	0.561	**0.794*****			
FS	0.396	0.341	0.476	**0.700****		
FI	0.327	0.562	0.394	0.567	**0.767***	
FP	0.441	0.350	0.406	0.339	0.423	**0.711**

Source: Own elaboration, Discriminant Validity Test Results

Model Fit Test

A total of six (6) statistical tests were conducted to verify the robustness of the SEM model in measuring inferential results. These model fit assessments formed an integral part of the second stage of the overall estimation process, namely the structural model evaluation. As summarized in Table 5, the indices included the Normed Fit Index (NFI = 2.861), which confirmed the overall fit of the sample by assessing data discrepancy, along with the Comparative Fit Index (CFI = 0.988), Tucker–Lewis Index (TLI = 0.987), Incremental Fit Index (IFI = 0.971), Goodness-of-Fit Index (GFI = 0.924), and the Root Mean Square Error of Approximation (RMSEA = 0.049). Collectively, these indices demonstrated that the model achieved an acceptable fit to the data, as all values met or exceeded the recommended thresholds, thereby confirming the authenticity and adequacy of the SEM model for subsequent inferential analysis.

Table 5. Model Fit Test Results

Model	Threshold	Results	Model	Threshold	Results
NFI	≤3.000	2.861	GFI	≥0.900	0.924
CFI	≥0.900	0.988	IFI	≥0.900	0.971
TLI	≥0.900	0.987	RMSEA	≤0.060	0.049

Source: Own elaboration, model test results

Hypotheses Test Results

The study formulated five (5) hypotheses to examine the indirect effects of cocoa-related factors on the marginal propensity to invest in crop diversification in Kilombero, Tanzania. The results of these hypotheses testing are presented in Table 6, which summarizes the inferential statistics derived from the structural model analysis. This analysis constituted the second phase of the SEM procedure, focusing on the structural relationships among the latent constructs and their implications for investment behavior in crop diversification.

Inferential statistics revealed that cocoa farmers' decision to invest in crop diversification was explained by 52.4% of their perception of financial strength derived from the premium market prices offered by potential cocoa buyers. This relationship was statistically supported by two key parameters: the coefficient ($\beta = 0.303$), which was positive, and the p-value ($p < 0.001$), which was well below the 0.05 threshold, indicating strong significance. The observed indirect effect aligned with the direct effect findings previously reported by Ahmad (2025) and Boysen et al. (2023). From this, it was deduced that farmers' perceptions enhanced the causal relationship between market price and marginal propensity to invest by 25.30%. In practical terms, higher cocoa prices enabled farmers to generate revenue beyond production overheads, thereby creating financial capacity for diversification. Conversely, when revenues fail

Table 6. Inferential Statistical Results

Market Price	Path	Coefficient "β"	*p*-value	*Adjusted* R^2	Decision
Direct Effect	MP-->CD	0.412	0.031	0.271	Accepted
Indirect Effect	MP-->FP-->CD	0.303	<0.001	0.524	Accepted
Payment Time					
Direct Effect	PT-->CD	0.432	0.049	0.310	Accepted
Indirect Effect	PT-->FP-->CD	0.263	0.007	0.566	Accepted
Off-farm Income					
Direct Effect	OI-->CD	0.540	0.011	0.303	Accepted
Indirect Effect	OI-->FP-->CD	-0.387	0.349	0.231	Not Accepted
Farm Size					
Direct Effect	FS-->CD	0.309	0.025	0.192	Accepted
Indirect Effect	FS-->FP-->CD	0.483	<0.001	0.397	Accepted
Farm Income					
Direct Effect	FI-->CD	0.212	0.034	0.357	Accepted
Indirect Effect	FI-->FP-->CD	0.389	<0.001	0.611	Accepted

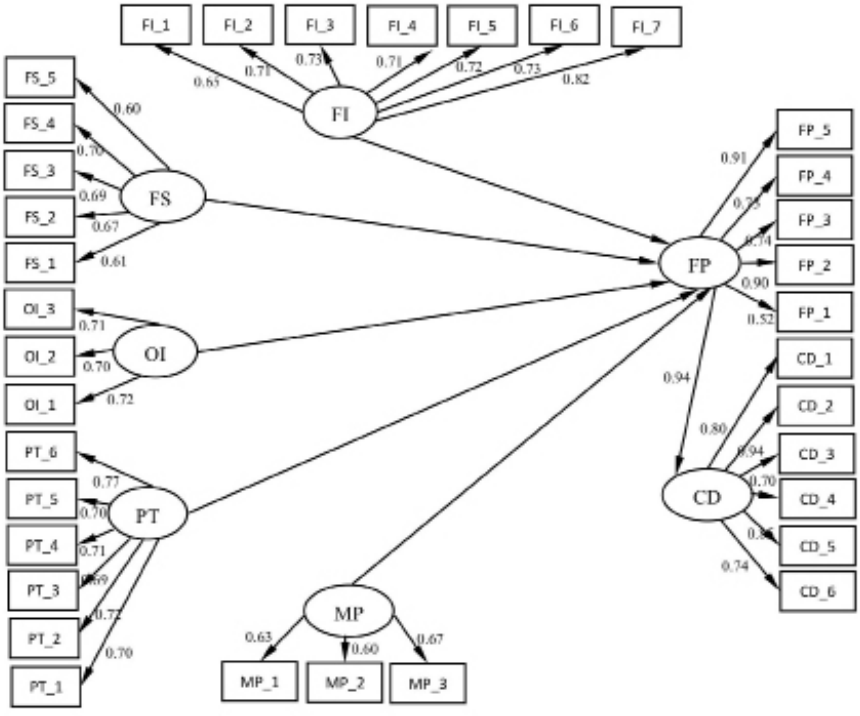
Source: Own elaboration, Structural Model Results

to cover production costs, the likelihood of farmers engaging in crop diversification schemes becomes minimal.

The indirect effect of farmers' perception on the causal relationship between payment waiting time and the marginal propensity to invest was found to be statistically significant (β = 0.303, p = 0.007). As highlighted earlier by Tuffour et al. (2023), Kimbi et al. (2021), and Belair (2021), the direct effect was further strengthened by 25.6% through the mediating role of farmers' perception. Overall, 56.60% of the decision by cocoa farmers to invest in crop diversification was explained by their perception of the importance of receiving payments promptly after auctions. Delays in payment often overlapped with the farm preparation period for other crops, rendering the proceeds less useful once received. Conversely, earlier payments, as emphasized in the sub-sector's marketing policy, increased the likelihood that farmers would allocate part of their cocoa earnings toward the production of other crops.

In contrast, although previous studies including Mtaturu (2024) identified off-farm income as a significant determinant of farmers' investment in crop diversification, the introduction of farmers' perception as a mediating variable produced different results. The statistical parameters (β = -0.387, p = 0.349) indicated that the mediating effect of perception on the relationship between off-farm income and investment decisions was not statistically significant. This outcome reflects the reality that cocoa farmers in Kilombero generated relatively low income from cocoa activities, limiting their capacity to accumulate sufficient off-farm capital. Consequently, expectations of financing diversification through off-farm income remained constrained.

Figure 2. Path Diagram



Source: Own elaboration, Structural Model Results

The structural model results revealed both direct and indirect effects of cocoa farm size on the marginal propensity to invest in crop diversification. These findings were consistent with those of Adesiyan and Kehinde (2024) and Tennhardt et al. (2024), who emphasized the significant role of farm size in shaping farmers' decisions to invest in crops beyond cocoa. Farmers' perception of the importance of farm size, particularly in relation to production capacity, accounted for 39.7% of their decision to diversify. The indirect effect of farm size ($\beta = 0.483$, $p < 0.001$) was 20.5% greater than the direct effect, which stood at 19.2%. Practically, cocoa farmers believed that larger farms guaranteed higher yields and, consequently, greater revenue. Notably, farmers in Kilombero actively sought to expand their farm sizes by planting new cocoa seedlings, a trend that contrasted with practices in other production areas of Tanzania, such as Kyela and Rungwe.

The final variable considered in this study was cocoa farm income, measured as the average revenue generated per acre of land. Results from the structural model analysis were consistent with the findings of Dogeje et al. (2024), which established a direct correlation between farm income and farmers' decisions to invest in crop diversification. The indirect effect analysis further revealed that 61.1% of farmers' decisions to diversify were explained by their perception of the usefulness of cocoa income. This contribution was 25.4% higher than the direct effect, which accounted for 35.7%. In practical terms, cocoa farmers require surplus income to finance investments in crops beyond cocoa agribusiness. Since income is determined by both production volume and market price, these factors are directly proportional to farmers' propensity to channel resources into other agribusiness ventures.

CONCLUSION

The study demonstrates that cocoa farmers' decisions to invest in crop diversification in Kilombero, Tanzania are shaped by a complex interplay of demographic characteristics, perceptions, and economic factors. Demographic analysis revealed that cocoa farming is predominantly male-driven, family-centered, and supported by relatively high literacy levels, providing a strong foundation for adoption of new practices.Structural model results confirmed the validity and reliability of the measurement model, with both direct and indirect effects highlighting the critical role of farmers' perceptions in mediating relationships between cocoa-related factors and diversification decisions. Specifically, perceptions of premium market prices, timely payments, farm size, and farm income significantly enhanced the causal pathways, often amplifying indirect effects beyond direct ones. These findings underscore that farmers' subjective evaluations of financial strength, payment timeliness, and production capacity are decisive in shaping their investment behavior.

Conversely, the mediating role of perception in the relationship between off-farm income and diversification was not statistically significant, reflecting the limited contribution of off-farm earnings in Kilombero. This suggests that diversification is primarily driven by cocoa-related revenues rather than external income streams.

Overall, the results highlight that strengthening market mechanisms such as ensuring premium prices, timely payments, and supporting farm expansion can substantially increase farmers' capacity and willingness to diversify. Policy interventions should therefore prioritize improving cocoa market structures and enhancing farmers' perceptions of income security, as these are pivotal in promoting sustainable crop diversification and resilience within cocoa farming communities.

Recommendations

It is important for government authorities to strengthen market mechanisms by ensuring consistent access to premium cocoa prices through transparent and competitive marketing systems. Cooperatives should be enhanced to guarantee fair pricing and reduce market uncertainty. Likewise, the payment systems should be improved by introducing policies that shorten the waiting time for cocoa payments after auctions. Furthermore, it is important to promote the digital payment platforms or mobile money services to enable faster transactions and reduce delays that overlap with preparation periods for other crops. Cocoa farmers should be facilitated to access land and inputs which will ensure both production and productivity per area. The training programs should be provided that emphasize the link between farm income, market opportunities, and diversification potential. This is essential for enhancing the farmer's perceptions and financial literacy. Government should strengthen extension services to build farmers' confidence in using cocoa revenues for investment in other agribusiness ventures. Policy-makers and stakeholders should design policies that integrate cocoa marketing reforms with crop diversification strategies. This will encourage farmer cooperatives and associations to act as intermediaries in negotiating better prices and faster payments.

Further researches may be conducted to explore contributions of crop diversification to personal finance of smallholder cocoa farmers in Tanzania. This will provide more insights on the importance of crop diversification not only to cocoa farmers but also to other smallholder farmers in the country.

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MONTE CARLO SIMULATION FOR STRESS TESTING ENDOGENOUS PROFITABILITY FACTORS DURING POLYCRISIS: A CASE STUDY FROM THE POULTRY SUBSECTOR

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Abstract: *Can historical company data help estimate future performance during economic uncertainty? This study investigates whether past business cycles can be used to estimate profitability in the context of a polycrisis – a period marked by overlapping disruptions such as avian influenza, COVID-19 trade restrictions, extreme weather events, and rising feed and energy prices. These shocks have severely impacted agro-related industries, such as poultry processing. Focusing on three Central European poultry processing companies, we use Monte Carlo simulations for stress testing their profitability for the 2023 period, aiming to support financial planning by analysing firm-specific, endogenous, management-controllable factors. Return on Sales (ROS) and Return on Equity (ROE) are used to evaluate profitability, incorporating variables such as euro exchange rates in the case of export-driven firms. Our results indicate that Company "A," characterized by stable operations, had the lowest probability of negative ROE, while Companies "B" and "C" demonstrated greater volatility. We found that the model provides a good estimate of the factors affecting the companies' profitability that are directly or indirectly reflected in their accounting data. Indicating that the test could be a valuable tool for supporting managerial decision-making in financial planning, though further refinements are needed to enhance accuracy.*

Keywords: *Monte-Carlo Simulation, Profitability, DuPont analysis, Poultry subsector*
(JEL code: G17, C15)

INTRODUCTION

Our research objective is to examine how historical data from previous business periods can be used to estimate future performance in an extreme economic environment. With the goal to support financial planning for business management in today's increasingly volatile economic environment by focusing on endogenous factors that could be more directly controlled by firms' management.

To this end, we examined three poultry processing companies in a case study, since this sector serves as an ideal candidate, as it was affected by multiple interlinking crisis factors throughout the recent periods, making long-term financial planning challenging. These negative effects include the avian flu and COVID-19 epidemics and the rise in energy and feed prices that were particularly pronounced in Central Europe's agricultural and agro-related companies.

According to Morin and Kern (1999) who first defined polycrisis, the greatest challenge today is the "interconnected and overlapping set of crises" that affect all of humanity. In their view, the challenge for the 21st century is not a single threat - such as climate change - but a complex set of interrelated and intertwined problems, a phenomenon they define as polycrisis (Morin and Kern, 1999).

Some literature takes a different approach to the polycrisis, viewing it as an umbrella term that includes new crises affecting the European Union and the consequences of the previous crisis of 2007-2009 (Zeitlin et al., 2019; Meissner and Schoeller, 2019). In contrast, according to Lawrence et al. (2022, 2024), similar to the work of Morin and Kern (1999), a "global polycrisis occurs when crises in multiple global systems become causally entangled in ways that significantly degrade humanity's prospects" (Lawrence et al., 2022). In their view, the crises of recent decades have been closely interlinked, building on each other's consequences, thus reinforcing and reshaping their effects, even reducing some of them (Lawrence et al., 2024).

In contrast to polycrisis—which refers to the interaction of several independent yet interrelated systemic shocks—systematic risk concerns vulnerabilities embedded within a particular system. It is an embedded risk that is not considered a risk and is therefore not necessarily monitored. However, a system-wide assessment may reveal that it has hidden risk potential that could negatively affect the overall performance

of the system if certain factors change (Kaufman, 1996; Kaufman and Scott, 2003). The 2008 economic crisis is an often-cited example of this type of risk. But the impact of systematic risk originates in one system and spills over through the interaction of other areas, affecting their performance or output (Aven, 2016).

Conversely, when a system experiences several adverse events simultaneously or sequentially that interact to cause widespread losses, we speak of compound risk (Lal et. al., 2012). According to Liu and Huag (2014), compound events occur when complex processes are extended but are not always directly related (Liu and Huang, 2014; Zscheischler et. al. 2020). Importantly, however, this risk also originates within a single system and spills over to other areas through interactions with them (Sulfikkar Ahamed et. al., 2023).

Where polycrisis differs from systematic and compound risk is in both the origin and nature of the interactions. Both systemic and compound risk report negative, mutually reinforcing events, whether they occur in finance, agriculture, or other areas. In the case of polycrisis, the interaction of these events does not necessarily lead to an increased adverse impact. In addition, systemic and compound risks originate within a single system and spill over into other fields. Polycrisis, on the other hand, deals with the interaction of events occurring independently in separate systems. The effects of the last 5 years have emerged within several structurally independent systems with predominant interactions. Thus, polycrisis as a concept can better describe the risks of this period –under which we aim to estimate the profitability of three selected firms – than the other two concepts.

LITERATURE REVIEW

There has been a long discussion in the relevant literature on whether firm or sector-specific factors influence firm performance to a more considerable extent (Bamiatzi and Hall, 2009; Goddard et al., 2009; Sala-Ríos, 2024). Sector-specific factors such as market concentration, sector growth rate, etc., are some of the key strategic factors that influence firms' performance. In contrast, firm-specific factors place the management of resources, their efficient use, efficient management of capital structure, etc., as key elements of profitability. In addition to these, many researchers also highlight the location of a firm as an important factor that determines its profitability (Arias et. al., 2020; Castro Aristizabal et. al., 2019).

When comparing the various - firm, industry, and location - factors, several authors, including Nanda and Panda (2018), Blažková and Dvouletý (2018), Alarussi and Alhaderi (2018), Pervan et. al. (2019), Aryantini and Jumono (2021), Sala-Ríos (2024), highlight company-specific factors as significant elements that influence the profitability of firms. Examples of such factors include firm size (as total sales), age, asset utilization (as asset turnover ratio), and capital structure (as financial leverage). Older and larger firms can leverage their accumulated knowledge and built-up knowledge capital to achieve higher profits. In addition, companies that can use their assets more efficiently can achieve higher returns on their assets and improve their performance. A negative relationship between capital structure and profitability can be highlighted, as a company can choose to finance a larger share of its activities from equity or debt, thus affecting its return on equity differently.

Based on the previous works, our profitability estimates primarily consider firm-specific factors. These are variables that companies can actively influence and manage, thereby directly impacting their financial performance, reacting to the changes in the economy. Location-specific factors were not included, as the selected firms operate in nearly identical geographical contexts and are similarly affected by polycrisis-related factors, rendering such variables largely irrelevant in this analysis.

Our method of choice for stress testing and estimating the distribution of profitability variables is Monte-Carlo simulation, which is widely used to evaluate the riskiness and return on investment of projects (Montes, et al., 2011; Senova et al., 2023), to manage the risk of financial forecasts (Liu, et. al., 2022), to optimize and plan production activities and budgeting (Janeková,et. al. 2015; Koroteev et. al. 2022). As well as for profitability estimation, where it allows the estimation of multiple scenarios to support effective decision-making (Montes et al., 2011; Ölçen, 2025). A key advantage of MC simulation lies in its flexibility: it accommodates non-linear distributions of input variables and allows for the simultaneous analysis of multiple parameters. Additionally, it can be effectively applied even when only aggregate data are available, without requiring full access to raw datasets. Compared to other methods, such as bootstrapping, MC simulation is also less computationally intensive, making it well suited for multi-level modelling (Preacher and Selig, 2012; Pavlik and Michalski, 2025).

Our simulation-based stress test was built on the basis of the annual reports of the selected companies, using 6 years of historical data to estimate the profitability of the firms for the period 2023 using the logic of the DuPont analysis (Aulová et al., 2019; Pavković et al., 2022). The analysis of the profitability situation examines the efficiency of the use of assets and resources owned by the firm (Szekeres and Orbán, 2018; Saus–Sala et al., 2021; Tömöri et al., 2021; Zielińska-Chmielewska et al., 2021).

The most commonly used metrics for assessing the profitability of companies are Return on Sales (ROS), Return on Assets (ROA) and Return on Equity (ROE), which can be examined in conjunction with each other using (Husain et al., 2020). Some literature (Ladvenicová et al., 2019; Fenyves et al., 2019; Kishibayeva and Jaxybekova, 2023) defines the DuPont model as a financial analysis and planning tool designed to present the factors affecting a company's return on equity using simple accounting relationships to help understand the effects of these factors. It is argued that the model allows for the evaluation of the components of ROE and helps management to assess the potential impact of strategic initiatives on financial performance (Jape and Malhotra, 2023).

Given the structure of the DuPont model, we had to account for multiple input parameters that are not necessarily linearly related (Fairfield and Yohn, 2001). To manage these complex interdependencies efficiently and to reduce computation time, we selected Monte Carlo simulation as our method

of choice for the stress test, owing to its high flexibility and suitability for handling non-linear relationships.

Our selected firms are located in the poultry processing sector which is part of the manufacturing industry and is mainly involved in the processing of raw materials produced in the primary sector. Due to the sector's location, it has operated in a highly turbulent environment since 2015 shaped by overlapping adverse events. Extreme weather anomalies – including recurrent drought, heatwaves, and sudden frosts – have affected feed-grain yields across Europe, increasing livestock purchase and feed costs (Lhotka and Kyselý, 2022; Tripathy and Mishra, 2023). These pressures were reinforced by the post 2022 surge in grain and energy prices (Smeets and Beach, 2023). At the same time, recurrent outbreaks of Highly Pathogenic Avian Influenza (HPAI) have imposed substantial operational and biosecurity costs, including culling and supply disruptions driving up costs even more. Additional trade restrictions during the COVID-19 pandemic further constrained export reliant processors and disrupted input supply chains (Rizou et al., 2020; Choi et. al., 2021; Sarkis, 2020; Tömöri et al., 2022; Raj et. al., 2022). Together, these events formed a polycrisis context that has amplified profit volatility within the poultry subsector (Radin et. al. 2017; Padilla et. al., 2025).

Though this subsector is not unique in experiencing high volatility during the examined period or in other polycrisis adjacent periods. Similar patterns of cost-driven profitability instability have been observed across several agri-food industries. For instance, pork processors have been affected by recurrent outbreaks of African Swine Fever (ASF), while dairy and beef cattle industries have faced disruptions linked to Foot-and-Mouth Disease (FMD) and Bovine Viral Diarrhea Virus (BVDV). These sectors have also been exposed to sharp input-price shocks and export-market disturbances similar to those observed recently in poultry processing. However, the poultry subsector is particularly vulnerable due to the epidemiological characteristics of HPAI: the virus persists longer outside its host and is more readily spread by migratory wildlife, making outbreaks both harder to contain locally and more frequent than in other livestock sectors (Rypuła et. al., 2020; Halasa et. al., 2020; Marschik et al., 2021).

Although the present case study focuses on poultry processors, the Monte Carlo–DuPont framework is broadly applicable across other agri-food industries that exhibit comparable interactions of virological, market-based, and cost-side shocks (Wu and Perrings, 2018; Brown et. al., 2021; Seeger et. al., 2021; Verhagen et al., 2021; Szymańska and Dziwulaki, 2022).

MATERIALS AND METHODS

Monte Carlo simulation was originally a stochastic simulation method used in mathematics to solve differential equations, whereby a large number of output values can be generated simultaneously from a large number of uncertain input variables that take random values with a given probability distribution, and then can be statistically evaluated. In Monte Carlo simulation, the normal distribution function of a variable is obtained as an empirical distribution of simulated values (Hamad, 2019; Becsky-Nagy et al., 2024).

The required data were obtained from the financial statements of the examined companies between 2017 and 2022, which are typically an informative tool for investors (Table 1.). After defining the problem, the second step in the application of the method is, the selection of the input variables of the model under uncertainty and the determination of the parameters that influence their probability distribution (Figure 1). For these indicators, if they are normally distributed, it is necessary to determine their expected values and their standard deviations, assuming that their expected value will be spread around the historical average and thus less likely to take a value further from the average (McLeish, 2005; Cevallos-Torres and Botto-Tobar, 2019; Fabianová et al., 2023).

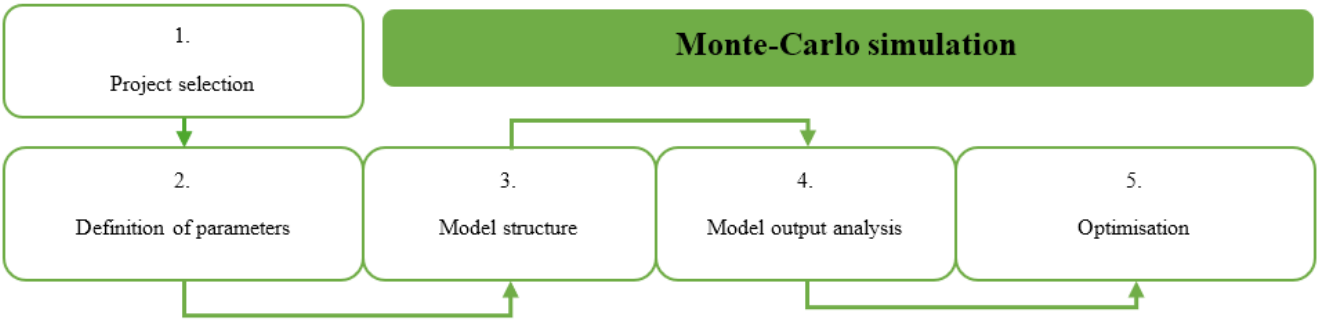
Table 1. Net sales revenue, ROS and ROE values between 2017 and 2022*

		2017	2018	2019	2020	2021	2022
Company "A"	Net sales revenue	104 024	126 448	120 771	106 620	131 067	183 101
	ROS	11,3%	13,5%	9,2%	4,6%	9,4%	11,6%
	ROE	30,9%	51,3%	27,7%	12,2%	24,4%	32,5%
Company "B"	Net sales revenue	29 651	29 877	29 526	29 031	30 148	35 530
	ROS	0,7%	-0,2%	0,1%	4,4%	5,4%	7,5%
	ROE	2,6%	-1,0%	0,4%	16,4%	17,5%	23,9%
Company "C"	Net sales revenue	18 127	18 938	23 940	26 885	25 168	29 015
	ROS	0,5%	-0,7%	1,1%	1,0%	-0,4%	4,6%
	ROE	1,6%	-2,4%	4,8%	5,3%	-1,8%	22,2%

**Net sales revenue in thousand EUR*

Source: Authors' compilation based on companies' annual reports

Figure 1. Monte-Carlo simulation steps



Source: Authors' compilation based on Fabianová et al., 2023

The third step is to set up a model to derive the output values to be estimated from the input data. The model must be set up in such a way that it ensures the iteration of several random outcomes as a function of the mean (m) and standard deviation (σ) of the specified input data. The future outputs thus generated can be used for probabilistic analysis, which is the next step in the simulation (Thomopoulos, 2013).

In our simulation-based stress test, we treated the following firm-specific input variables as probability distributions:

- the expected percentage change in domestic (DOT) turnover (marked with: gDOM)
- the expected percentage change in export earnings (EXP) (if the export activity was significant for the company, with an indication: gEXP)
- the expected value of own capitalised performance (marked as CVOP)
- the expected value of the material ratio (ratio of material costs to turnover) (denoted MAr)
- the expected value of the wage ratio (ratio of personnel costs to turnover) (marked Wr)
- the expected value of the depreciation ratio (the ratio of depreciation to turnover) (denoted as DEPr)
- the expected percentage change in total assets (TA) (marked with: gTA)

These companies are predominantly involved in intracommunity trade so the appropriate EUR exchange rate was taken as a benchmark at the estimation of the export revenue, if it was significant. Based on the experience of the years under review, our assumptions are: that the change in equity (EQ) is influenced only by the profit after tax derived from the above data, the expected value of other income and expenses offset each other, and the profit on financial operations (PFO) in the last year (due to the predictable nature of the majority of interest rate repayments) is assumed to remain unchanged (and excluding the effect of exchange rate differences).

Lastly to validate our assumption that the profitability indicators follow normal distribution, we tested the historical values of both ROS and ROE utilizing the Shapiro-Wilk test. The test was conducted on the six-year period under review. In all three cases the test yielded p-values above the 0.05 significance level, indicating that the null hypothesis – that the samples originate from normally distributed population – could not be rejected for our input variables. This result supports the use of the normal distribution as a modelling approximation.

However, due to the limited sample size – six historical years –, the statistical power of the Shapiro–Wilk test is inherently low, meaning that moderate deviations from normality may remain undetected. Consequently, while the empirical distributions do not contradict the normality assumption, the resulting probability distributions should be interpreted with caution from a robustness perspective. Even so, it is assumed that the profitability of firms follows past growth trends. The possible outcomes of profitability may deviate both positively and negatively from the average, but their magnitude can be considered proportional to the fluctuations observed in previous years. In light of these considerations, we think that the normal distribution provides a good approximation for modelling the probability distribution of profitability in 2023, and it also offers ease of implementation in the simulation process. Thus, the random numbers can be generated (1):

$$X \sim N(m_X, \sigma_X^2) \quad (1)$$

We calculate the total sales revenue (S) according to equation (2):

$$S = DOT_{2022} * \left(1 + X_{gDOM}\right) + EXP_{2022} * \left(1 + X_{gEXP}\right) \quad (2)$$

and then, according to equation (3), the profit after taxation (r^{TAX}):

$$Profit = [S + X_{CVOP} - S * (X_{MAr} + X_{Wr} + X_{DEPr}) + PFO] * (1 - r^{TAX}) \quad (3)$$

and hence the Return on Equity (4), taking into account the expected change in total assets (TA), in accordance with Du Pont:

$$ROE = \frac{Profit}{S} * \frac{S}{TA_{2022} * (1 + X_{gTA})} * \frac{TA_{2022} * (1 + X_{gTA})}{EQ_{2022} + Profit} \quad (4)$$

Given the output dataset (in which the number of iterations is n), the probability that the ROE will take a negative value can be estimated according to (5):

$$P(ROE < 0) = \frac{n|_{ROE<0}}{n} \quad (5)$$

Finally, as a last step, if necessary, the model can be further optimised if the probability variables change too much or to an extreme. One way of doing this is to refine the model parameters in order to reduce the extreme outcomes between the randomly generated values and thus make them more similar to the normal distribution we have assumed (Papadopoulos and Yeung, 2001). In the next section, we present the results of the model and the conclusions drawn from them, which are then compared with the companies' actual 2023 figures.

RESULT AND DISCUSSION

The expected distribution of the ROS and ROE data series generated from 15.000 iterations using the random number generator after setting up the model is illustrated in a box-plot

diagram in Figure 2., while Table 2. presents the distribution parameters (mean and standard deviation) of the model input data. Also to quantify the difference between the simulated and actual 2023 values, deviation percentages were calculated (6):

$$\text{Diviation (\%)} = \frac{Profitability_{2023} - Simulated\ Profitability_{2023}}{Simulated\ Profitability_{2023}} \quad (6)$$

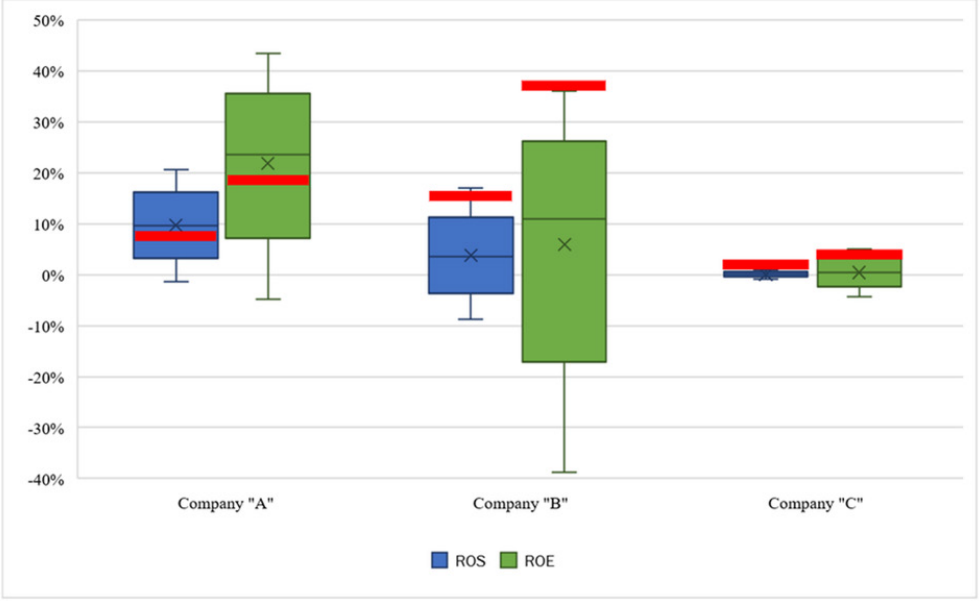
"A" Company's performance, both in terms of revenue and capital, based on 15.000 possible output data sets, is likely to be positive in 2023, when the company's ROS is expected to pick up between -1% and 20%. On average, the cases studied show a ROS of 9,68% and a standard deviation of around 3%, which can be considered low overall. This is basically due to the high number of iterations and lower variances of the input parameters affecting the results. In contrast, if we broaden the range of variables considered to include changes in all assets and thus calculate the ROE, we obtain a much larger and broader distribution of results. The ROE values for Company "A" average 23,40% with a standard deviation of around 6,27%. The 2023 figures confirm the conclusions drawn from the model. Company "A"'s ROE value was 18,58%, within one standard deviation of the average, and a similar trend can be observed for ROS with 7,86%.

Table 2. Average and Scatter of Monte-Carlo Simulation data

Title	Company "A"		Company "C"		Company "B"	
	Average	*Standard deviation*	*Average*	*Standard deviation*	*Average*	*Standard deviation*
Domestic turnover growth rate (%)	24,73%	25,54%	11,68%	11,87%	9,32%	11,03%
Export turnover (EUR) growth rate (%)	9,65%	23,15%	13,35%	17,01%	-	
EUR/HUF exchange rate	382,04	8,37	382,04	8,37		
CVOP (EUR)	853 725	3 190 923	210 521	325 080	385 238	297 463
Material ratio (%)	77.48%	2,41%	79,76%	1,46%	77,94%	2,81%
Wage ratio (%)	9,66%	1,58%	15,25%	1,25%	14,51%	1,77%
DEP ratio (%)	2,37%	0,43%	3,39%	0,24%	3,92%	0,27%
Change in total assets (%)	18,82%	16,73%	17,35%	40,70%	16,55%	23,69%

Source: Authors' own calculation based on companies' annual reports

Figure 2. Company "A", "B" and "C" Possible Distributions of ROS and ROE (%)



Source: Authors' own calculation based on companies' annual reports

But the fall in export performance in Company "A"'s sales activity increased the outcome of extreme cases to a greater extent, although the favourable trend of rising exchange rates – with the company's larger foreign currency holdings – was able to minimise these negative swings, so that the company's estimated ROS was less likely ($p<0,1\%$) to take a negative value, which is also supported by the actual ROS value in 2023. The probability that the company's ROE is expected to exceed its ROS is estimated to be more than 98%, due to the company's outstanding business policy, which has included several positive investments in the recent period, such as the acquisition of a slaughterhouse, which subsequently increased its sales performance and the revenue per total assets. The improved sales have also led to a gradual increase in the company's equity, and the simulated values estimated this change. In terms of percentage differences, the actual ROS (7,86%) was 18,8% below the simulated mean (9,68%), while the actual ROE (18,56%) was 20,6% lower than the simulated average (23,40%), indicating

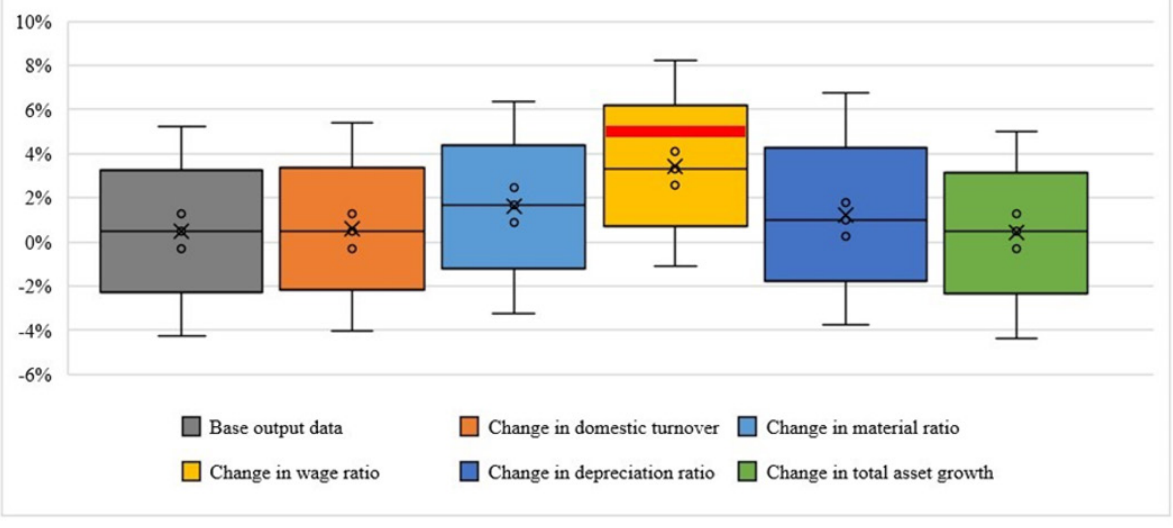
that the model captured the firm's typical performance accurately.

In the case of Company "B", the fluctuations in the company's turnover, profit after tax, total assets and equity were much higher during the period of the study. The impact of these is also noticeable in the estimated ROS and ROE. In the case of ROS, this broader effect means in particular that it has a higher probability of taking a negative value of around 12%. Based on the ROS estimate, a maximum over 17% and a minimum -9% return on sales can be expected by the company's management, due to the lower performance of the company in its early years, which determined the initial distribution parameter, followed by a more drastic positive turnaround over the next 4 years. This growth potential, however, was not fully captured by the model, with a ROS value of 15,16% in 2023. This ROS value exceeded the simulated mean (3,57%) by 324,69%, but remained 10,59% below the maximum simulated ROS value (16,96%). Figure 2 shows that the ROE of the company could change much more in the period to 2023. One of the reasons for this was the company's major investment project launched in 2021, which continued in 2022 with the establishment of a subsidiary. This resulted in a more significant increase in the company's equity multiplier (EQM) value and a more significant decrease in rotation speed of total asset due to an increase in the value of total assets. The inclusion of a drastic change in the company's performance resulted in a slightly more extreme estimate. The model also failed to adequately capture the growth potential, as the company's 2023 ROE value was 36,53%, which was above the simulated average (10,20%) by 258,05%, while also exceeding the maximum estimated ROE (36,03%) by 1,39%. These results are surprising given the model, but based on more detailed profitability analysis, this increase in the company's performance was expected. In the more recent periods, the company has not only increased its horizontal scope of activities, but has also engaged in major development initiatives and launched a significant marketing campaign to strengthen its brand with the help of its parent company. Overall, the outstanding growth potential could not be addressed by the model and the actual 2023 figures were caught either in the upper quartile or fell outside of the estimation range. In contrast, the result for Company "A" was much more consistent despite the decline in export activity during the polycrisis, the company's growth rate was steadier, resulting in a more balanced estimate that was a good approximation of the actual data.

In the case of Company "C", unlike its two predecessors, we see a slightly more pessimistic estimate: while the average of the possible outcomes examined is approximately 0,1%, and the standard deviation is 0,22%. The ROS indicator results are more concentrated for the company, which may have been driven mainly by fluctuations in its sales activity of the same magnitude between 2017 and 2021, which were only offset by a larger positive spike in 2022. This implies that the company's profitability can take on a larger spread and thus equity investment in the company can be considered riskier than in the case of Company "A" or "B". This is also evident in the estimated performance for 2023: the probability that the company's ROE will be negative is estimated at around 34%, the highest of the three companies. Taking into account changes in total assets and equity does not change this value, but merely magnifies the dispersion of expected results. However, this multiplier effect is lower than in the case of "B" and "A". Although the company had the highest probability of a negative return, it was not unprofitable in 2023, with a ROS value of 1% and an ROE of 4,79%. So, similar to Company "B", the top quartile estimates were proved by the model. The actual ROS (1%) exceeded the simulated mean (0,09%) by 1055,86% and surpassed the maximum expected ROS (0,89%) by 12,02%, which indicating that the model underestimated the magnitude of the firm's positive outlier performance. Likewise, the 2023 ROE (4,79%) surpassed the simulated mean (0,46%) by 949,35%, while remaining 5,49% below the maximum expected ROE (5,07%).

Figure 3 illustrates how the distribution of Company "C"'s ROE data series in the simulation-based stress test would change, if the average parameter of one of the input variables were to be replaced by the average parameter of the same input value of Company "A".

Figure 3. Distributions of the ROE value of Company "C" if one of the input data is replaced by the values of Company "A"



Source: Authors' own calculation based on companies' annual reports

It is observed that the most effective change in its business policy would be to reduce its wage ratio, rather than to adjust its material ratio, depreciation ratio or sales growth rate to that of Company "A", which would increase the maximum ROE by 1-1,5% and reduce the probability that it would not be negative by 15-25%. By contrast, a significant reduction in the wage ratio would, ceteris paribus, reduce the probability of the return on equity becoming negative by 33,5%, while increasing the maximum ROE by 3%. One way of reducing this cost ratio could be to phase out the company's "Care for the Family" incentive scheme. Indeed, as the company supplementary annex comprises, its long-term application has increased the number of overtime hours and weekend production times, for which extra benefits are paid to employees, but as the results show, their reduction could significantly improve the company's ROE, while it could expand its foreign partners base. This support scheme was rolled out in 2023, which allowed the company to increase its ROE to 4,79%. Our findings on the reduction of the wage ratio are therefore validated, and if we observed Figure 3, the 2023 factual figure falls within one standard deviation of our revised estimate. Calculating the percentage difference between the actual ROE value and the new simulated average ROE confirms this improvement. The 2023 ROE value being only 43,62% above the new simulated mean (3,34%), which is a 905,72% improvement from our original simulation. So, although our original model was only able to capture the upper quartile of the actual values, the model rerun on the basis of the propositions was able to estimate these values more accurately.

The diverging performance of the three companies is illustrated by the simulation, which takes into account extreme changes over 6 years. The changes in this polycrisis period were undoubtedly observed in the estimated ROE of the companies.

The expected return on equity ratio for Company "C" is in the narrowest range, approximately -4% to 5%, with a median value of around 0,46%, significantly lower than the other two competitors. This was also due to past fluctuations in the company's sales activity. Indeed, the company continuously invested during the period under examination, increasing its total assets. In many cases, the positive effects of these increases were diminished by fluctuations in the company's sales activity, either directly through the ROS indicator or indirectly through the EQM. As a result, the effects of the company's exceptional performance in 2022 were estimated to be negatively affected by the weak performance in earlier periods.

Company "A" is still very likely to increase its profitability, and a significant decrease is unlikely. In the case of Company "B", the distributions are more balanced between periods of higher and lower performance so that it considers the more extreme cases, but if the calculation were only based on the last 4 years, a much more optimistic picture would emerge. However, there is still no doubt that the company's performance is likely to continue to improve.

Company "C"'s situation, on the other hand, is much more confusing. The company has few commercial partners and basically failed to take advantage of the market opportunity created by the coronavirus in certain regions to strengthen its position in European markets, and diversify its partnerships, but has instead increased its exposure to the country of the parent company, which seemed to be more favourable to it during this period. It experienced the consequences of this in 2021 with the introduction of trade restrictions in the region due to the epidemic. Still, it is questionable whether it could build this experience into its business strategy after its outstanding performance in 2022. In terms of investment policy, it has phased out the "Care for the Family" subsidy scheme, which has improved the company's bottom line as estimated by the model. In addition, a major investment project was completed during this period, resulting in the modernisation of its machinery and real estate. As a result of these, the company was able to remain profitable in 2023 although by a small margin.

Among Company "B"'s inputs, two of the six examined years were significantly low or even negative, followed by four years of outstanding performance. Therefore, by removing the two low performance periods and looking only at the last four periods, the model should hypothetically be able to provide a more accurate estimate of the company's growth potential. Using this new estimated growth potential in the original calculation, the 2023 actual figures would be better caught by the model.

This growth potential estimate can be observed for Company "A". The company's performance has not turned negative in the periods under review, although a more moderate decline can be observed, but still an outlier at the sector level. This decline is the reason for the wide range of the estimated ROE in the model, but nevertheless, the simulation was able to estimate the 2023 values with great accuracy due to the company's stable growth rate and small leverage.

Overall, for Company "B", the model could not account for the high growth potential and, therefore could not capture the 2023 values adequately. In the case of Company "A" due to the steady growth rate over the period of the study it was able to capture actual rates of ROE and ROS. In contrast, Company "C"'s performance in the periods under review has been very extreme. A period of high profits was followed by a period of sharp losses. One of the reasons for these fluctuations is the company's significant exposure to the parent company's market, where its products are assumed to play a substitutive role. Thus, the company's lack of diversification in its partnerships resulted in highly variable sales trends in the examined period. These high variances in the historical data have been cancelled out in the calculation, resulting in a more concentrated estimate that no longer only includes the adverse effects of polycrisis factors but also the riskiness of the company's activities instead of its growth potential.

Lastly it is important to highlight that all model estimations rely on only six years of historical firm-level data, which inherently limits the robustness of the simulated distributions. With such a short time horizon, the estimated means and variances of the input parameters are more sensitive to year-specific shocks – especially those induced by the polycrisis period – and may not fully represent the underlying long-term dynamics of the firms' profitability. Therefore, while the simulation-based stress test provides meaningful insights into firm-level profitability under polycrisis conditions, the results should be interpreted with caution. Longer time series or higher-frequency data would be necessary to increase the robustness of the distributional estimates

and to better capture the firm performance over time.

CONCLUSION

The objective of this research is to examine, through a case study, the extent to which historical data from previous business periods can be used to estimate future performance in an extreme economic environment. In doing so, it aims to support companies' financial planning for the upcoming financial years.

In building the model, company-specific factors were primarily selected as inputs, as these are within management's control and can be adjusted in response to extreme changes. Using the logic of the DuPont analysis and after reviewing the trends of previous years, we assumed that the company would follow a similar operating trend. Thus, the potential profitability outcomes may deviate positively and negatively from the average, with their magnitude being proportional. Based on this, we assumed the variables would follow normal distribution.

Based on our calculations, the simulation can deal well with factors that affect the profitability of companies, such as changes in raw material and energy prices, or management decisions such as investment, inventory optimisation activities, and all the factors that appear in the companies' accounts, directly or indirectly. On this basis, the Monte Carlo methodology could be a valuable tool for management in supporting financial planning activities. Aiding the controlling functions of companies could help identify areas that may influence future performance.

However, there is still room to optimise the model by incorporating more specific and detailed company-level parameters. As our analysis is based on publicly reported data, it should be considered an external assessment, which limits our ability to examine internal performance drivers—such as the allocation of material and labour costs across operational areas. Another area for improvement is determining the probability factors of firms' financial activities and forecasting high growth potentials. In our model, the results of these financial operations were assumed to be constant due to the high share of interest payable, but in addition to interest payable, exchange rate changes also affected the profitability of the companies, especially for Company “A” and “C”, although to a lesser extent. Though the growth potential was estimated from historical data, it did not adequately reflect the real growth rate assumed by Company “B”. The estimation might improve for such above average companies if these rates are calculated on the basis of the years during which the performance of these companies has shown a significant upward trend. It should also be noted that only six years of firm-level data were used, which is not ideal for generating robust probability distributions, as estimated means and variances of the input parameters are more sensitive to year-specific shocks. Future research should therefore consider a longer time horizon or higher-frequency data necessary to increase the robustness of the distributional estimates.

DECLARATIONS

Author Contributions
All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Máté Varga and Patrícia Becsky-Nagy. The first draft of the manuscript was written by Máté Varga, and all authors commented on previous versions of the manuscript. The final draft of the manuscript was critically revised by Patrícia Becsky-Nagy. All authors read and approved the final manuscript.

Conflicts of Interest
The authors declare no conflicts of interest.

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THE INFLUENCE OF COVERAGE ATTRIBUTES ON COMMUNAL FARMERS' WILLINGNESS TO ADOPT CATTLE INSURANCE IN LUPANE DISTRICT, ZIMBABWE

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Abstract: *This study , examines the role of coverage attributes specifically, their scope, clarity, and relevance in influencing the willingness of communal farmers to adopt cattle insurance. The research was guided by the Stakeholder Networking Theory. Employing a mixed-methods approach in Lupane District, Zimbabwe, the research utilized a sample of 219 communal farmers, selected via multistage sampling for quantitative data, and 25 key informants, selected via purposive sampling for qualitative data. The Probit regression analysis revealed a statistically significant positive coefficient of 0.242 ($p<0.001$) for the relationship between Coverage Attributes and Willingness to Adopt. This indicates that farmers' decisions are significantly driven by the comprehensiveness of covered risks and the simplicity of the policy's terms. The findings highlight that existing products fail to meet farmer expectations regarding risk coverage and ease of understanding. This study concludes that insurance schemes must be designed to be both comprehensive and user-friendly, providing practical insights for creating policies that are genuinely attractive and relevant to the specific needs of this vulnerable demographic.*

Keywords: *Coverage Attributes, Insurance Design, Risk Perceptions, Communal Farmers, Zimbabwe*
(JEL code: Q13)

INTRODUCTION

Communal cattle farming in Zimbabwe is a cornerstone of rural livelihoods, providing income, social status, and a crucial buffer against economic shocks. However, this sector is highly exposed to multidimensional risks, including frequent and severe droughts, disease outbreaks like Theileriosis (January disease), and other hazards such as veld fires (Gumede, 2024). In recent years, these risks have intensified due to climate change, leading to significant herd losses and deepening poverty (Dziva, 2021). While agricultural insurance is globally recognized as a vital tool for risk management, its uptake among smallholder farmers remains critically low.

Globally, and especially across the African continent, the challenge of low agricultural insurance uptake persists despite concerted efforts by governments, non-governmental organizations, and development partners (Hadebe, 2022). In Zimbabwe, the problem is particularly acute, with many initiatives failing to achieve widespread, sustainable adoption (Bhebhe et al., 2021; Jumbe & Bwawa, 2021; Nhamo et al., 2022). This problem continues to persist despite significant efforts by many organizations and the government, as existing products often fail to address the specific needs and perceptions of communal farmers, leading to a disconnect between supply and demand. Farmers frequently perceive policies as complex, irrelevant to their most pressing risks, or simply not worth the investment (Sithole, 2024). This study therefore argues that to increase uptake, it is essential to move beyond a focus on affordability and delve into the design of the policies themselves specifically, the coverage attributes. Understanding what farmers want to be covered, and how they need that information to be presented, is fundamental to designing a product that they will trust and

adopt. This research aims to fill this gap by analyzing the influence of coverage attributes from the farmers' perspective, using a detailed case study from Lupane District, a region particularly affected by these risks.

Theoretical Framework

This study is grounded in the Stakeholder Networking Theory proposed by Rowley 1997, which posits that the success of a project or organization is dependent on the effective collaboration and interaction between all relevant stakeholders. In the context of agricultural insurance, this theory highlights that a successful insurance scheme cannot be developed in isolation. It requires a network of relationships among various stakeholders, including the farmers (the primary beneficiaries), government agencies, traditional leaders, agricultural extension officers, and insurance companies.

The theory suggests that an insurance product's design is not merely a technical exercise but a social one, shaped by the needs and interests of all actors within this network. This study applies this lens to understand how stakeholder relationships and the flow of information among them influence the design and ultimate acceptance of coverage attributes. The failure of existing schemes can therefore be viewed as a breakdown in this network, where the needs of the farmers (their desired coverage attributes) are not effectively communicated or integrated into the product design by the insurers.

MATERIALS AND METHODS

This study adopted a pragmatic philosophy, combining both quantitative and qualitative research methodologies to gain a comprehensive understanding of the topic. A mixed-methods approach with a sequential explanatory design was used, where the quantitative data was collected and analyzed first, followed by the qualitative data. This allowed the qualitative phase to explain and elaborate on the initial quantitative findings, providing a richer context for the statistical relationships observed.

Methods

Description of the Study Site: The research was conducted in Lupane District, located in the Matebeleland North Province of Zimbabwe. The district is characterized by a semi-arid climate, making it highly susceptible to recurrent droughts. The primary economic activity is communal cattle farming, which is the main source of income and food security for the majority of the population. The region's environmental and socio-economic conditions make it an ideal site for studying risk perceptions and insurance uptake.

Population and Sample Size Determination

The target population comprised all communal cattle farmers in Lupane District. A representative sample was essential due to the large and dispersed nature of the population. The sample size was determined using the Krejcie and Morgan (1970) formula, with a confidence level of 95% and a margin of error of 5%. From an estimated population of over 20,000 communal farmers, a sample size of 377 was calculated.

Sampling

A multi-stage sampling technique was employed. First, simple random sampling was used to select five wards within the Lupane District. Within each selected ward, systematic random sampling was used to choose households from a list of cattle farmers. The first household was randomly selected, and then every k-th household was chosen thereafter to ensure a representative sample from each ward. For the qualitative phase, 25 key informants were chosen using purposive sampling, based on their knowledge and experience related to cattle farming and community leadership.

Data Collection

• Quantitative Data Collection: A structured questionnaire was used to collect quantitative data from 219 communal cattle farmers. The data was collected using KoboCollect on mobile devices for real-time data capturing.

• Qualitative Data Collection: In-depth, semi-structured interviews were conducted to collect qualitative data from the 25 key informants, allowing for detailed insights into risk perceptions and traditional risk-sharing mechanisms.

Analyses

Quantitative Data Analysis: Quantitative data was exported from KoboCollect and analyzed using the JAMOVI statistical package. The primary analytical technique was Structural Equation Modeling (SEM), and for this specific objective, a probit regression analysis was employed to test the direct relationship between coverage attributes and a farmer's willingness to adopt cattle insurance.

Qualitative Data Analysis: Qualitative data from the interviews were analyzed using thematic analysis. Interview transcripts were read, coded, and then synthesized to identify recurring themes and patterns related to coverage attributes.

Diagnostic and Reliability Tests: To ensure the validity and reliability of the data, a series of diagnostic tests were performed:

Reliability Test

The reliability of the measurement scale was assessed using Cronbach's Alpha (α), with a value above 0.70 considered acceptable.

Table 1. Reliability and validity measures employed in the study

Scale Reliability Statistics		
Mean	**Cronbach's α**	**McDonald's ω**
2.98	**0.844**	**0.847**

Source: Primary Data (2025)

The Mean of 2.98 indicates the average score across the items measured. The overall Cronbach's α (Alpha) value of

0.844 suggests that the scale has good internal consistency. Generally, a Cronbach's α value above 0.70 is considered acceptable, while values above 0.80 indicate good reliability. This high value implies that the items on the scale are measuring the same underlying construct and are highly correlated. The McDonald's ω (Omega) value of 0.847 further supports the reliability of the scale. McDonald's ω is often considered a more accurate estimate of reliability than Cronbach's α, especially when the assumptions of α are not met. The close values of Cronbach's α and McDonald's ω indicate that the scale is robust and reliable. This approach ensured that the questionnaire effectively measured the intended constructs.

Validity Tests

The model's validity and overall fit were assessed using key fit indices, including the Chi-Square Test ($\chi 2$), Root Mean Square Error of Approximation (RMSEA) (<0.08), Comparative Fit Index (CFI) (>0.90), and Tucker-Lewis Index (TLI) (>0.90).

Table 2. Model Fit Indices

Fit Index	Value	Threshold	Interpretation
Chi-square/df (CMIN/df)	1.53	< 3.00	Good fit
SRMR (Standardized Root Mean Square Residual)	0.054	≤ 0.08	Excellent fit
RMSEA (Root Mean Square Error of Approximation)	0.070 (Classical), 0.118 (Scaled)	< 0.08 acceptable, < 0.05 excellent	Acceptable to moderate fit
CFI (Comparative Fit Index)	0.994 (Classical), 0.969 (Robust)	≥ 0.90 acceptable, ≥ 0.95 excellent	Excellent fit
TLI (Tucker-Lewis Index)	0.991 (Classical), 0.954 (Robust)	≥ 0.90 acceptable, ≥ 0.95 excellent	Excellent fit
NFI, IFI, RFI, NNFI	≥ 0.95	≥ 0.90	Strong incremental and comparative fit
GFI	≥ 0.90	≥ 0.90	Acceptable fit (used with caution)

Source: Primary data analysis by Jamovi, 2025

The model's fit to the data was evaluated using both absolute and incremental fit indices. The User Model yielded a chi-square value of 58.0 with 38 degrees of freedom, and p = 0.020, indicating a statistically significant but not unacceptable fit given the sample size. More importantly, the Satorra-Bentler Scaled Chi-Square was 95.7 (df = 38, p < .001), which again confirmed model significance under robust estimation. The Standardized Root Mean Square Residual (SRMR) was 0.074, within the acceptable threshold of ≤ 0.08. The Root Mean Square Error of Approximation (RMSEA) under the classical approach was 0.070, with a 90% confidence interval ranging from 0.028 to 0.104, and a p-close of 0.180, suggesting an acceptable fit. Although the Scaled RMSEA was slightly elevated at 0.118, its effect was counterbalanced by strong incremental fit indices: Comparative Fit Index (CFI) = 0.969, Tucker-Lewis Index (TLI) = 0.954, Normed Fit Index (NFI) = 0.950, and Incremental Fit Index (IFI) = 0.969all comfortably exceeding the minimum recommended threshold of 0.90, with some even approaching 0.95. The Parsimony Normed Fit Index (PNFI) was 0.645, indicating a balance between model complexity and goodness of fit. The diagnostic tests confirm that the SEM model developed in this study is statistically robust and empirically sound. The sample size is sufficient, reliability and validity measures are consistently above recommended thresholds, and multicollinearity and outlier issues are absent. Despite minor deviations in normality and a slightly elevated scaled RMSEA, the model's overall fit is strongly supported by the majority of fit indices, especially CFI (0.969), TLI (0.954), SRMR (0.074), and NFI (0.950). These results affirm that the model is appropriately specified and suitable for further interpretation and hypothesis testing regarding factors influencing communal farmers' adoption of cattle insurance in Lupane District.

RESULTS AND DISCUSSION

The analysis revealed a positive and statistically significant relationship between coverage attributes and communal farmers' willingness to adopt cattle insurance.

Table 3. Probit regression model results

Predictor	Coefficient (β)	Std. Error	z-value	p-value	Marginal Effect (dy/dx)	Interpretation
Intercept (β_0)	-0.823	0.287	-2.867	0.004		Baseline probability without CA
Coverage Attributes (CA)	0.614	0.149	4.122	< 0.001	0.241	A one-unit increase in CA increases probability of uptake by 24.1%

Source: Survey Results, 2025

Quantitative Results: The Probit regression analysis showed a statistically significant positive coefficient of 0.242 for the relationship between Coverage Attributes (CA) and Willingness to Adopt (WIA), with a p-value of < 0.001. This indicates that for a one-unit increase in the perceived quality of coverage attributes, the likelihood of a farmer being willing to adopt insurance increases by a factor of 0.242.

Qualitative Insights: Thematic analysis confirmed that the comprehensiveness of covered risks and the clarity of policy terms are the most critical issues for farmers. Interviews revealed that farmers often perceive existing products as too limited, frequently excluding the most common threats like specific diseases or drought-related losses. They also expressed frustration with complex language and a lack of transparency, which undermines their trust and willingness to commit. The degree to which coverage attributes resonate with farmers' lived realities and needs strongly shapes their insurance decisions.

• Excerpt 7 (P22, Communal Farmer):

"Coverage must match local challenges. For example, in Lupane we struggle with both drought and theft. Insurance must address these."

• Excerpt 8 (P4, Agritex Officer):

"Sometimes insurers design policies based on urban models, ignoring communal farmers' realities. This disconnect reduces uptake."

• Excerpt 9 (P16, Cattle Insurer):

"We tailor policies after consultations with local farmers, ensuring coverage is relevant to their specific risks."

This convergence of quantitative and qualitative findings strongly suggests that insurance providers must prioritize designing policies that are both comprehensive in their coverage and straight-forward in their communication to meet the expectations of this community.

CONCLUSION

This study concludes that coverage attributes are a significant determinant of cattle insurance uptake among communal farmers. The research provides a clear message to policymakers and insurers: to increase adoption, they must move beyond simply offering a product and instead focus on designing policies that are truly relevant, comprehensive, and clear. By aligning policy coverage with the multidimensional risks farmers face and simplifying the language used, stakeholders can build the trust necessary to drive long-term adoption.

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Conflict of Interest

The authors declare no conflict of interest in conducting this research or in the publication of this article.

Author Contributions

• Nyasha Nyakuchena: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing - Original Draft Preparation.

• Dr. Joseph P. Musara: Supervision, Validation, Review & Editing.

• Dr. Emmanuel Zivenge: Supervision, Validation, Review & Editing.

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Applied Studies in Agribusiness and Commerce – APSTRACT
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ECONOMIC ANALYSIS OF A COMPLEX PIG FARM

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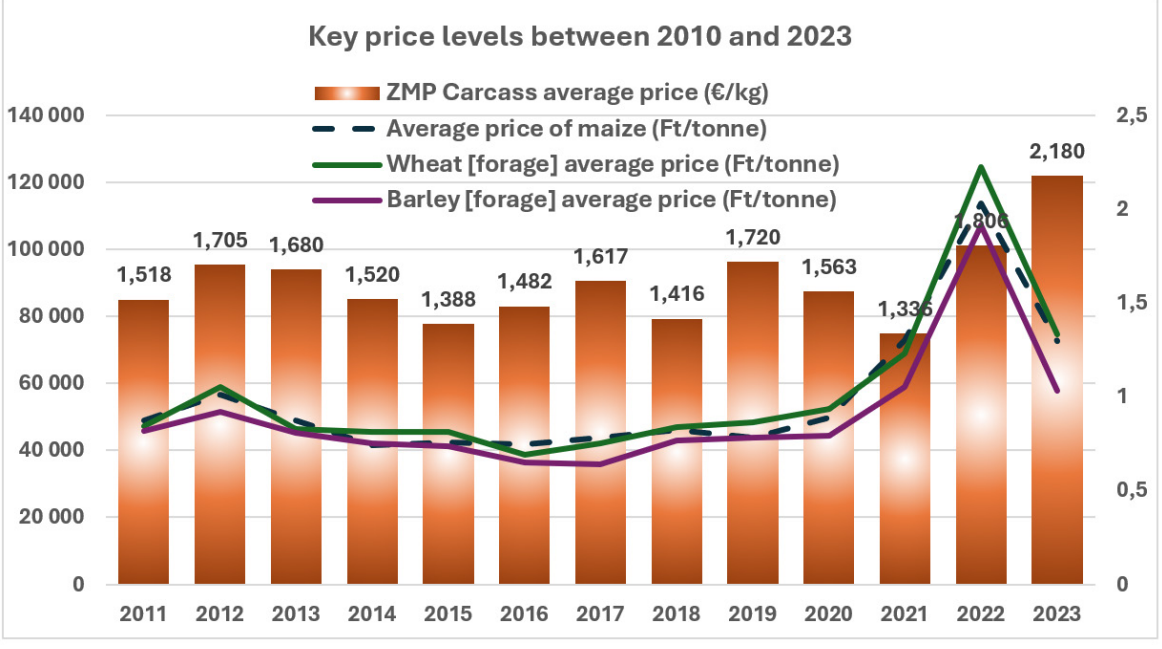
Abstract: *The objective of this study is, beyond presenting the production and economic indicators of a complex pig farm established as a brownfield investment, to analyze its cost-income and profitability relations. The Authors conducted their calculations based on primary data collection and a preliminary calculation model. The technological equipment of the presented pig farm is competitive at the European level, and its production indicators also show favorable results. The capital investment demonstrates adequate profitability, as the internal rate of return (IRR) is 12.35%, while the net present value (NPV) of the investment at the end of the 15th year is HUF 1.36 billion. According to the model, the results indicate that, on the one hand, the investment is capital-intensive, but at the same time, large-scale livestock farms equipped with similarly advanced technology are definitely necessary, as they greatly contribute to improving the sector's efficiency. There is further potential for achieving competitive advantages through increasing economies of scale. Appropriate human resources with the necessary expertise, genetics, and feeding must accompany the technological advancement.*

Keywords: *pig sector, investment analysis, case study*
(JEL code: Q56, D12)

INTRODUCTION

The intensive price fluctuations in recent periods have significantly affected livestock farmers, including pig breeders. Figure 1 below tracks the evolution of average prices that play a role in the formation of the two primary factors determining the profitability of pig farming, namely the sales price and the feed cost.

Figure 1. Key price levels



Source: own compilation, based on ZMP prices published by https://www.schuttert.nl/ and data from KSH (2023)

Evaluating the data, it can be stated that the purchase prices of the three main cereal crops involved in pig feeding — maize, feed wheat, and feed barley — moved together in the period between 2011 and 2020, with values showing relatively small year-to-year fluctuations. Compared to the movements of feed prices, the German ZMP quotation, which functions as a reference in setting the sales price of slaughter pigs, already showed greater volatility. Following the data in the figure, in the period 2021-2023, it can be observed that in 2021, the German ZMP quotation decreased on an annual average to €1.336 per carcass kg, forming the lowest average price of the past 10 years; only in 2015 was a similar magnitude recorded, with €1.338 per carcass kg. At the same time, the purchase prices of cereals began to increase intensively due to various reasons, and in 2022, grain prices soared, causing absolute disproportions in the output–input price relations of pig farming.

Further analyzing the data, Table 1 compares the intense and sometimes explosive prices of 2021, 2022, and 2023 to the average prices of 2011-2020.

Table 1. Changes in the average price of ZMP and major grain crops between 2011 and 2023

Name	2011–2020 average	2021	2022	2023	Year 2021 / 10-year base	Year 2022 / 10-year base	Year 2023 / 10-year base
ZMP average price (€/kg)	1,561	1,336	1,806	2,180	86%	116%	140%
Corn (Ft/t)	46 353	72 823	113 683	72 602	157%	245%	157%
Feed wheat (Ft/t)	47 186	68 927	124 678	74 529	146%	264%	158%
Feed barley (Ft/t)	42 941	58 872	107 211	57 755	137%	250%	134%

Source: own compilation, based on data from ZMP and KSH (2023)

The German ZMP quotation, which plays a central role in setting pig prices, reacted much later to the intensive and explosive increases occurring on the input side, practically creating a crisis situation in pig farming. Regarding the year 2023, it can be said that price levels consolidated from a livestock farming perspective; however, it is important to note that in 2021 and 2022, financial reserves used to survive were depleted, and there is a lack of resources for replenishing these reserves and launching further developments.

Consequently, it is an important and timely question to evaluate the cost and income relations of a new and efficiently operating pig farm, thereby forecasting the return on investments, which this study undertakes based on a preliminary calculation model.

In our investigation, we set out to answer the following questions: how does the cost structure and profitability of a newly built pig farm, operating with the best housing and feeding technology, develop, and within what time frame does the investment pay off? Related to this, our hypotheses were formulated as follows:

(H1) A pig farm operating efficiently both technologically and in physical terms functions profitably.

(H2) The discounted cash flow generated ensures a payback period of less than 10 years.

LITERATURE REVIEW

Pig Meat Production

In 2022, the EU-27 member states accounted for 12.4% of global meat production, exceeding a self-sufficiency level of 100%, reaching an average of 111% in 2023. In total, eight member states, including Hungary, exhibited above-average self-sufficiency in 2023. A significant portion of the export market was represented by pork, accounting for 61.7% in 2022, while poultry meat exports were nearly 30% (EC, 2024). It can be stated that meat production in the EU-27 increased over the past twenty years, although at different rates and magnitudes depending on the type of meat: poultry production increased the most, while beef and pork production showed more modest growth (Meat Atlas, 2022).

Following poultry, pork is globally the most produced meat type by volume, and according to ten-year forecasts, no significant changes are expected in its production trends, as pork and poultry meat will continue to hold a leading position — jointly accounting for 74.8% (OECD-FAO, 2024). The EU-27's pork production fell by 5% in 2022 compared to 2021, amounting to 22.5 million tonnes. Production decreased in both Germany and Spain, the two largest pork-producing countries. Germany saw a 9.6% decline in 2022, while Spain experienced a 2.2% reduction. The most significant reductions occurred in Poland and Denmark; however, production levels were also lower in other member states. This means that production in 2022 nearly reached the low point recorded in 2009 (OECD-FAO, 2023). A similar trend was observed in per capita meat consumption, with a 5.2% decrease in pork consumption. The background to this lies in changing attitudes related to health, stricter environmental policies in the EU, and their societal perception (EUROSTAT, 2024).

Production Costs

Beyond the current problems of pig breeding, it is important to highlight that specialization is not a general characteristic among Hungarian producers, despite the fact that specialization can significantly increase farm efficiency. Pig breeding consists of two production processes: one is sow keeping and piglet rearing, while the other is fattening, which results in slaughter pigs (Apáti-Szőllősi, 2018). In light of this fact, it is worth examining the production costs of pig production in an international comparison, presented in Table 2. The larg-

est cost item is feed, which accounted for 57% in Hungary in 2022. Due to the automation of pig farms, relatively few human resources are required to manage large-scale farms. Therefore, in Hungary, labor costs accounted for 5.8% of the total cost in pig production in 2022.

Table 2. Evolution of production costs in pig production, 2022

Country	Animal feed	Other operating expenses	Labour costs	Depreciation and other financial costs	Total
	(€/kg)	(€/kg)	(€/kg)	(€/kg)	(€/kg)
Italy	1,82	0,44	0,15	0,48	2,89
United Kingdom (closed)	1,82	0,27	0,17	0,29	2,55
United Kingdom (open)	1,83	0,31	0,18	0,22	2,54
Sweden	1,74	0,18	0,18	0,38	2,48
Finland	1,26	0,42	0,20	0,35	2,23
Germany	1,44	0,32	0,15	0,31	2,22
Ireland	1,47	0,29	0,15	0,28	2,19
Netherlands	1,33	0,39	0,13	0,23	2,08
Spain	1,46	0,30	0,10	0,20	2,06
Hungary	**1,16**	**0,26**	**0,12**	**0,50**	**2,04**
Austria	1,38	0,06	0,20	0,40	2,04
Belgium	1,42	0,23	0,12	0,23	2,00
France	1,28	0,25	0,13	0,26	1,92
Denmark	1,20	0,26	0,17	0,23	1,86
USA	1,31	0,18	0,10	0,21	1,80
Brazil, southern region	1,28	0,11	0,04	0,17	1,60
Brazil, central-western region	1,09	0,10	0,04	0,18	1,41

Source: own compilation, based on data from ZMP and KSH (2023)

The volume of investments taking place in agriculture is influenced, in addition to the national economic situation, by the condition of agriculture and its output. Hungarian agricultural output in 2023 exceeded HUF 4.3 billion, which was 6.6% higher than a year earlier. Among the reasons for the increase was a 25% growth in total production volume, of which crop production was 45% higher, while livestock production decreased by 0.5% (KSH, 2023). The domestic development needs are significant, as competitiveness often lags behind that of Western European countries.

The Growth Loan Program was a major financing factor for many years, while market-based lending came back to the fore in 2016. Another source of financing is the Rural Development Programme (RDP) 2014-2020 (Prime Minister's Office, 2015). Unlike previous programs, in this case, sectors creating higher added value became the focus, which also have a significantly greater labor demand (animal husbandry, horticulture), so machinery investments (large-scale tractors related to arable farming) were excluded from the support system. Additionally, a significant change was that the object of investment determined the evaluation of support intensity. 10-15% of pig farmers benefited from decisions supporting the modernization of pig farms. It is likely that the developments did not affect all facilities of the farms, but due to the high coverage, the effect of support is reflected in the competitiveness of the entire sector (Bíró et al., 2020).

MATERIALS AND METHODS

Primary data collection was based on a pig farm built in 2023 as a brownfield investment in Hungary, using a preliminary calculation model. The natural parameters were calculated considering values realized during previous investments of the organization, already equipped with new and modern technology, similarly for individual cost elements.

The planned sales price of slaughter pigs was determined as follows: for setting pig prices, the reference price of the German ZMP quotation was planned at €2.1 per carcass kg, which, applying a conversion factor of 1.238 between carcass and live weight and an exchange rate of HUF 395/€, corresponds to a price level of HUF 670 per live weight kg. As part of the investment, the following production capacities were built:

Figure 1. Key price levels

Source: own photograph

The pig farm, operating since the 1970s, was demolished in 2022, and a modern pig farm consisting of four livestock buildings was built on the site. In a building of 2,730 m² gross area, breeding sows were housed in both group and individual housing systems. The breeding building was equipped with 456 group gestation spaces ("gestation house"), 258 individual sow stalls (breeding stalls), and 64 gilt accommodation spaces. For incoming gilts, an additional 8 pens are available, accommodating 64 animals, and there is space for 4 teaser boars with separate housing. Another building was designed for farrowing pens over 2,340 m² and for nursery rooms totaling 1,590 m². In the six farrowing rooms, each has 36 farrowing crates of 6.24 m², so-called "free-farrowing" pens, which already exceed future animal welfare standards, providing better comfort and well-being for breeding animals during farrowing and piglet rearing. (This is the first large-scale farrowing capacity in the organization examined, built with loose housing systems.) As a result, the piglets selected for weaning are more vigorous and better developed and can adapt more efficiently to conditions in subsequent production phases. Breeding sows moved from the more comfortable and freer farrowing pens can stay productive for longer and, due to their better physical condition, are capable of higher milk production, reflected in the growth of the offspring herd. The nursery, consisting of 6 rooms with 16 pens each, totaling 2,976 places, and the finishing barns built in two buildings of 4,510 m² each, totaling 8,640 places, are lagoon-based systems, with external thermal insulation, reinforced concrete walls, wooden roof structures, sandwich panel roofing, and, of course, include mechanical, storage, and electrical rooms. With an average sow stock of 800, the farm will produce 25,000 slaughter pigs per year, with an average live weight of 118 kg, amounting to 2,950 tons of output.

The selected housing technology features a lagoon system whose main components include a pen system, an automated feed delivery system, and an automated ventilation system. Heating is supported by a heat pump system. The building is equipped with the most modern ventilation technology. Through central air inlets, fresh, temperature-controlled air, both in winter and summer, is directed into underfloor air ducts, from where it is delivered in a regulated quantity and speed into the animal housing space via air distribution columns, so-called exatops. Exhaust fans remove used air from the housing areas, ensuring that the amount and temperature of fresh air entering the individual rooms precisely meet the animals' needs. The feeding of breeding sows and piglets is ensured by dry feed delivery and distribution systems, while the finishing barns' feeding is provided by a well-controlled liquid feeding system.

In examining the payback of the investment, we applied the following four dynamic investment profitability indicators: Net Present Value (NPV), Discounted Payback Period (DPP), Internal Rate of Return (IRR), and Profitability Index (PI). When preparing the model, we took into account the financing structure of the investment.

Among indicators supporting investment decisions, NPV is one of the most frequently used. This difference-type indicator expresses how much return is generated by subtracting the initial cash outflow from the discounted total of post-tax cash flows, i.e., the net profit of the investment over its entire duration expressed in discounted value. Due to the specific situation of agriculture, it is advisable to use NPV after careful examinations, keeping sector-specific characteristics in mind (Karácsonyi, 2007). Using the DPP, we obtain the number of periods during which the funds invested in the project are recovered. The IRR calculation is also based on the net present value, as it indicates the interest rate at which the present value of net returns generated in the future equals the present value of the investment (Ulbert, 2018).

The PI indicator expresses the cost-benefit ratio, representing the present value of the investment relative to the initial cash outflow.

RESULT AND DISCUSSION

Cost and Income Relations

The examined farm applies Topigs-Norsvin (Dutch–Swedish) genetics under the following natural parameters. Table 3 summarizes the various production indicators.

Table 3. Development of key production indicators at the site under review

Suckling piglet mortality (%)	8,0%
Piglet mortality (%)	2,2%
Fattening pig mortality (%)	2,0%
FCR [battery] (kg/kg)	1,50
FCR [fattening] (kg/kg)	2,55
FCR [farm] (kg/kg)	2,61
Body weight gain [farrowing] (g/day)	425
Body weight gain [fattening] (g/day)	850
Average number of sows	812,8
Number of piglets selected per sow per year	31,10
Fattening pigs sold per sow per year	30,48

Source: based on own data collection (2024)

Table 4 presents the modeled production values of the farm, showing production value and production costs. It can be established that the complex pig farm operates profitably, with a cost-to-income profitability ratio of 15.61%.

Table 4. Production values of the pig farm under review, 2023

Name		Total settlement (thousand HUF/year))	Specific value per 1 kg of weight sold (Ft/kg)	Unique value per sow (thousand HUF/sow)
1.	Revenue	1 985 790	665,56	2 443
2.	Subsidies	73 493	24,63	90
3.	Production value	2 059 283	690,19	2 534
4.	Direct costs	1 615 373	552,57	1 987
5.	General + financing costs	122 513	41,06	**151**
6.	Production costs	1 737 886	582,47	2 138
7.	Profit	321 397	107,72	395
8.	Depreciation (excluding breeding animals)	259 456	86,96	319
9.	EBITDA	580 853	194,68	715
10.	Rerurn on production value		15,61%	
11.	EBITDA on production value		28,21%	

Source: own compilation, based on data from ZMP and KSH (2023)

The cost structure of the production at the examined pig farm is illustrated in Table 5. The most significant cost item is feed costs, which account for more than 52%, followed by depreciation costs at 14.93%, representing HUF 259 million annually for buildings, machinery, and technology. The depreciation of breeding animals is shown on a separate line, accounting for nearly 4%. Personnel expenses include the salaries and social contributions of the farm manager and eleven employees. The cost of services used constitutes 8.48% of all direct costs, while energy costs similarly appear with a share of 8.38%.

Table 5. Cost structure of the pig farm under review, 2023

	Cost structure	Thousand HUF/year	Ratio
1.	Feed costs	909 272	52,32%
2.	Fertilizing material	7 647	0,44%
3.	Energy costs	145 635	8,38%
4.	Veterinary medicine and hygiene materials	39 971	2,30%
5.	Other material costs	9 906	0,57%
6.	Cost of services used	147 373	8,48%
7.	Personnel expenses	149 806	8,62%
8.	Depreciation of breeding animals	68 820	3,96%
9.	Depreciation (buildings, machinery, technology)	259 456	14,93%
10.	Total direct costs	1 737 886	100,00%

Source: based on own data collection (2024)

Sensitivity Analysis (Cross-tabulation Analysis)

Based on the preliminary calculation model, considering the cost and income situation, we performed cross-tabulation analyses, which allow examination of two variables simultaneously. In the sensitivity analysis, we examined how changes in the two factors we consider the most important, namely feed prices and the sales price of slaughter pigs, affect the result and the EBITDA value. We analyzed the results in the function of feed prices varying between HUF 80–150 per kg and slaughter pig sales prices ranging from HUF 500–725 per kg. The results suggest that in the economic year 2023, to cover a feed price of HUF 140/kg, a sales price of HUF 650/kg or higher was necessary for slaughter pig sales to remain profitable.

including (Terry and Ogg, 2017; Birthal et al., 2021; Koide et al., 2021; Vo et al., 2021), emphasising the significance of irrigation in agricultural practices.

Table 6. Cross-tabulation analysis of results based on feed prices and slaughter pig sales prices

Income (thousand HUF/year)	Feed price (HUF/kg)							
Slaughter pig sales price (HUF/kg)	80	90	100	110	120	130	140	150
500	75 386	-800	-76 987	-153 174	-229 360	-305 547	-381 734	-457 921
525	148 470	72 284	-3 903	-80 090	-156 276	-232 463	-308 650	-384 837
550	221 555	145 369	69 182	-7 005	-83 191	-159 378	-235 565	-311 752
575	294 639	218 453	142 266	66 079	-10 107	-86 294	-162 481	-238 668
600	367 724	291 538	215 351	139 164	62 978	-13 209	-89 396	-165 583
625	440 808	364 622	288 435	212 248	136 062	59 875	-16 312	-92 499
650	513 893	437 707	361 520	285 333	209 147	132 960	56 773	-19 414
675	586 977	510 791	434 604	358 417	282 231	206 044	129 857	53 670
700	660 062	583 876	507 689	431 502	355 316	279 129	202 942	126 755
725	733 146	656 960	580 773	504 586	428 400	352 213	276 026	199 839

Source: own data collection and calculations (2024)

Continuing the logical calculation, we also performed the cross-tabulation analysis regarding EBITDA (Table 7). In this case, at a feed price of HUF 140/kg, a sales price of HUF 550/kg was sufficient for production not to be loss-making.

Table 7. Cross-tabulation analysis in terms of EBITDA, depending on feed prices and slaughter pig sales prices

EBITDA	Feed price (HUF/kg)							
Slaughter pig sales price (HUF/kg	80	90	100	110	120	130	140	150
500	334 842	258 656	182 469	106 282	30 096	-46 091	-122 278	-198 465
525	407 926	331 740	255 553	179 366	103 180	26 993	-49 194	-125 381
550	481 011	404 825	328 638	252 451	176 265	100 078	23 891	-52 296
575	554 095	477 909	401 722	325 535	249 349	173 162	96 975	20 788
600	627 180	550 994	474 807	398 620	322 434	246 247	170 060	93 873
625	700 264	624 078	547 891	471 704	395 518	319 331	243 144	166 957
650	773 349	697 163	620 976	544 789	468 603	392 416	316 229	240 042
675	846 433	770 247	694 060	617 873	541 687	465 500	389 313	313 126
700	919 518	843 332	767 145	690 958	614 772	538 585	462 398	386 211
725	992 602	916 416	840 229	764 042	687 856	611 669	535 482	459 295

Source: own data collection and calculations (2024)

Evaluation of the Investment's Payback

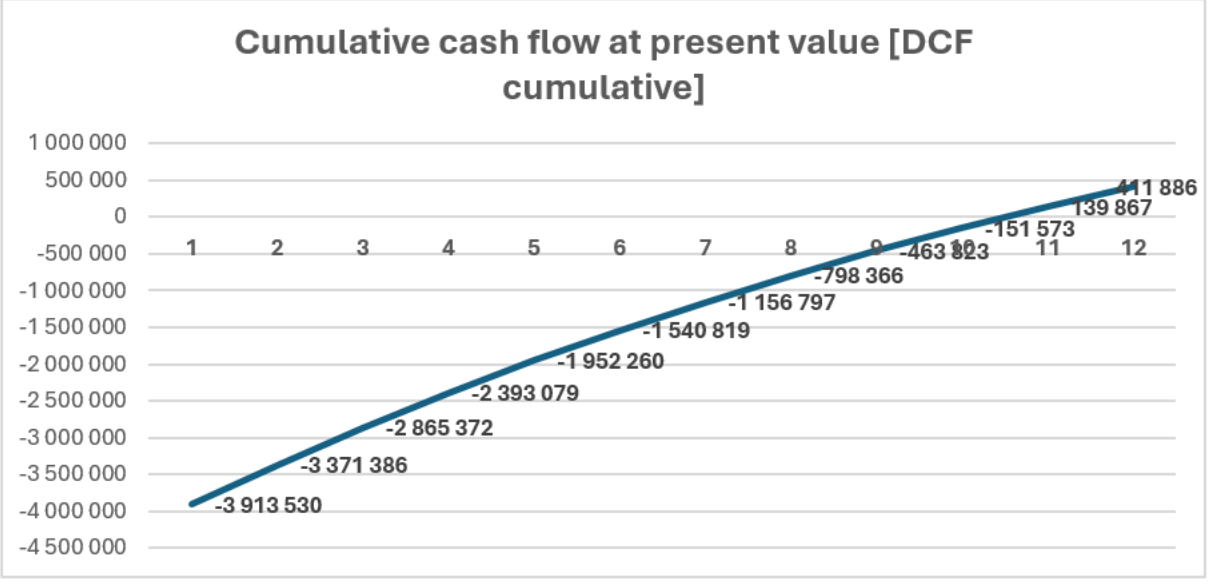
Regarding the composition of the financing sources for the investment, the total cost of the project was HUF 6.13 billion, of which 36.65% was a non-refundable subsidy. Accordingly, own resources amounted to HUF 3.88 billion, consisting of equity and investment loans, representing a share of 63.35%.

Table 8. Influence of traditional risk management on the association of farm business risk and repayment status

	Thousand HUF	Ratio
Total investment cost	6 130 000	100,0%
Non-refundable subsidy	2 246 470	36,65%
Total own resources	3 883 530	63,35%
of which - own contribution	1 226 000	20,00%
- investment loan	2 805 000	45,76%

Source: own data collection and calculations (2024)

Figure 3. Key price levels



Source: own calculations (2024)

According to our calculations, the net present value (NPV) of the investment at the end of the 15th year from the investment date is HUF 1.36 billion, with a discounted payback period (DPP) of 9.5 years. The internal rate of return (IRR) is 12.35%. Overall, we are dealing with a capital-intensive investment, considering the structure of financing (36.65% non-refundable subsidy, 45.76% investment loan), which significantly improves the examined indicators from the company's perspective. Including subsidies in the financing structure results in more favorable returns under the income relations examined since a pig farm investment implemented purely from own resources would not be able to achieve payback even within ten years.

CONCLUSION

In our study, we presented a complex pig farm established as a brownfield investment in 2023, analyzing it in terms of cost and income relations. The results obtained were presented, among other things, using a preliminary calculation model. It can be stated that the production indicators of the examined pig farm are competitive even in an international context, representing a high technological standard, equipped with an automated feed distribution system and modern ventilation. Thus, we accept our first hypothesis (H1) that a pig farm operating with modern technology and physical efficiency can operate profitably.

Our investigation also highlighted that implementing an operation considered competitive and modern in an international context requires extraordinary capital, which purely from own resources would not ensure even a 10-year payback period. For this reason, it is definitely necessary to further improve support policies and investment financing for enterprises because making Hungarian pig breeding more efficient is indispensable. Therefore, we accept our second hypothesis (H2) that the discounted cash flow produced ensures a payback period of less than 10 years.

In our opinion, in the future, through similar efficiency-enhancing investments and technological developments, a reduction in production costs can be observed, thereby increasing competitive positions, in line with the results of numerous other researchers (Nábrádi et al., 2009; Kirkaya, 2020; Szántó et al., 2020). The use of modern production technologies and genetic progress is expected to increase productivity positively.

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THE CHANGES IN THE HUNGARIAN HIGHER EDUCATION SYSTEM DURING THE CHANGE OF REGIME – THE SPREAD OF CHURCH AND FOUNDATION RUN INSTITUTIONS

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Abstract: *This study examines the transformation of the Hungarian higher education system during the change of regime (1989-1990), with particular emphasis on the spread of church- and foundation-run institutions. It presents the legal framework that enabled the establishment of non-state institutions, highlighting Act XXIII of 1990 and subsequent legislation. It uses statistical data to support the significant increase in the number of institutions and students in the non-state sector. It illustrates the different development paths of these institutions through case studies of Károli Gáspár Reformed University and Kodolányi János University. The article analyzes the socio-economic impacts of the changes, including social mobility, economic development, and educational equality. Finally, it reflects on the current challenges and future prospects of Hungarian higher education.*

Keywords: *change of regime, privatization, church institutions, foundation institutions, educational reform*
(JEL code: I23, L33)

INTRODUCTION

The period of system change (1989-1990) brought radical changes to the Hungarian higher education system. After the fall of the communist regime, the liberalization and decentralization of higher education became essential for the country to adapt to the requirements of a democratic society and a market economy. A significant increase in student numbers, the expansion of the institutional network, and the emergence of church- and foundation-run institutions fundamentally changed the higher education sector.

Legal instruments have been the main drivers of the evolution of higher education policy (Derényi, 2009, 32.). This can also be seen from the example of the establishment of non-state institutions based on Law XXIII of 1990 (Böcskei, 2003, 37.). It is important to note that the transformation, which proved necessary despite the economic problems of the 1990s, affected not only the institutional network, but also the increase in student numbers and the integration into the Bologna system.

This study analyzes these changes in detail, with a special focus on the role and impact of non-state institutions and the privatization process. It aims to provide a comprehensive overview of post-transition higher education reforms, while examining the topic from an academic perspective.

LITERATURE REVIEW

The higher education reforms that took place in post-communist countries were crucial for democratic transition and the establishment of market economies. Numerous studies have addressed issues such as privatization, decentralization, and quality assurance. (Csizmadia, 2009; Polónyi, 2012). Non-state funded higher education institutions have played a significant role in the transformation of the sector through their flexibility and rapid adaptation to market demands (Szemerszki, 2003). In the case of church institutions, the preservation of religious and cultural identity provided additional motivation (Gloviczki, 2021).

Legal background and institutional changes

Act XXIII of 1990 marked a turning point in Hungarian higher education, as it enabled the establishment of non-state-maintained institutions. This legislation paved the way for legal and natural persons, as well as foreign institutions, to establish higher education institutions (Böcskei, 2003). The 1996 amendment further relaxed the dual system, allowing universities and colleges to launch programs at each other's educational levels, provided they met the conditions (Derényi, 2009). The Bologna Declaration signed in 1999 and the three-cycle education system introduced in 2006 brought further structural changes in

line with European trends (Temesi, 2016).

The main drivers of change

One of the goals set at the time of the change of regime was to increase the number of students based on Western patterns, affecting 30% of the age group concerned. The trend towards expansion was not only typical in the West but also worldwide, leading to a differentiation and diversification of the higher education sector and the students within it (Doktor, 2008, 57.).

From 1989 to 1993, the number of students admitted every year doubled, and from 1993 to 2003, it increased 6.5-fold (Derényi, 2009, 33.). In concrete terms, while in 1989, 15,000 applicants were admitted to higher education, in 2004, 100,000 students started their higher education studies. The expansion was necessary due to specific demographic characteristics, as the cohort entering higher education in the 1990s was already larger than before (Böcskei, 2003, 62.).

In addition to the number of students, there has also been an increase in the number of institutions. This peaked in the academic year 1992/1993, when there were ninety-one institutions. This process then stagnated until the integration measures of the 2000s (after which the number of institutions fell to sixty-two) (Doktor, 2008, 66.).

The increase in the number of students has had consequences such as changes in the social composition of students (Sárhegyi, 2019, 8.) and the emergence of fee-based courses from 1998 onwards (Temesi, 2016, 70.). The first period of an increase in the number of students was from 1990 to 2004-2005 (Derényi, 2009, 33.), and there has been a decrease since 2011 (Temesi, 2016, 56.). Some experts, however, report on the expansion in a negative way, as the process took place in a shorter period of time than in other countries and at a time when Hungary was experiencing particularly unfavourable economic conditions.

„It could be argued that Western European countries have implemented a gradual, interdependent process, and that no harmful interference has occurred there. They were able to carry out structural reforms in a favourable economic environment, in parallel with expansion, and then, once this was complete, they could embark on training reforms and large-scale mobility. (...) Assuming that multi-cycle training and the changes it entails are flawed in Hungary, are these flaws not the result of the negative interaction between delay, forced catching-up and the - also forced - pace of training reforms in the meantime?" (Temesi, 2016, 65.)

„(...) In 15 years, the number of teachers has increased by only 37 percent, while the amount of state aid per student has fallen to 38 percent of the 1990 level by 2000. Capacity has therefore not followed the growth in the number of students at all." (Derényi, 2009, 33.)

It is undeniable, however, that in addition to the external pressure and "duress", there was also an internal need for change (Temesi, 2016, 65.)

The amendment of the law in 1996 enabled the introduction of higher vocational education for higher education institutions and cooperating institutions offering secondary education. However, the positioning of this form of education was questionable for a long time, as neither the higher education sector nor vocational education considered it as its own (Derényi, 2009, 35.). The same amendment to the law loosened the dual system, allowing universities to offer college-level courses and colleges to offer university-level courses, provided they had the necessary conditions (Derényi, 2009, 37.). Legal equality between universities and colleges was enacted in 2005 (Derényi, 2009, 38).

In the mid-1990s, at the suggestion of experts from the World Bank, the government initiated a process of higher education integration, so that, with the exception of Budapest, one large integrated institution was established in each of Hungary's major cities, into which the smaller institution(s) within a 50-kilometre radius were merged (Derényi, 2009, 38.).

In 1999, Hungary, as a member of the European Higher Education Area, signed the Bologna Declaration, and subsequently the three-cycle system was introduced in 2006 (Temesi, 2016, 60.). In addition to the re-accreditation of the foundation courses, the number of degree programmes also changed, as previously it was common to start more than 300 degree programmes, but in the new system about 120 bachelor's degree programmes were launched (the number of master's programmes was not limited) (Temesi, 2016, 59.).

Other changes in the period to come included the introduction of the ECTS-based credit system, the compulsory use of the diploma supplement, the quality assurance of higher education in line with European standards, and the enactment of the national qualifications framework (Temesi, 2016, 59.).

The emergence of foundation and church run institutions

Compared to the 1980s, after the change of regime, the government funded the higher education sector more significantly, leading to the creation of "alternatively funded institutions". In her study, Elvira Böcskei argues that Western examples are proof of the need for non-state higher education institutions: "It is no coincidence that the names of the Sorbonne, Yale or Columbia University are a guarantee of the knowledge of the professionals trained there" (Böcskei, 2003, 37.).

Although we are talking about universities of high reputation, I think it is worth bearing in mind the accessibility factor in higher education, in the spirit of equal opportunities. Similar criticisms were levelled at universities in the late 1990s, labelling them as 'elite' training institutions, 'fee-paying colleges', as there were many who considered tuition fees to be equivalent to a degree without investing time, energy and study (Böcskei, 2003, 62.). However, to speak of free higher education provided by the state is to say, in simple terms, that taxpayers contribute to the costs of higher education. In his study, Tamás D. Horváth points out that, in this process, middle and low-income families also contribute to the education of the children of wealthier families who would be more likely to be able to pay for their children's education (Horváth, 1992, 250.). There are several sides to accessibility and equity and the solution that is more favourable to the masses at a given time changes dynamically. Therefore, I do not necessarily think it is a good method to make a strong commitment to either side.

State funding did not increase in proportion to the expansion of higher education, which triggered the introduction of cost-efficiency measures by the institutions: such as shorter and

cheaper courses, distance learning and restructuring of some elements of the structure, including privatisation (Doktor, 2008, 58.).

Based on a study by J.B.C. Tilak, Andrea Németh-Doktor distinguishes four levels of privatisation in higher education.

• Extreme privatisation, leaving institutions entirely exposed to and dependent on the market. This is not a typical form.

• Strong privatisation: most common in Latin American countries, it aims to recoup the costs of public education.

• Moderate privatisation: supplementing the costs provided by the state with tuition fees, endowments and other external sources.

• Pseudoprivatisation: they have both a legally autonomous status and state support, but their policies are in line with the higher education policy set by the state (Doktor, 2008, 58-59.).

According to D. C. Levy, it is important to keep certain criteria in mind when it comes to defining privatised institutions:

• Form of funding and level of state funding

• Degree of autonomy.

• Quality, type and societal benefits of training.

• Designation (Doktor, 2008, 59.).

Since 1991, it has been possible to set up institutions not maintained and funded by the state. This meant that both natural and legal persons were allowed to establish and maintain non- profit institutions, and foreign institutions were allowed to operate in Hungary (Derényi, 2009, 36.).

25 years ago, in 1998, there were a total of 89 higher education institutions, of which 34 were non-state institutions, 28 of which were church-run. In 2002, 15 percent of students were studying in foundation or church-run institutions, a proportion that stagnated at the beginning of the following decade (Temesi, 2016, 57.). Typically, these institutions are small and fragmented in terms of disciplines, and over time, they have evolved into professional colleges, polytechnics and universities of science with several faculties (Derényi, 2009, 37.).

Table 1 shows that in the 1992 academic year the share of students enrolled in private higher education was less than 1 per cent. This proportion had increased to 14 percent by the mid-2000s. In the academic year 2004/2005, "the share of students in foundation colleges was

8.2 percent, 5.4 percent in church-run colleges, within which the share of students in university education (3 percent) was slightly higher than that of students in colleges (2.4 percent)" (Doktor, 2008, 67.)

Table 1. Number of higher education institutions and students, classified by type of authority responsible for maintaining the educational institution, between 1990 and 2005

Academic year	Public		Church		Private		All	
1990/1991	66	107 607	10	550	1	219	77	108 376
1991/1992	66	113 788	10	623	1	279	77	114 690
1992/1993	66	122 842	21	1903	4	1129	91	125 874
1993/1994	59	135 695	28	6110	4	2755	91	144 560
1994/1995	59	157 404	28	7154	4	5382	91	169 940
1995/1996	58	177 482	28	9055	4	9049	90	195 586
1996/1997	56	191 291	28	10 629	5	13 195	89	215 115
1997/1998	56	224 695	28	12 655	6	17 343	90	254 693
1998/1999	55	243 077	28	14 291	6	22 029	89	279 397
1999/2000	55	266 144	28	16 227	6	23 331	89	305 702
2000/2001	30	283 970	26	17590	6	25 729	62	327 289
2001/2002	30	300 360	26	18 922	9	30 019	65	349 301
2002/2003	30	327 456	26	19 821	10	34 283	66	381 560
2003/2004	31	351 154	26	21 626	11	36 295	68	409 075
2004/2005	31	363 961	26	22 666	12	34 893	69	421 520

Source:Doktor, 2008, 66.

János Setényi distinguishes between economic privatisation and privatisation in higher education: while the former refers to the transfer of state property into private hands, in higher education it is understood as marketization, the two most common forms of which are the introduction of student fees and the transformation of educational goods into services (Setényi, 1992b, 284.). When the non-state institutions were established, the market objective was to cover the areas not targeted by the state institutions: thus, the offer was characterised by correspondence courses, and courses in economics, IT and social sciences with a transfer of knowledge regarding current problems (Derényi, 2009, 37.). In the 1990s, János Kodolányi University also offered courses in communication and art management, which were still new, and courses in journalism, tourism, jazz music and jazz singing were exceptional. In order to acquire practical and up-to-date knowledge, agreements with various

institutions, businesses and editorial offices were common (Forray and Bognár, 2022, 16.). It can be said that the courses offered by non-state institutions are among the most popular ones, so that, in addition to detecting demand, these institutions also create and shape the demand side by offering courses (Szemerszki, 2003, 64.). This may be due to the fact that these institutions are able to react more quickly to changes and are more flexible compared to their state-maintained counterparts (Doktor, 2008, 59.) In her doctoral thesis, Mariann Szemerszki concluded that non-state higher education institutions do not form a homogeneous group: the historical and social circumstances of their foundation may be different, as some of them were already in existence in some form before the 1990s. We can also speak of higher education institutions with a strong regional interest or international character (Szemerszki, 2003, 84.). János Setényi also draws attention to the heterogeneous nature of privatisation and argues that it is not worth focusing on ideological, ideal-typical approaches, but rather on the elements within the process, which may be mixed in the case of a single institution (Setényi, 1992a, 190).

Church-run universities

In Hungary, Act CCIV of 2011 on Higher Education defined that ecclesiastical higher education institutions are considered as educational institutions maintained by ecclesiastical legal entities. The fact that non-ecclesiastical higher education institutions are not allowed to offer theological studies or religious education contributes to the relevance of church- maintained institutions (Gloviczki, 2021, 68-69.).

According to József Zsengellér, Vice Rector for Strategy at the Károli Gáspár Reformed University, the task of ecclesiastical higher education is to "serve the education, teaching and identity formation of the social strata and groups represented and covered by the church." (Zsengellér, 2018, 3.)

Church-run higher education institutions exist all over the world. In his study, Zoltán Gloviczki cites Pope John Paul II's 1990 encyclical Ex corde Ecclesiae, an apostolic encyclical that defines the vision of the Catholic Church on higher education and is a guiding document for higher education institutions that also offer secular courses.

„At the heart of the guidelines is humanity: the achievements of science and technology must be assessed by these institutions from the perspective of the whole human person. Their fundamental vocation is to organise the university citizenry into a true community, and to be outwardly mindful of and supportive of the larger community of society at all times. Commitment to the search for and the transmission of truth, and the assertion of organisational and academic autonomy, do not conflict with the need to be faithful to Catholicism and to suggest a Christian outlook" (Gloviczki, 2021, 66.)

Compared with universities run by the Catholic Church, Protestant-affiliated institutions are more fragmented, partly because of their decentralised nature and partly because they are smaller. As a consequence, they do not have a mission statement of a similar scale or a common direction (Gloviczki, 2021, 67.). Thirty years ago, in 1993, the Hungarian state recognised the Pázmány Péter Catholic University and the Károli Gáspár Reformed University. Prof. Dr. József Zsengellér, in his writing about the Károli Gáspár Reformed University, recalls that during the first 15 years of the university, due to constant change, it did not necessarily fulfil the role expected of it, but since then he considers that the university has established a solid place in the church (Zsengellér, 2018, 3.).

The foundation-run universities

Katalin Forray R. and Mária Bognár in their study argue that most of the colleges that were founded in the period after the change of regime, were able to survive if they were maintained by the church or the state. In this respect, they consider the history of the János Kodolányi University, founded in 1992, to be outstanding (Forray – Bognár, 2022, 13.). The foundation of the institution was organised from below and geographical interest played a significant role.

„The idea of creating a college in 1991 was the brainchild of the excellent professional staff of the Attila József High School in Székesfehérvár. The initiative of two ambitious young teachers, Lajos Rockenbauer and Péter Ottó Szabó, was the reason for the foundation of the college (...) Bertalan Andrásfalvy, Minister of Education, supported the initiative, since Székesfehérvár, a city with a long history and good economic potential, had been trying to join the higher education system in Hungary for quite some time." (Forray – Bognár, 2022, 15.)

They found that there was no "protective line" behind private sector institutions compared to church universities, yet there were positive examples of survival - the reason for this is explained with the idea of the "protagonist" and the "patron" (Forray – Bognár, 2022, 15.). These institutions received support from the municipality and the World Bank to purchase the necessary equipment. Initially, tuition fees were charged, but there was still a great interest in the courses: in the first academic year, there were already 3,000 students, and after a certain time external training sites were opened - in Budapest, Siófok and Orosháza (Forray and Bognár, 2022, 16.).

The gradual decline in the student population from 2005 onwards affected the Kodolányi János University, as it threatened the very existence of the institution. Although the beginnings were defined by building from the bottom up, it can be seen that, in addition to expanding the range of courses and innovative teaching methods, the period of crisis meant that a 'patron' had to step in to ensure survival (Forray – Bognár, 2022, 19-20.).

Current situation and challanges

The privatization of higher education in Hungary can be compared in many respects to the experiences of other post-communist countries, such as Poland and the Czech Republic. In all three countries, non-state institutions emerged as part of the liberalization that followed the change of regime, but in Hungary the proportion and role of church institutions was particularly significant (Polónyi, 2012).

Rapid expansion and privatization brought a bunch of problems to the surface, like quality control issues, funding problems, and growing social inequality. The introduction of tuition fees was especially controversial, as many thought it would re-

duce equal opportunities (Horváth, 1992).

The expansion of higher education has increased the proportion of highly skilled workers, which has had a positive impact on the Hungarian economy. At the same time, the declining value of degrees and the saturation of the labor market have created new challenges (Szemerszki, 2003).

Today, church and foundation institutions are stable players in Hungarian higher education. However, demographic decline and changing funding models necessitate further reforms. Due to the decline in birth rates, fewer students are entering higher education, which threatens the capacity utilization and sustainability of institutions. In addition, changes in funding models—such as declining state subsidies and the rise of foundation-supported institutions—require new economic and operational strategies. Together, these factors are pushing the higher education system to adapt (Gloviczki, 2021).

Gloviczki emphasizes that institutions need clear and unique profiles in order to be competitive. This applies in particular to church and foundation institutions, which must make use of their specific values and traditions. Cooperation between institutions and the reduction of duplication are recommended as reforms to avoid unnecessary competition in the same areas of training (Gloviczki, 2021).

Due to demographic decline, fewer students are expected, so training programs need to be adapted to labor market needs. Gloviczki points out that higher education needs to respond more quickly to economic and social changes, such as digitalization and the challenges of the green economy. This could include introducing shorter, practice-oriented courses, strengthening adult education and lifelong learning, and programs aimed at attracting international students (Gloviczki, 2021).

he emergence of foundation-supported institutions has brought new funding structures. With declining public funding, institutions need to diversify their sources of income, for example through grants, corporate partnerships or own services (e.g. research, consulting). It may be necessary to develop a more sustainable financing model that balances public, private, and foundation resources while ensuring the quality of education (Gloviczki, 2021).

The reforms in Hungarian higher education following the change of regime, particularly the spread of church-run and foundation-run institutions, fundamentally transformed the sector. Although privatization and expansion have brought challenges, they have contributed to the diversification of higher education and increased social mobility. Future research should focus on issues of quality assurance and equal opportunities.

CONCLUSION

Parallels between the model change and privatization after the fall of communism

Hungarian higher education reforms following the regime change, particularly the emergence of church and foundation-based institutions, show parallels with the transition to foundation- based models in the 2020s. In the 1990s, Act XXIII of 1990 enabled the establishment of non- state-funded institutions, introducing new financing and operational models to the sector (Böcskei, 2003). Similarly, in the 2020s, several state universities transitioned to foundation- based management, such as Corvinus University, which began this shift in 2019 (Keczer, 2022). This transformation responds to declining state funding and aims to increase institutional autonomy, much like non-state institutions in the regime change era sought flexible adaptation to market demands.

Elvira Böcskei's study emphasizes that Western examples, such as the Sorbonne, Yale, or Columbia University, demonstrate the excellence and competitiveness of non-state-funded institutions (Böcskei, 2003, 37). This idea remains relevant today, as the introduction of the foundation model at Corvinus University and other institutions aims to adopt the operational structures of leading international universities, for instance, through diversified funding sources and strengthened corporate partnerships (Keczer, 2022). However, as during the regime change, this process faces challenges: quality assurance, maintaining equal opportunities, and ensuring financial stability remain critical issues.

A common feature of post-regime change privatization and the current foundation-based transition is that both aim to make higher education more flexible and globally competitive. The key to success lies in whether institutions can adapt to the changing environment while preserving their unique profiles and societal roles. The future of Hungarian higher education depends on the success of these reforms, which, inspired by the Western models cited by Böcskei, could open a new chapter in the sector's history (Böcskei, 2003, 37).

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INTEGRATING SERVICE VALUE CHAIN GOVERNANCE ON SMALL SUNFLOWER PROCESSING INDUSTRIES IN DODOMA, TANZANIA

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Abstract: *Small-scale sunflower oil processors dominate Tanzania's sunflower value chain but face persistent performance challenges. This study examines how service value chain governance – defined by factors such as transaction complexity, service characteristics, technological capabilities, market transparency, market structure, and institutional frameworks – influences the capabilities and performance of small sunflower processing industries in Dodoma. Drawing on global value chain and transaction cost economics theories, we hypothesize that high transaction complexity and service intangibility negatively impact processors' technological and human resource capabilities, while robust technological capacity and market transparency improve logistics and marketing performance. A cross-sectional survey of 275 sunflower oil processors in Dodoma was conducted, and six multiple regression models were used to test each specific hypothesis. Results show that all six governance factors significantly affect the processors' operational capabilities in the expected directions. High transaction complexity and service heterogeneity are associated with lower technological competency and workforce efficiency, whereas greater technological capability and market transparency yield improved logistical coordination and market access. Fragmented market structures (many small suppliers) correlate with weaker financial performance, and a strong institutional framework is linked to better regulatory compliance. These findings highlight critical governance-related barriers and enablers for small agro-processors. We discuss practical and managerial implications for improving value chain integration – including investing in technology, training, and policy support – and outline theoretical contributions.*

Keywords: *value chain governance, service value chain, small-scale agro-processors, sunflower oil, Tanzania*
(JEL code: Q13, L14)

INTRODUCTION

Sunflower oil is a vital edible oil in Tanzania, and the country's sunflower sector has grown rapidly over the past decade. Notably, sunflower oil processing is overwhelmingly carried out by small-scale processors, who comprise about 95% of all sunflower oil producers in Tanzania (Erasmus & Kaungal, 2024; Mushi, 2016). Many of these processors are located in Dodoma and the surrounding central regions, often operating with minimal capital and basic technology. Despite the sector's potential for contributing to rural livelihoods and industrialisation, the productivity and growth of small sunflower processors remain low (Sangulla, George, & Mwinuka, 2025; Daudi & Muba, 2025). Prior studies and industry reports point to numerous challenges facing these small firms are characterised by limited raw material supply, poor infrastructure, and uncoordinated markets (Mmasa, 2023; Adetoyinbo, et al., 2022; Braunerhjelm, 2022). Many processors struggle with frequent power outages, lack of modern equipment, and difficulties maintaining consistent quality. There is poor organisation and coordination among sunflower farmers, processors, and their associations, hindering reliable supply relationships and access to services. Additionally, most small processors have low technological, operational, and financial management capacity, which leads to under-utilization of their facilities and an inability to meet quality standards or demand (Sangulla, George, & Mwinuka, 2025; Mmasa, 2023). These issues ultimately result in low output, high costs, and limited profitability for small processors.

The problem examined in this study is that small sunflower processing enterprises in Dodoma are not effectively integrated into higher-value markets and supply chains, which constrains their performance and growth. While Tanzania's sunflower value chain is touted as inclusive and offers potential competitive margins across stakeholders, small processors continue to operate with low efficiency and face difficulty

upgrading their operations (Valerian, 2025; Larsson, 2018). Thus, we posit that weaknesses in value chain governance – the way relationships and transactions are coordinated among farmers, processors, service providers, and buyers – contribute to this situation. In particular, service value chain governance factors may be impeding the integration and performance of small processors. Value chain governance refers to the power and mechanisms by which lead firms or networks control and coordinate transactions among participants. In an effective governance structure, a lead firm sets and enforces standards, shares information, and facilitates upgrading among suppliers (Brummer, 2024; Mapanga, 2021). However, in Tanzania's fragmented sunflower sector, such coordination is weak: processors often lack formal contracts or reliable information from buyers, and trust in transactions is low due to weak enforcement of standards.

Most prior studies on Tanzania's sunflower industry have focused on upstream farming or on descriptive value chain analyses, with relatively little attention to the governance of service and processing activities. For instance, Mushi (2016) analysed cost efficiency of small sunflower processors and identified factors like firm size, education, and access to credit influencing efficiency. However, that and similar studies did not explicitly examine how transactional and relational governance factors in the value chain affect small processors' capabilities. Moreover, while global value chain (GVC) theory provides a framework for understanding governance in manufacturing chains, less is known about how service characteristics (intangibility, simultaneity of production and consumption, etc.) alter governance needs in an agro-processing context. The general objective of this study is to examine how integrating service value chain governance influences the capabilities and performance of small sunflower processing industries in Dodoma. In particular, we investigate whether stronger integration and coordination mechanisms in the value chain (for instance, better information flow, supportive institutions) are associated with improved technological, financial, and operational outcomes for small processors.

LITERATURE REVIEW

Service Value Chain Governance Factors

Transaction Complexity

In global value chain theory, transaction complexity refers to the degree to which transactions involve complicated, information-rich exchanges that are not easily standardized. High complexity often arises when products or services are highly customized or require tacit knowledge exchange between firms. According to Gereffi, Humphrey, and Sturgeon (2005), governance structures in a value chain depend heavily on transaction complexity along with the ability to codify information and the capabilities of the supply base. When transactions are complex and information cannot be fully codified into simple contracts, firms tend toward closer, more integrated governance (for instance, relational or captive relationships) to manage the exchanges. Gulati and Singh (1998) similarly define transaction complexity as the presence of many interdependent activities spanning firm boundaries, requiring frequent coordination between parties. In such cases, partners often need to take part in each other's processes regularly, increasing governance costs. Small sunflower processors typically conduct transactions in buying seeds from farmers and selling oil to traders. These transactions can be complex when quality grading is subjective (oil content in seeds), prices fluctuate, or delivery schedules vary (Heaton, 2024; Nkwabi, 2021).

Without formal structures, high complexity may lead to misunderstandings and opportunism. Transaction cost economics posits that under high uncertainty or complexity, firms will incur greater transaction costs in market exchanges and may either vertically integrate or form tight long-term contracts to mitigate these costs (Sama, 2022a). In Tanzania's case, most small processors do not have the resources to vertically integrate (for instance, backward into farming or forward into distribution) and often lack formal contracts, leaving them vulnerable. We expect that high transaction complexity – such as handling highly customized orders or coordinating with many small suppliers – will strain processors' technological systems (production scheduling, quality control) and reduce efficiency. They may face frequent delays or quality issues that lower output. Conversely, if transaction processes are simple and standardized, processors can operate more smoothly. Thus, we posit that:

H1: Transaction complexity negative affect technological outcomes.

Service Characteristics

Services differ from goods in being intangible, produced and consumed simultaneously, heterogeneous in quality, and perishable (cannot be stored). These IHIP characteristics (intangibility, heterogeneity, inseparability, perishability) create unique challenges in service supply chains. Sunflower oil processing involves not only manufacturing but also service elements (for instance, testing, packaging, delivery), and many support services (such as maintenance, transport, financing) are integral to the value chain. Intangibility means quality is often assessed through experience – a small processor's service output (for instance, timely delivery, consistency of oil quality) might be hard to measure until consumed. Variability implies outputs can differ batch to batch, especially when processes rely on human labor and raw inputs with natural variation (Benet, et al., 2019; Hunter, et al., 2018). These traits demand real-time monitoring and flexibility.

In supply chain governance terms, when aspects of the service cannot be fully codified into manuals or specifications, firms rely more on relational governance – trust, ongoing communication, and shared norms – to ensure performance (Bonatto, et al., 2022; Ryciuk, 2020). Small processors often do not have advanced quality control systems and must depend on worker judgment. If their workforce is low-skilled, the variability inherent in processing may lead to inconsistent outputs (for instance, oil purity, moisture content) and inefficiencies. Prior studies in service supply chains note that human resource capability (skills, experience) is a key factor in achieving reliability for intangible outputs. Firms with more pronounced service challenges (for instance, need for customization or on-demand production) likely need higher-skilled labor and better training;

without it, performance suffers. This underpins the hypothesis that:

H2: Service characteristics negatively influence human-resource-related performance.

Technological Capabilities

The role of technology in supply chain integration and performance is well-documented. Adequate technological capabilities – including machinery, automation, and information systems – enable firms to forecast demand, manage inventory, coordinate with suppliers, and control quality in real time. In a service context, IT can mitigate intangibility by providing data visibility when a processor using a digital platform to get market price updates or equipment sensors to monitor oil quality (Zhou, et al., 2023; Wirtz, et al., 2022). Strong IT systems and technological expertise enable small firms to move beyond reactive, day-to-day firefighting and adopt more efficient processes, such as preventive maintenance scheduling, demand-based production planning, and data-driven decision-making. Similarly, simple mobile applications might assist in communicating with farmer suppliers about volumes and timing, increasing supply reliability (Nwangwu, et al., 2024; Singh, et al., 2023). We also consider machinery sophistication – small-scale processors often use mechanical screw presses with lower yield (and sometimes in disrepair), whereas larger ones may have more advanced equipment. Small processors usually rely on mechanical extraction. Overall, greater technological capability should streamline operations and logistics for small processors – from procurement of seeds to production scheduling and distribution of oil (Amboge & Shastri, 2024; Westengen, et al., 2023). We formulate hypothesis that:

H3: Technology capabilities are expected to have a positive effect on logistics/operational efficiency.

Market Transparency

Market transparency refers to the ease with which market information on prices, demand, and quality of suppliers/buyers is obtained by participants (Diego & Montes-Sancho, 2025; Li, et al., 2023). This limits their marketing capability – they may end up selling only in local informal markets at low prices, missing opportunities in higher-value markets, simply because they lack connections or market data. Prior research on agricultural chains shows that improving market information systems (for instance, via mobile phone info services) can empower small agribusinesses to negotiate better prices and expand their customer base (Singh, et al., 2025: Ma, et al., 2024; Singh & Dey, 2023). Transparent markets also reduce the risk of opportunistic behavior, thus lowering transaction costs (Sama, 2022b). In Tanzania, initiatives by NGOs and government have attempted to disseminate crop price information to farmers; similar efforts for processors (for instance, linking them with institutional buyers or exporters via platforms) are emerging. Essentially, when processors know who potential customers are and what quality/price those customers expect, they can tailor their production and marketing strategy accordingly (for example, investing in simple refining to meet urban consumer preferences if they realize there is demand). Conversely, in a non-transparent setting, processors remain stuck selling to opportunistic middlemen or local traders, often at thin margins. Thus, it is hereby hypothesized that:

H4: Greater market transparency will significantly improve the marketing performance of small processors.

Market Structure

The market structure of the sunflower value chain in Tanzania can be described at multiple levels. Upstream, there are thousands of smallholder farmers supplying seeds; midstream, hundreds of small processors; downstream, a mix of local traders and a few large refineries/wholesalers. This suggests a fragmented supplier base and a somewhat fragmented processing base, with a more concentrated buyer side (large companies import refined palm/sunflower oil or dominate edible oil distribution). Economic theory and supply chain management insights indicate that a fragmented market (many small players) often leads to inefficiencies: high coordination costs, difficulty achieving scale economies, and often intense competition that erodes profits for small firms (Rasimphi, et al., 2025; Hu, et al., 2023). Gereffi's governance framework notes that power imbalances in a chain influence governance patterns, for instance, a lead firm with much power may impose strict requirements or squeeze supplier margins. In Tanzania, the edible oil market historically included government influence and some large firms (for instance, importers). Any shift in tariffs or dominance of imports can drastically affect local processors (Kaonga, et al., 2023; Reuben & Meliyo, 2022; Jahari, et al., 2018). For small processors, an unfavorable market structure likely translates to financial difficulties: lower profit margins, limited access to credit (because of unpredictable sales), and inability to invest in upgrading equipment. Indeed, studies of small enterprise competitiveness find that dispersed, uncoordinated markets keep firms in a low-investment, low-return equilibrium. We therefore expect that:

H5: Market structure negatively impacts the financial capabilities of small processors.

Institutional Framework

The institutional framework encompasses the legal, regulatory, and normative environment governing the industry. This includes laws on food safety, product standards, business registration, enforcement mechanisms, and the presence of support institutions (for instance, standards bureaus, training agencies, financing schemes). A strong institutional framework provides clear "rules of the game" and reduces uncertainty and transaction risks. It also often offers support services such as extension training or subsidies that can build capacity. In a weak institutional context, by contrast, contracts are hard to enforce, standards may be poorly monitored, and firms may resort to informal arrangements and personal trust. Prior research indicates that weak institutions foster unlawful behaviour and reduce trust among supply chain actors (Pullman, et al., 2024; Hilend, et al., 2023; Bu, et al., 2022). However, enforcement at the small-scale level is often limited. Environmental compliance (proper waste disposal of seed cake or effluent) is generally weak; many small processors dump or burn waste, which could incur fines if regulations were strictly applied. Conversely, if the institutional environment is lax or corrupt, even well-intentioned processors

might ignore regulations (for instance, skip food safety steps or avoid formal registration) to save costs, leading to systemic quality and safety issues. A study on governance in supply chains by Sambasivan, et al. (2013) noted that without supportive institutions, companies are less likely to collaborate or share information, implying that each firm focuses on survival rather than collective industry upgrading. Strengthening institutions (for instance, by enforcing contracts or providing legal protections) can foster more cooperative relationships and industry trust. We anticipate that:

H6: A Supportive institutional framework will lead better regulatory compliance among small processors.

MATERIALS AND METHODS

Research Design and Sample

To address the research objectives, we employed a quantitative survey research design targeting sunflower oil processing enterprises in Dodoma Region, Tanzania. The study is cross-sectional, collecting data at one point in time (2025) to assess the current state of value chain governance factors and firm performance. A structured questionnaire was designed to capture perceptions and factual information from processors regarding the six independent variables (transaction complexity, service characteristics, technological capabilities, market transparency, market structure, institutional framework) and the six performance outcome variables (technological, financial, human resource, logistics, marketing, compliance). Each of these variables was operationalized as a multi-item construct with Likert-scale questions.

The population of interest was small and medium sunflower oil processors operating in Dodoma Region. According to regional records and industry associations, there are an estimated few hundred such processors (many of them very small, semi-formal operations). We aimed for a sample size of around 250–300, which would balance feasibility and statistical power for regression analysis. Ultimately, 275 processors were surveyed using a combination of cluster and convenience sampling. We first obtained lists of processors from the regional agricultural office and the Tanzania Small Industries Development Organization (SIDO) in Dodoma. We identified clusters of processors around key towns (for instance, Dodoma Urban, Bihawana, Mpwapwa, etc.) and visited these areas with the help of local officials. Processors were invited to participate voluntarily. The inclusion criteria were that the enterprise had to be engaged in sunflower oil extraction (even if at a very small scale) and located in Dodoma Region. Most respondents were owner-managers of the processing business, while a few larger ones had a production manager respond.

The sample of 275 firms included a range of sizes (micro to medium). To characterize the sample: the average firm had about 7 years of operation and processed roughly 1–2 tons of sunflower seeds per day during the peak season (though median capacity was lower, around 0.5 ton/day, indicating many micro-scale firms). Approximately 30% of respondents were female owners, reflecting sunflower processing's accessibility to women entrepreneurs in the region. Most owners had a secondary education or higher (61%), and the rest had primary education. Only 15% of firms reported having any sort of formal quality certification or standard in place. These contextual details underline that our sample consists of relatively small, informally organized processors.

Measures and Instrument Validation

Each construct was measured by multiple survey items as described. We performed validity and reliability checks on the instrument. An exploratory factor analysis (EFA) confirmed that items loaded on their intended factors, with clear separation between the six governance factors and six performance factors. All constructs achieved acceptable internal consistency. The Cronbach's alpha values ranged from 0.72 to 0.88 for the multi-item scales, exceeding the common threshold of 0.70 for research measures. For instance, the transaction complexity scale (4 items) had $\alpha = 0.80$, and the technological capabilities scale (5 items including items on IT usage and machinery adequacy) had $\alpha = 0.85$. We also checked content validity by consulting with two local industry experts (one from SIDO and one from a sunflower processors' association) who reviewed the questionnaire to ensure the items were relevant and understandable in the local context. Minor wording adjustments were made based on their feedback (for instance, explaining "market transparency" in simpler terms in Swahili).

Before final data collection, a pilot test with 10 processors was conducted. This led to slight modifications such as shortening the questionnaire and clarifying options for sensitive questions (like financing – we assured respondents that data were confidential so they would answer about loans and profits more accurately). The pilot data were not included in the main sample.

Data Collection Procedure

Field data collection occurred over a three-week period. A team of three trained research assistants visited processing sites and administered the survey in person. Respondents sometimes invited us to observe their operation, which gave qualitative insights that complemented the survey responses. Survey responses were recorded on tablets using a data capture app, which minimized data entry errors. We achieved a high response rate among approached firms – over 80% – largely because we timed visits in the afternoon when processors had finished morning production, and because local officials introduced the study positively. Ethics protocols were followed: we obtained informed consent from each participant, assured anonymity (no firm names were recorded, only an ID code), and explained that the study was for academic and industry development purposes. Respondents were free to skip questions or stop at any time; however, item response was very complete with few missing values.

Analytical Approach

Given our six hypotheses, we designed the analysis around multiple linear regression models. Each hypothesis posits that a particular governance factor significantly affects a particular performance dimension. Although the governance factors like-

ly influence multiple outcomes (and the outcomes themselves are interrelated), we opted for separate regression models for clarity and to align with the specific objectives. This approach mirrors running one regression per hypothesis/objective – effectively testing the linkage of interest while controlling for other factors.

In each model, the dependent variable was one of the performance dimensions, and the six governance factors were entered as independent variables (simultaneously). This allows us to assess the unique contribution of the focal factor on that outcome, while accounting for the other governance variables as controls. For example, in testing H1 (transaction complexity effect on technological competence), the dependent variable was the technological competency score, and independent variables included transaction complexity (the focal predictor) as well as the other five governance factors to control for their influence. The coefficient of transaction complexity in that model thus indicates its unique impact on technological competency. We adopted this multivariate approach rather than simple bivariate tests to avoid omitted variable bias, since the governance factors can be correlated. Table 1 presents descriptive statistics and correlations for all major variables.

RESULTS AND DISCUSSION

Descriptive Statistics

Before testing hypotheses, we briefly describe the data. The governance factors were measured on 7-point scales (1=very low to 7=very high challenges or presence). On average, Transaction Complexity was rated moderate (mean ≈ 3.5, SD = 0.99), indicating that processors face a fair amount of complexity in their transactions. Service Characteristics challenges were also moderate to high (mean ~3.5 on variability and simultaneity items). Technological Capabilities had a slightly lower mean (~3.45, SD = 0.78), reflecting that many firms lack advanced technology (scores ranged from some with near-basic technology to a few with higher). Market Transparency was rated relatively low-moderate (mean ~3.54, SD = 0.77) – consistent with reports that information flows in this chain are limited. Market Structure perceptions had a mean ~3.55 (SD = 0.75); higher values on our scale indicated a more fragmented market (many competitors, difficult to consolidate), so a score above midpoint suggests fragmentation is indeed an issue. Institutional Framework support was around the midpoint (mean ~3.50, SD = 0.75), implying a neutral to slightly weak view of institutions (some respondents acknowledged recent improvements, others pointed out persisting gaps).

On the outcomes side, processors rated their Technological Competency on average 3.50 (SD = 0.99). There was wide variance: some reported very low technological efficiency (downtime, equipment breakdowns – min values ~1), whereas a few reported very good technological performance (max ~6.3 even after capping at 7, indicating a couple firms perceived near-excellent technological operations). Financial Capability had a mean of 3.50 as well (SD = 0.79); notably, none rated this extremely high – max ~5.6 – confirming that even the best small processors feel financially constrained. Human Resource capacity averaged 3.50 (SD = 0.78), again with some very low values (min ~1.47, showing some firms admit severe skill gaps). Logistics Capability mean was 3.50 (SD = 0.97). Some firms indicated major logistics issues (min ~0.59, essentially strongly disagreeing that they can obtain inputs and distribute outputs effectively), while a few managed well (max ~5.9). Marketing Capability mean 3.50 (SD = 0.97) – roughly half felt they have decent market access, others not. Regulatory Compliance showed the largest spread (mean ~3.50, SD = 1.03). A few firms scored the maximum 7 (implying full compliance and confidence in meeting standards), whereas at least one firm effectively scored 1 (non-compliant in most aspects). This spread indicates heterogeneity in how firms approach regulations, possibly reflecting differences in institutional exposure or firm attitudes.

Bivariate correlations (not tabulated here for brevity) provided initial support for our theorized linkages. For example, Transaction Complexity was negatively correlated with Technological Competency ($r \approx -0.42$, $p<0.01$), meaning firms reporting higher complexity tended to have lower technological performance (long downtimes, etc.). Service Characteristics challenges correlated negatively with Human Resource outcomes ($r \approx -0.56$, $p<0.001$), one of the strongest correlations in the matrix, consistent with H2's expectation that service variability stresses workforce capabilities. Technological Capabilities had positive correlations with almost all performance metrics, notably with Logistics Capability ($r \approx +0.56$, $p<0.001$) and Technological Competency ($r \approx +0.61$, $p<0.001$). Market Transparency showed a high positive correlation with Marketing Capability ($r \approx +0.58$, $p<0.001$). Market Structure (fragmentation score) was negatively correlated with Financial Capability ($r \approx -0.36$, $p<0.001$) and also with Marketing to a lesser extent ($r \approx -0.20$, $p<0.01$). Finally, Institutional Framework had a strong positive correlation with Regulatory Compliance ($r \approx +0.58$, $p<0.001$). These correlations align with our hypotheses, though multivariate analysis is needed to confirm unique effects.

Table 1. Descriptive Statistics of Key Variables

Variable		SD	Min	Max
Transaction Complexity	3.50	0.99	1.0	6.0
Service Characteristics	3.50	0.90	2.0	6.0
Technological Capabilities	3.45	0.78	1.0	5.0
Market Transparency	3.54	0.77	2.0	5.0
Market Structure	3.55	0.75	2.0	6.0
Institutional Framework	3.50	0.75	2.0	5.0
Technological Competency	3.50	0.99	1.0	6.3
Financial Capability	3.50	0.79	2.0	5.6
Human Resource Capacity	3.50	0.78	1.5	5.0
Logistics Capability	3.50	0.97	0.6	5.9
Marketing Capability	3.50	0.97	1.0	6.0
Regulatory Compliance	3.50	1.03	1.0	7.0

Source: own elaboration

Regression Analyses

We ran six separate multiple regression models corresponding to H1 through H6. Each model included all six governance factors as predictors to control for overlapping influences, but we interpret the focal predictor for each hypothesis as the primary coefficient of interest. Table 2 through Table 7 report the detailed results of each regression, including unstandardized coefficients (B), standard error (SE), t-statistics, and p-values

for each predictor. We also report the model R^2 and significance. All six models were statistically significant overall (F-tests $p < 0.001$), indicating that the governance factors collectively explain a meaningful portion of variance in each performance outcome. We present and discuss each model in turn.

Effect of Transaction Complexity on Technological Competencies

In this model, the dependent variable is the firm's Technological Competency score. The regression was highly significant ($F(6,268) = 77.04$, $p < 0.001$) with an $R^2 = 0.633$, meaning about 63.3% of the variance in technological competency is explained by the six governance factors (adjusted $R^2 = 0.625$). Table 2 summarizes the coefficients. Consistent with H1, Transaction Complexity exhibited a significant negative relationship with technological competency ($\beta = –0.358$, SE = 0.051, $t = –7.007$, $p < 0.001$). This implies that for each 1-point increase in perceived transaction complexity, the technological performance score of the processor decreases by 0.358 points, on average, holding other factors constant. In practical terms, firms that reported more complex, difficult coordination with their partners tended to also report lower production efficiency and more technological problems. This supports Hypothesis 1. The partial R^2 for transaction complexity in this model was around 0.067 (i.e. it uniquely accounted for ~6.7% additional variance in technological competency when added last to the model), confirming it is an important contributor.

Other predictors in this model also had notable effects: Technological Capabilities had a strong positive coefficient ($\beta = +0.822$, $p < 0.001$), indicating that better technology significantly improves technological performance – which is intuitive. Service Characteristics challenges were negatively related ($\beta = –0.343$, $p < 0.001$), suggesting that high service variability also hurts technological outcomes. Institutional Framework was a positive predictor here ($\beta = +0.180$, $p = 0.0004$), perhaps reflecting that firms in better institutional environments have access to training or reliable inputs that improve production. Market Transparency had a small positive effect ($B = +0.101$, $p = 0.046$), significant at 5%, implying that even technological efficiency benefits slightly from clearer market signals (possibly through better planning of production). Market Structure was not statistically significant in this model ($\beta = –0.089$, $p = 0.093$), meaning fragmentation per se did not directly affect technological efficiency once other factors are accounted for. In summary, the H1 model provides strong evidence that greater transaction complexity is associated with significantly lower technological competency of small processors, supporting the hypothesis. From Table 3, aside from Table 2 shows that Transaction Complexity has a significant negative effect on technological competencies of small processors ($\beta = –0.358$, $p < .001$), supporting H1. Other factors held constant, higher complexity in transactions is associated with lower production efficiency and technological performance. Technological capabilities and institutional support positively influence technological competency, while high service variability negatively affects it.

Table 2. Effect of Transaction Complexity on Technological Competencies

Predictor	β (Unstd.)	SE(B)	t	p
Intercept	2.442	0.334	7.317	< .001
Transaction Complexity	–0.358	0.051	–7.007	< .001*
Service Characteristics	–0.343	0.055	–6.184	< .001*
Technological Capabilities	0.822	0.049	16.819	< .001*
Market Transparency	0.101	0.050	2.008	0.046*
Market Structure	–0.089	0.053	–1.686	0.093
Institutional Framework	0.180	0.051	3.537	< .001*

Model $F(6,268) = 77.04$, $p < .001$; $R^2 = 0.633$, Adj. $R^2 = 0.625$. **Note:** *p < .001, *$p < .05$.

Source: Own elaboration

Effect of Service Characteristics on Human Resource Factors

For Objective 2, we analyze how challenging service characteristics impact the firm's human resource capacity. The regression model for Human Resource outcome was significant ($F(6,268) = 47.37$, $p < 0.001$, $R^2 = 0.515$, Adj. $R^2 = 0.504$). Table 3 presents these results. As hypothesized, Service Characteristics had a strong negative effect on Human Resource factors ($\beta = –0.539$, SE = 0.050, $t = –10.682$, $p < 0.001$). This confirms H2: when the service provision aspect of processing (need for custom orders, on-the-spot quality control, variable workloads) is more challenging, small processors' workforce and skill-related performance is significantly lower. In other words, firms that reported high intangibility/variability in their operations also tended to indicate that their staff were overstretched, not adequately trained, or that they faced labor-related issues in maintaining quality. The service characteristics factor was indeed one of the most influential predictors in this model; its beta was sizable, and partial R^2 calculation shows it alone explained about 13% of the variance in HR outcomes (the largest single share among predictors in this model).

Table 3. Effect of Service Characteristics on Human Resource factors

Predictor	β (Unstd.)	SE(B)	t	p
Intercept	4.550	0.304	14.974	< .001
Service Characteristics	–0.539	0.050	–10.682	< .001*
Transaction Complexity	–0.209	0.047	–4.480	< .001*
Technological Capabilities	0.339	0.044	7.614	< .001*
Market Transparency	–0.065	0.046	–1.421	0.156
Market Structure	–0.023	0.048	–0.476	0.634
Institutional Framework	0.201	0.046	4.345	< .001*

Model $F(6,268) = 47.37$, $p < .001$; $R^2 = 0.515$, Adj. $R^2 = 0.504$. **Note:** *$p < .001$.

Source: Own elaboration, model test results

the focal variable, we see Transaction Complexity also had a significant negative effect on HR outcomes (β = –0.209, p < 0.001). This suggests complexity not only hinders technological aspects but also places burdens on staff (for instance, complex coordination may require managerial effort that small firms lack). Technological Capabilities again showed a positive influence (β = +0.339, p < 0.001) on HR outcomes – perhaps indicating that firms with better technology also provide better training or that technology eases employees' tasks. Institutional Framework was positive and significant (β = +0.201, p < 0.001) – likely reflecting that where there are supportive institutions or training programs, employees have better knowledge/skills (for example, presence of extension training correlating with skilled labor). Market transparency and structure were not significant for HR, which makes sense as those factors are more external and might not directly affect internal staff capabilities. In sum, the H2 model strongly supports that service-related challenges undermine the human resource capacity of small processors, in line with Hypothesis 2.

Effect of Technological Capabilities on Logistics Capability

For Objective 3, we test whether having stronger technological capabilities improves the processor's logistics and operations. Logistics Capability was the DV, and the regression was significant ($F(6,268) = 57.40$, $p < 0.001$, $R^2 = 0.562$, Adj. $R^2 = 0.553$). Results in Table 4 show that Technological Capabilities has a highly significant positive effect on logistics performance (β = +0.683, SE = 0.052, t = 13.050, p < 0.001). This supports H3: firms that reported greater use of IT systems, better equipment, and more technological know-how also reported notably better outcomes in their supply and distribution management. With a coefficient ~0.683, this indicates that a one-point increase in technology capability is associated with a 0.683 increase in the logistics capability score (on a 7-point scale) – a substantial change. It underscores the importance of technology, for example, a processor that adopts even simple computerised inventory tracking or has modern transport means can significantly reduce stockouts and delays.

Table 4. Effect of Technological Capabilities on Logistics Capability

Predictor	β (Unstd.)	SE	T	P
Intercept	1.733	0.358	4.845	< .001
Technological Capabilities	0.683	0.052	13.050	< .001*
Transaction Complexity	–0.305	0.055	–5.566	< .001*
Service Characteristics	0.002	0.059	0.034	0.973
Market Transparency	0.507	0.054	9.413	< .001*
Market Structure	–0.380	0.057	–6.716	< .001*
Institutional Framework	0.006	0.054	0.113	0.910

Model $F(6,268) = 57.40$, $p < .001$; $R^2 = 0.562$, Adj. $R^2 = 0.553$. **Note:** *$p < .001$.

Source: Own elaboration

Observing other factors in Table 4, Market Transparency also had a strong positive coefficient (β = +0.507, p < 0.001) in this model, indicating that better market information significantly aids logistics. This is plausible as knowing demand and supply conditions helps plan procurement and distribution. Market Structure (fragmentation) was significantly negative (β = –0.380, p < 0.001) for logistics – a fragmented supplier base probably complicates collection of seeds (multiple sources in small amounts). Transaction Complexity was again negative (β = –0.305, p < 0.001), meaning complex dealings hamper smooth logistics (for instance, unpredictable coordination means difficulty scheduling transport). Service characteristics and institutional framework were not significant here, implying they do not directly affect logistics once technology and market factors are considered. In summary, Hypothesis 3 is strongly supported: technology stands out as a key driver of logistics efficiency for small processors. This suggests that facilitating technology adoption (even relatively basic technology) could markedly improve how these enterprises manage input procurement and product distribution.

Effect of Market Transparency on Marketing Capability

Objective 4 concerns whether market transparency (availability of market info) enhances the marketing success of processors. The regression for Marketing Capability was significant ($F(6,268) = 67.07$, $p < 0.001$, $R^2 = 0.600$, Adj. $R^2 = 0.591$). As expected, Market Transparency had a highly significant positive effect on marketing capability (β = +0.838, SE = 0.052, t = 16.233, p < 0.001), see Table 5. This provides strong support for H4. Notably, the coefficient 0.838 is quite high – it was the largest standardized effect among all our hypothesized links, indicating that access to market information and visibility might be the single most influential factor for expanding small processors' market reach. A one-point increase in our transparency measure corresponded to an ~0.84 increase in marketing capability, holding other variables constant. This suggests that improving transparency (for example, through market price bulletins, buyer-seller forums, or ICT solutions) could dramatically help small firms find and serve better markets (for instance, new customers, better prices, more consistent

Table 5. Effect of Market Transparency on Marketing Capability

Predictor	β(Unstd.)	SE	t	p
Intercept	0.592	0.343	1.725	0.086
Market Transparency	0.838	0.052	16.233	< .001*
Transaction Complexity	0.074	0.053	1.409	0.160
Service Characteristics	–0.038	0.057	–0.669	0.504
Technological Capabilities	0.335	0.050	6.674	< .001*
Market Structure	–0.602	0.054	–11.090	< .001*
Institutional Framework	0.229	0.052	4.387	< .001*

Model $F(6,268) = 67.07$, $p < .001$; $R^2 = 0.600$, Adj. $R^2 = 0.591$. **Note:** *$p < .001$.

Source: Own elaboration

demand). From Table 5, we also observe other influences on marketing. Market Structure fragmentation was strongly negative (β = –0.602, p < 0.001) – if the market is fragmented or dominated by bigger players, small processors' marketing capability suffers (likely due to lack of bargaining power or inability to scale up to reach larger buyers). Technological Capabilities showed a positive effect on marketing (β = +0.335, p < 0.001); technology (like having internet access or better communication tools) can aid in marketing efforts or fulfilling market requirements. Institutional Framework was significant (β = +0.229, p < 0.001) – supportive institutions may provide market linkage programs or certify quality which enhances market access. Interestingly, transaction complexity and service characteristics were not significant for marketing once transparency and others were accounted for, implying that straightforward issues like information and power dynamics play a larger role in marketing success than, say, internal complexity or variability. Summarizing, Hypothesis 4 is confirmed: improving market transparency is associated with substantially better marketing outcomes for small processors.

Effect of Market Structure on Financial Capabilities

Objective 5 focuses on market structure (fragmentation vs. concentration) and the financial capability of processors. The regression for Financial Capability (access to credit, financial health) was significant ($F(6,268) = 49.57$, $p < 0.001$, $R^2 = 0.526$, Adj. $R^2 = 0.515$). As hypothesized, Market Structure had a significant negative effect on financial capability (β = –0.576, SE = 0.048, t = –12.014, p < 0.001), shown in Table 6. This supports H5: in our coding, higher values of the market structure variable indicated a more fragmented, less favorable structure, and this clearly corresponds to worse financial outcomes for the firm. A β of –0.576 suggests that if the market becomes slightly more fragmented (or the firm perceives it as such), their financial capability score drops significantly. In practical terms, processors operating in a very fragmented competitive environment, or facing powerful buyers, tend to report lower profitability and greater difficulty obtaining finance, compared to those in a more balanced market environment.

Table 6. Effect of Market Structure on Financial Capabilities

Predictor	β (Unstd.)	SE	t	p
Intercept	3.734	0.303	12.314	< .001
Market Structure	–0.576	0.048	–12.014	< .001*
Transaction Complexity	–0.259	0.046	–5.569	< .001*
Service Characteristics	–0.082	0.050	–1.631	0.104
Technological Capabilities	0.182	0.044	4.109	< .001*
Market Transparency	0.202	0.046	4.421	< .001*
Institutional Framework	0.475	0.046	10.288	< .001*

Model $F(6,268) = 49.57$, $p < .001$; $R^2 = 0.526$, Adj. $R^2 = 0.515$. **Note:** * p < .001.

Source: Own elaboration

Other variables in Table 6 provide additional context. Institutional Framework had a large positive effect on financial capacity (β = +0.475, p < 0.001). This suggests that where institutions (for instance, government programs or banks) provide support (like credit schemes, training in financial management), small processors are more financially capable – they can access loans or manage finances better. Market Transparency was also positive (β = +0.202, p < 0.001), implying that knowing market prices and conditions helps them financially (likely by allowing better sales decisions or planning). Technological Capabilities again showed a positive relation (β = +0.182, p < 0.001); better technology might lower costs or help record finances, improving financial stability. Transaction Complexity was negatively associated (β = –0.259, p < 0.001) with financial outcomes – complex transactions could lead to unpredictable costs or payment delays hurting cash flow. Service characteristics was not significant in this model (p = 0.104). Collectively, the results illustrate that an unfavorable market structure (many rivals or exploitative buyers) significantly erodes small firms' financial strength, while strong institutions and transparency help counteract that. Hypothesis 5 is thus strongly supported.

Effect of Institutional Framework on Regulatory Compliance

Finally, Objective 6 examines the institutional environment's impact on firms' regulatory compliance. The Regulatory Compliance regression was significant ($F(6,268) =$

Table 7. Effect of Institutional Framework on Regulatory Compliance

Predictor	β(Unstd.)	SE	t	p
Intercept	–0.461	0.380	–1.212	0.226
Institutional Framework	0.781	0.058	13.500	< .001*
Transaction Complexity	–0.065	0.058	–1.118	0.265
Service Characteristics	0.055	0.063	0.865	0.388
Technological Capabilities	0.526	0.056	9.447	< .001*
Market Transparency	0.191	0.057	3.335	0.001*
Market Structure	–0.344	0.060	–5.714	< .001*

Model $F(6,268) = 56.53$, $p < .001$; $R^2 = 0.559$, Adj. $R^2 = 0.549$. **Note:** *p < .001, ***p* < .01.

Source: Own elaboration

56.53, $p < 0.001$, $R^2 = 0.559$, Adj. $R^2 = 0.549$). As posited, Institutional Framework had a highly significant positive effect on compliance ($\beta = +0.781$, SE = 0.058, $t = 13.500$, $p < 0.001$), see Table 7. This confirms H6: a stronger institutional framework (for instance, clear regulations, enforcement, and support systems) is associated with substantially higher compliance by small processors with standards and regulations. The magnitude of $\beta = 0.781$ indicates that if the institutional support and enforcement were to improve by one scale point (which could mean, for instance, moving from "poor" to "fair" in terms of support), the firm's compliance rating would increase by ~0.78 (on a 7-point compliance scale). That is a considerable effect, highlighting the critical role institutions play. Without strong institutions, many processors likely operate informally or ignore certain regulations (as anecdotal evidence suggested), whereas with stronger oversight or assistance, they align more with required practices (such as licensing, food safety measures, proper waste disposal).

Table 7 also shows that Technological Capabilities had a strong positive effect on compliance ($\beta = +0.526$, $p < 0.001$). This could be because technology (like proper equipment) helps meet environmental or safety standards (for example, better presses might emit less waste or are safer to operate), or record-keeping technology helps with compliance paperwork. Market Structure fragmentation had a negative effect on compliance ($\beta = –0.344$, $p < 0.001$); in highly fragmented settings, enforcement might be harder or firms might cut corners to survive in tough competition, lowering compliance. Market Transparency was a positive predictor here too ($\beta = +0.191$, $p = 0.001$), perhaps because more transparent markets include dissemination of standards information or reputational effects that encourage compliance. Transaction complexity and service characteristics did not significantly influence compliance in the multivariate model ($p > 0.2$). Therefore, Hypothesis 6 is strongly supported: the strength of formal institutions and regulations correlates with better compliance among small processors. This aligns with prior understanding that when the "rules of the game" are clear and enforced, firms improve practices.

The above results provide empirical confirmation for the theoretical expectations drawn from value chain governance and service operations literature. In this section, we delve into the meaning and implications of each major finding, and compare them with prior studies:

Transaction Complexity and Technological Performance

We found that transaction complexity has a significant negative impact on the technological competency of small processors (H1). This aligns with Transaction Cost Economics and Global Value Chain (GVC) theory, which argue that when transactions are complex and cannot be easily standardized, small firms struggle to manage them efficiently. Our finding mirrors Bonatto et al. (2020)'s observation that high complexity in supply chains necessitates more coordination and can reduce performance if not met with sufficient capabilities. In the context of Dodoma's sunflower processors, complex transactions likely mean unpredictable procurement (varying seed quality, last-minute quantity changes) and sales arrangements (variable buyer requirements), which overwhelm their simple processes. Many respondents described scenarios such as having to coordinate with dozens of smallholder farmers for seeds or negotiate quality issues with buyers on the fly – leading to delays and frequent machine stoppages to adjust production. The significant coefficient for transaction complexity suggests that simplifying transactions or giving processors better tools to handle complexity (for instance, standardized contracts or intermediary aggregation of seeds) could directly improve their technological efficiency. This finding reinforces the argument for relational governance mechanisms in high-complexity contexts: since small firms cannot reduce complexity on their own, forming closer relationships (or using intermediaries) might mitigate its adverse effects (Heaton, 2024; Nkwabi, 2021). It also suggests a policy implication – interventions that streamline the purchasing process (such as establishing contract farming or cooperative buying) could yield technological efficiency gains for processors by reducing uncertainty in the production schedule.

Service Characteristics and Human Resources

The negative effect of challenging service characteristics on human resource capacity (H2) underscores how the inherent nature of service operations can strain small enterprises. The intangibility and variability of sunflower processing services (especially the need to ensure product quality in real time, and manage simultaneous production and inspection) require a skilled and adaptable workforce. Our data showed that where service demands were high (for instance, frequent product adjustments, on-demand production runs), firms reported their staff were not able to cope well – reflecting lower labor productivity or skill adequacy. This finding resonates with general services management theory which emphasizes training and employee flexibility for service quality, often framed by the heterogeneity of service output that demands human judgment. It also complements Mushi's (2016) observation that education level of processors correlated with efficiency – in our results, the need for knowledgeable staff becomes even more critical under high service complexity. The strong magnitude of this effect ($\beta\_std \approx –0.46$) suggests that interventions focusing on capacity building – for instance, technological training programs for operators on quality management, or hiring skilled supervisors – could substantially improve performance for firms where variability is unavoidable (Bonatto, et al., 2022; Ryciuk, 2020).

Technological Capabilities and Logistics Efficiency

Perhaps one of the clearest results was the powerful positive impact of technological capabilities on logistics performance (H3). This is highly consistent with numerous studies on supply chain integration that identify technology as a key enabler of coordination and efficiency. Our analysis shows that technology's effect remains strong even when controlling for other factors like market transparency or structure,

indicating it has an intrinsic value in making operations efficient. This finding ties into the broader discussion of digitalization in agribusiness; it provides micro-level evidence that digital tools and mechanization can bridge coordination gaps in fragmented chains. It aligns with Zhou et al. (2024) who confirmed that digital capabilities enhance supply chain integration and performance in manufacturing. For Tanzanian policymakers and development agencies, this underscores the importance of programs that facilitate technology adoption among small processors – whether through subsidies for modern equipment (presses, filtering machines) or training on using software and mobile applications for inventory and delivery management. This indicates that technological upgrades have spillover benefits across multiple performance areas – a new machine can increase throughput (technological), reduce wastage (compliance), and ease distribution planning (logistics) (Nwangwu, et al., 2024; Singh, et al., 2023). Thus, investing in technology might be the single most leverageable strategy for boosting small processor integration.

Market Transparency and Marketing Performance

The analysis strongly confirmed that increased market transparency is linked to significantly better marketing capability (H4). This finding echoes the fundamental economic principle that information asymmetry hurts market efficiency (Akerlof's "lemons" problem) and that reducing it (increasing transparency) improves outcomes for sellers and buyers. Small processors often operate in an information-poor environment. Those who had higher transparency (through market linkages, info services, or personal networks) were able to find more buyers, get better prices, or adjust their products to market needs, thereby expanding their market access and stability. This result parallels evidence from other value chains: for instance, studies in other Tanzanian sectors have noted that farmers or SMEs with access to price information via mobile phones achieved higher incomes than those without. Our study extends that concept into the processing segment, demonstrating quantitatively that lack of market information is a major barrier for processors trying to move beyond local markets (Diego & Montes-Sancho, 2025; Li, et al., 2023). Many respondents who scored low on marketing capability admitted they only sell in local markets because they "do not know where else to sell" or fear not getting paid by unknown buyers. This underscores a need for improving transparency through, for instance, creating market forums, trade fairs, or digital marketplaces connecting processors to bulk buyers (for instance, large wholesalers, retailers, or even export markets). The huge effect size for transparency (partial $R^2 \sim 0.34$) suggests that simply giving processors reliable information on prices and potential customers can increase their confidence to engage with new markets and negotiate better – ultimately driving growth (Singh, et al., 2025: Ma, et al., 2023).

Market Structure and Financial Performance

The negative association between a fragmented market structure and processors' financial capability (H5) supports the narrative that structural conditions in the sunflower value chain are not favoring small processors. When a market has many small players and possibly a few dominant actors (either large importers or big processing firms in other regions), small processors face both intense competition and weak bargaining power. Our finding resonates with Porter's Five Forces concept, where an industry with many rivals and powerful buyers will have lower profitability for individual firms. The data suggest that in areas with numerous processors (a fragmentation scenario common in Dodoma), profit margins are squeezed – potentially due to price wars or oversupply. Similarly, if they are dealing with powerful middlemen or wholesalers who dictate prices, small firms cannot earn enough to strengthen their finances or invest in growth. This situation is somewhat similar to the captive governance in GVC terms, where small suppliers are captive to big buyers and operate at thin margins (Rasimphi, et al., 2025; Hu, et al., 2023). Our result extends that concept: in this chain, the captor might not even be a single lead firm but the structural circumstance of too many small actors. A direct outcome we observe is limited access to credit – many small processors reported they cannot get bank loans due to irregular revenues and lack of collateral, which ties back to their low profitability and informal status. The policy implication is two-fold: encourage consolidation or cooperation among small processors to increase their collective market power (for instance, via cooperatives or cluster associations that can do collective marketing), and address distortions like cheap imported oils or buyer cartels that tilt the market against small local processors. Interestingly, institutional framework had a very strong positive effect on financial capability, meaning where the government or NGOs provided financial training or credit facilities (like guarantee schemes), processors had better financial outcomes (Diego & Montes-Sancho, 2025; Li, et al., 2023). This indicates that even if market structure is inherently difficult to change in short term (one can't easily reduce competitor count), improving institutional support can mitigate its impact by giving small firms tools to survive (loans, etc.). Nonetheless, over the long term, some rationalization of the processing sector may be needed – possibly moving smaller ones into networks or value addition niches, while others scale up – to achieve sustainable financial viability.

Institutional Framework and Compliance

Our finding that a robust institutional framework leads to higher regulatory compliance (H6) is intuitive yet crucial. It suggests that the presence of strong governance at the macro level begets better governance at the micro (firm) level. In regions or periods where the government actively enforces quality standards and provides support for compliance (like training on hygiene or partial grants for safety equipment), small processors adhere significantly more to regulations. For example, we learned that in sub-areas where the Tanzania Food and Drugs Authority (FDA) conducted inspections, processors made investments in stainless steel tanks and proper labeling to avoid penalties – those respondents scored higher on compliance. In contrast, in areas with little oversight, some processors admitted to not having any food safety certification or to discharging waste improperly. The positive effect of institutional strength is in line with Sam-

basivan et al. (2013), who noted that weak institutions breed non-compliance and mistrust. Our evidence shows the flip side: strong institutions breed compliance and likely trust. This has theoretical implications too – it supports the idea from New Institutional Economics that institutions lower transaction costs and promote mutually beneficial behavior (here compliance can be seen as a cooperative behavior for the greater supply chain good of quality assurance). Another angle is that strong institutions might foster informal norms of professionalism; if an industry sees enforcement regularly, over time complying becomes part of the business norms (Pullman, et al., 2024; Hilend, et al., 2023; Bu, et al., 2022). Our result therefore encourages policymakers to strengthen institutional outreach – for instance, regularise inspections, offer certification programs (with incentives for those who comply), and educate processors about regulations. Over time, this could upgrade the whole industry's standard and open up higher-value markets (like urban supermarkets that require certified oil).

Practical Implications

For policymakers and development agencies in Tanzania (and similar contexts), this study underscores specific areas to focus on to strengthen small agro-processing industries. Since transaction complexity harms performance, establishing coordination mechanisms can help. This could involve promoting contract farming or aggregator models where an intermediary (for instance, a cooperative or lead firm) organises the supply from many farmers to processors, simplifying procurement. The government could facilitate template contracts or a digital trading platform for sunflower seeds, reducing uncertainty for processors. The negative impact of complexity suggests that efforts at value chain coordination (such as forming cluster networks or introducing supply chain management training for processors) would increase efficiency.

The human resource constraints highlighted by our results imply that investing in human capital is critical. Programs to train processor owners and workers in operations management, quality control, and equipment maintenance would directly address the service heterogeneity challenge. For instance, SIDO or NGOs could run workshops on best practices in small-scale oil processing (covering how to handle variable seed inputs, how to maintain consistent quality). Additionally, incorporating basic business and negotiation skills in training could empower processors to cope better with market dealings (thus indirectly reducing perceived complexity and improving financial outcomes). Essentially, strengthening skills and knowledge at the processor level is a practical way to improve integration.

Managerial Implications

For owner-managers of small sunflower processing enterprises (and similarly for managers in other small agro-processing firms), our study highlights key areas to focus on internally, whereby Managers should look for ways to simplify and standardise their operations where possible. This might include establishing standard operating procedures for dealing with suppliers and customers, rather than handling everything ad hoc. For example, a processor could implement a policy to only buy seeds above a certain quality grade and use a consistent pricing formula – this reduces transaction haggling complexity. Simplifying product lines (maybe focusing on a core product or two, instead of many oil varieties or packaging formats) can reduce variability and thus ease pressure on staff and equipment. Managers might initially fear losing business by not customizing for every buyer, but as our findings suggest, the cost of over-complexity is high. It may be beneficial to identify the most profitable segment and streamline around it, improving efficiency and reliability for that market.

Theoretical Implications

This research contributes to several streams of literature and offers theoretical insights which includes the following. Our study bridges global value chain governance theory with service operations in an agro-processing context. We empirically demonstrated that classic GVC factors (transaction complexity, supplier capability – here proxied by technology – and codifiability/information, analogous to transparency) as identified by Gereffi et al. (2005) are highly relevant to performance outcomes of SMEs. We also showed that the unique characteristics of services (IHIP) have tangible performance effects, thereby extending service supply chain theory into an agribusiness domain. The implication is that theories of manufacturing value chain governance need to incorporate service dimensions when applied to contexts like small-scale food processing, where production and service delivery (ensuring product quality, meeting buyer specifications) happen concurrently. Our findings reinforce that relational governance (trust, communication) likely becomes more critical as complexity and service intangibility rise, aligning with relational exchange theory. Future theoretical models of SME value chains should thus explicitly include factors for service complexity and institutional environment to predict performance.

The results highlight that the effectiveness of different governance mechanisms can be contingent on context. For example, we found that institutional framework strength (more formal governance) improves outcomes significantly. This suggests that in environments with weaker formal institutions, firms may rely on informal or relational governance to get by, but at a cost to performance (Pullman, et al., 2024; Hilend, et al., 2023; Bu, et al., 2022). Our study thus empirically supports a contingency view: formal governance (like strong legal systems) provides a foundation for better performance, but in their absence, other governance forms (relational, network-based) must fill the gap albeit less efficiently. This adds nuance to TCE – yes, firms minimize costs by choosing governance forms, but the menu of choices and their costs are shaped by the macro-institutional context. In other words, our findings can inform the literature on institutional voids: small firms in developing markets suffer performance losses due to institutional voids, quantifying those losses and the gains when voids are filled.

CONCLUSION

This research set out to examine the integration of service value chain governance in the context of small sunflower oil processing industries in Dodoma, Tanzania. Through an extensive literature-informed analysis and survey-based empirical study, we demonstrated that key governance factors – transaction complexity, service characteristics, technological capabilities, market transparency, market structure, and institutional framework have significant and substantially impacts on the performance and capacity of small agro-processing firms. Each specific objective was met: we found that excessive transaction complexity and the inherent challenges of service production negatively affect technological and human resource performance; conversely, strong technological capabilities and transparent market information markedly improve logistics and marketing outcomes; a fragmented, uncoordinated market structure impairs financial viability; and a robust institutional environment greatly enhances regulatory compliance and overall governance.

These findings lead to several concluding observations. First, integrating small processing industries into higher value chains is not solely a matter of firm-level effort; it depends on the surrounding ecosystem of governance. Small firms can work hard and be entrepreneurial, but if they lack information, technology, and support, their integration will stall. Conversely, when the ecosystem is improved (through better infrastructure, policy, networks), even small firms can thrive and upgrade. Second, the results underscore the importance of a holistic approach in addressing one or two constraints in isolation (for instance, giving technology without improving market access, or vice versa) may yield limited gains, whereas coordinated improvements across multiple governance dimensions reinforce each other. This is an important consideration for practitioners and theorists alike – the components of value chain governance function as an interconnected system.

In concluding, our study provides evidence that targeted interventions in service value chain governance can meaningfully improve the prospects of small-scale processors. This has positive implications not only for those enterprises' incomes but also for broader economic development goals such as rural industrialization, job creation, and reducing dependency on imports (Tanzania currently imports a portion of edible oil; stronger local processors could replace that with domestic production). The sunflower oil sector in Dodoma, with its numerous small players, exemplifies both the potential and the pitfalls of smallholder-based industries. With the right governance improvements – simplifying transactions, empowering with technology and knowledge, opening market channels, fostering cooperation, and strengthening institutions – these small enterprises can become more competitive, sustainable, and integrated into both national and possibly export markets.

Limitations and Future Research

While our study is comprehensive, it is not without limitations. The data are cross-sectional, which limits our ability to make strong causal inferences. We assumed certain directions based on theory (and these are reasonable), but longitudinal research would be valuable to observe how changes in governance factors lead to performance changes over time. We also relied on self-reported measures, which might introduce bias (though we took steps to assure anonymity and validate responses, there could be some over- or under-statement). Future research could incorporate objective performance data (for instance, actual financial records, production data, compliance audit results) to complement perceptions. Another limitation is generalizability. Our context was specific – sunflower processors in one region. The situation may differ with other products or regions (for instance, areas with different crops or closer to major cities might have different dynamics). We encourage researchers to test our framework in other contexts: for instance, small dairy processing hubs, fruit processing SMEs, or handicraft clusters, to see if these governance factors similarly predict outcomes. It would also be useful to examine larger firms or cooperative societies to compare how governance influences differ by scale.

Future studies might also delve deeper into each factor. For example, transaction complexity could be unpacked into its components (asset specificity, uncertainty, frequency) in a service setting to see which is most problematic. Service characteristics could be studied in terms of how firms attempt to tangibilise or standardize their service to cope – are those who invest in branding or certifications (to tangibilise quality) doing better? Technological capabilities invites research into adoption barriers – qualitatively, why do some processors not adopt technology even when beneficial? Understanding the behavioral or resource constraints there could help design interventions to boost technology uptake. Research could also explore network and relational governance explicitly. Our study hints at the value of associations and trust, but we did not directly measure relational governance (like strength of relationships with suppliers/buyers). Investigating the role of trust and informal networks as mediators or moderators would enrich the governance narrative – perhaps strong informal relationships mitigate some negatives of a weak formal institutional framework, for instance.

Additionally, considering consumer perspective might be interesting: if small processors improve compliance and quality (due to better governance), does that reflect in consumer trust and demand? Essentially, closing the loop of how governance affects not just firm performance but end-market acceptance would be a full value chain analysis. Finally, policy-oriented research can build on our findings by conducting intervention studies – implementing certain improvements (say a market information system in one region but not another as a control) and measuring outcomes, to provide more rigorous evidence of causality. This kind of field experiment could validate many of the relationships we found and convince stakeholders of the ROI (return on investment) of governance interventions.

In general, our study contributes to both knowledge and practice by illuminating the pivotal governance linkages that integrate small firms into larger value chains. It calls on

stakeholders to view small enterprise development not just as an internal enterprise problem, but as a value chain governance challenge that can be addressed through collaborative and systemic solutions. The sunflower processors of Dodoma – and countless similar small firms in developing economies – can prosper if we collectively implement the lessons gleaned: simplify where possible, innovate and inform, cooperate strategically, and strengthen the institutional fabric that holds the chain together.

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